CHARGING SYSTEM

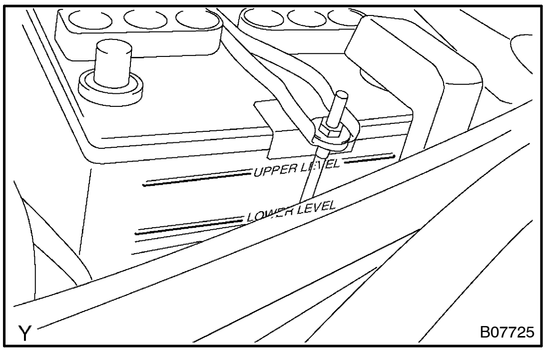
CH021–01

PRECAUTION

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

CH0AP–02

ON–VEHICLE INSPECTION



1. CHECK BATTERY ELECTROLYTE LEVEL

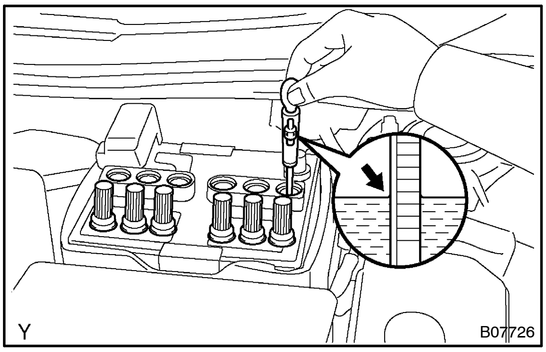
Check the electrolyte quantity of each cell.

Maintenance–Free Battery:

If under the lower level, replace the battery (or add distilled water if possible) and check the charging system.

Except Maintenance–Free Battery:

If under the lower level, add distilled water.

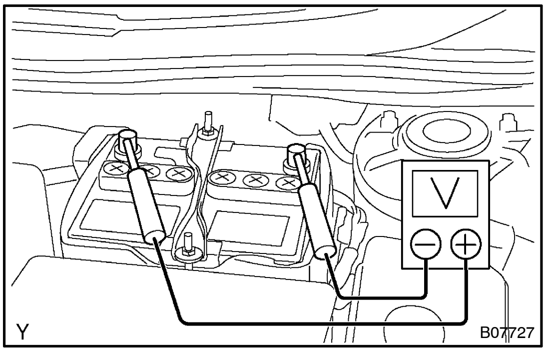


2. Except Maintenance–Free Battery:
CHECK BATTERY SPECIFIC GRAVITY

Check the specific gravity of each cell.

Standard specific gravity:
1.25 – 1.29 at 20°C (68 °F)

If the specific gravity is less than specification, charge the battery.



3. CHECK BATTERY VOLTAGE

(a) After having driven the vehicle and in the case that 20 minutes have not passed after having stopped the engine, turn the ignition switch ON and turn on the electrical system (headlight, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.

(b) Turn the ignition switch OFF and turn off the electrical systems.

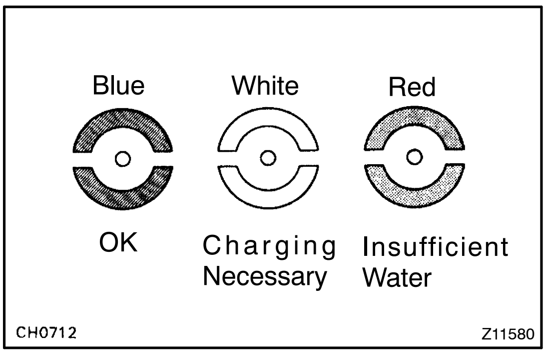
(c) Measure the battery voltage between the negative (–) and positive (+) terminals of the battery.

Standard voltage:
12.5 – 12.9 V at 20°C (68°F)

If the voltage is less than specification, charge the battery.

HINT:

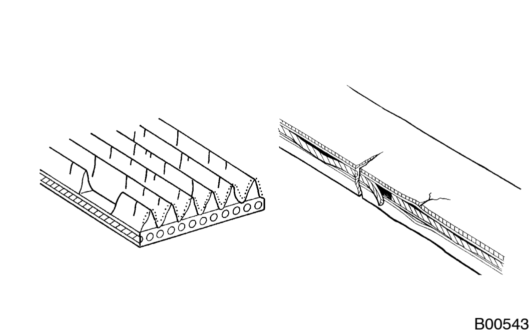
Check the indicator as shown in illustration.



4. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

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

(b) Check the fusible link, H–fuses and fuses for continuity.


B00543

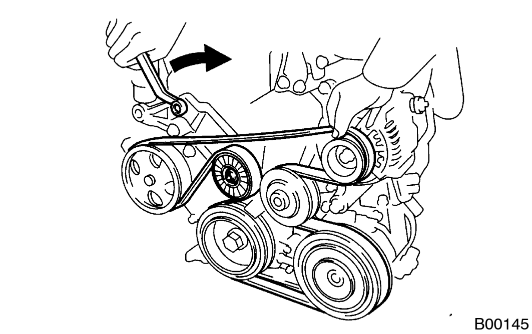
5. **INSPECT DRIVE BELT**

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

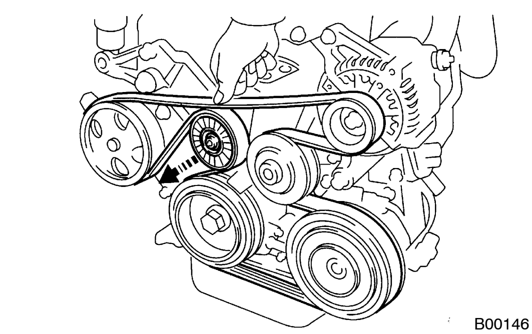
If any defect has been found, replace the drive belt.

HINT:

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


B00145

- The drive belt tension can be released by turning the belt tensioner clockwise.


B00146

(b) Check the belt tensioner operation.
   - Check that belt tensioner moves downward when the drive belt is pressed down at the points indicated in the illustration.
   - Check the alighment of the belt tensioner pulley to make sure the drive belt will not slip off the pulley.

If necessary, replace the belt tensioner.

B00540

HINT:

- After installing a belt, check that it fits properly in the ribbed grooves.
- Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.

6. **VISUALLY CHECK GENERATOR WIRING AND LISTEN FOR ABNORMAL NOISES**

(a) Check that the wiring is in good condition.

(b) Check that there is no abnormal noise from the generator while the engine is running.

7. **INSPECT DISCHARGE WARNING LIGHT CIRCUIT**

(a) Turn the ignition switch ”ON”. Check that the discharge warning light comes on.

(b) Start the engine. Check that the light goes off.

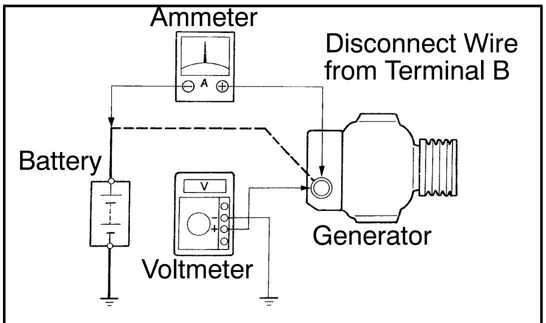
If the light does not operate as specified, troubleshoot the discharge warning light circuit.

8. INSPECT CHARGING CIRCUIT WITHOUT LOAD

HINT:

If a battery/generator tester is available, connect the tester to the charging circuit as permanufacturer's instructions.

(a) If a tester is not available, connect a voltmeter to the charging circuit as follows:
- Disconnect to the wire from terminal B of the generator and connect it to the negative (–) lead of the ammeter.



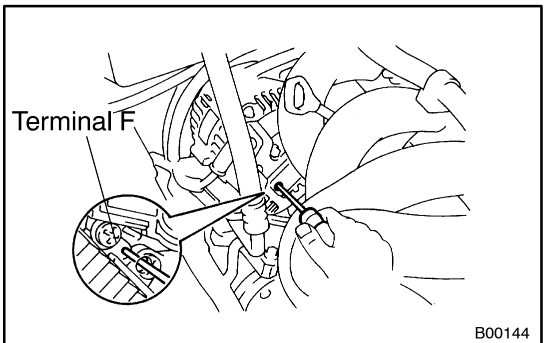
CH0732

- Connect the positive (+) lead of the ammeter to terminal B of the generator.
- Connect the positive (+) lead of the voltmeter to terminal B of the generator.
- Ground the negative (–) lead of the voltmeter.

(b) Check the charging circuit as follows:
With the engine running from idle to 2,000 rpm, check the reading on the ammeter and voltmeter.
Standard amperage:
10A or less
Standard voltage:
13.2 – 14.8 V

If the voltmeter reading is more than standard voltage, replace the voltage regulator.

If the voltmeter reading is less than the standard voltage, check the voltage regulator and generator as follows:



B00144

- With terminal F grounded, start the engine and check the voltmeter reading of terminal B.
- If the voltmeter reading is more than standard voltage, replace the voltage regulator.
- If the voltmeter reading is less than standard voltage, check the generator.

9. INSPECT CHARGING CIRCUIT WITH LOAD

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

(b) Check the reading on the ammeter.
Standard amperage:
30 A or more

If the ammeter reading is less than standard amperage, repair the generator.

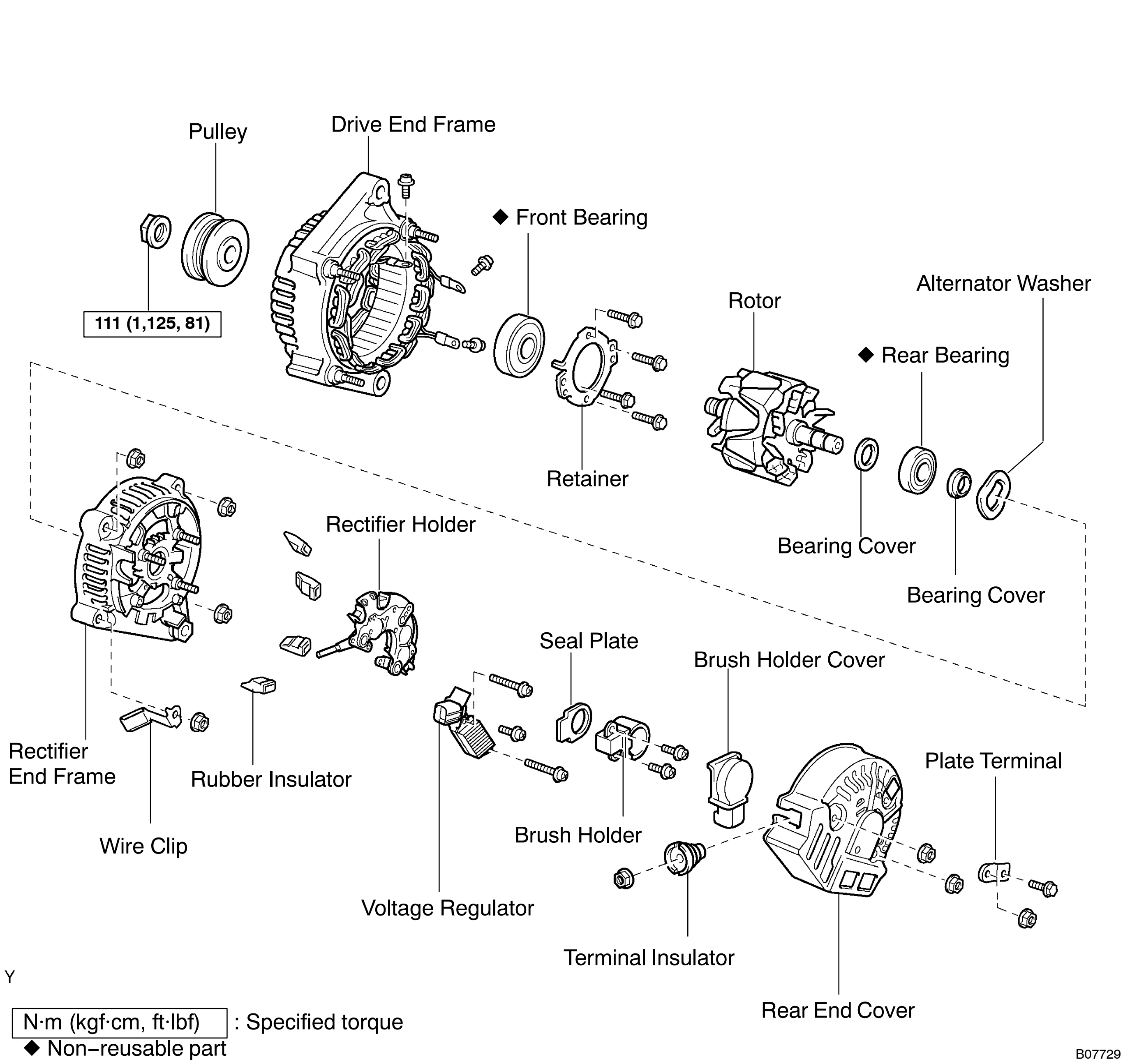
HINT:

If the battery is fully charged, the indication will sometimes be less than standard amperage.

ALTERNATOR

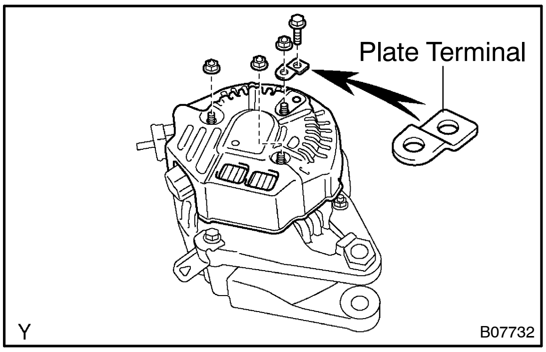
CH0C8–01

COMPONENTS

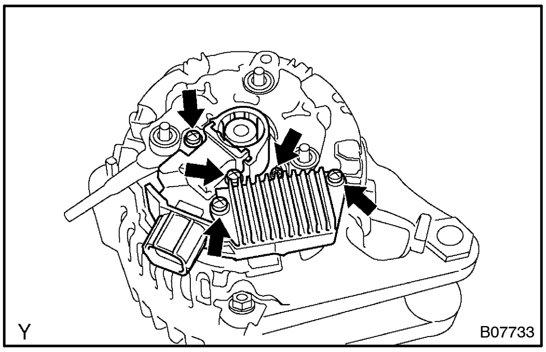


CH025–02

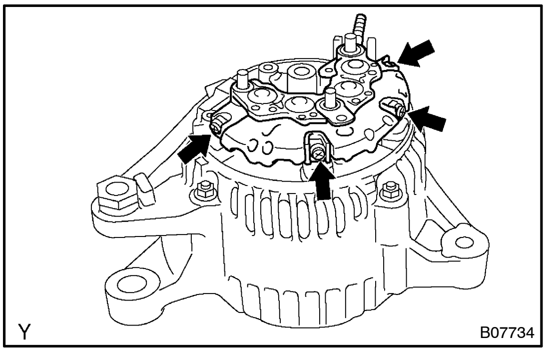
DISASSEMBLY



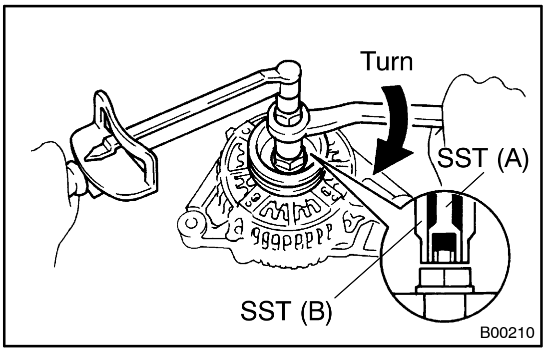
1. **REMOVE REAR END COVER**
(a) Remove the nut and terminal insulator.
(b) Remove the bolt, 3 nuts, plate terminal and end cover.



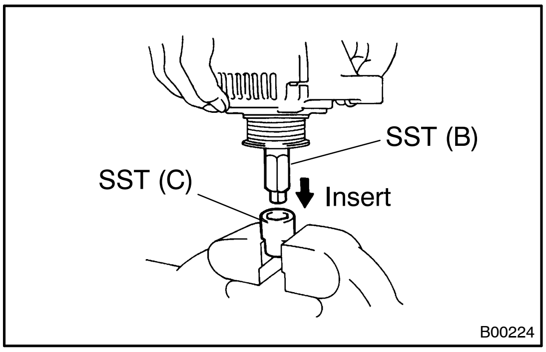
2. **REMOVE BRUSH HOLDER AND VOLTAGE REGULATOR**
(a) Remove the brush holder cover from the brush holder.
(b) Remove the 5 screws, brush holder and voltage regulator.
(c) Remove the seal plate from the rectifier end frame.



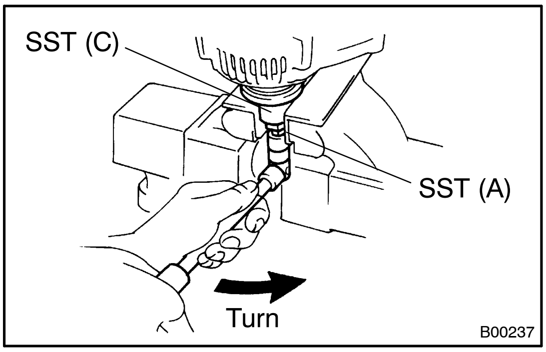
3. **REMOVE RECTIFIER HOLDER**
(a) Remove the 4 screws and rectifier holder.
(b) Remove the 4 rubber insulators.



4. **REMOVE PULLEY**
(a) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.
SST 09820–63010
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)
(b) Check that SST (A) is secured to the rotor shaft.



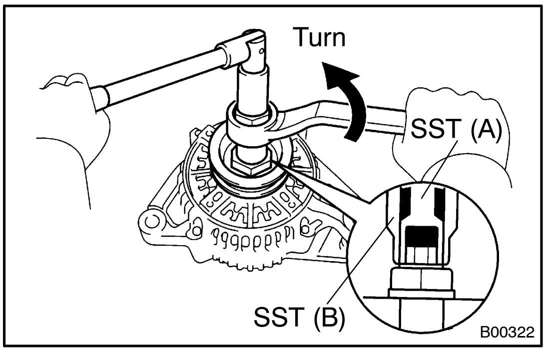
(c) Mount SST (C) in a vise.
(d) Insert SST (B) into SST (C), and attach the pulley nut to SST (C).



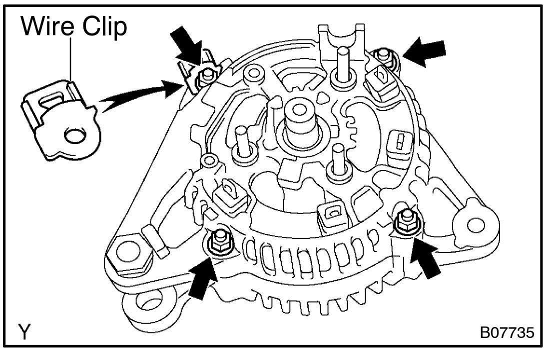
(e) To loosen the pulley nut, turn SST (A) in the direction shown in the illustration.

NOTICE:
To prevent damage to the rotor shaft, do not loosen the pulley nut more than one−half of a turn.

(f) Remove the alternator from SST (C).

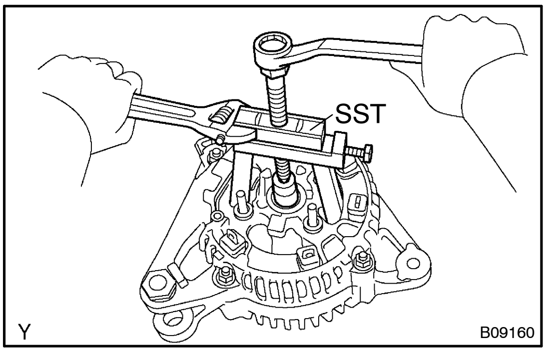


(g) Turn SST (B), and remove SST (A and B).
(h) Remove the pulley nut and pulley.



5. REMOVE RECTIFIER END FRAME

(a) Remove the 4 nuts and wire clip.

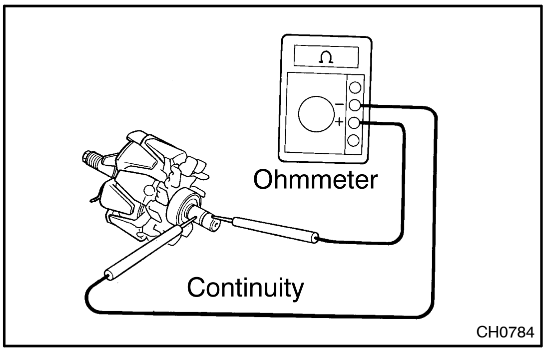


(b) Using SST, remove the rectifier end frame.
SST 09286−46011
(c) Remove the alternator washer from the rotor

6. REMOVE ROTOR FROM DRIVE END FRAME

CH026–03

INSPECTION

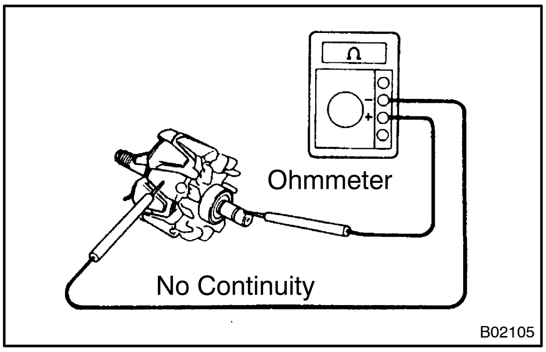


1. INSPECT ROTOR FOR OPEN CIRCUIT

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

Standard resistance:
2.7 – 3.1 Ω at 20°C (68°F)

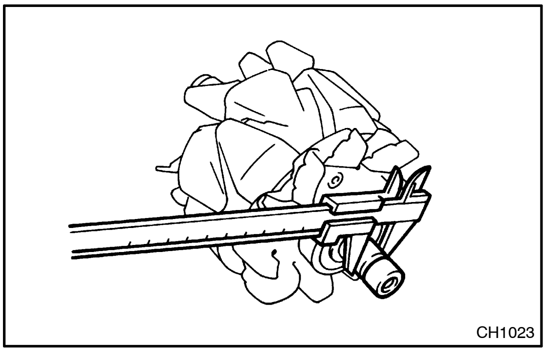
If there is no continuity, replace the rotor.



2. INSPECT ROTOR FOR GROUND

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

If there is continuity, replace the rotor.



3. INSPECT SLIP RINGS

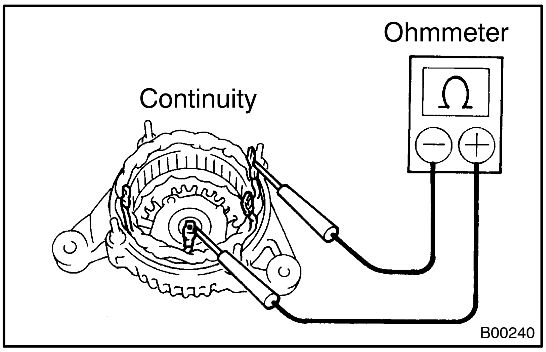
(a) Check that the slip rings are not rough or scored.

If rough or scored, replace the rotor.

(b) Using a vernier caliper, measure the slip ring diameter.

Standard diameter:
14.2 – 14.4 mm (0.559 – 0.567 in.)
Minimum diameter:
12.8 mm (0.504 in.)

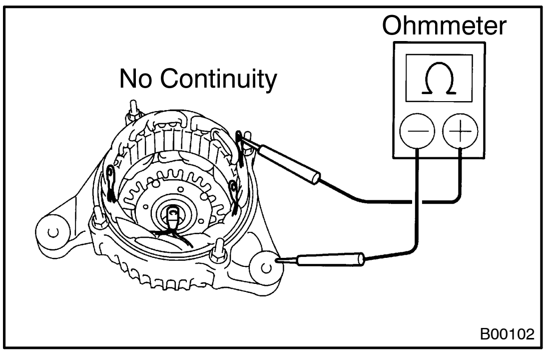
If the diameter is less than minimum, replace the rotor.



4. INSPECT STATOR (DRIVE END FRAME) FOR OPEN CIRCUIT

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

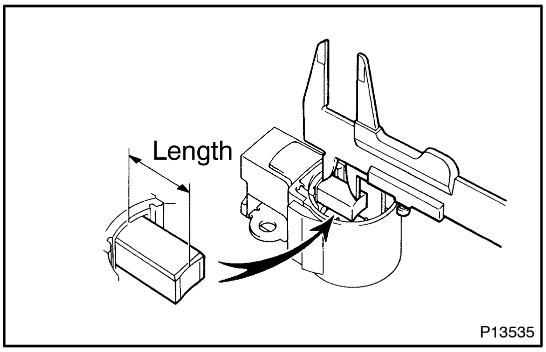
If there is no continuity, replace the drive end frame assembly



5. INSPECT STATOR (DRIVE END FRAME) FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil lead and drive end frame.

If there is continuity, replace the drive end frame assembly



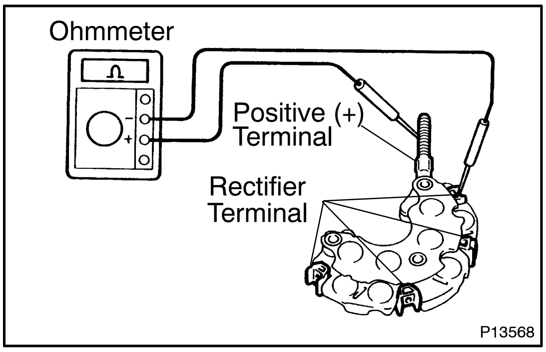
P13535

6. INSPECT EXPOSED BRUSH LENGTH

Using vernier calipers, measure the exposed brush length.

Standard exposed length:
9.5 – 11.5 mm (0.374 – 0.453 in.)
Minimum exposed length:
1.5 mm (0.059 in.)

If the exposed length is less than minimum, replace the brush holder assembly.

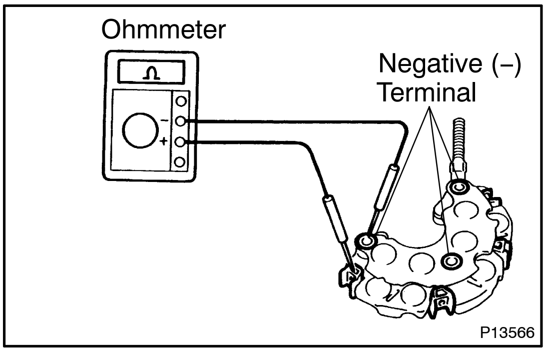


P13568

7. INSPECT POSITIVE RECTIFIER HOLDER

(a) Using an ohmmeter, connect one tester probe to the positive (+) terminal and the other to each rectifier terminal.
(b) Reverse the polarity of the tester probes and repeat step (a).
(c) Check that one shows continuity and the other shows no continuity.

If continuity is not as specified, replace the rectifier holder.

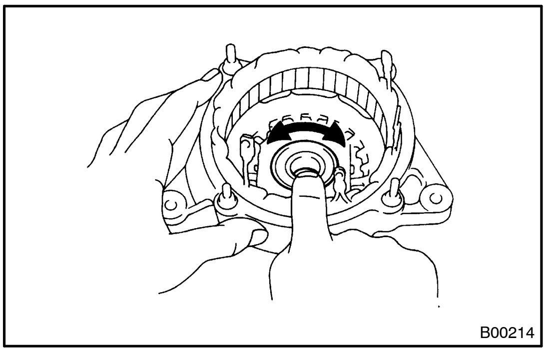


P13566

8. INSPECT NEGATIVE RECTIFIER HOLDER

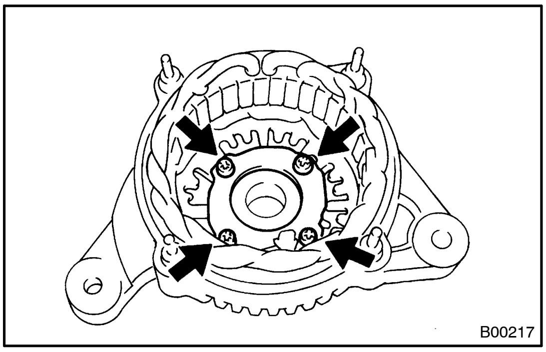
(a) Using an ohmmeter, connect one tester probe to each negative (–) terminal and the other to each rectifier terminal.
(b) Reverse the polarity of the tester probes and repeat step (a).
(c) Check that one shows continuity and the other shows no continuity.

If continuity is not as specified, replace the rectifier holder.


B00214

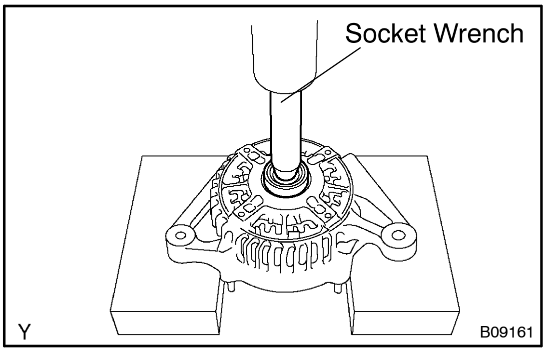
9. INSPECT FRONT BEARING

Check that the bearing is not rough or worn.

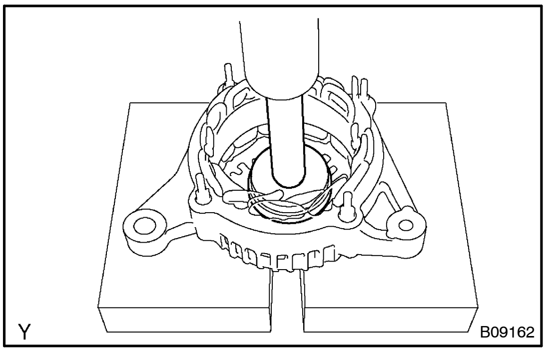

B00217

10. IF NECESSARY, REPLACE FRONT BEARING

(a) Remove the 4 screws, bearing retainer and bearing.

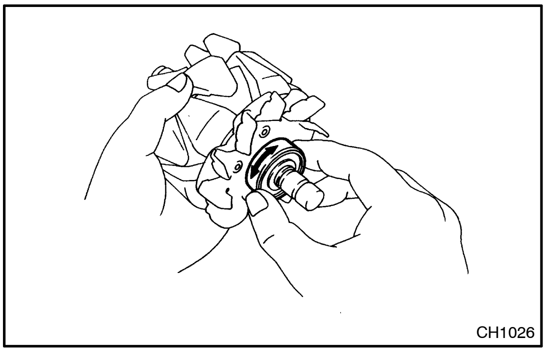


(b) Using SST and a press, press out the bearing.
SST 09950−60010 (09951−00350) 09950−70010 (09951−07100)



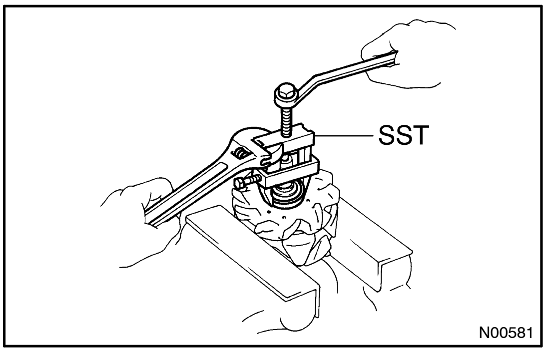
(c) Using SST and a press, press in a new bearing.
SST 09950−60010 (09951−00530) 09950−70010 (09951−07100)

(d) Install the bearing retainer with the 4 screws.
Torque: 3.0 N·m (31 kgf·cm, 27 in.·lbf)



11. INSPECT REAR BEARING

Check that the bearing is not rough or worn.

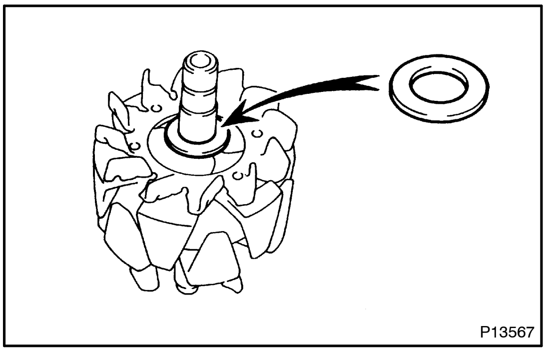


12. IF NECESSARY, REPLACE REAR BEARING

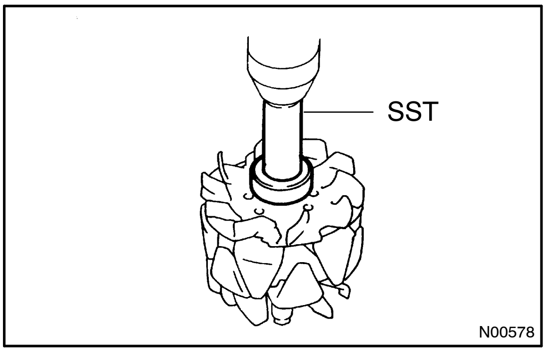
(a) Using SST, remove the bearing cover (outside) and bearing.
SST 09820−00021

NOTICE:
Be careful not to damage the fan.

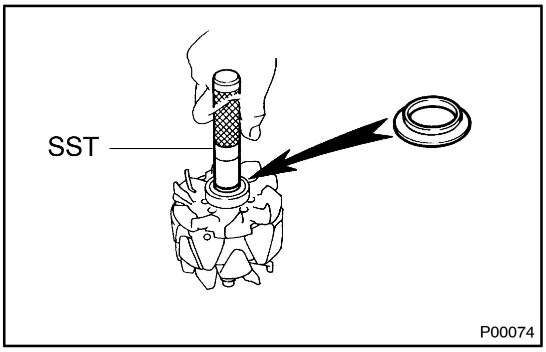
(b) Remove the bearing cover (inside).



(c) Place the bearing cover (inside) on the rotor.



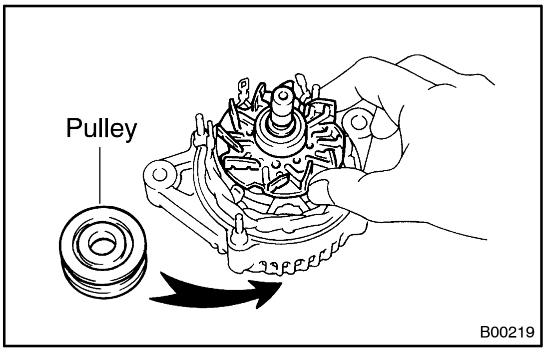
(d) Using SST and a press, press in a new bearing.
SST 09820-00030



(e) Using SST, push in the bearing cover (outside).
SST 09285-76010

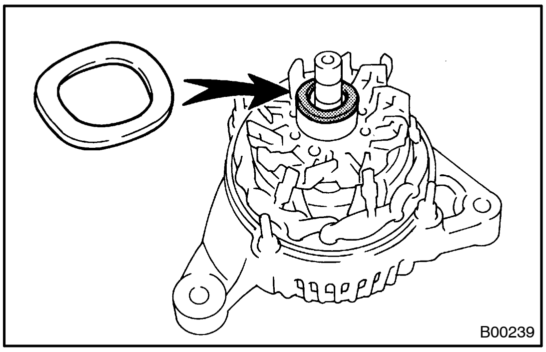
CH0C9–01

REASSEMBLY



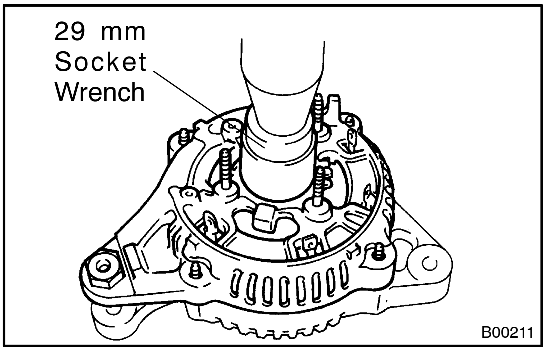
1. INSTALL ROTOR TO DRIVE END FRAME

(a) Place the drive end frame on the pulley.
(b) Install the rotor to the drive end frame.

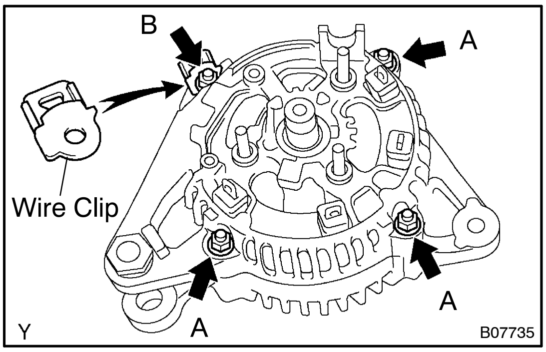


2. INSTALL RECTIFIER END FRAME

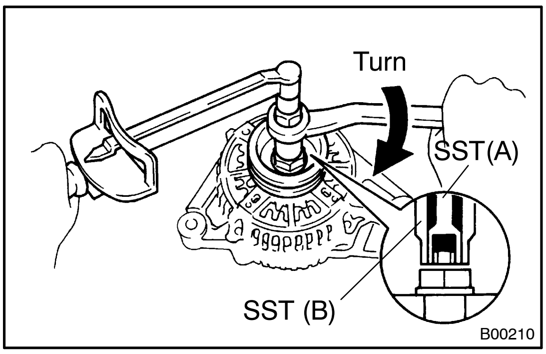
(a) Place the alternator washer on the rotor.



(b) Using a 29 mm socket wrench and press, slowly press in the rectifier end frame.

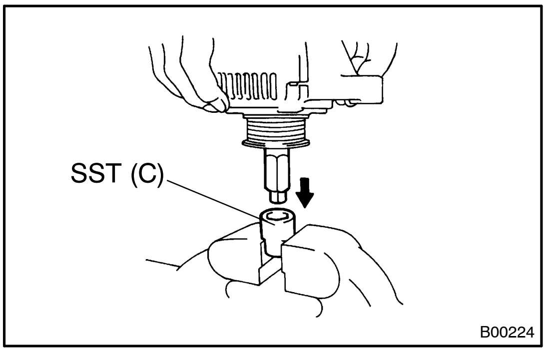


(c) Install the wire clip and 4 nuts.
Torque:
Nut A 4.5 N·m (46 kgf·cm, 40 in.·lbf)
Nut B 5.4 N·m (55 kgf·cm, 48 in.·lbf)

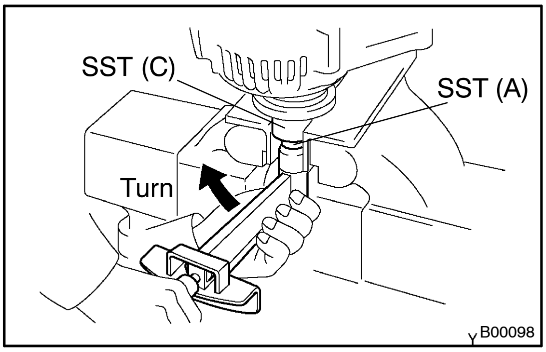


3. INSTALL PULLEY

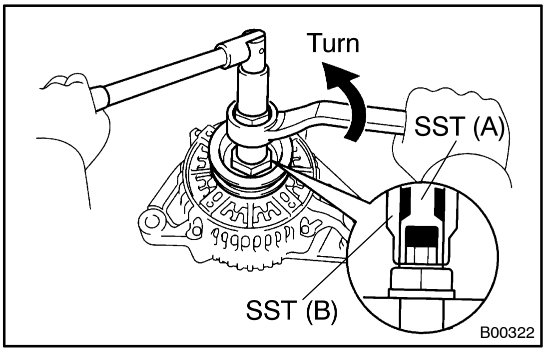
(a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.
(b) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.
SST 09820–63010
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)
(c) Check that SST (A) is secured to the pulley shaft.



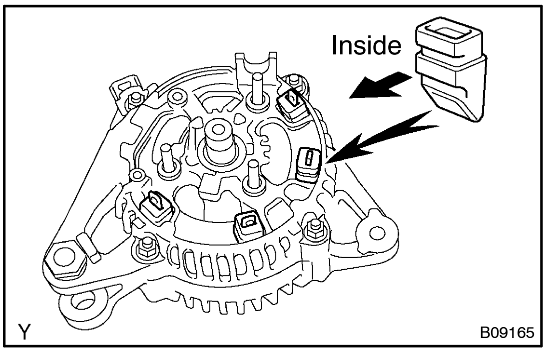
(d) Mount SST (C) in a vise.
(e) Insert SST (B) into SST (C), and attach the pulley nut to SST (C).



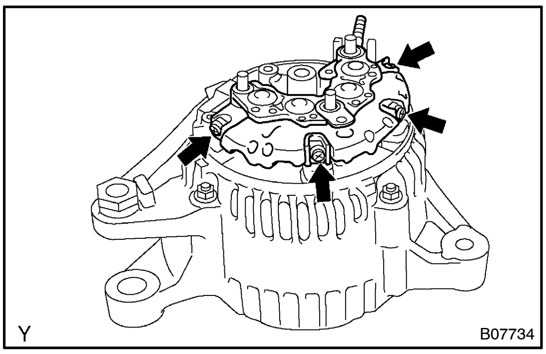
(f) To torque the pulley nut, turn SST (A) in the direction shown in the illustration.
Torque: 111 N·m (1,125 kgf·cm, 81 ft·lbf)
(g) Remove the alternator from SST (C).



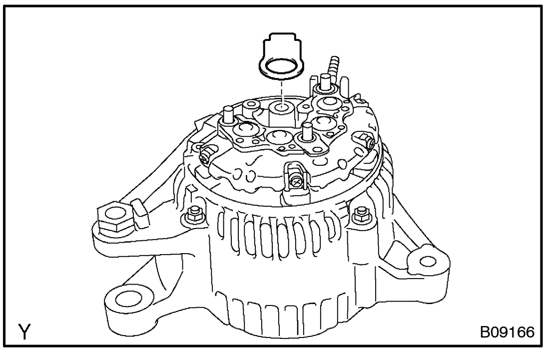
(h) Turn SST (B), and remove SST (A and B).



4. INSTALL RECTIFIER HOLDER
(a) Install the 4 rubber insulators on the lead wires.
NOTICE:
Be careful of the rubber insulators installation direction.

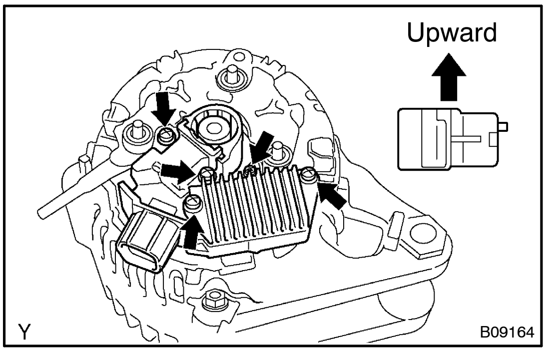


(b) Install the rectifier holder while pushing it with the 4 screws
Torque: 2.9 N·m (30 kgf·cm, 26 in.·lbf)



5. INSTALL VOLTAGE REGULATOR AND BRUSH HOLDER

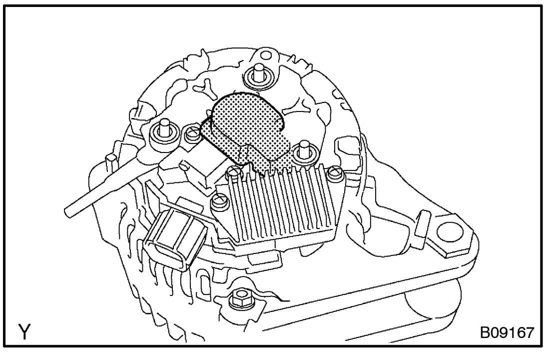
(a) Place the seal plate on the rectifier end frame.



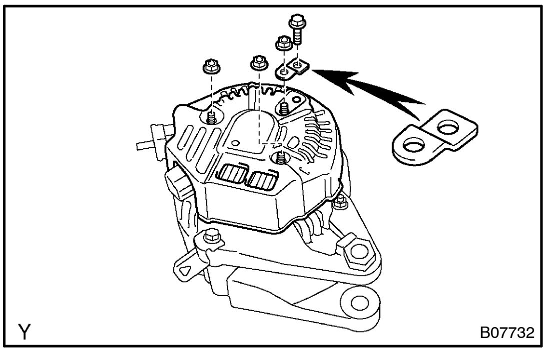
(b) Place the voltage regulator and brush holder on the rectifier end frame.

NOTICE:
Be careful of the holder installation direction.

(c) Install the 5 screws.
Torque: 2.0 N·m (20 kgf·cm, 18 in.·lbf)



(d) Place the brush holder cover on the brush holder.



6. INSTALL REAR END COVER

(a) Install the end cover and plate terminal with the bolt and 3 nuts.
Torque:
Nut 4.4 N·m (45 kgf·cm, 39 in.·lbf)
Bolt 3.9 N·m (39 kgf·cm, 35 in.·lbf)

(b) Install the terminal insulator with the nut.
Torque: 4.1 N·m (42 kgf·cm, 36 in.·lbf)

7. CHECK THAT ROTOR ROTATES SMOOTHLY

COOLANT

CO04D–04

INSPECTION

HINT:

Check the coolant level when the engine is cold.

1. CHECK ENGINE COOLANT LEVEL AT RESERVOIR

The engine coolant level should be between the ”LOW” and ”FULL” line.

If low, check for leaks and add ”Toyota Long Life Coolant” or equivalent up to the ”FULL” line.

2. CHECK ENGINE COOLANT QUALITY

(a) Remove the reservoir cap.

CAUTION:

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

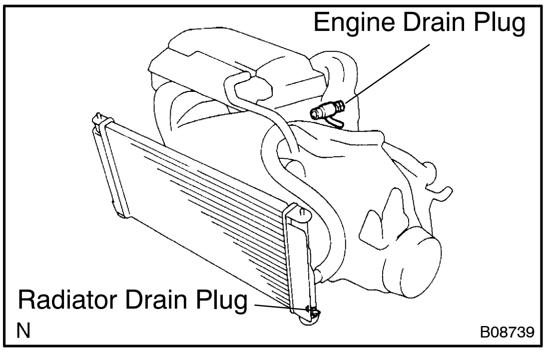
(b) There should not be any excessive deposits of rust or scale around the reservoir cap or reservoir filler hole, and the coolant should be free from oil.

If excessively dirty, replace the coolant.

(c) Reinstall the reservoir cap.

CO0WX–02

REPLACEMENT



HINT:
For replacing the heater parts such a heater core or heater hose, refer to Pub. No. RM734E AC section.

1. DRAIN ENGINE COOLANT

(a) Remove the reservoir cap.

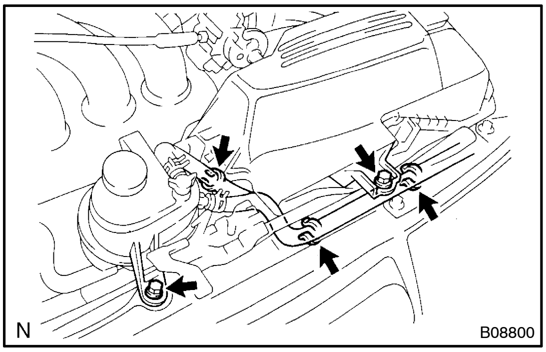
CAUTION:
To avoid the danger of being burned, do not remove the reservoir cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

(b) Loosen the radiator drain plug (on the left under side of the radiator tank) and engine drain plug on the engine coolant drain union (on the left rear of the cylinder block), and drain the coolant.

(c) Close the drain plugs.
Torque: 12.7 N·m (130 kgf·cm, 9 ft·lbf) for engine

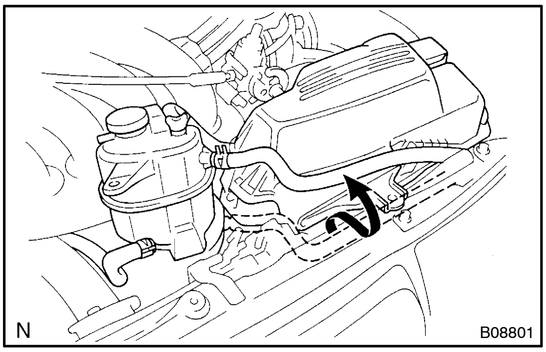
2. FILL ENGINE COOLANT

(a) Remove the upper front fender apron seal and upper radiator support seal.



(b) Remove the 2 bolts.

(c) Disconnect the 3 clamps and 2 hoses, then place hoses on air cleaner case.



(d) Lift the engine coolant reservoir and hook it on a hood latch to fix.

HINT:

(e) Remove the bleeder plug.

(f) Supply coolant of approx. 3.7 liters into the reserve tank until the level reaches FULL line.

- Use of improper coolants may damage engine cooling system.
- Use ”Toyota Long Life Coolant” or equivalent and mix it with plain water according to the manufactures directions.
- Use of the coolant which includes more than 50% [freezing protection down to –35˚C (–31˚F)] or 60% [freezing protection down to –50˚C (–58˚F)] of ethylene–glycol is recommended, but not more than 70%.

NOTICE:

- **Do not use an alcohol type coolant or plain water alone.**
- **The coolant should be mixed with plain water (preferably demineralized water or distilled water).**

Capacity:

1ZZ–FE:

M/T	5.7 litters (6.0 US qts, 5.0 Imp. qts)
A/T	5.6 litters (5.9 US qts, 4.9 Imp. qts)

2ZZ–GE:

M/T	5.9 litters (6.2 US qts, 5.2 Imp. qts)
A/T	5.8 litters (6.1 US qts, 5.1 Imp. qts)

HINT:

When the level can not be lowered before the supply of the 3.7 liters coolant, squeeze the radiator lower hose several times while blocking the hole in the bleeder plug with a finger, and surely supply the coolant.

(g) Start the engine with the reservoir cap and the bleeder plug removed and warm it up until the cooling fan blows first and then stops.

HINT:

At this time, the A/C switch should be OFF.

(h) Additionally supply 500 cc coolant with the engine idling.

(i) Install the bleeder plug and reservoir cap.

HINT:

Close the reservoir cap by marking approx. 2.5 rotations until clicks is heard.

(j) Repeat 5 sec. engine operation at 3,000 rpm and 5 sec. idling alternately for 15 min. or more.

(k) After complete cooling of the engine, the level shall be between Low and FULL.

HINT:

After warming–up of engine, the level shall be over the FULL.

(l) Connect the 2 hoses and clamps.

(m) Install the 2 bolts.

(n) Install the cover.

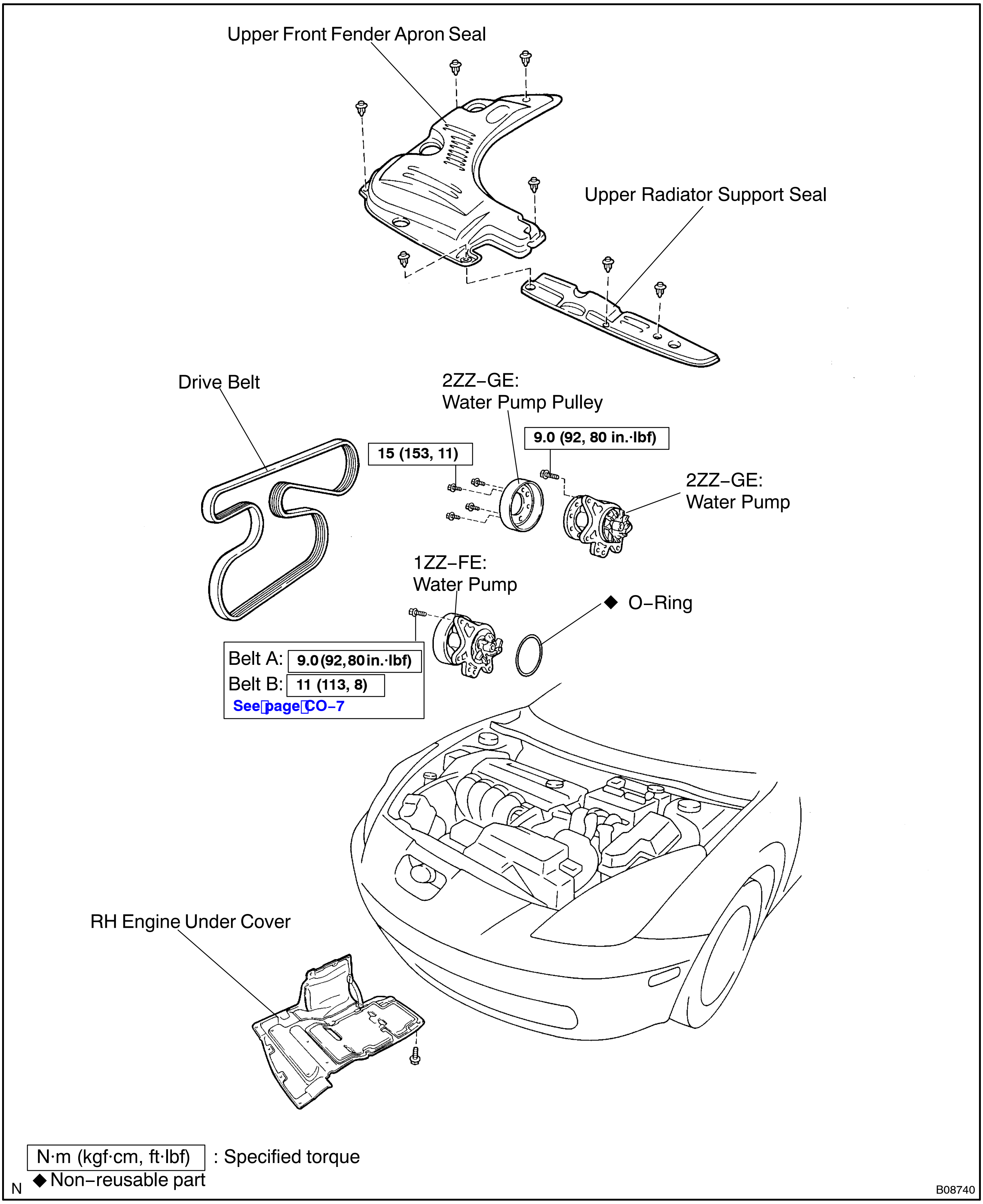
3. CHECK FOR COOLANT LEAKS

4. CHECK ENGINE COOLANT SPECIFIC GRAVITY CORRECTLY

WATER PUMP

COMPONENTS

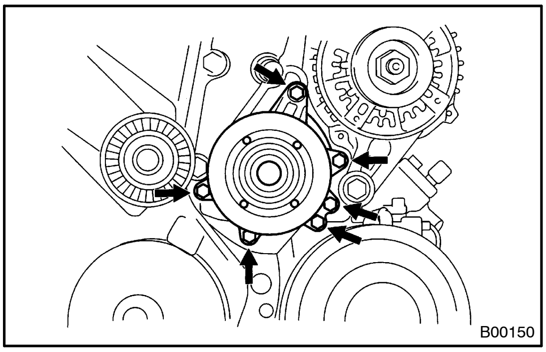
CO04F–04



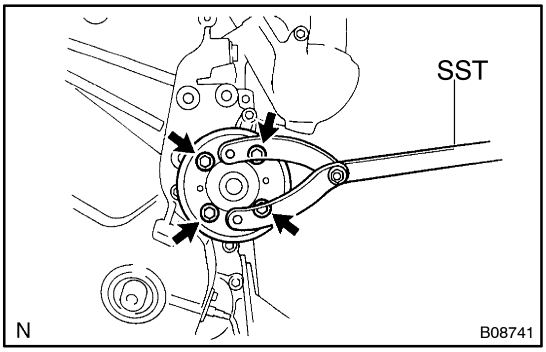
CO0WY–02

REMOVAL

1. **REMOVE RH ENGINE UNDER COVER**
2. **DRAIN ENGINE COOLANT**
3. **REMOVE DRIVE BELT (See page CH–5)**


B00150

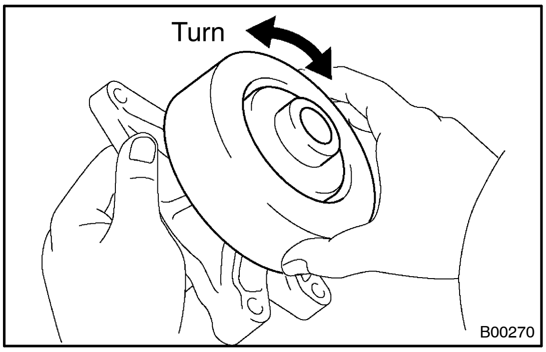
4. **1ZZ–FE:**
REMOVE WATER PUMP
(a) Remove the 6 bolts, water pump and O–ring.
(b) Clean up the engine coolant from the water chamber room.



B08741

5. **2ZZ–GE:**
REMOVE WATER PUMP
(a) Using SST, remove the 4 water pump pulley set bolts.
SST 09960–10010 (09962–01000, 09963–00600)
(b) Remove the water pump pulley.
(c) Remove the 6 bolts, water pump and O–ring.
(d) Clean up the engine coolant from the water chamber room.

NOTICE:
Do not remove the RH engine mounting bracket and alternator when the water pump alone is replaced.



CO04H–04

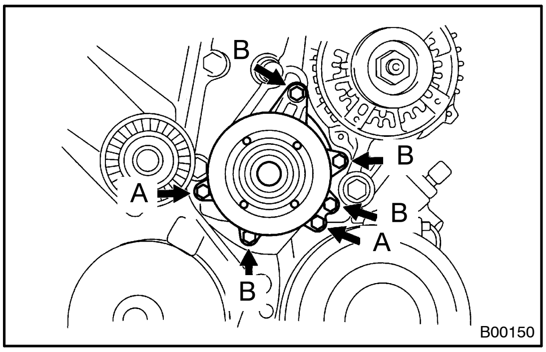
INSPECTION

INSPECT WATER PUMP

(a) Visually check the drain hole for coolant leakage.
If leakage is found, replace the water pump.

(b) Turn the pulley, and check that the water pump bearing moves smoothly and quietly.

If necessary, replace the water pump.



CO0WZ–02

INSTALLATION

1. 1ZZ–FE:
INSTALL WATER PUMP

(a) Place a new O–ring on the timing chain cover.

(b) Install the water pump with the 6 bolts.

Torque:
Bolt A 9.0 N·m (92 kgf·cm, 80 in.·lbf)
Bolt B 11 N·m (113 kgf·cm, 8 ft·lbf)

HINT:
Each bolt length is indicated in the illustration.

A: 30 mm (1.18 in.)
B: 35 mm (1.38 in.)

2. 2ZZ–GE:
INSTALL WATER PUMP

(a) Place a new O–ring on the timing chain cover.

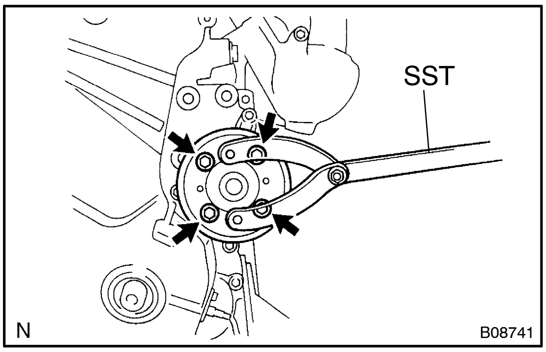
(b) Install the water pump with the 6 bolts.

Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

HINT:
Each bolt length is indicated in the illustration.

A: 30 mm (1.18 in.)
B: 35 mm (1.38 in.)

(c) Install the water pump pulley.



(d) Using SST, tighten the 4 water pump pulley set bolts.
SST 09960–10010 (09962–01000, 09963–00600)
Torque: 15 N·m (153 kgf·cm, 11 ft·lbf)

3. INSTALL RH ENGINE UNDER COVER

4. INSTALL DRIVE BELT
(See page CH–5)

5. FILL WITH ENGINE COOLANT

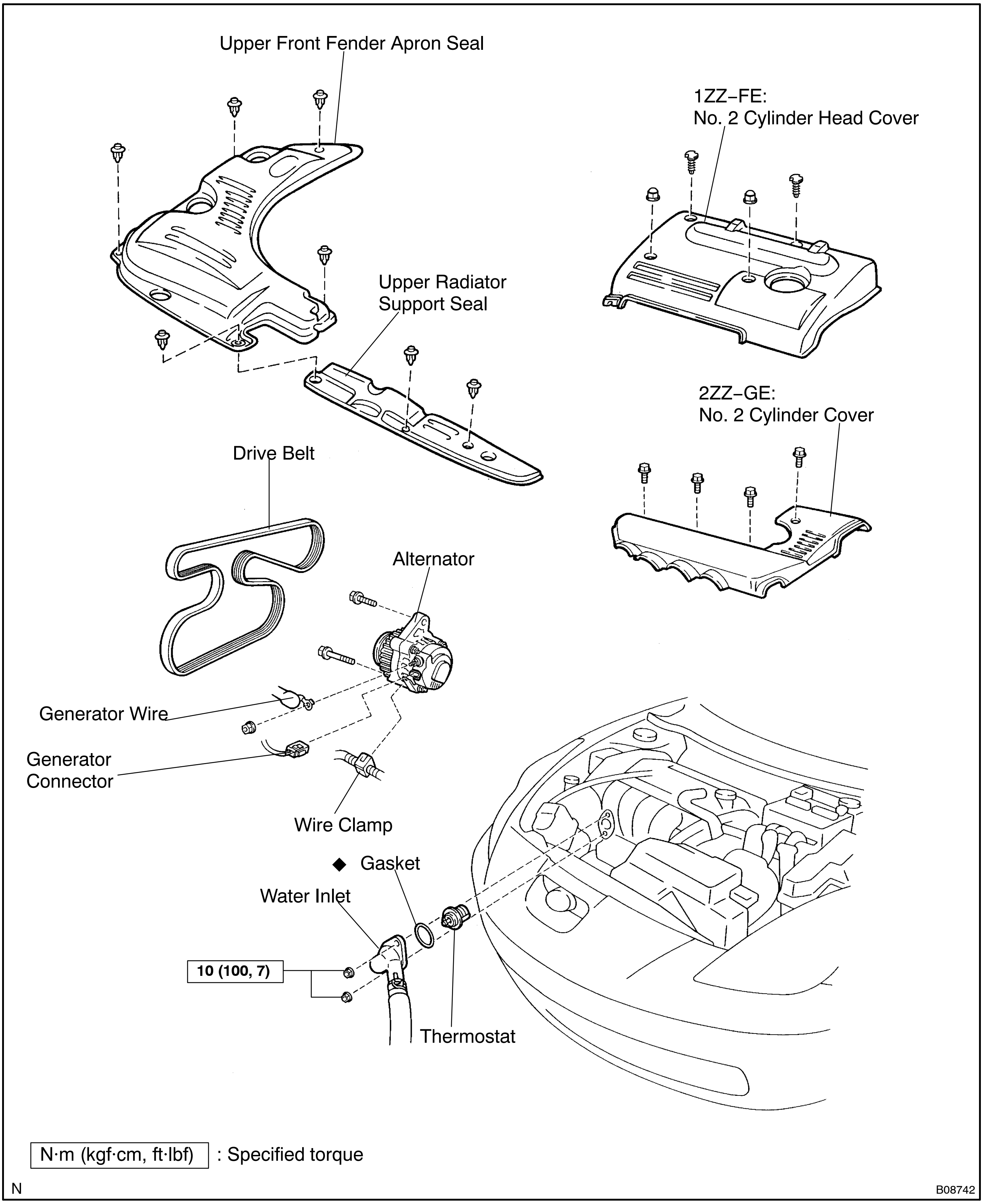
6. START ENGINE AND CHECK FOR LEAKS

7. RECHECK ENGINE COOLANT LEVEL

THERMOSTAT

COMPONENTS

CO04J–05



CO04K–05

REMOVAL

HINT:
Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

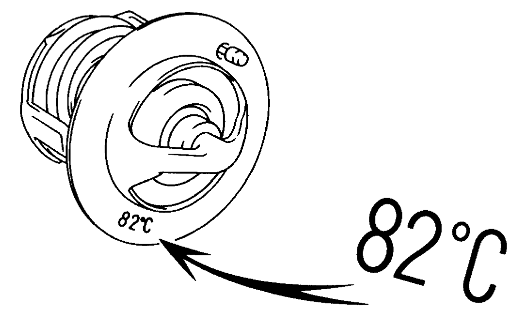
1. DRAIN ENGINE COOLANT

2. REMOVE DRIVE BELT AND ALTERNATOR

3. REMOVE WATER INLET AND THERMOSTAT

(a) Remove the 2 nuts, and disconnect the water inlet from the cylinder block.
(b) Remove the thermostat.
(c) Remove the gasket from the thermostat.

CO04L–04



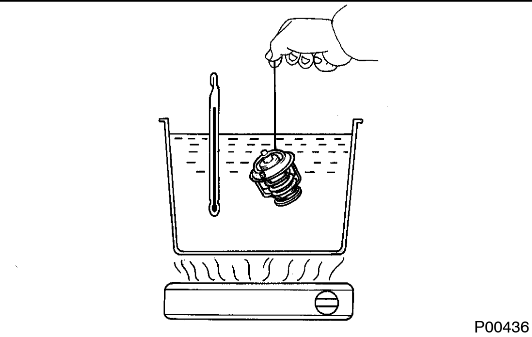
P13560

INSPECTION

INSPECT THERMOSTAT

HINT:

The thermostat is numbered with the valve opening temperature.


P00436

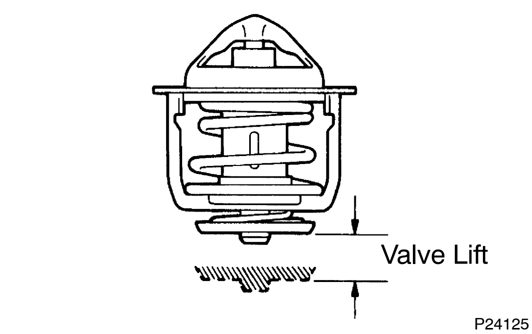
(a) Immerse the thermostat in water and gradually heat the water.

(b) Check the valve opening temperature.

Valve opening temperature:

80.0 – 84.0°C (176 – 183°F)

If the valve opening temperature is not as specified, replace the thermostat.



P24125

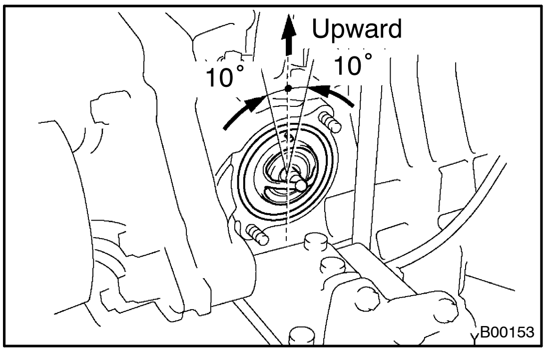
(c) Check the valve lift.

Valve lift: 10 mm (0.39 in.) or more at 90°C (194°F)

If the valve lift is not as specified, replace the thermostat.

(d) Check that the valve is fully closed when the thermostat is at low temperatures (below 40°C (104°F)).

If not closed, replace the thermostat.



CO04M–05

INSTALLATION

1. PLACE THERMOSTAT IN CYLINDER BLOCK

(a) Install a new gasket to the thermostat.

(b) Install the thermostat with the jiggle valve upward.

HINT:

The jiggle valve may be set within 10° of either side of the prescribed position.

2. INSTALL WATER INLET

Install the water inlet with the 2 nuts.

Torque: 10 N·m (100 kgf·cm, 7 ft·lbf)

3. INSTALL ALTERNATOR AND DRIVE BELT

4. FILL WITH ENGINE COOLANT

5. START ENGINE, AND CHECK FOR COOLANT LEAKS.

RADIATOR

CO04N−01

ON−VEHICLE CLEANING

CLEAN RADIATOR

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

NOTICE:

If using a high pressure type cleaner, be careful not to deform the fins of the radiator core (i.e. Maintain a distance between the cleaner nozzle and radiator core.).

CO04O–04

ON–VEHICLE INSPECTION

1. REMOVE RESERVOIR CAP

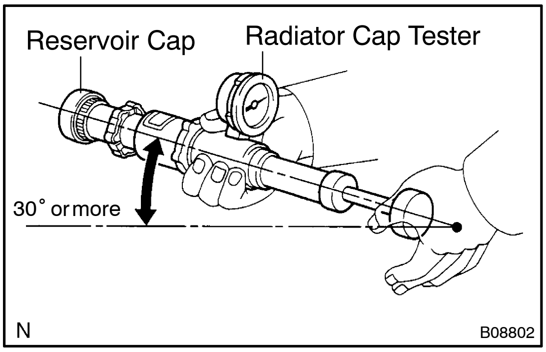
CAUTION:

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

2. INSPECT RESERVOIR CAP

NOTICE:

- **If the reservoir cap has contaminations, always rinse it with water.**
- **Before using a radiator cap tester, wet the relief valve and pressure valve with engine coolant or water.**
- **When performing steps (a) and (b) below, keep the radiator cap tester at an angle of over 30° above the horizontal.**



(a) Using a radiator cap tester, slowly pump the tester and check that air is coming from the vacuum valve.

Pump speed: 1 push/(3 seconds or more)

NOTICE:

Push the pump at a constant speed.

If air is not coming from the vacuum valve, replace the reservoir cap.

(b) Pump the tester and measure the relief valve opening pressure.

Pump speed: 1 push within 1 seconds

NOTICE:

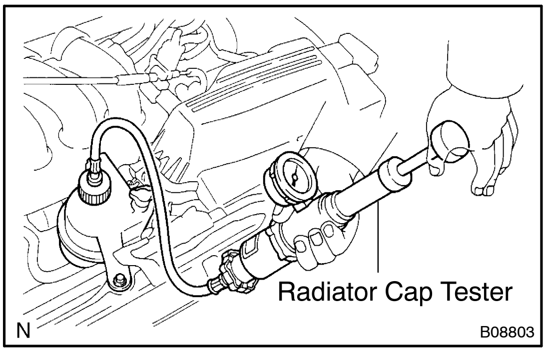
This pump speed is for the first pump only (in order to close the vacuum valve). After this, the pump speed can be reduced.

Standard opening pressure:
93 – 123 kPa (0.95 – 1.25 kgf/cm^2, 13.5 – 17.8 psi)
Minimum opening pressure:
79 kPa (0.8 kgf/cm^2, 11.5 psi)

HINT:

Use the tester's maximum reading as the opening pressure.

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



3. **INSPECT COOLING SYSTEM FOR LEAKS**

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

(b) Warm up the engine.

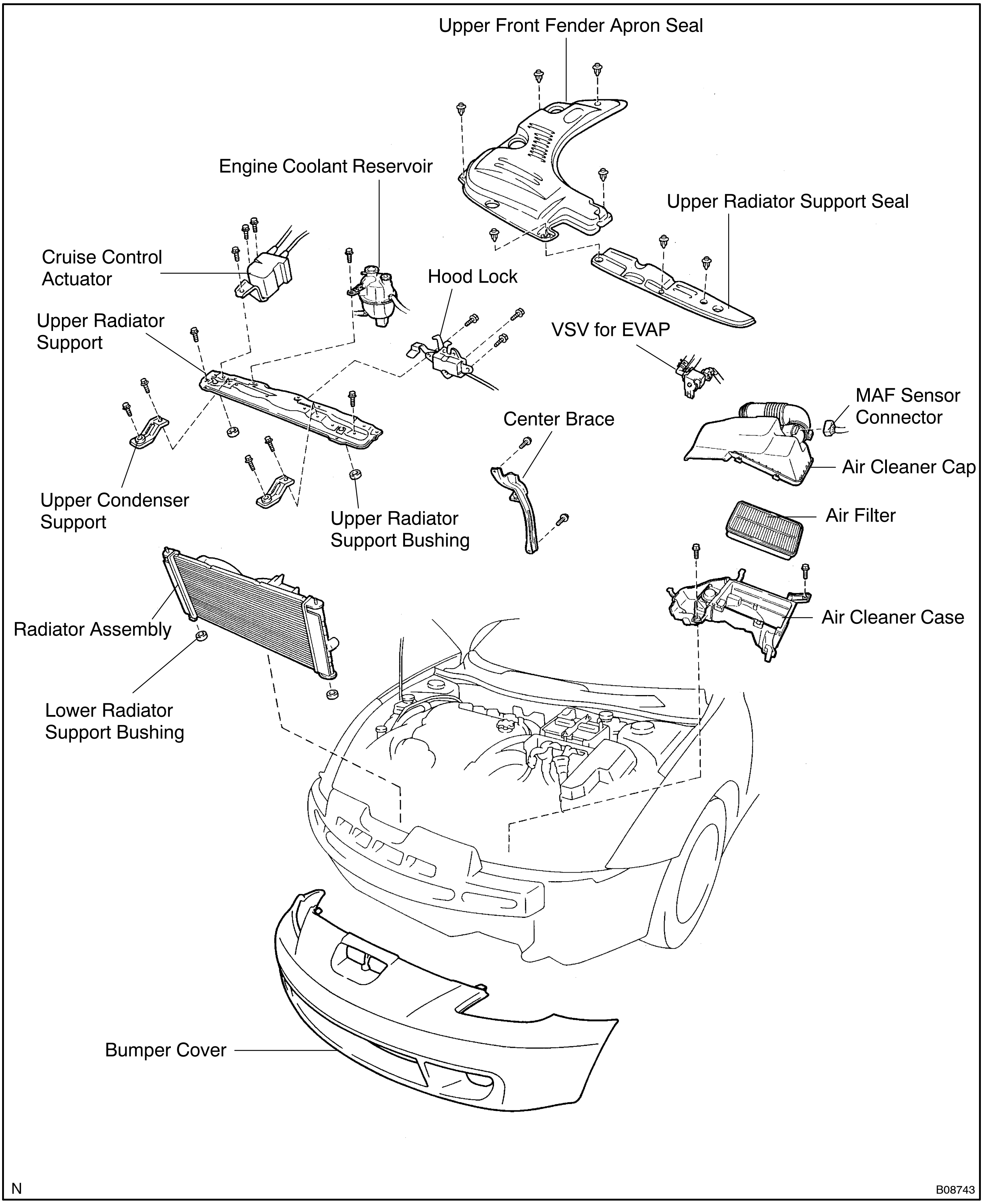
(c) Pump it to 118 kPa (1.2 kgf/cm^2, 17.1 psi), and check that the pressure does not drop.

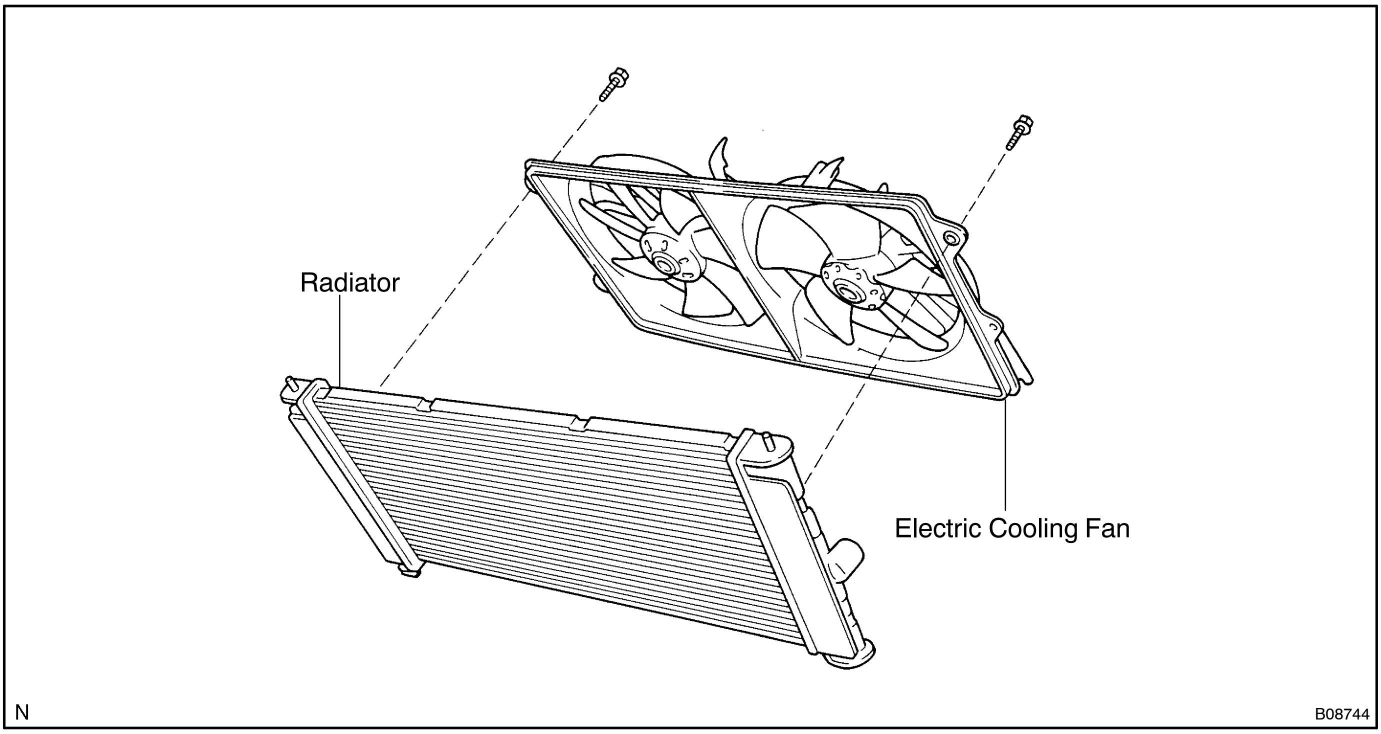
If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, cylinder block and head.

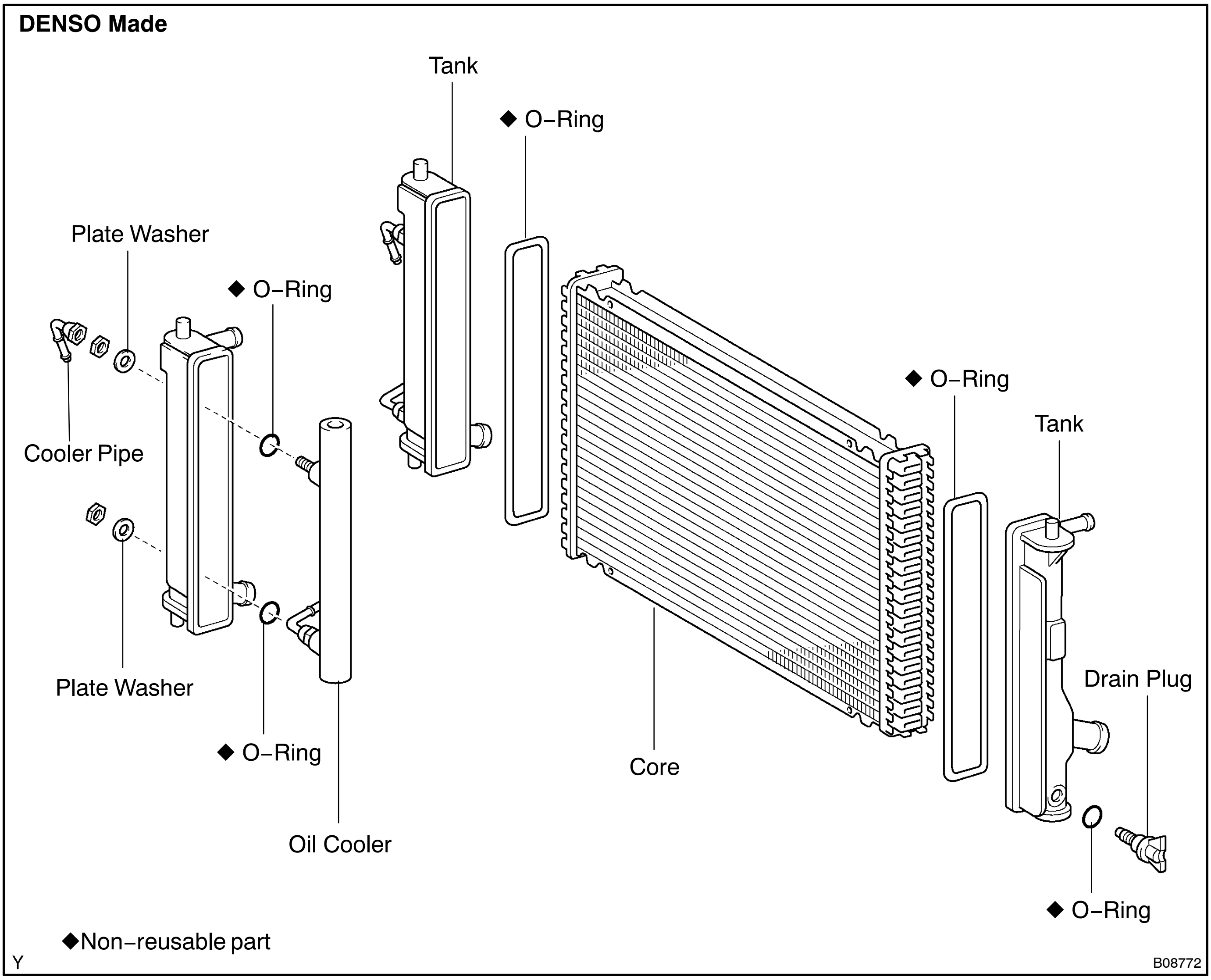
4. **REINSTALL RESERVOIR CAP**

COMPONENTS

CO04P–03



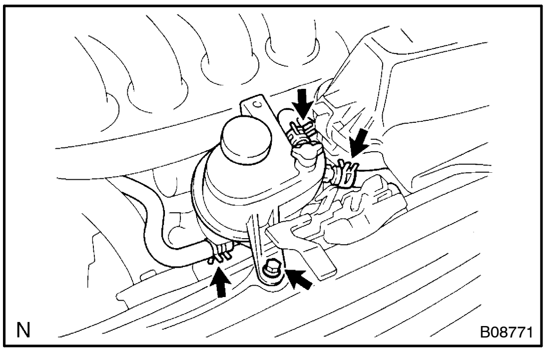

Radiator
Electric Cooling Fan
N
B08744


DENSO Made
Tank
◆ O–Ring
Plate Washer
◆ O–Ring
Cooler Pipe
◆ O–Ring
Tank
Drain Plug
Plate Washer
◆ O–Ring
Core
Oil Cooler
◆ O–Ring
◆Non–reusable part
Y
B08772

CO0X4–02

REMOVAL

1. **REMOVE UPPER FRONT FENDER APRON SEAL AND UPPER RADIATOR SUPPORT SEAL**
2. **DRAIN ENGINE COOLANT**
3. **REMOVE BUMPER COVER**
   (See Pub. No. RM734E BO section)
4. **REMOVE AIR CLEANER**

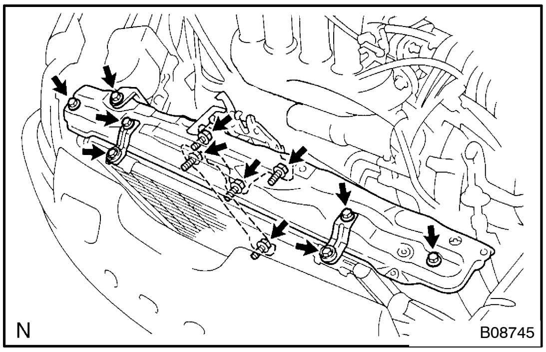


5. **REMOVE ENGINE COOLANT RESERVOIR**

(a) Disconnect the 3 radiator reservoir hoses.
(b) Remove the bolt and engine coolant reservoir.

6. **REMOVE RADIATOR ASSEMBLY**

(a) Disconnect the No. 1 electric cooling fan connector.
(b) Disconnect the No. 2 electric cooling fan connector.
(c) Disconnect the upper radiator hose.
(d) Disconnect the lower radiator hose.
(e) Disconnect the 2 A/T oil cooler hoses.



(f) Remove the 3 bolts, and disconnect the hood lock.
(g) Remove the 2 bolts and center brace.
(h) Remove the 2 bolts, 2 nuts and 2 condensor upper supports.
(i) w/ Cruise control system:
Remove the bolt, and disconnect the cruise control acuator.
(j) Remove the 2 bolts and radiator upper support.
(k) Remove the 2 upper radiator support bushings.
(l) Remove the radiator assembly.
(m) Remove the 2 lower radiator support bushings.

7. **REMOVE ELECTRIC COOLING FAN FROM RADIATOR**

Remove the 2 bolts and cooling fan assembly.

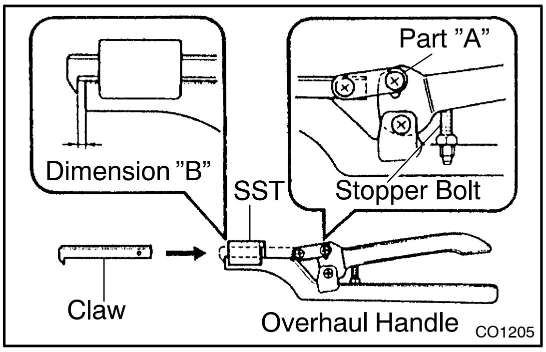
CO04R–04

DISASSEMBLY

1. REMOVE DRAIN PLUG

(a) Remove the drain plug.

(b) Remove the O–ring.



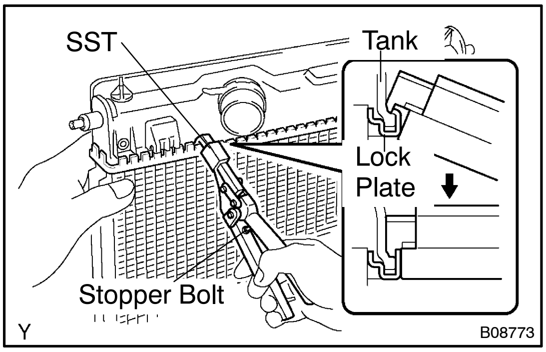
2. DENSO Made:
ASSEMBLE SST

SST 09230–01010

(a) Install the claw to the overhaul handle, inserting it in the hole in part ”A” as shown in the diagram.

(b) While gripping the handle, adjust the stopper bolts so that dimension ”B” shown in the diagram is 0.2 – 0.3 mm (0.008 – 0.012 in.).

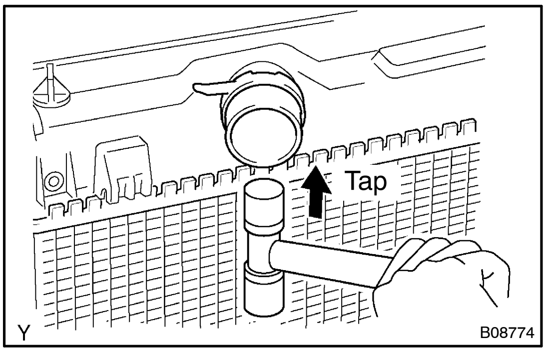
NOTICE:
If this adjustment is not done the claw may be damaged.



3. DENSO Made:
UNCAULK LOCK PLATES

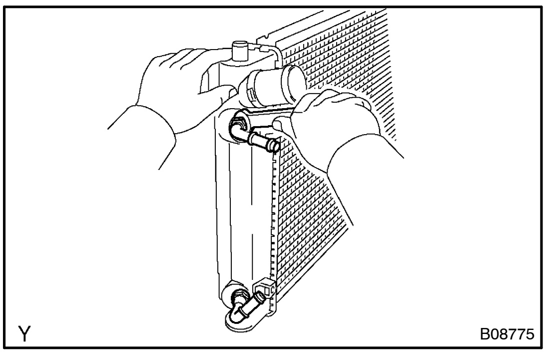
Using SST to release the caulking, squeeze the handle until stopped by the stopper bolts.

SST 09230–01010



4. DENSO Made:
REMOVE TANKS AND O–RINGS

Lightly tap the bracket of the radiator (or radiator inlet or outlet) with a soft–faced hammer, and remove the tank and the O–ring.

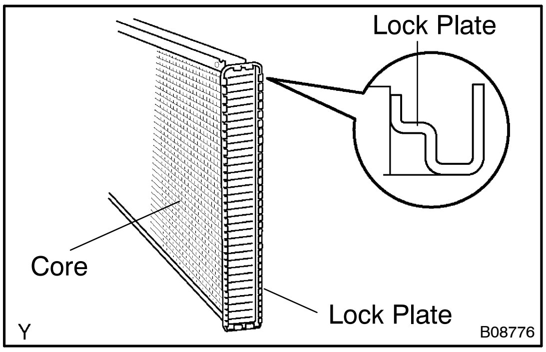


5. A/T (DENSO Made):
REMOVE OIL COOLER FROM LOWER TANK

(a) Loosen the nut, and remove the cooler pipe.

(b) Remove the 2 nuts and 2 plate washers.

(c) Remove the oil cooler and 2 O–rings.



CO04S–04

INSPECTION

DENSO Made:

INSPECT LOCK PLATE FOR DAMAGE

HINT:

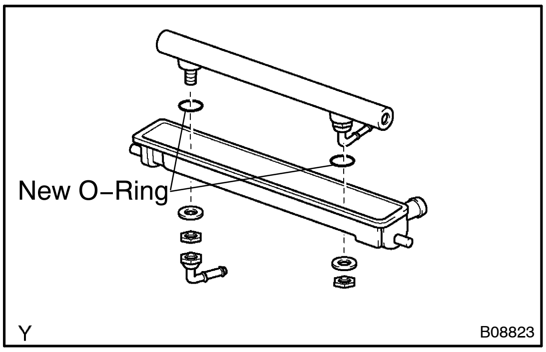
- If the sides of the lock plate groove are deformed, reassembly of the tank will be impossible.
- Therefore, first correct any deformation with pliers or similar object. Water leakage will result if the bottom of the lock plate groove is damaged.

NOTICE:

The radiator can only be recaulked 2 times. After the 2nd time, the radiator core must be replaced.

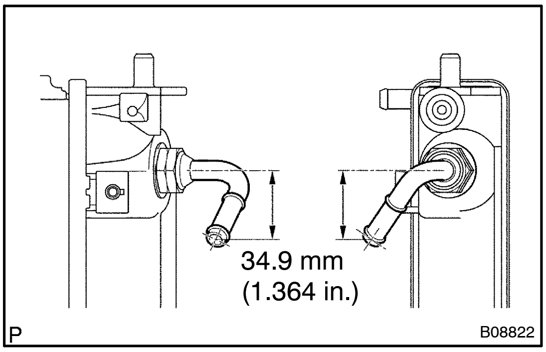
CO0X5–01

REASSEMBLY

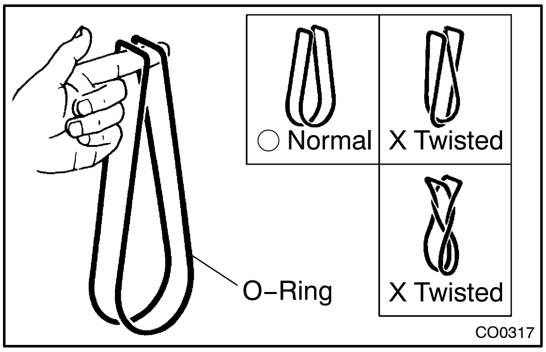


1. **A/T (DENSO Made):**
   INSTALL OIL COOLER TO LOWER TANK

(a) Clean the O–ring contact surface of the lower tank and oil cooler.
(b) Install 2 new O–rings to the oil cooler.
(c) Install the oil cooler to the lower tank.
(d) Install the 2 plate washers and 2 nuts.
Torque: 8.34 N·m (85 kgf·cm, 74 in.·lbf)



(e) Install the cooler pipe in the direction indicated as shown in the illustration.
Torque: 14.7 N·m (150 kgf·cm, 11 ft·lbf)

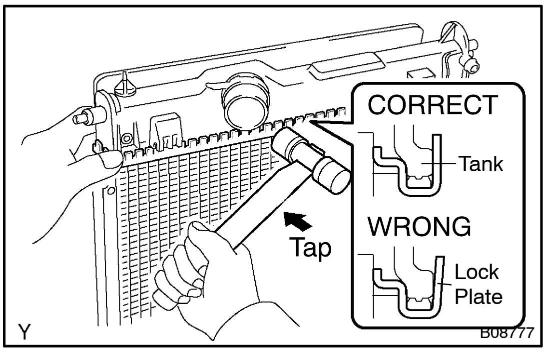


2. **DENSO Made:**
   INSTALL NEW O–RINGS AND TANKS

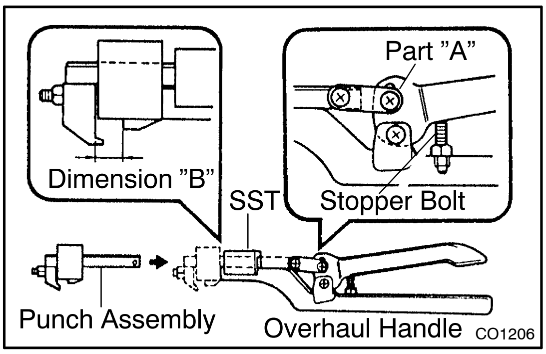
(a) After checking that there are no foreign objects in the lock plate groove, install the new O–ring without twisting it.

HINT:
When cleaning the lock plate groove, lightly rub it with sand paper without scratching it.

(b) Install the tank without damaging the O–ring.

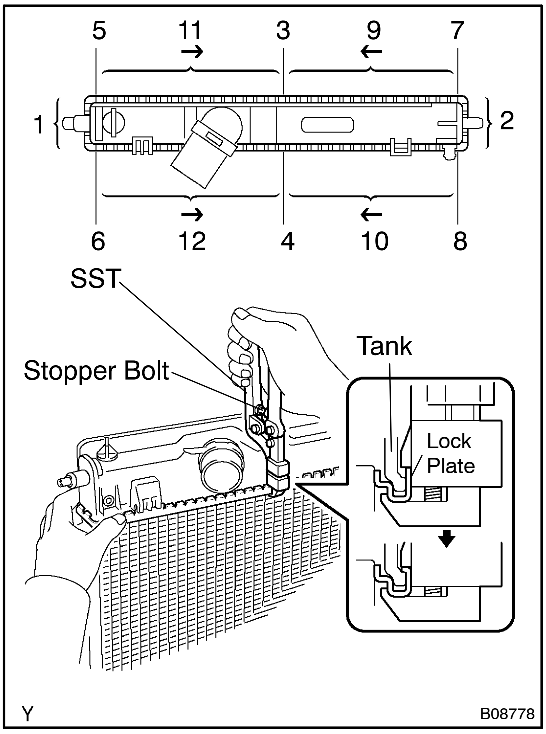


(c) Tap the lock prate with a soft–faced hammer so that there is no gap between it and the tank.



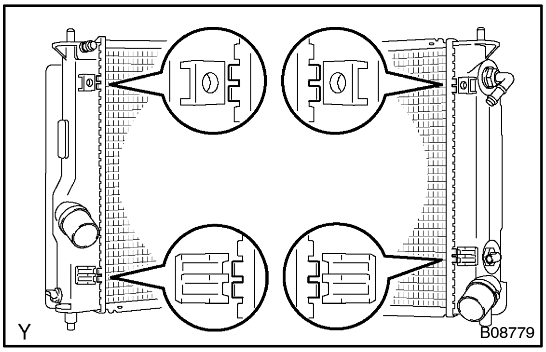
3. **DENSO Made:**
   ASSEMBLE SST
   SST 09230–01010, 09231–14010

(a) Install the punch assembly to the overhaul handle, inserting it in the hole in part ”A” as shown in the illustration.
(b) While gripping the handle, adjust the stopper bolt so that dimension ”B” is as shown in the illustration.
Dimension: 8.4 mm (0.331 in.)



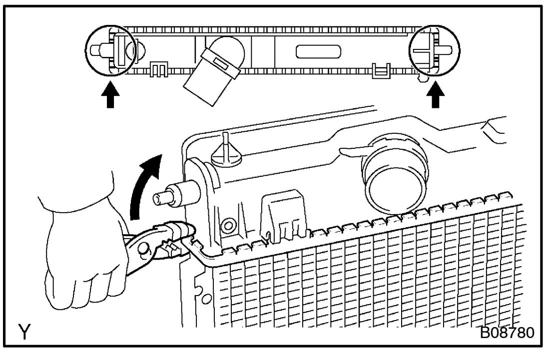
4. **DENSO Made:**
CAULK LOCK PLATE

(a) Lightly press SST against the lock plate in the order shown in the illustration. After repeating this a few times, fully caulk the lock plate by squeezing the handle until stopped by the stopped plate.
SST 09230–01010

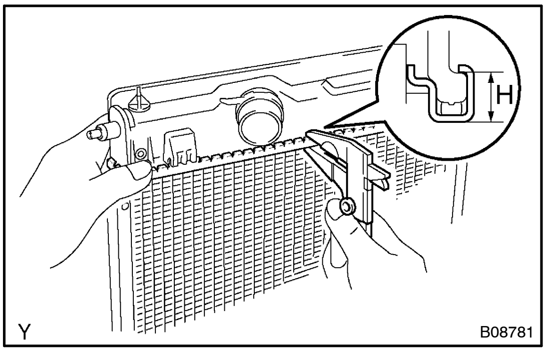


HINT:

- Do not stake the areas protruding around the pipes, brackets or tank rids.



- The points shown in the illustration and oil cooler near here (A/T) cannot be staked with SST. Use wrap vinyl tape around the tip of a pair or similar object and be careful not to damage the core plates.



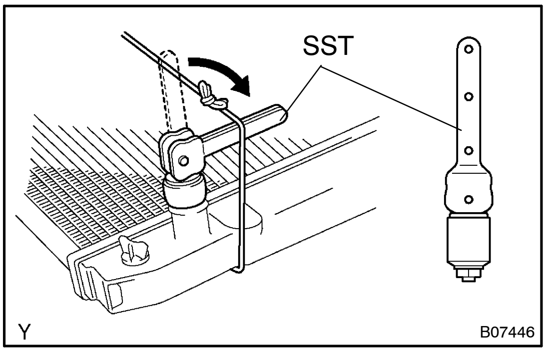
(b) Check the lock plate height (H) after completing the caulking.
Plate height: 7.40 – 7.80 mm (0.2913 – 0.3071 in.)

If not within the specified height, adjust the stopper bolt of the handle again and caulk again.

5. **INSTALL DRAIN PLUG**

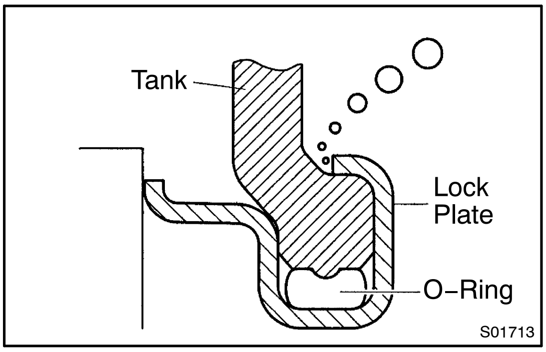
(a) Install a new O–ring to the drain plug.

(b) Install the drain plug.



6. INSPECT FOR WATER LEAKS

(a) Tighten the drain plug.
(b) Install the engine coolant reservoir.
(c) Plug the inlet and outlet pipes of the radiator with SST.
SST 09230–01010
(d) Using a radiator cap tester, apply pressure to the radiator.
Test pressure: 177 kPa (1.8 kgf/cm^2, 26 psi)
(e) Submerge the radiator in water.



(f) Inspect for leaks.

HINT:
On radiators with resin tanks, there is a clearance between the tank and lock plate where a minute amount of air will remain, giving the appearance of an air leak when the radiator is submerged in water. therefore, before doing the water leak test, first swish the radiator around in the water until all bubbles disappear.

CO0X3–02

INSTALLATION

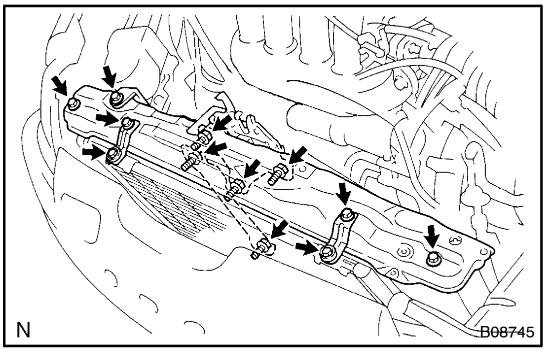
1. **INSTALL ELECTRIC COOLING FAN TO RADIATOR**

Install the cooling fan with the 2 bolts.

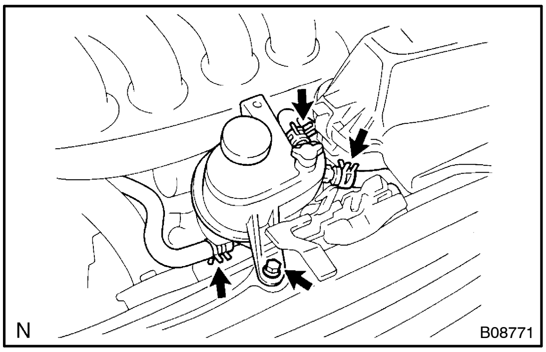
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)

2. **INSTALL RADIATOR ASSEMBLY**

(a) Install the 2 lower radiator support bushings.
(b) Install the radiator assembly.
(c) Install the 2 upper radiator support bushings.



(d) Install the radiator upper support with the 2 bolts.
(e) w/ Cruise control system:
Install the cruise control actuator with the 3 bolts.
(f) Install the 2 condenser upper supports with the 2 bolts and nuts.
(g) Install the center brace with the 2 bolts.
(h) Install the hood lock with the 3 bolts.
(i) Connect the 2 A/T oil cooler hoses.
(j) Connect the lower radiator hose.
(k) Connect the upper radiator hose.
(l) Connect the No. 1 electric cooling fan connector.
(m) Connect the No. 2 electric cooling fan connector.



3. **INSTALL ENGINE COOLANT RESERVOIR**

(a) Install the engine coolant reservoir with the bolt.
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)
(b) Connect the 3 radiator reservoir hoses.

4. **INSTALL AIR CLEANER**
5. **INSTALL BUMPER COVER**
(See Pub. No. RM734E BO section)
6. **FILL WITH ENGINE COOLANT**
7. **INSTALL UPPER FRONT FENDER APRON SEAL AND UPPER RADIATOR SUPPORT SEAL**
8. **START ENGINE AND CHECK FOR COOLANT LEAKS**

ELECTRIC COOLING FAN

CO0X0–02

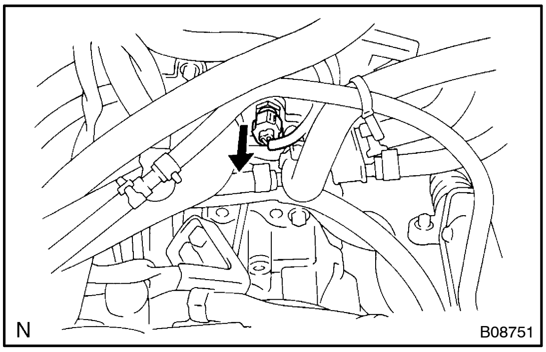
ON–VEHICLE INSPECTION

1. **CHECK COOLING FAN OPERATION WITH LOW TEMPERATURE (Below 83˚C (181˚F))**

(a) Turn the ignition switch ON.

(b) Check that the cooling fan stops.

If not, check the cooling fan relay and water temperature sensor, and check for a separated connector or severed wire between the cooling fan relay and water temperature sensor.



(c) Disconnect the water temperature sensor connector.

(d) Check that the cooling fan rotates.

If not, check the engine main relay, cooling fan relay, cooling fan, fuses, and check for short circuit between the cooling fan relay and water temperature sensor.

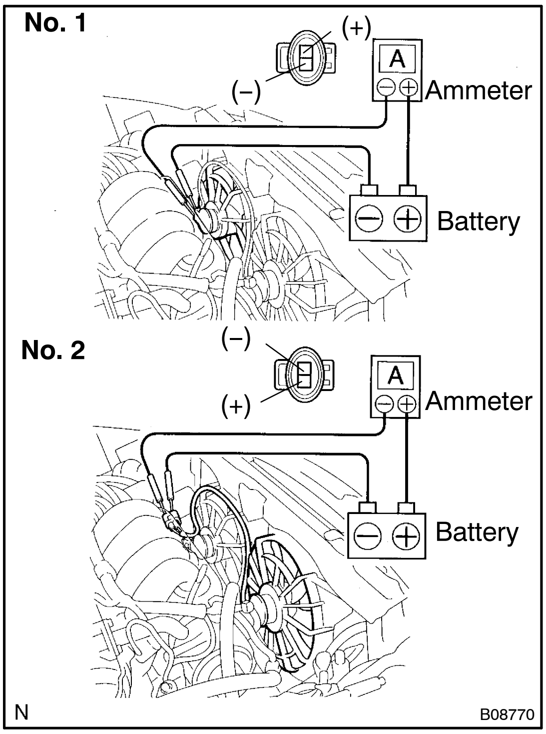
(e) Reconnect the water temperature sensor connector.

2. **CHECK COOLING FAN OPERATION WITH HIGH TEMPERATURE (Above 93˚C (199˚F))**

(a) Start the engine, and raise coolant temperature to above 93˚C (199˚F).

(b) Check that the cooling fan rotates.

If not, replace the water temperature sensor.



3. **INSPECT COOLING FANS**

(a) Disconnect the cooling fan connector.

(b) Connect battery and ammeter to the connector.

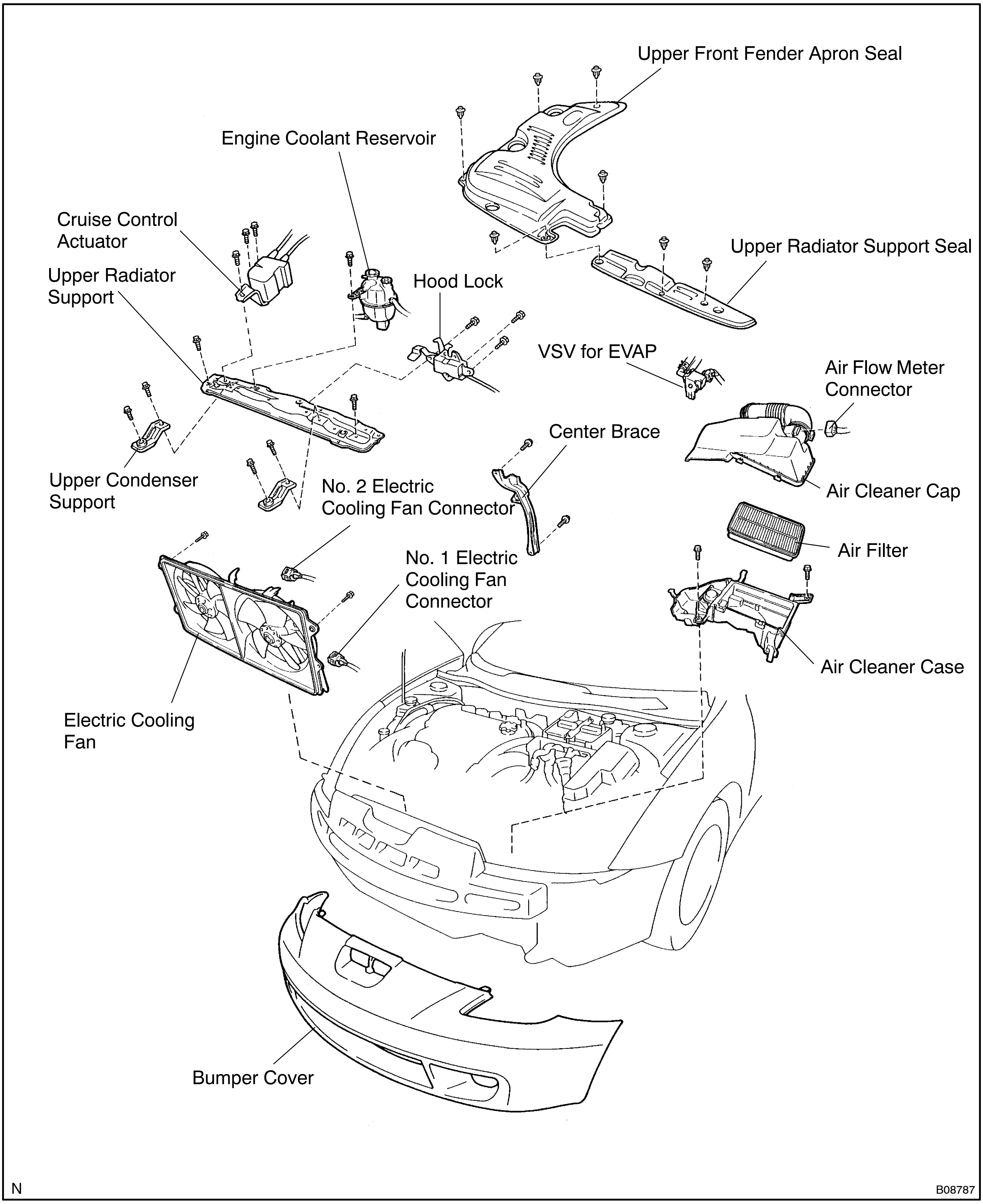
(c) Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

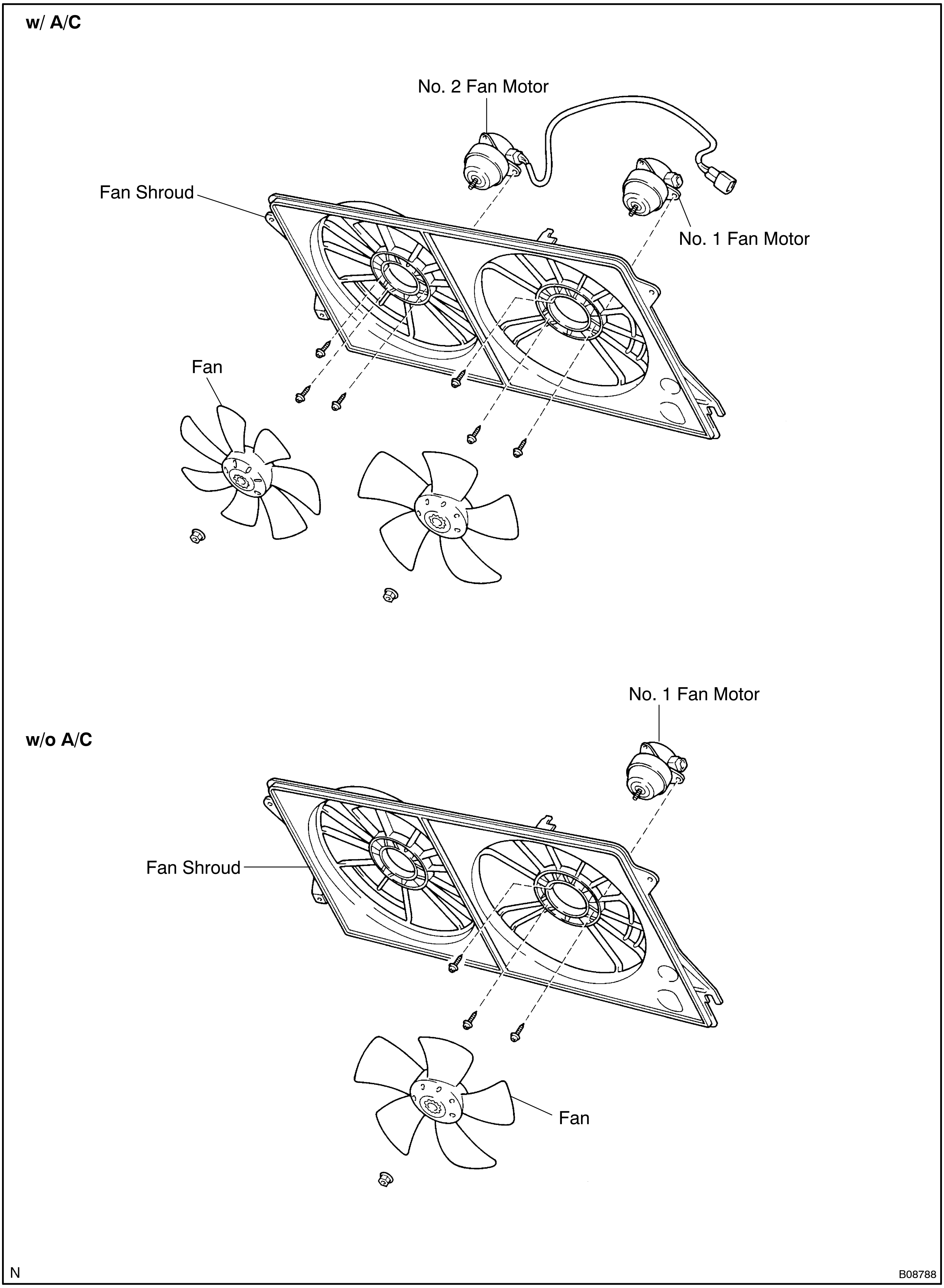
Standard amperage: 5.2 – 8.2 A

(d) Reconnect the cooling fan connector.

CO04W–04

COMPONENTS




w/ A/C
No. 2 Fan Motor
Fan Shroud
No. 1 Fan Motor
Fan
w/o A/C
No. 1 Fan Motor
Fan Shroud
Fan
N
B08788

CO04X–04

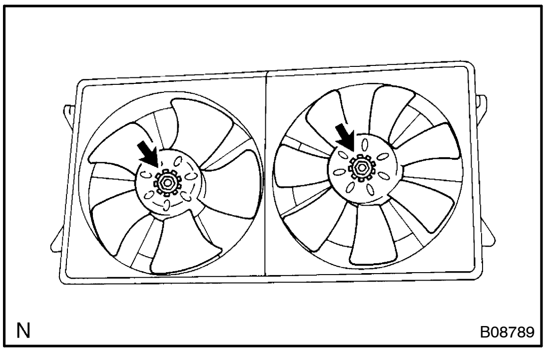
REMOVAL

1. **REMOVE UPPER FRONT FENDER APRON SEAL AND UPPER RADIATOR SUPPORT SEAL**
2. **DRAIN ENGINE COOLANT**
3. **REMOVE BUMPER COVER (See Pub. No. RM734E BO section)**
4. **REMOVE RADIATOR UPPER SUPPORT**

(a) Remove the air cleaner assembly.
(b) Remove the engine coolant reservoir.
(c) Remove the 3 bolts, and disconnect the hood lock.
(d) Remove the 2 bolts and center brace.
(e) Remove the 2 bolts, 2 nuts and 2 condenser upper supports.
(f) w/ Cruise control system:
Remove the bolt, and disconnect the cruise control actuator.
(g) Remove the 2 bolts and radiator upper support.

5. **REMOVE COOLING FAN**

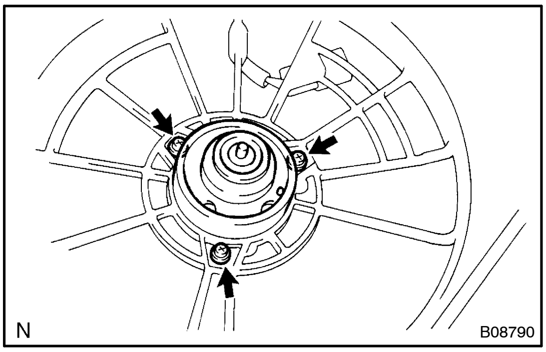
(a) Disconnect the 2 cooling fan connectors.
(b) Remove the 2 bolts and cooling fan.



CO04Y–03

DISASSEMBLY

1. **REMOVE FAN(S)**
   Remove the nut and fan.
2. **REMOVE FAN MOTOR(S)**
   (a) Disconnect the wire and connector holder from the fan shroud.
   (b) Remove the 3 screws and fan motor.



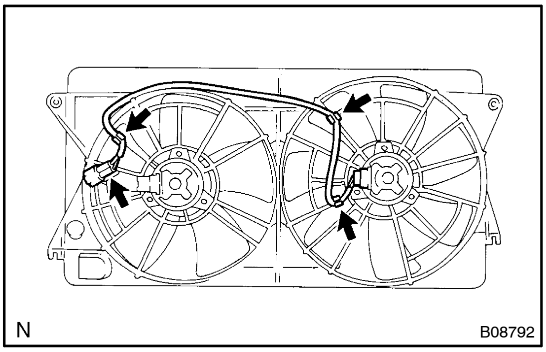
CO0X1–01

REASSEMBLY

1. INSTALL FAN MOTOR(S)

(a) Install the fan motor with the 3 screws.

Torque: 2.55 N·m (26 kgf·cm, 23 in.·lbf)



(b) Install the wire and connector holder to the fan shroud.

2. INSTALL FAN(S)

Install the fan with the nut.

Torque: 6.18 N·m (63 kgf·cm, 55 in.·lbf)

CO0X2–02

INSTALLATION

1. INSTALL COOLING FAN

(a) Install the cooling fan with the 2 bolts.
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)

(b) Connect the 2 cooling fan connectors.

2. INSTALL RADIATOR UPPER SUPPORT

(a) Install the radiator upper support with the 2 bolts.

(b) w/ Cruise control system:
Install the cruise control actuator with the 3 bolts.

(c) Install the 2 condenser upper supports with the 2 bolts and nuts.

(d) Install the center brace with the 2 bolts.

(e) Install the hood lock with the 3 bolts.

(f) Install the engine coolant reservoir.

(g) Install the air cleaner assembly.

3. INSTALL FRONT BUMPER (See Pub. No. RM734E BO section)

4. FILL WITH ENGINE COOLANT

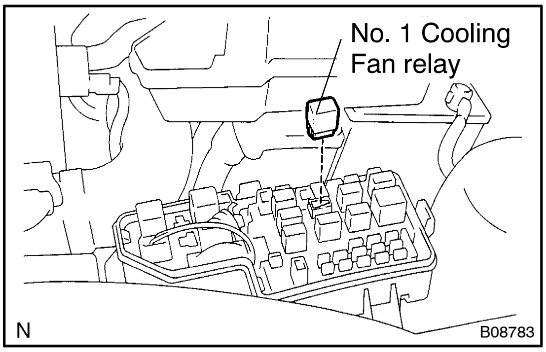
5. INSTALL COOLING FAN

6. START ENGINE AND CHECK FOR COOLANT LEAKS

COOLING FAN RELAY

CO054–03

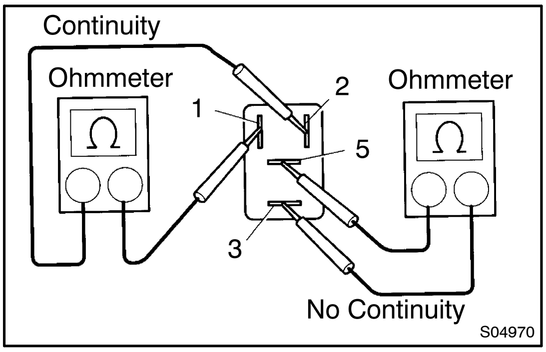
INSPECTION



1. INSPECT NO. 1 COOLING FAN RELAY

(a) Remove the relay box cover.

(b) Remove the No. 1 cooling fan relay. (Marking: FAN No. 1)



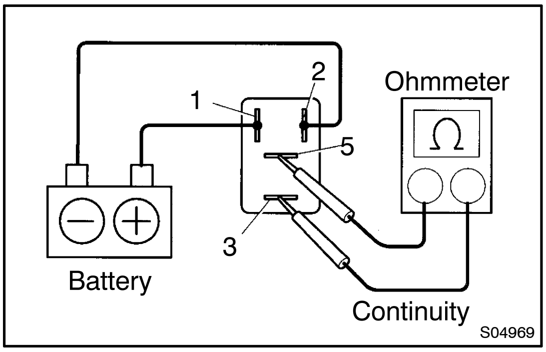
(c) Inspect the No. 1 cooling fan relay continuity.

(1) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

(2) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.



(d) Inspect the No. 1 cooling fan relay operation.

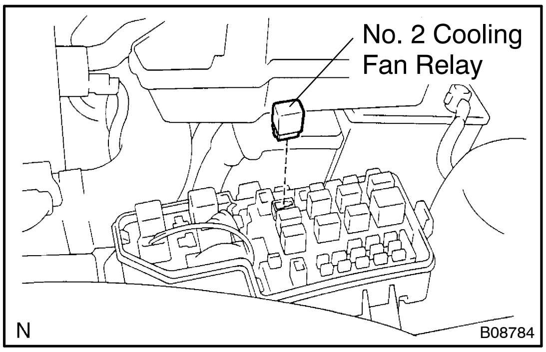
(1) Apply battery positive voltage across terminals 1 and 2.

(2) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If there is no continuity, replace the relay.

(e) Reinstall the No. 3 cooling fan relay.

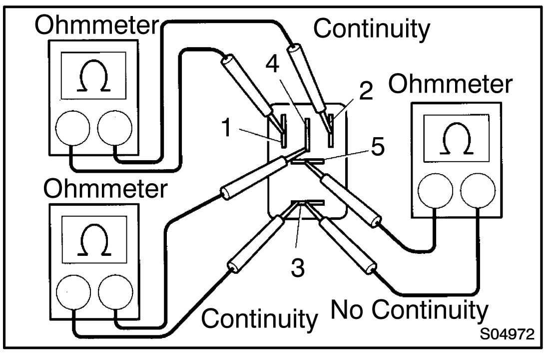
(f) Reinstall the relay box cover.



2. w/ A/C:
INSPECT NO. 2 COOLING FAN RELAY

(a) Remove the relay box cover.

(b) Remove the No. 2 cooling fan relay. (Marking: FAN No. 2)



(c) Inspect the No. 2 cooling fan relay continuity.

(1) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

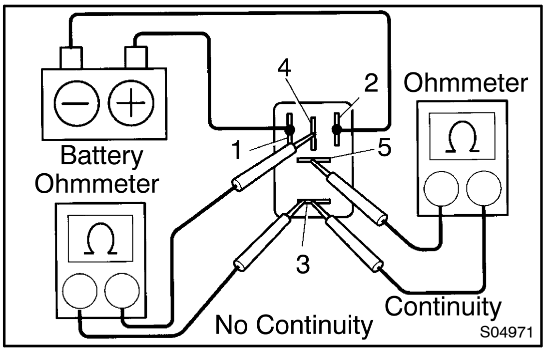
If there is no continuity, replace the relay.

(2) Check that there is continuity between terminals 3 and 4.

If there is no continuity, replace the relay.

(3) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.



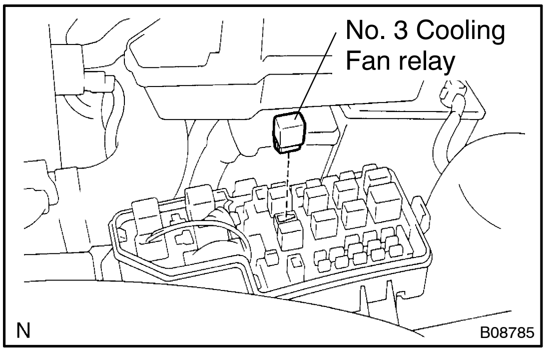
(d) Inspect the No. 2 cooling fan relay operation.
(1) Apply battery positive voltage across terminals 1 and 2.
(2) Using an ohmmeter, check that there is no continuity between terminals 3 and 4.

If there is continuity, replace the relay.
(3) Check that there is continuity between terminals 3 and 5.

If there is no continuity, replace the relay.

(e) Reinstall the No. 2 cooling fan relay.

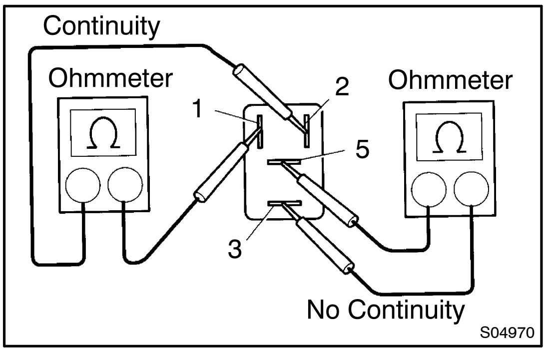
(f) Reinstall the relay box cover.



3. w/ A/C:
INSPECT NO. 3 COOLING FAN RELAY

(a) Remove the relay box cover.

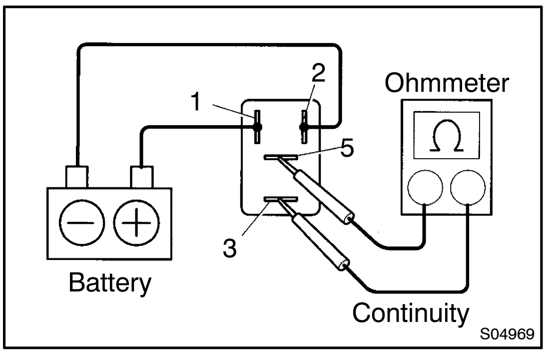
(b) Remove the No. 3 cooling fan relay. (Marking: FAN No. 3)



(c) Inspect the No. 3 cooling fan relay continuity.
(1) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.
(2) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.



(d) Inspect the No. 3 cooling fan relay operation.
(1) Apply battery positive voltage across terminals 1 and 2.
(2) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If there is no continuity, replace the relay.

(e) Reinstall the No. 3 cooling fan relay.

(f) Reinstall the relay box cover.

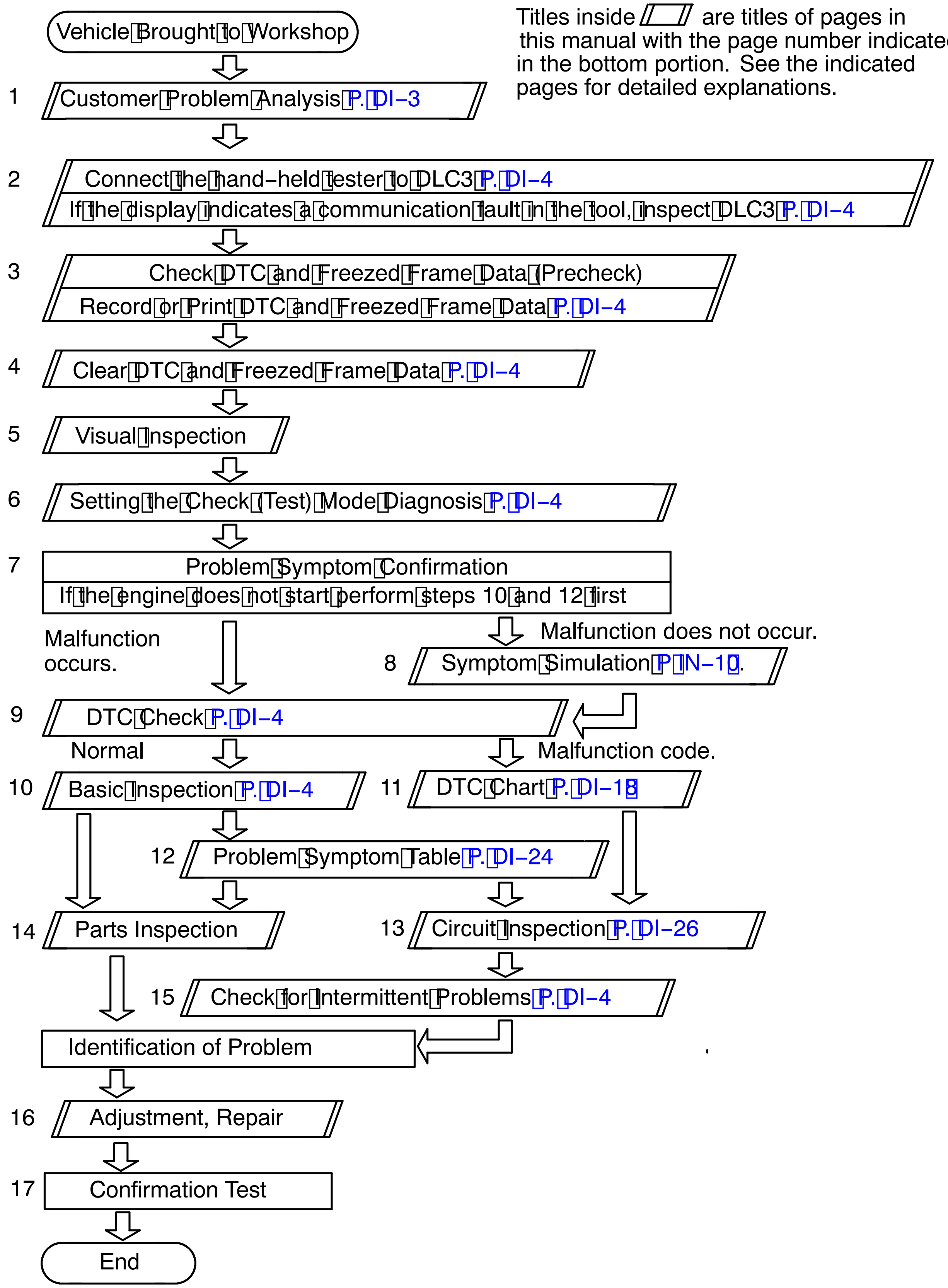
ENGINE

DI4DW-04

HOW TO PROCEED WITH TROUBLESHOOTING

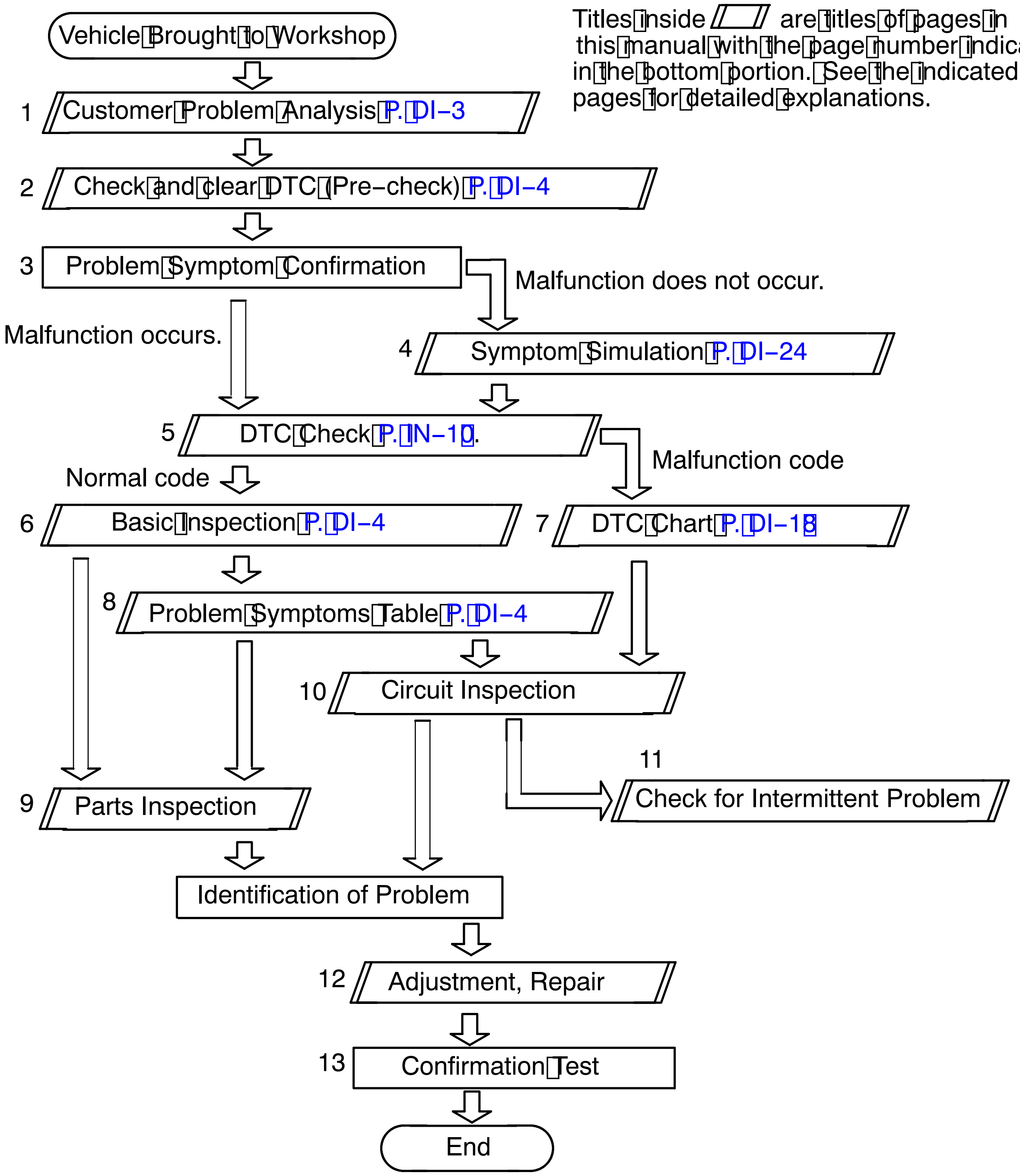
When using hand–held tester, troubleshooting in accordance with the procedure on the following page.

Titles inside ▱ are titles of pages in this manual with the page number indicated in the bottom portion. See the indicated pages for detailed explanations.



When not using hand–held tester, troubleshooting in accordance with the procedure on the following pages.

Titles inside ▱ are titles of pages in this manual with the page number indicated in the bottom portion. See the indicated pages for detailed explanations.



DI4DX–02

CUSTOMER PROBLEM ANALYSIS CHECK

ENGINE CONTROL SYSTEM Check Sheet

Inspector's Name ____________________

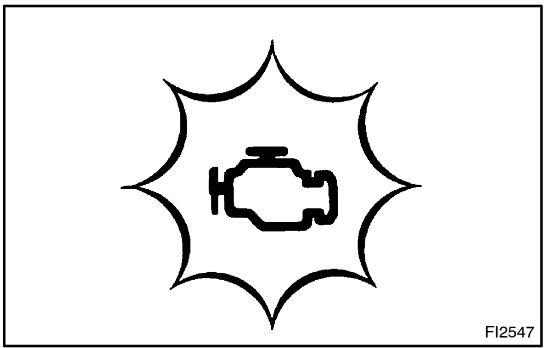
Customer's Name		Model and Model Year	
Driver's Name		Frame No.	
Data Vehicle Brought in		Engine Model	
License No.		Odometer Reading	km miles

Problem Symptoms	☐ Engine does not Start	☐ Engine does not crank ☐ No initial combustion ☐ No complete combustion
	☐ Difficult to Start	☐ Engine cranks slowly ☐ Other ____________________
	☐ Poor Idling	☐ Incorrect first idle ☐ Idling rpm is abnormal ☐ High (rpm) ☐ Low (rpm) ☐ Rough idling ☐ Other ____________________
	☐ Poor Drivability	☐ Hesitation ☐ Back fire ☐ Muffler explosion (after–fire) ☐ Surging ☐ Knocking ☐ Other ____________________
	☐ Engine Stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C operation ☐ Shifting from N to D ☐ Other ____________________
	☐ Others	

Datas Problem Occurred		
Problem Frequency		☐ Constant ☐ Sometimes (times per day/month) ☐ Once only ☐ Other ____________________
Condition When Problem Occurs	Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Other ____________
	Outdoor Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold (approx. ____ °F/____ °C)
	Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other ____________________
	Engine Temp.	☐ Cold ☐ Warming up ☐ After Warming up ☐ Any temp. ☐ Other ________
	Engine Operation	☐ Starting ☐ Just after starting (min.) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other ____________________

Condition of check engine warning light (CHK ENG)		☐ Remains on	☐ Sometimes light up ☐ Does not light up
DTC Inspection	Normal mode (Precheck)	☐ Normal	☐ Malfunction code(s) (code) ☐ Freezed frame data ( )
	Check Mode	☐ Normal	☐ Malfunction code(s) (code) ☐ Freezed frame data ( )

DI1I6–05

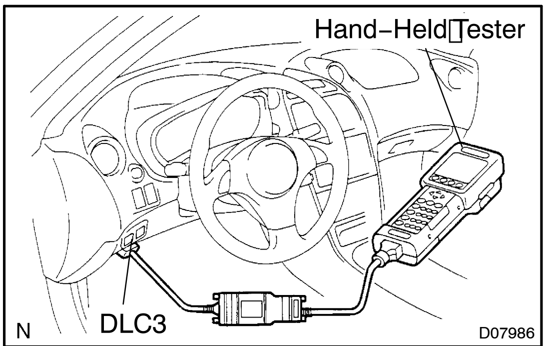

FI2547

PRE–CHECK

1. DIAGNOSIS SYSTEM

(a) Description for Euro–OBD (European spec.)

- When troubleshooting Euro–OBD vehicles, the only difference from the usual troubleshooting procedure is that you connect to the vehicle the OBD scan tool complying with ISO 15031–4 or hand–held tester, and read off various data output from the vehicle's engine ECU.
- Euro–OBD regulations require that the vehicle's on–board computer lights up the check engine warning light on the instrument panel when the computer detects a malfunction in the emission control system / components or in the power train control components which affect vehicle emissions, or a malfunction in the computer. In addition to the check engine warning light lighting up when a malfunction is detected, the applicable Diagnostic Trouble Codes (DTC) prescribed by ISO 15031–4 are recorded in the engine ECU memory (See page DI–18). If the malfunction does not reoccur in 3 consecutive trips, the check engine warning light goes off automatically but the DTCs remain recorded in the engine ECU memory.



D07986

- To check the DTCs, connect the OBD scan tool or hand–held tester to Data Link Connector 3 (DLC3) on the vehicle. The OBD scan tool or hand–held tester also enables you to erase the DTCs and check freezed frame data and various forms of engine data. (For operating instructions, see the OBD scan tool's instruction book.)
  DTCs include ISO controlled codes and manufacturer controlled codes. ISO controlled codes must be set as prescribed by the ISO, while manufacturer controlled codes can be set freely by the manufacturer within the prescribed limits. (See DTC chart on page DI–18)
- The diagnosis system operates in normal mode during normal vehicle use. It also has a check mode for technicians to simulate malfunction symptoms and troubleshoot. Most DTCs use 2 trip detection logic* to prevent erroneous detection, and ensure thorough malfunction detection. By switching the engine ECU to check mode when troubleshooting,

the technician can cause the check engine warning light to light up for a malfunction that is only detected once or momentarily. (hand–held tester only) (See step 2)

- *2 trip detection logic: When a malfunction is 1st detected, the malfunction is temporarily stored in the engine ECU memory. (1st trip) If the same malfunction is detected again during the second drive test, this 2nd detection causes the check engine warning light to light up. (2nd trip)
  (However, the IG switch must be turned OFF between the 1st trip and the 2nd trip.)
- Freeze frame data:
  Freeze frame data records the engine condition when a misfire (DTCs P0300/93 – P0304/93) or fuel trim malfunction (DTCs P0171/25) or other malfunction (first malfunction only), is detected.
  Because freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.
- Priorities for troubleshooting:
  If troubleshooting priorities for multiple DTCs are given in the applicable DTC chart, these should be followed.

If no instructions are given troubleshoot DTCs according to the following priorities.

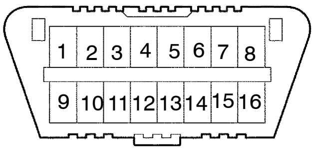
(1) DTCs other than fuel trim malfunction (DTCs P0171/25) and misfire (DTCs P0300/93 – P0304/93).
(2) Fuel trim malfunction (DTCs P0171/25).
(3) Misfire (DTCs P0300/93 – P0304/93).

(b) Description for M–OBD (Except European spec.)

- When troubleshooting Multiplex OBD (M–OBD) vehicles, the only difference from the usual troubleshooting procedure is that you connect the hand–held tester to the vehicle, and read off various data output from the vehicle's engine ECU.
- The vehicle's on–board computer lights up the check engine warning light (CHK ENG) on the instrument panel when the computer detects a malfunction in the computer itself or in drive system components. In addition to the check engine warning light lighting up when a malfunction is detected, the applicable Diagnosis Trouble Code (DTC) are recorded in the engine ECU memory.

(See page DI–18)
If the malfunction has been repaired, the check engine warning light goes off automatically but the DTCs remain recorded in the engine ECU memory.

- To check the DTCs, connect the hand–held tester to Data Link Connector 3 (DLC3) on the vehicle. or read the number of blinks of the check engine warning light when TC and CG terminals on the DLC3 are connected. The hand–held tester also enables you to erase the DTCs and activate the several actuators and check freezed frame data and various forms of engine data (For operating instructions, see the hand–held tester instruction book.)
- The diagnosis system operates in normal mode during normal vehicle use. It also has a check (test) mode for technician to simulate malfunction symptoms and troubleshoot. Most DTCs use 2 trip detection logic to prevent erroneous detection and ensure thorough malfunction detection. By switching the engine ECU to check (test) mode using hand–held tester when troubleshooting, the technician can cause the check engine warning (CHK ENG) to light up for a malfunction that is only detected once or momentarily. (Hand–held tester only)
(See step 3.)
- * 2 trip detection logic
When a logic malfunction is fist detected, the malfunction is temporally stored in the engine ECU memory. If the same malfunction is detected again during the second drive test, this second detection cases the check engine warning (CHK ENG) to light up.
The 2 trip repeats the same mode for 2 times. (However, the IG switch must be turned OFF between the 1st trip and 2nd trip)
- Freeze frame data:
Freeze frame data records the engine condition when malfunction is detected.
Because freeze frame data records the engine conditions (fuel system, calculator load, water temperature, fuel trim, engine speed, vehicle speed, etc.) when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.



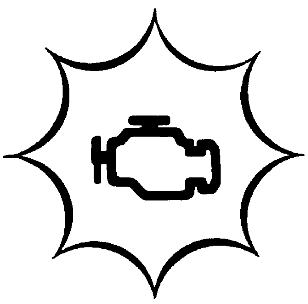
A04550

(c) Check the DLC3.
The vehicle's engine ECU uses the ISO 9141–2(Euro–OBD) / ISO 14230(M–OBD) communication protocol. The terminal arrangement of DLC3 complies with ISO 15031–03 and matches the ISO 9141–2 / ISO 14230 format.

Terminal No.	Connection / Voltage or Resistance	Condition
7	Bus ⊕ Line / Pulse generation	During transmission
4	Chassis Ground / ↔ Body Ground 1 Ω or less	Always
16	Battery Positive / ↔ Body Ground 9 – 14 V	Always

HINT:
If your display shows "UNABLE TO CONNECT TO VEHICLE" when you have connected the cable of the OBD scan tool or hand–held tester to DLC3, turned the ignition switch ON and operated the hand–held tester, there is a problem on the vehicle side or tool side.

- If communication is normal when the tool is connected to another vehicle, inspect DLC3 on the original vehicle.
- If communication is still not possible is when the tool is connected to another vehicle, the problem is probably in the tool itself, so consult the Service Debarment listed in the tool,s instruction manual.


FI2547

2. INSPECT DIAGNOSIS (Normal Mode)

(a) Check the check engine warning light.

(1) The check engine warning (CHK ENG) comes on when the ignition switch is turned ON and the engine is not running.

HINT:
If the check engine warning (CHK ENG) does not light up, troubleshoot the combination meter.

(2) When the engine is started, the check engine warning light should go off. If the lamp remains on, the diagnosis system has detected a malfunction or abnormality in the system

(b) Check the DTC, using hand–held tester.

NOTICE:

(Hand–held tester only): When the diagnosis system is switched from normal mode to check (test) mode, it erases all DTCs and freezed frame data recorded in normal mode. So before switching modes, always check the DTCs and freezed frame data, and note them down.

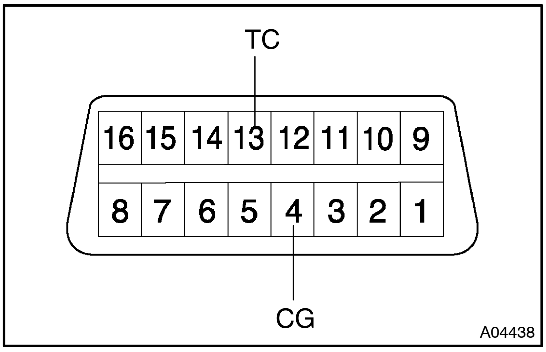
(1) Prepare the hand–held tester.

(2) Connect the hand–held tester to DLC3.

(3) Turn the ignition switch ON and switch the hand–held tester main switch ON.

(4) Use the hand–held tester to check the DTCs and freezed frame data; note them down. (For operating instructions, see the hand–held tester,s instruction book.)

(5) See page DI–18 to confirm the details of the DTCs.

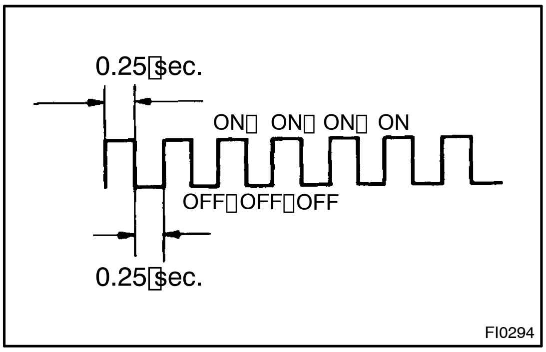


(c) If you have no hand–held tester, perform the following step (1) to (6).

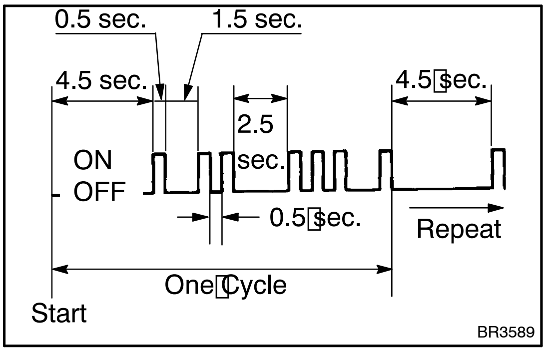
(1) Turn the ignition switch ON.

(2) Using SST, connect between terminals 13 (TC) and 4 (CG) of DLC3.

SST 09843 – 18040



(3) Read the DTC from the check engine warning light (CHK ENG).



(4) As an example, the blinking patterns for codes, normal, 12 and 31 are as shown on the illustration.

(5) Check the details of the malfunction using the DTC chart on page DI–18.

(6) After completing the check, disconnect terminals 13 (TC) and 4 (CG) and turn off the display.

HINT:

In the event of 2 or more malfunction cords, indication will begin from the smaller numbered cord and continue in order to the larger.

NOTICE:

- **When simulating symptoms without a hand–held tester to check the DTCs, use normal mode. For codes on the DTCs, chart subject to "2 trip detection logic", turn the ignition switch OFF after the symptom is simulated the first time. Then repeat the simulation process again. When the problem has been simulated twice, the check engine warning light lights up and the DTCs, are recorded in the engine ECU**
- **Check the 1st trip DTC using Mode7 for ISO 15031 (Continuous Test Results of Euro–OBD function in hand–held tester).**

3. INSPECT DIAGNOSIS (Check (Test) Mode)

HINT:

Hand–held tester only:

Compared to the normal mode, the check mode has an increased sensitivity to detect malfunctions.

Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the check (test) mode.

(a) Check the DTC.

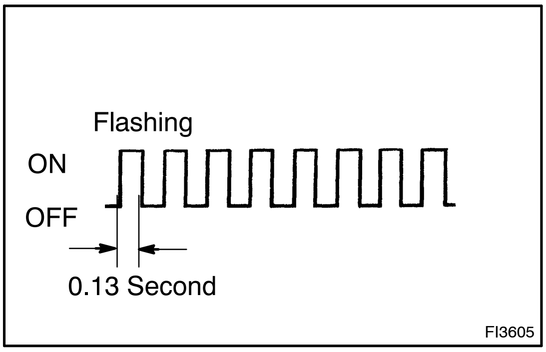
(1) Initial conditions
- Battery positive voltage 11V or more.
- Throttle valve fully closed.
- Transmission in "P" or "N" position.
- Air conditioning switched OFF.

(2) Turn ignition switch OFF.

(3) Prepare the hand–held tester.

(4) Connect the hand–held tester to DLC3 on the at the lower left of the instrument panel.

(5) Turn the ignition switch ON and switch the push the hand–held tester ON.



(6) Switch the hand–held tester normal mode to check (test) mode. (Check that the check engine warning light (CHK ENG) flashes.)

(7) Start the engine. (The check engine warning (CHK ENG) light goes out after the engine start.)

(8) Simulate the conditions of the malfunction described by the customer.

NOTICE:

Leave the ignition switch ON until you have checked the DTC, etc.

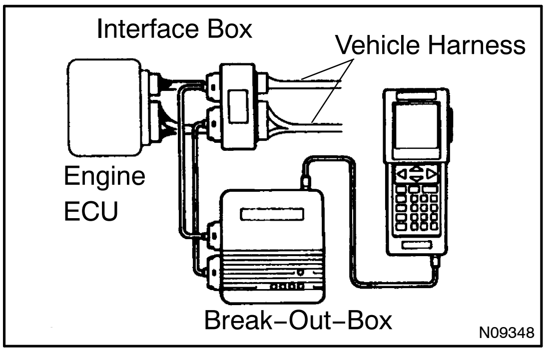
(9) After simulating the malfunction conditions, use the hand–held tester diagnosis selector to check the DTCs and freezed frame data, etc.

HINT:
Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from check (test) mode to normal mode. so all DTCs, etc. are erased.

(10) After checking the DTCs, inspect the applicable circuit.

(b) Clear the DTC.
The following actions will erase the DTCs and freezed frame data.
- Operating the hand–held tester to erase the codes. (See the hand–held tester's instruction book for operating instructions.)
- Disconnecting the battery terminals or EFI fuse.

NOTICE:
If the hand–held tester switches the engine ECU from normal mode to check mode or vice–versa, or if the ignition switch is turned from ON to ACC or OFF during check mode, the DTCs and freezed frame data will be erased.



(c) Using break–out–box and hand–held tester
(1) Hook up the break–out–box and hand–held tester to the vehicle.
(2) Read the engine ECU input/output values following the prompts on the tester screen.

HINT:
Hand–held tester has a "Snapshot" function. This records the measured values and is effective in the diagnosis of intermittent problems.
Please refer to the hand–held tester/break–out–box operator,s manual for further details.

4. FAIL–SAFE CHART

If any of the following codes is recorded, the engine ECU enters fail–safe mode.

DTC No.	Fail–Safe Operation	Fail–Safe Deactivation Conditions
P0110/24	Intake air temp. is fixed at 20°C (68°F)	Returned to normal condition
P0115/22	Water temp. is fixed at 80°(176°F)	Returned to normal condition
P0120/41	VTA is fixed at 0°	The following condition must be repeated at least 2 times consecutively When closed throttle position switch is ON: 0.1 V ≦ VTA and 0.95 V
P0325/52	Max. timing retardation	IG switch OFF
P0500/42	High RPM for cut is prohibited ISC control prohibited	Returned to normal condition
P1300/14 P1305/15 P1310/14 P1315/15	Fuel cut	Feturned to normal condition

5. CHECK FOR INTERMITTENT PROBLEMS

HAND–HELD TESTER only:

By putting the vehicle's engine ECU in check (test) mode, 1 trip detection logic is possible instead of 2 trip detection logic and sensitivity to detect open circuits is increased. This makes it easier to detect intermittent problems.

(1) Clear the DTC (See step 3.).
(2) Set the check (test) mode (See step 3.).
(3) Perform a simulation test (See page IN–10).
(4) Check the connector and terminal (See page IN–20).
(5) Check the visual check and contact pressure (See page IN–20).
(6) Handle the connector (See page IN–20).

6. BASIC INSPECTION

When the malfunction code is not confirmed in the DTC check, troubleshooting should be carried out in the order for all possible circuits to be considered as the causes of the problems. In many cases, by carrying out the basic engine check shown in the following flow chart, the location causing the problem can be found quickly and efficiently. Therefore, use of this check is essential in engine troubleshooting.

1	**Is battery positive voltage 11V or more when engine is stopped ?**

NO → **Charge or replace battery.**

YES

2	Is engine cranked ?

NO → Proceed to problem table on page DI–24.

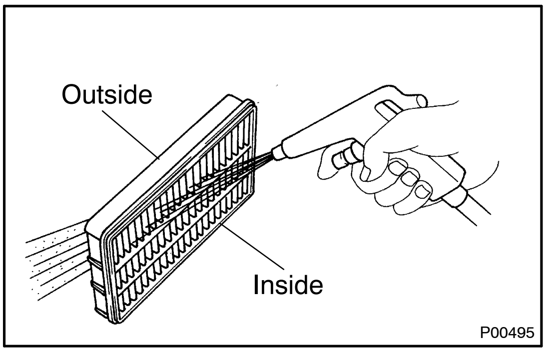
YES

3	Does engine start ?

NO → Go to step 7.

YES

4	Check air filter.

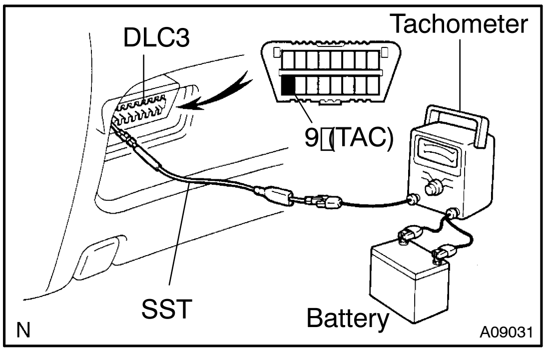


PREPARATION:
Remove the air filter.
CHECK:
Visually check that the air filter is not excessively dirty or oily.
HINT:
If necessary, clean the filter with compressed air. First blow from inside thoroughly, then blow from outside of filter.

NG → Repair or replace.

OK

5	**Check engine idle speed.**



PREPARATION:

(a) Warm up engine to normal operating temperature.
(b) Switch off all accessories.
(c) Switch off air conditioning.
(d) Shift transmission into the ”N” position.
(e) Connect the hand–held tester to DLC3 on the vehicle.
(f) If you have no hand–held tester, connect tachometer test prove to terminal 9 (TAC) of DLC3.
SST 09843–18030

NOTICE:
As some tachometer are not compatible with this ignition system, we recommend that you confirm the compatibility of your until before use.

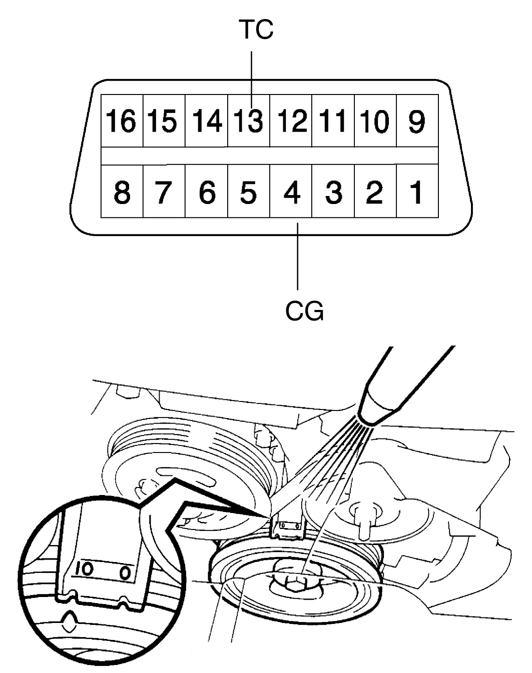
CHECK:
Check the idle speed.

OK:
Idle speed:
1ZZ–FE: 650 – 750 rpm
2ZZ–GE (M/T): 750 – 850 rpm
2ZZ–GE (A/T): 700 – 800 rpm

NG	**Proceed to problem symptoms table on page DI–24.**

OK

6	**Check ignition timing.**



PREPARATION:

(a) Warm up engine to normal operating temperature.
(b) Switch off all accessories.
(c) Switch off air conditioning
(d) Shift transmission into the "N" or "P" position.
(e) Using SST, connect terminals 13 (TC) and 4 (CG) of DLC3.
SST 09843–18040
(f) Connect the timing light.

CHECK:

Check ignition timing.

OK:

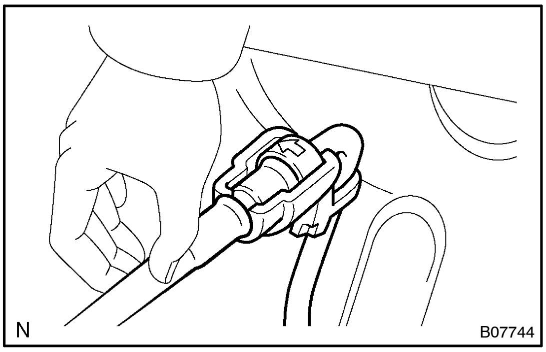
Ignition timing:
1ZZ–FE: 10 – 18° BTDC at idle
2ZZ–GE: 8 – 12° BTDC at idle

NG → **Proceed to page IG–1 and continue to troubleshoot.**

OK

Proceed to problem symptoms table on page DI–24.

7	Check fuel pressure.



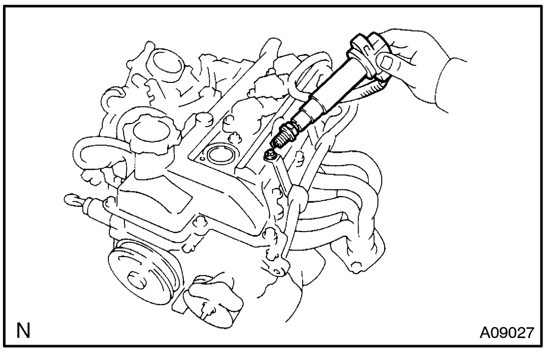
PREPARATION:
(a) Be sure that enough fuel is in the tank.
(b) Turn the ignition switch ON.
(c) Connect the hand–held tester to the DLC3.
(d) Use ACTIVE TEST mode to operate the fuel pump.
(e) If you have no hand–held tester, connect the positive (+) and negative (–) leads from the battery to the fuel pump connector (See page FI–6).

CHECK:
Check that the pulsation damper screw rises up when the fuel pump operates.

NG	**Proceed to page FI–6, and continue to troubleshoot.**

OK

8	Check for spark.



PREPARATION:
(a) Remove ignition coil.
(b) Remove the spark plug.
(c) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(d) Hold the end about 12.5 mm (0.5 in.) from the ground.
(e) Disconnect the injector connector.

CHECK:
Check if spark occurs while engine is being cranked.

NOTICE:
To prevent excess fuel being injected from the injectors during this test, don't crank the engine for more than 5 ~ 10 seconds at a time.

NG	**Proceed to page IG–1 and continue to troubleshoot.**

OK

Proceed to problem symptoms table on page DI–24.

7. ENGINE OPERATING CONDITION

NOTICE:

The values given below for "Normal Condition" are representative values, so a vehicle may still be normal even if its value from those listed here. So do not decide whether a part is faulty or not solely according to the "Normal Condition" here.

Hand–held tester display	Measurement Item	Normal Condition*1
FUEL SYS #1	Fuel System Bank 1 OPEN: Air–fuel ratio feedback stopped CLOSED: Air–fuel ratio feedback operating	Idling after warming up: CLOSED
CALC LOAD	Calculator Load: Current intake air volume as a proportion of max. intake air volume	Idling: 1ZZ–FE: 11.3 – 16.0 % 2ZZ–GE: 9.1 – 20.0 % Racing without load (2,500rpm): 1ZZ–FE: 12.3 – 17.9 % 2ZZ–GE: 11.0 – 23.0 %
COOLANT TEMP/WATER TEMP.	Water Temp. Sensor Value	After warming up: 80 – 95°C (176 – 203°F)
SHORT FT #1	Short–term Fuel Trim Bank 1	0 ± 20%
LONG FT #1	Long–term Fuel Trim Bank 1	0 ± 20%
MAF/AFM	Air Flow Rate Through Mass Air Flow Meter	Idling: 1ZZ–FE: 1.4 – 2.0 gm/sec. 2ZZ–GE: 1.5 – 5.0 gm/sec. Racing without load (2,500 rpm): 1ZZ–FE: 5.4 – 7.9 gm/sec. 2ZZ–GE: 5.0 – 15.0 gm/sec.
ENGINE SPD	Engine Speed	Idling: 1ZZ–FE: 650 – 750 rpm 2ZZ–GE (MT): 750 – 850 rpm 2ZZ–GE (AT): 700 – 800 rpm
VEHICLE SPD	Vehicle Speed	Vehicle Stopped: 0 km/h (0 mph)
IGN ADVANCE	Ignition Advance: Ignition Timing of Cylinder No. 1	Idling: BTDC 10 – 18°
INTAKE AIR	Intake Air Temp. Sensor Value	Equivalent to Ambient Temp.
THROTTLE POS	Voltage Output of Throttle Position Sensor Calculated as a percentage: 0 V → 0%, 5 V → 100%	Throttle Fully Closed: 6 – 16 % Throttle Fully Open: 64 – 98 %
INJECTOR	Fuel injection time for cylinder No.1	Idling: 1ZZ–FE: 1.1 – 2.1 ms 2ZZ–GE: 0.8 – 2.0 ms
O2S B1, S1	Voltage Output of Oxygen Sensor Bank 1, Sensor 1	Idling: 0.05 – 0.95 V
O2FT B1, S1	Oxygen Sensor Fuel Trim Bank 1, Sensor 1 (Same as SHORT FT #1)	0 ± 20 %
O2S B1, S2*3	Voltage Output of Oxygen Sensor Bank 1 Sensor 2	Driving 50 km/h (31 mph): 0.05 – 0.95 V
MIL ON RUN DIST	Distance since activation of check engine warning light	When there is no DTC: 0 km (0 mile)
ISC DUTY RATIO	Intake Air Control Valve Duty Ratio Opening ratio rotary solenoid type IAC valve	Idling: 1ZZ–FE: 25 – 35 % 2ZZ–GE: 22 – 35 %
STARTER SIG	Starter Signal	Cranking: ON
CTP SW	Closed Throttle Position Switch Signal	Throttle Fully Closed: ON
A/C SIG	A/C Switch Signal	A/C ON: ON

STOP LIGHT SW	Stop Light Switch Signal	Stop light switch ON: ON
FC IDL	Fuel Cut Idle: Fuel cut when throttle valve fully closed, during deceleration	Fuel cut operating: ON
PNP SW/NSW *2	Neutral start switch signal	P or N position: ON
FC TAU	Fuel Cut TAU: Fuel cut during very light load	Fuel cut operating: ON
CYL#1, CYL#2, CYL#3, CYL#4	Abnormal revolution variation for each cylinder	0 %
A/C CUT SIG	A/C Cut Signal	A/C S/W OFF: ON
FUEL PUMP	Fuel Pump Signal	Idling: ON
EVAP (PURGE) VSV	EVAP VSV Signal	VSV operation: Above 30 %
TOTAL FT B1*3	Total Fuel Trim Bank 1: Average value for fuel trim system of bank 1	Idling: 0.8 – 1.2 V

*1: If no conditions are specifically stated for "Idling", it means the shift lever is at N or P position, the A/C switch is OFF and all accessory switches are OFF.
*2: A/T only
*3: European spec. only.

DI12C–11

DIAGNOSTIC TROUBLE CODE CHART

SAE CONTROLLED

HINT:

Parameters listed in the chart may not be exactly the same as your reading due to the type of instrument or other factors.

If a malfunction code is displayed during the DTC check in check mode, check the circuit for that code listed in the table below. For details of each code, turn to the page referred to under the "See page " for the respective "DTC No." in the DTC chart.

DTC No. (See Page)	Detection Item	Trouble Area	CHK ENG*1	Memory
P0100/31 (DI–26)	Mass Air Flow Circuit Malfunction	• Open or short in air flow meter circuit • Air flow meter • Engine ECU	○	○
P0101/31*2 (DI–32)	Mass Air Flow Circuit Range/Performance Problem	• Air flow meter	○	○
P0110/24 (DI–33)	Intake Air Temp. Circuit Malfunction	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor (built into air flow meter) • Engine ECU	○	○
P0115/22 (DI–39)	Engine Coolant Temp. Circuit Malfunction	• Open or short in water temp. sensor circuit • Water temp. sensor • Engine ECU	○	○
P0120/41 (DI–46)	Throttle/Pedal Position Sensor/ Switch "A" Circuit Malfunction	• Open or short in throttle position sensor circuit • Throttle position sensor • Engine ECU	○	○
P0121/41*2 (DI–52)	Throttle/Pedal Position Sensor/ Switch "A" Circuit Range/Performance Problem	• Throttle position sensor	○	○
P0125/91*2 (DI–53)	Insufficient Coolant Temp. for Closed Loop Fuel Control	• Air induction system • Fuel pressure • Injector injection • Gas leakage on exhaust system • Open or short in heated oxygen sensor (bank 1 sensor 1) circuit • Oxygen sensor (bank 1 sensor 1)	○	○
P0130/21 (DI–53)	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)	• Air induction system • Fuel pressure • Injector injection • Open or short in heated oxygen sensor circuit • Heated oxygen sensor	○	○
P0133/21*2 (DI–60)	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)	• Air induction system • Fuel pressure • Injector injection • Open or short in heated oxygen sensor circuit • Heated oxygen sensor • Engine ECU	○	○
P0135/21 (DI–63)	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	• Open or short in heater circuit of oxygen sensor • Oxygen sensor heater • Engine ECU	○	○
P0136/27*2 (DI–65)	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	• Open or short in heater circuit of oxygen sensor • Oxygen sensor	○*2	○
P0141/21*2 (DI–63)	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	• Same as DTC No. P0135	○	○

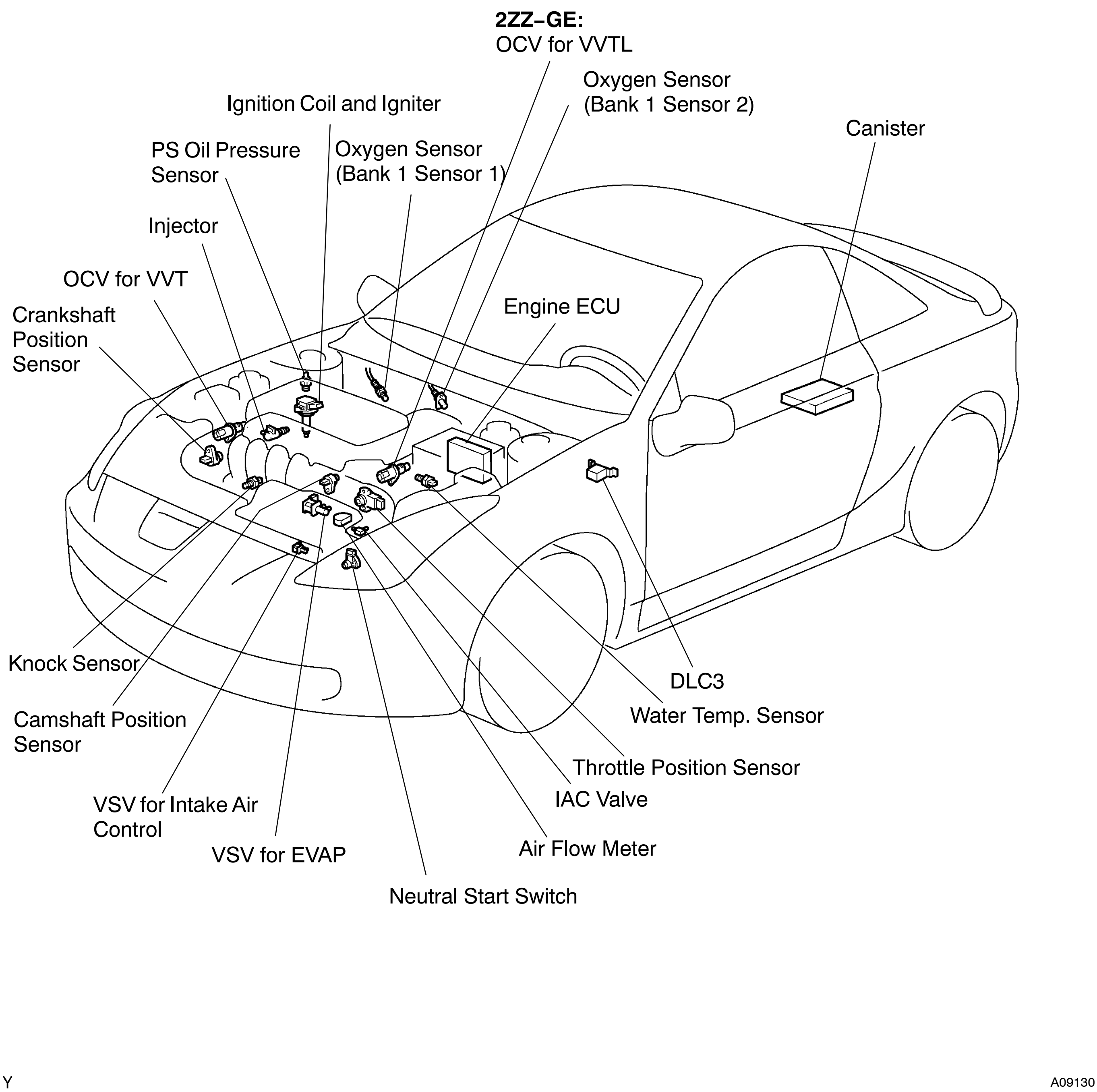
P0171/25 (DI–67)	Fuel Trim System too Lean (Air–Fuel Ratio Lean Malfunction, Bank 1)	• Air intake (hose loose) • Fuel line pressure • Injector blockage • Oxygen sensor malfunction • Air flow meter • Water temp. sensor	○*2	○
P0172/26 (DI–67)	System too Rich (Fuel Trim)	• Injector leak, blockage • Air flow meter • Engine coolant temp. sensor • Ignition system • Fuel pressure • Gas leakage on exhaust system • Open or short in heated oxygen sensor (bank 1 sensor 1) circuit • Heated oxygen sensor (bank 1 sensor 1)	○	○
P0300/93*2 (DI–73)	Random/Multiple Cylinder Misfire Detected	• Ignition system • Injector • Fuel pressure • Compression pressure • Valve clearance • Valve timing • Air flow meter • Water temp. sensor • Open or short in engine wire • Connector connection • Engine ECU	○	○
P0301/93*2 P0302/93*2 P0303/93*2 P0304/93*2 (DI–73)	Misfire Detected – Cylinder 1 – Cylinder 2 – Cylinder 3 – Cylinder 4			
P0325/52 (DI–79)	Knock Sensor 1 Circuit Malfunction	• Open or short in knock sensor 1 circuit • Knock sensor 1 (looseness) • Engine ECU	○	○
P0335/12,13 (DI–82)	Crankshaft Position Sensor ”A” Circuit Malfunction	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Signal plate • Engine ECU	○	○
P0340/12 (DI–84)	Camshaft Position Sensor Circuit Malfunction	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Engine ECU	○	○
P0420/94 (DI–86)	Catalyst System Efficiency Below Threshold (Bank 1)	• Gas leakage on exhaust system • Open or short in heated oxygen sensor circuit • Heated oxygen sensor • Three–way catalytic converter	○	○
P0500/42 (DI–89)	Vehicle Speed Sensor Malfunction	• Combination meter • Open or short in No.1 vehicle speed sensor circuit • Engine ECU • No.1 vehicle speed sensor	○	○
P0505/33 (DI–92)	Idle Control System Malfunction	• ISC valve is stuck or closed • Open or short in ISC valve circuit • Open or short A/C switch circuit • Air induction system • Engine ECU	○	○
P1300/14 (DI–97)	Igniter Circuit Malfunction (No.1)	• Open or short in IGF or IGT1 circuit from ignition coil with igniter to Engine ECU • No.1 ignition coil with igniter • Engine ECU	○	○

P1305/15 (DI–97)	Igniter Circuit Malfunction (No.2)	• Open or short in IGF or IGT2 circuit from No.2 ignition coil with igniter to engine ECU • No.2 ignition coil with igniter • Engine ECU	○	○
P1310/14 (DI–97)	Igniter Circuit Malfunction (No.3)	• Open or short in IGF or IGT3 circuit from No.3 ignition coil with igniter to Engine ECU • No.3 ignition coil with igniter • Engine ECU	○	○
P1315/15 (DI–97)	Igniter Circuit Malfunction (No.4)	• Open or short in IGF or IGT4 circuit from No.4 ignition coil with igniter to engine ECU • No.4 ignition coil with igniter • Engine ECU	○	○
P1335/13 (DI–104)	VVT Sensor Circuit Malfunction	• Open or short in VVT sensor circuit • VVT sensor • Engine ECU	○	○
P1346/18 (DI–105)	VVT Sensor Circuit Range/Performance Problem	• Mechanical system (Jumping teeth of timing belt, belt stretched) • Engine ECU	○	○
P1349/59*2 (DI–107)	VVT System Malfunction	• Valve timing • OCV • VVT controller assembly • Engine ECU	○	○
P1520/95*2 (DI–114)	Stop Light Switch Signal Malfunction	• Short in stop light switch signal circuit • Stop light switch • ECM	○	○
P1600/96*2 (DI–117)	Engine ECU BATT Malfunction	• Open in back up power source circuit • Engine ECU	○	○
P1645/82 (DI–119)	Body ECU Malfunction	• Body ECU • A/C ECU • Communication bus	○	○
P1656/39 (DI–120)	OCV Circuit Malfunction	• Open or short in OCV circuit (bank 1) • OCV • Engine ECU	○	○
P1690/39*3 (DI–123)	OCV Circuit Malfunction (for VVL)	• Open or short in OCV circuit • OCV for VVL • ECM	○	○
P1692/39*3 (DI–127)	OCV Open Malfunction (for VVL)	• Open or short in OCV circuit • OCV for VVL • ECM	○	○
P1693/39*3 (DI–127)	OCV Close Malfunction (for VVL)	• Open or short in OCV circuit • OCV for VVL • ECM	○	○

*1: – Check engine warning light does not light up.
○ Check engine warning light lights up.
*2: European spec. only
*3: 2ZZ–GE only

DI68L–02

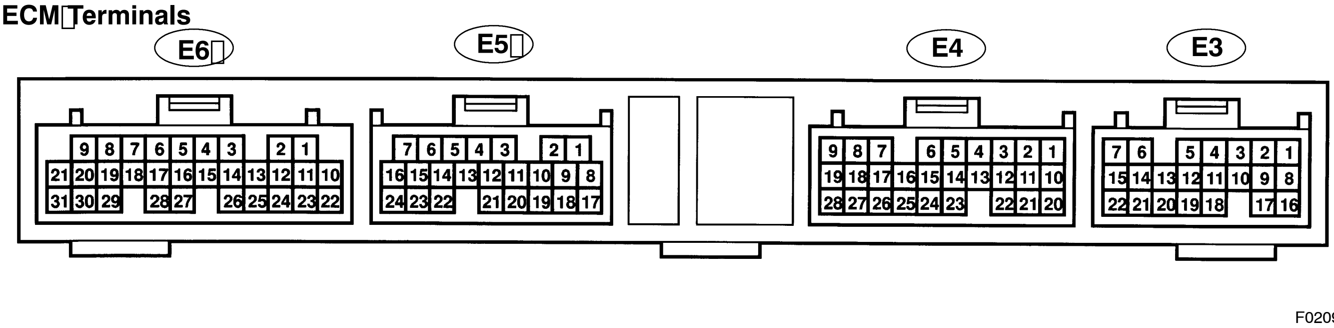
PARTS LOCATION



DI68M–02

TERMINALS OF ECU

ECM Terminals



Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
BATT (E3 – 1) – E1 (E5 – 17)	W ↔ BR	Always	9 – 14
FC (E3 – 3) – E1 (E5 – 17)	G–R ↔ BR	IG switch ON	9 – 14
		Idling	0 – 0.3
PTNK (E3 – 4) – E1 (E5 – 17)	L–B ↔ BR	IG switch ON, fuel cap taken off	2.9 – 3.7
IGSW (E3 – 8) – E1 (E5 – 17)	B–O ↔ BR	IG switch ON	9 – 14
W (E3 – 15) – E1 (E5 – 17)	R–B ↔ BR	Idling	9 – 14
		IG switch ON	Below 3.0
+B (E3 – 16) – E1 (E5 – 17)	B–R ↔ BR	IG switch ON	9 – 14
STP (E4 – 6) – E1 (E5 – 17)	G–W ↔ BR	IG switch ON, brake pedal depressed	7.5 – 14
		IG switch ON, brake pedal depressed	Below 1.5
F/PS (E4 – 8) – E1 (E5 – 17)	P ↔ BR	IG switch ON	Below 1.5
VSV (E4 – 9) – E1 (E5 – 17)	R–L ↔ BR	IG switch ON	9 – 14
STA (E4 – 11) – E1 (E5 – 17)	L ↔ BR	Cranking	6.0 or more
HT1B (E4 – 16) – E03 (E3 – 7)	Y–G ↔ W–B	Idling	Below 3.0
		IG switch ON	9 – 14
MREL (E4 – 21) – E1 (E5 – 17)	L–B ↔ BR	IG switch ON	9 – 14
SPD (E4 – 22) – E1 (E5 – 17)	W–R ↔ BR	IG switch ON, rotate driving wheel slowly	Pulse generation
OX1B (E4 – 25) – E2 (E5 – 18)	W ↔ BR	Maintain engine speed at 2,500 rpm for 2 min. after warning up	Pulse generation (See page DI–53)
TACH (E4 – 27) – E1 (E5 – 17)	BR–W ↔ BR	Idling	Pulse generation
VC (E5 – 2) – E2 (E5 – 18)	R ↔ BR	IG switch ON	9 – 14
HT1A (E5 – 3) – E03 (E3 – 7)	Y–R ↔ BR	Idling	Below 3.0
		IG switch ON	9 – 14
EVP1 (E5 – 4) – E01 (E6 – 21)	G–O ↔ W–B	IG switch ON	9 – 14
OVL+ (E5 – 7) – OVL– (E5 – 6)	L–W ↔ L–B	Engine speed at 6,000 rpm or more	9 – 14
VG (E5 – 11) – EVG (E5 – 1)	G–W ↔ Y–G	Idling, A/C switch OFF	1.1 – 1.5
OX1A (E5 – 12) – E2 (E5 – 18)	B ↔ BR	Maintain engine speed at 2,500 rpm for 2 min. after warning up	Pulse generation (See page DI–53)
THW (E5 – 14) – E2 (E5 – 18)	G ↔ BR	Idling, Engine coolant temp. at 80 °C (176 °F)	0.2 – 1.0
NE+ (E5 – 16) – NE– (E5 – 24)	O ↔ W	Idling	Pulse generation (See page DI–82)
OSW (E5 – 21) – E1 (E5 – 17)	GR ↔ BR	Idling	9 – 14
THA (E5 – 22) – E2 (E5 – 18)	L–R ↔ BR	Idling, intake air temp. 20 °C (68 °F)	0.5 – 3.4

Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
VTA (E5 – 23) – E2 (E5 – 18)	B–W ↔ BR	IG switch ON, throttle valve fully closed	0.3 – 1.0
		IG switch ON, throttle valve fully open	3.2 – 4.9
#10 (E6 – 1) – E01 (E6 – 21)	R ↔ W–B	IG switch ON	9 – 14
		Idling	Pulse generation (See page DI–73)
#20 (E6 – 2) – E01 (E6 – 21)	R–L ↔ W–B	IG switch ON	9 – 14
		Idling	Pulse generation (See page DI–73)
#30 (E6 – 3) – E01 (E6 – 21)	R–W ↔ W–B	IG switch ON	9 – 14
		Idling	Pulse generation (See page DI–73)
#40 (E6 – 4) – E01 (E6 – 21)	R–B ↔ W–B	IG switch ON	9 – 14
		Idling	Pulse generation (See page DI–73)
IGT1 (E6 – 10) – E1 (E5 – 17)	R–B ↔ BR	Idling	Pulse generation (See page DI–97)
IGT2 (E6 – 11) – E1 (E5 – 17)	R–W ↔ BR	Idling	Pulse generation (See pageDI–97)
IGT3 (E6 – 12) – E1 (E5 – 17)	G–R ↔ BR	Idling	Pulse generation (See pageDI–97)
IGT4 (E6 – 13) – E1 (E5 – 17)	R–Y ↔ BR	Idling	Pulse generation (See pageDI–97)
CCV (E6 – 17) – E1 (E5 – 17)	V–W ↔ BR	IG switch ON	9 – 14
RSO (E6 – 18) – E01 (E6 – 21)	B–W ↔ W–B	IG switch ON, disconnect E4 of E4 connector	9 – 14
MOPS (E6 – 22) – E1 (E6 – 17)	Y–B ↔ BR	Idling	9 – 14
OCV+ (E6 – 24) – OCV– (E6 – 23)	G–O ↔ W	IG switch ON	Pulse generation (See page DI–107)
IGF (E6 – 25) – E1 (E5 – 17)	B–Y ↔ BR	IG switch ON	4.5 – 5.5
		Idling	Pulse generation (See page DI–97)
KNK1 (E6 – 27) – E1 (E5 – 17)	W ↔ BR	Idling	Pulse generation (See page DI–79)
PS (E6 – 28) – E1 (E5 – 17)	P ↔ BR	IG switch ON	9 – 14

*1: Only for A/T models.
*2: Only for 2ZZ–GE models.

DI1IA–10

PROBLEM SYMPTOMS TABLE

When the malfunction code is not confirmed in the diagnostic trouble code check and the problem still can not be confirmed in the basic inspection, proceed to this problem symptoms tables and troubleshoot according to the numbered order given below.

Symptom	Suspect Area	See page
Engine does not crank (Does not start)	1. Starter and starter relay	ST–5 ST–15
	2. Neutral start switch circuit*	DI–138
No initial combustion (Does not start)	1. ECU power source circuit	DI–129
	2. Ignition coil (w/ Igniter) circuit	DI–97
	3. Fuel pump control circuit	DI–133
	4. Injector circuit	DI–73
No complete combustion (Does not start)	1. Fuel pump control circuit	DI–133
	2. Ignition coil (w/ Igniter) circuit	DI–97
	3. Injector circuit	DI–73
Engine cranks normally (Difficult to start)	1. Starter signal circuit	–
	2. ISC valve circuit	DI–92
	3. Fuel pump control circuit	DI–133
	4. Ignition coil (w/ Igniter)	DI–97
	5. Spark plug	IG–1
	6. Compression	EM–3
	7. Injector circuit	DI–73
Cold engine (Difficult to start)	1. Starter signal circuit	–
	2. ISC valve circuit	DI–92
	3. Fuel pump control circuit	DI–133
	4. Injector circuit	DI–73
	5. Ignition coil (w/ Igniter)	DI–97
	6. Spark plug	IG–1
Hot engine (Difficult to start)	1. Starter signal circuit	–
	2. ISC valve circuit	DI–92
	3. Fuel pump control circuit	DI–133
	4. Injector circuit	DI–73
	5. Ignition coil (w/ Igniter)	DI–97
	6. Spark plug	IG–1
Incorrect first idle (Poor idling)	1. ISC valve circuit	DI–92
High engine idle speed (Poor idling)	1. ISC valve circuit	DI–92
	2. ECU power source circuit	DI–129
	3. Neutral start switch circuit*	DI–138
	4. Back up power source circuit	DI–117
Low engine idle speed (Poor idling)	1. ISC valve circuit	DI–92
	2. Neutral start switch circuit*	DI–138
	3. Fuel pump control circuit	DI–133
	4. Injector circuit	DI–73
	5. Back up power source circuit	DI–117
Rough idling (Poor idling)	1. ISC valve circuit	DI–92
	2. Injector circuit	DI–73
	3. Ignition coil (w/Igniter) circuit	DI–97
	4. Compression	EM–3
	5. Fuel pump control circuit	DI–133
	6. Back up power source circuit	DI–117
Hunting (Poor idling)	1. ISC valve circuit	DI–92
	2. ECU power source circuit	DI–129
	3. Fuel pump control circuit	DI–133

Hesitation/Poor acceleration (Poor drivability)	1. Injector circuit 2. Fuel pump control circuit 3. Ignition coil (w/ Igniter) circuit 4. A/T faulty*	DI–73 DI–133 DI–97 –
Muffler explosion, after fire (Poor drivability)	1. Ignition coil (w/ Igniter) 2. Spark plug 3. Injector circuit	DI–97 IG–1 DI–73
Surging (Poor drivability)	1. Fuel pump control circuit 2. Spark plug 3. Injector circuit	DI–133 IG–1 DI–73
Engine stall (Soon after starting)	1. Fuel pump control circuit 2. ISC valve circuit	DI–133 DI–92
Engine stall (After accelerator pedal released)	1. Injector circuit 2. ISC valve circuit 3. Engine ECU	DI–73 DI–92 IN–20
Engine stall (When shifting N to D)	1. Neutral start switch circuit* 2. ISC valve circuit	DI–138 DI–92

*: A/T only

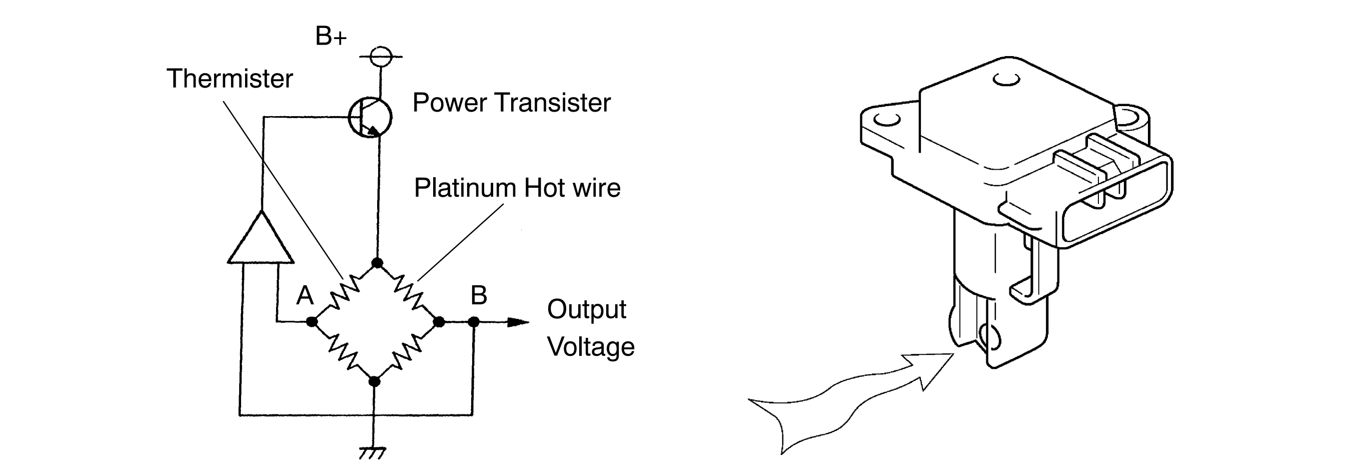
DI3OW–04

CIRCUIT INSPECTION

DTC	P0100/31	Mass Air Flow Circuit Malfunction

CIRCUIT DESCRIPTION

The air flow meter uses a platinum hot wire. The hot wire air flow meter consists of a platinum hot wire, thermistor and a control circuit installed in a plastic housing. The hot wire air flow meter works on the principle that the hot wire and thermistor located in the intake air bypass of the housing detect any changes in the intake air temperature.
The hot wire is maintained at the set temperature by controlling the current flow through the hot wire. This current flow is then measured as the output voltage of the air flow meter.
The circuit is constructed so that the platinum hot wire and thermistor provide a bridge circuit, with the power transistor controlled so that the potential of A and B remains equal to maintain the set temperature.



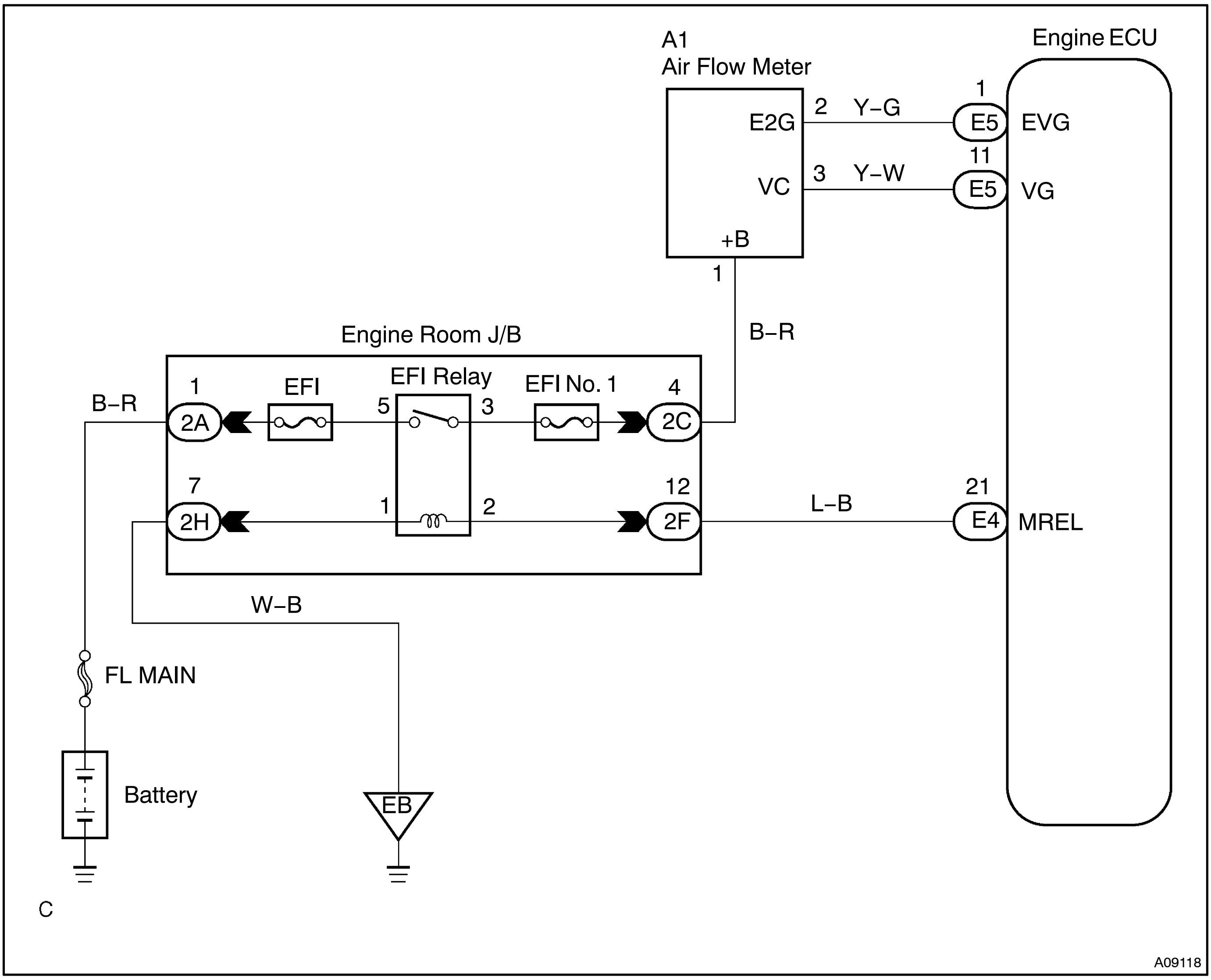
FI6929
S05741
A06106

DTC No.	DTC Detecting Condition	Trouble Area
P0100/31	Open or short in air flow meter circuit with more than 3 sec. engine speed less than 4,000 rpm	• Open or short in air flow meter circuit • Air flow meter • Engine ECU

HINT:
After confirming DTC P0100/31 use the hand–held tester to confirm the air flow ratio from CURRENT DATA.

Air Flow Value (gm/sec.)	Malfunction
Approx. 0.0	• Air flow meter power source circuit open • VG circuit open or short
271.0 or more	• EVG circuit open

WIRING DIAGRAM



INSPECTION PROCEDURE

When using hand–held tester

HINT:

Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	**Connect hand–held tester, and read value of air flow rate.**

PREPARATION:

(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester main switch ON.
(c) Start the engine.

CHECK:

Read air flow rate on the hand–held tester.

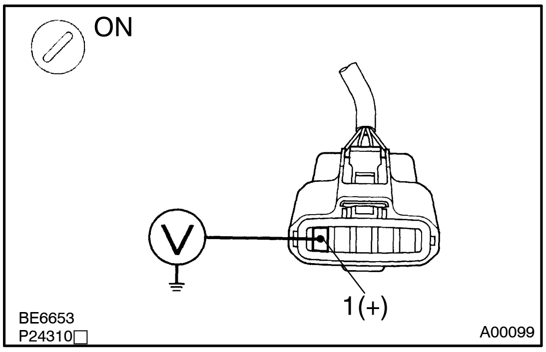
RESULT:

	Type I	Type II
Air flow rata (gm/sec.)	0.0	271.0 or more

Type I → **Go to step 2.**

Type II → **Go to step 5.**

2	**Check voltage of air flow meter power source.**



PREPARATION:

(a) Disconnect the air flow meter connector.

(b) Turn the ignition switch ON.

CHECK:

Measure voltage between terminal 4 of the air flow meter connector and body ground.

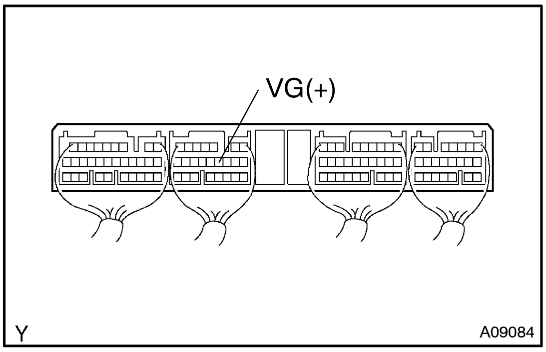
OK:

Voltage: 9 – 14 V

NG → **Check for open in harness and connector between EFI main relay (Marking: EFI) and air flow meter (See page IN–20).**

OK

3	**Check voltage between terminals VG of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the engine ECU cover.

(b) Start the engine.

CHECK:

Measure voltage between terminal VG of the engine ECU connector and body ground while engine is idling.

OK:

Voltage:
0.5 – 3.0 V (P or N position and A/C switch OFF)

OK → **Check and replace engine ECU (See page IN–20).**

NG

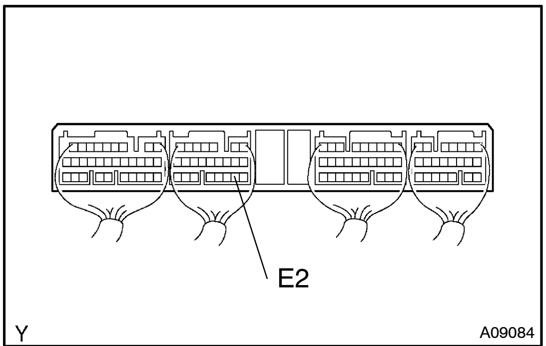
4	**Check for open and short in harness and connector between air flow meter and engine ECU (See page IN–20).**

NG → **Repair or replace harness or connector.**

OK

Replace air flow meter.

5	**Check continuity between terminal EVG of engine ECU connector and body ground.**



PREPARATION:

Remove the engine ECU cover.

CHECK:

Check continuity between terminal EVG of the engine ECU connector and body ground.

OK:

Continuity (1 Ω or less)

NG → **Check and replace engine ECU (See page IN–20).**

OK

6	**Check for open in harness and connector between air flow meter and engine ECU (See page IN–20).**

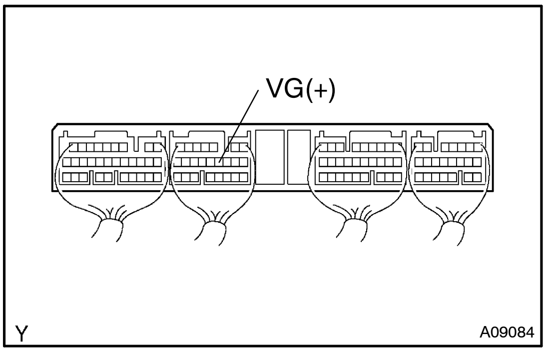
NG → **Repair or replace harness or connector.**

OK

Replace air flow meter.

When not using hand–held tester

1	Check voltage between terminals VG of engine ECU connector and body ground.

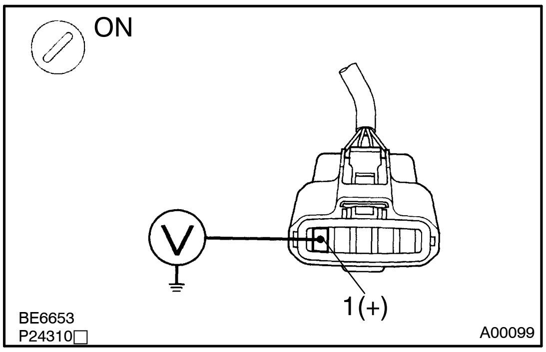


PREPARATION:
(a) Remove the engine ECU cover.
(b) Start the engine.
CHECK:
Measure voltage between terminal VG of the engine ECU connector and body ground while engine is idling.
OK:
Voltage:
0.5 – 3.0 V (P or N position and A/C switch OFF)

OK → **Check and replace engine ECU (See page IN–20).**

NG

2	Check voltage of air flow meter power source.



PREPARATION:
(a) Disconnect the air flow meter connector.
(b) Turn the ignition switch ON.
CHECK:
Measure voltage between terminal 4 of the air flow meter connector and body ground.
OK:
Voltage: 9 – 14 V

NG → **Check for open in harness and connector between EFI main relay (Marking: EFI) and air flow meter (See page IN–20).**

OK

3	Check for open in harness and connector between air flow meter and engine ECU (See page IN–20).

NG → **Repair or replace harness or connector.**

OK

Replace air flow meter.

DI1LC–05

DTC P0101/31 Mass Air Flow Circuit Range/Performance Problem

CIRCUIT DESCRIPTION

Refer to DTC P0100/31 (Mass Air Flow Circuit Malfunction) on page DI–26.

DTC No.	DTC Detecting Condition	Trouble Area
P0101/31	After engine is warmed up, conditions (1) and (2) continue with more than 10 sec. engine speed 900 rpm or less: (2 trip detection logic) 1. Throttle valve fully closed 2. Air flow meter output > 2.2 V	• Air flow meter
	Conditions (1) and (2) continue with more than 10 sec. engine speed 1,500 rpm or more: (2 trip detection logic) 1. VTA ≧ 0.63 V 2. Air flow meter output < 1.0 V	

INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	Are there any other codes (besides DTC P0101/31) being output?

NO → **Replace air flow meter.**

YES

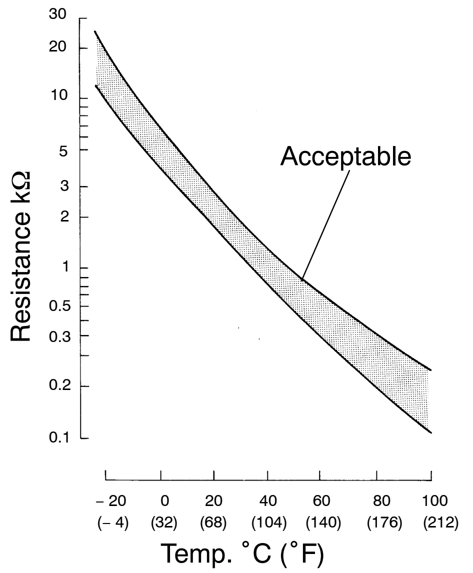
Go to relevant DTC chart (See page DI–18).

DI5YB–03

DTC	P0110/24	Intake Air Temp. Circuit Malfunction

CIRCUIT DESCRIPTION

(fig. 1)



FI4741

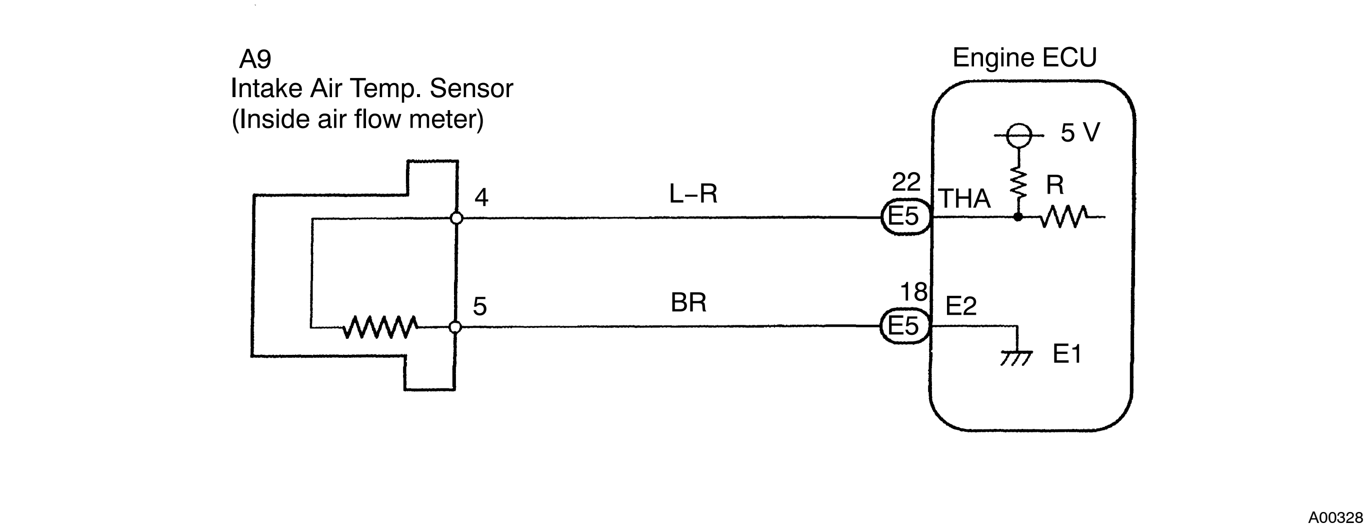
The intake air temp. sensor is built into the air flow meter and senses the intake air temperature.
A thermistor built in the sensor changes the resistance value according to the intake air temperature.
The lower the intake air temperature, the greater the thermistor resistance value, and the higher the intake air temperature, the lower the thermistor resistance value (See fig. 1).
The intake air temp. sensor is connected to the engine ECU (See below). The 5 V power source voltage in the engine ECU is applied to the intake air temp. sensor from the terminal THA (THAR) via resistor R.
That is, the resistor R and the intake air temp. sensor are connected in series. When the resistance value of the intake air temp. sensor changes in accordance with changes in the intake air temperature, the potential at terminal THA (THAR) also changes. Based on this signal, the engine ECU increases the fuel injection volume to improve driveability during cold engine operation.

DTC No.	DTC Detecting Condition	Trouble Area
P0110/24	Open or short in intake air temp. sensor circuit	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor (inside air flow meter) • Engine ECU

HINT:
After confirming DTC P0110/24 use the hand–held tester to confirm the intake air temperature from CURRENT DATA.

Temperature Displayed	Malfunction
–40°C (–40°F)	Open circuit
140°C (284°F) or more	Short circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTC P0110/24 (Intake Air Temp. Circuit Malfunction), P0115/22 (Water Temp. Circuit Malfunction), P0120/41 (Throttle/Pedal Position Sensor/Switch "A" Malfunction), P0550/75 (Power Steering Pressure Sensor Circuit Malfunction) are output simultaneously, E2 (Sensor Ground) may be open.
- Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

When using hand–held tester

1	Connect hand–held tester, and read value of intake air temperature.

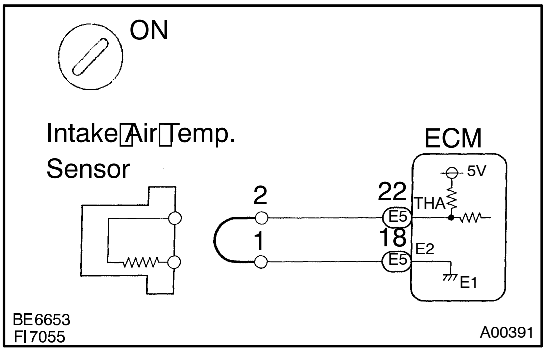
PREPARATION:
(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester main switch ON.
CHECK:
Read temperature value on the hand–held tester.
OK:
Same as actual intake air temperature
HINT:
- If there is open circuit, hand–held tester indicates –40°C (–40°F).
- If there is short circuit, hand–held tester indicates 140°C (284°F) or more.

NG → **–40°C (–40°F)...Go to step 2**
140°C (284°F) or more...Go to step 4.

OK ↓

Check for intermittent problems (See page DI–4).

2	Check for open in harness or engine ECU.

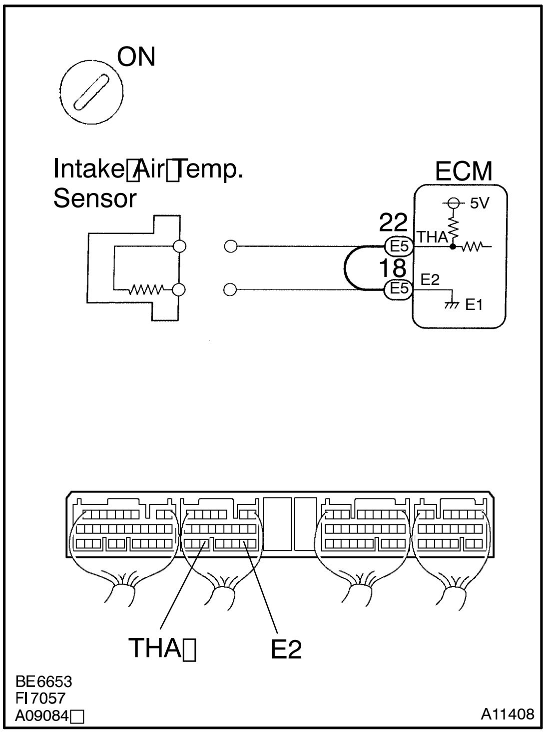


PREPARATION:
(a) Disconnect the air flow meter connector.
(b) Connect the sensor wire harness terminals together.
(c) Turn the ignition switch ON.
CHECK:
Read temperature value on the hand–held tester.
OK:
Temperature value: 140°C (284°F) or more

OK → **Confirm good connection at sensor. If OK, replace air flow meter.**

NG ↓

3	Check for open in harness or engine ECU.



PREPARATION:
(a) Remove the engine ECU cover.
(b) Connect between terminals THA and E2 of the engine ECU connector.

HINT:
Air flow meter connector is disconnected.
Before checking, do a visual and contact pressure check for the engine ECU connector (See page IN–20).

CHECK:
Read temperature value on the hand–held tester.

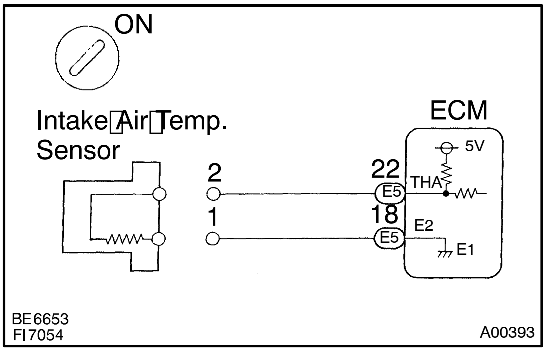
OK:
Temperature value: 140°C (284°F) or more

OK	Open in harness between terminals E2 or THA, repair or replace harness.

NG

Confirm good connection at engine ECU.
If OK, check and replace engine ECU.
(See page IN–20)

4	Check for short in harness and engine ECU.



PREPARATION:
(a) Disconnect the air flow meter connector.
(b) Turn the ignition switch ON.

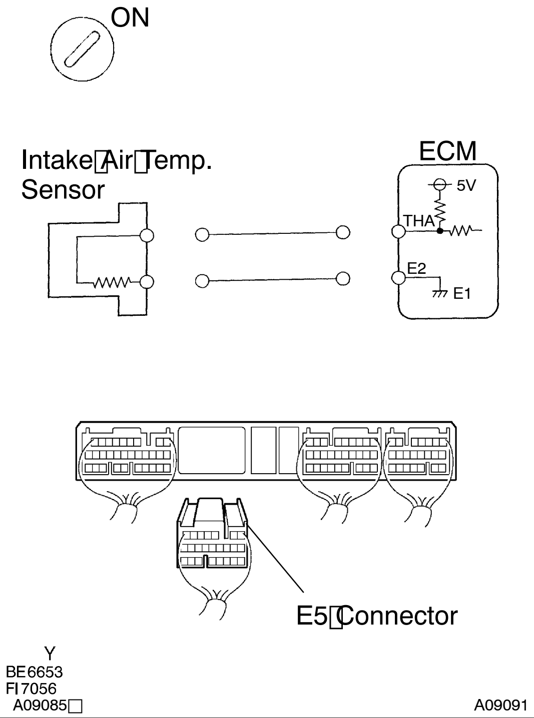
CHECK:
Read temperature value on the hand–held tester.

OK:
Temperature value: –40°C (–40°F)

OK	Replace air flow meter.

NG

5	Check for short in harness or engine ECU.



PREPARATION:

(a) Remove the engine ECU cover.

(b) Disconnect the E5 connector of the engine ECU.

HINT:

Air flow meter connector is disconnected.

(c) Turn the ignition switch ON.

CHECK:

Read temperature value on the hand–held tester.

OK:

Temperature value: –40°C (–40°F)

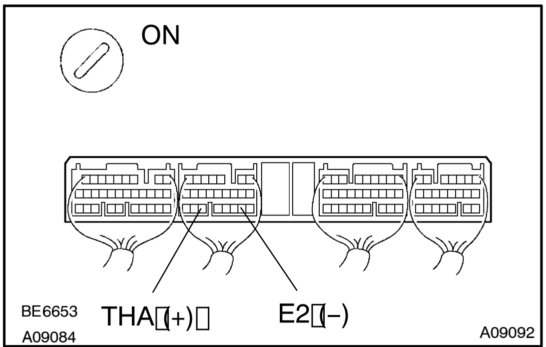
OK → **Repair or replace harness or connector.**

NG

Check and replace engine ECU (See page IN–20).

When not using hand–held tester

1	Check voltage between terminals THA and E2 of engine ECU connector.



PREPARATION:

(a) Remove the engine ECU cover.

(b) Turn ignition switch ON.

CHECK:

Measure voltage between terminals THA and E2 of engine ECU connector.

OK:

Intake air temp. °C (°F)	Voltage
20 (68)	0.5 – 3.4 V
60 (140)	0.2 – 1.0 V

OK — Check for intermittent problems (See page DI–18).

NG

2	Check intake air temp. sensor (See page FI–28).

NG — Replace air flow meter.

OK

3	Check for open and short in harness and connector between engine ECU and intake air temp. sensor (See page IN–20).

NG — Repair or replace harness or connector.

OK

Check and replace engine ECU.

DI2S4–06

DTC	P0115/22	Water Temp. Circuit Malfunction

CIRCUIT DESCRIPTION

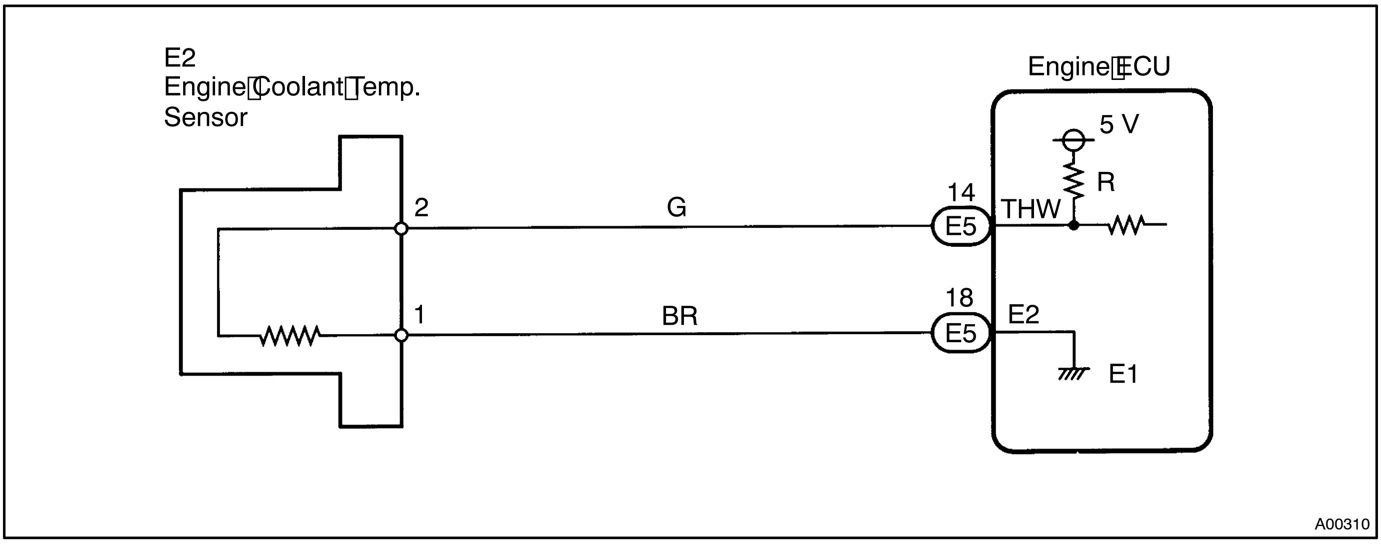
A thermistor built into the water temp. sensor changes the resistance value according to the water temperature.
The structure of the sensor and connection to the engine ECU is the same as in the DTC P0110/24 (Intake Air Temp. Circuit Malfunction) shown on page DI–33.

DTC No.	DTC Detecting Condition	Trouble Area
P0115/22	Open or short in water temp. sensor circuit	• Open or short in water temp. sensor circuit • Water temp. sensor • Engine ECU

HINT:
After confirming DTC P0115/22 use the hand–held tester to confirm the water temperature from CURRENT DATA.

Temperature Displayed	Malfunction
–40°C (–40°F)	Open circuit
140C° (284°F) or more	Short circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTC P0100/31 (Air Flow Meter Circuit Malfunction), P0101/31 (Air Flow Meter Circuit Range/Performance Problem), P0110/24 (Intake Air Temp. Circuit Malfunction), P0115/22 (Engine Coolant Temp. Circuit Malfunction), P0120/41 (Throttle/Pedal Position Sensor/Switch "A" Circuit Malfunction) are output simultaneously, E2 (sensor ground) may be open.
- Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

When using hand–held tester

1	**Connect hand–held tester, and read value of water temperature.**

PREPARATION:

(a) Connect the hand–held tester to the DLC3.

(b) Turn the ignition switch ON and switch the hand–held tester main switch ON.

CHECK:

Read temperature value on the hand–held tester.

OK:

Same as actual water temperature

HINT:

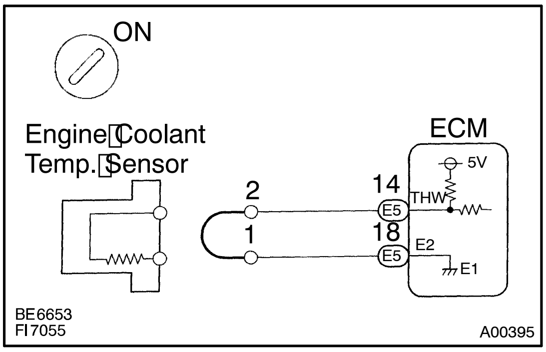
- If there is open circuit, Hand–held tester indicates –40°C (–40°F).
- If there is short circuit, Hand–held tester indicates 140°C (284°F) or more.

NG → **–40°C (–40°F)...Go to step 2.**
140°C (284°F) or more...Go to step 4.

OK

Check for intermittent problems (See page DI–4).

2	**Check for open in harness or engine ECU.**



PREPARATION:

(a) Disconnect the water temp. sensor connector.
(b) Connect sensor wire harness terminals together.
(c) Turn the ignition switch ON.

CHECK:

Read temperature value on the hand–held tester.

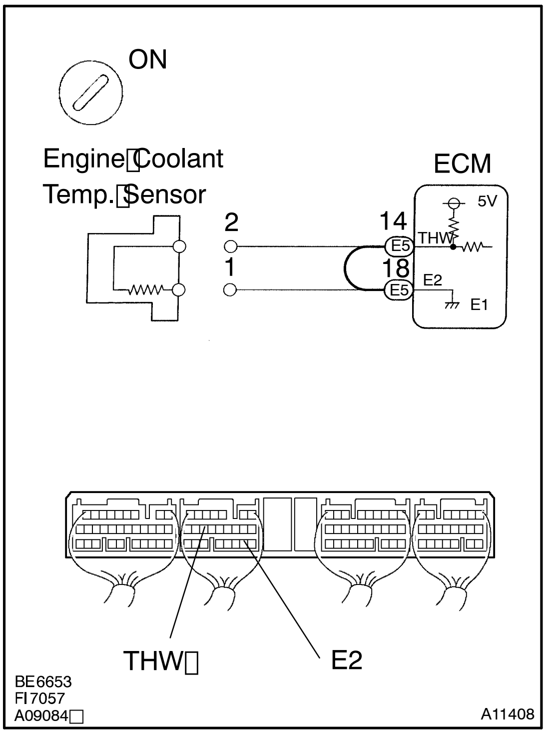
OK:

Temperature value: 140°C (284°F) or more

OK → **Confirm good connection at sensor. If OK, replace water temp. sensor.**

NG ↓

3	**Check for open in harness or engine ECU.**



PREPARATION:

(a) Remove the engine ECU cover.
(b) Connect between terminals THW, and E2 of the engine ECU connector.

HINT:

Water temp. sensor connector is disconnected.
Before checking, do a visual and contact pressure check for the engine ECU connector (See page IN–20).

(c) Turn the ignition switch ON.

CHECK:

Read temperature value on the hand–held tester.

OK:

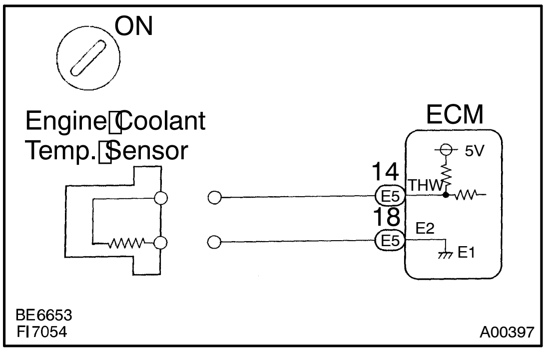
Temperature value: 140°C (284°F) or more

OK → **Open in harness between terminals E2 or THW, repair or replace harness.**

NG ↓

Confirm good connection at engine ECU.
If OK, check and replace engine ECU (See page IN–20).

4	Check for short in harness and engine ECU.

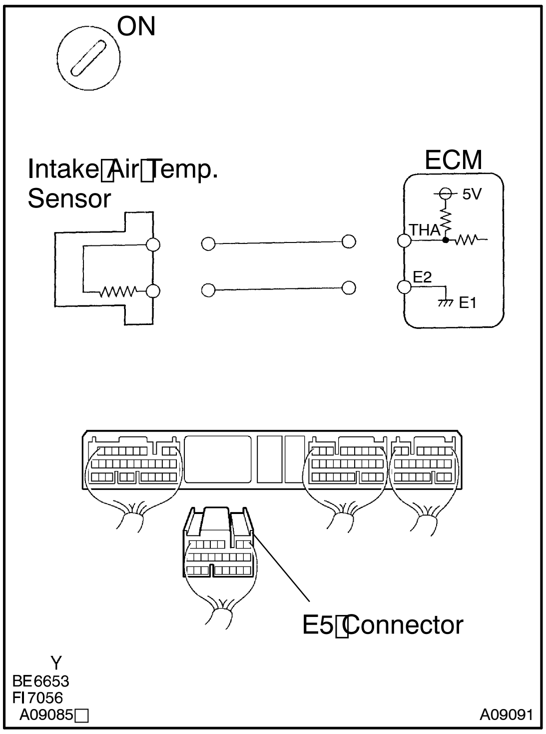


PREPARATION:
(a) Disconnect the water temp. sensor connector.
(b) Turn the ignition switch ON.
CHECK:
Read temperature value on the hand–held tester.
OK:
Temperature value: –40°C (–40°F)

OK	Replace water temp. sensor.

NG

5	Check for short in harness or engine ECU.



PREPARATION:
(a) Remove the engine ECU cover.
(b) Disconnect the E5 connector of the engine ECU.
HINT:
Water temp. sensor connector is disconnected.
(c) Turn the ignition switch ON.
CHECK:
Read temperature value on the hand–held tester.
OK:
Temperature value: –40°C (–40°F)

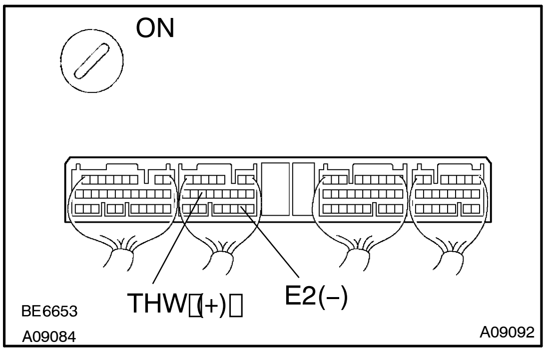
OK	Repair or replace harness or connector.

NG

Check and replace engine ECU (See page IN–20).

When not using hand–held tester

1	**Check voltage between terminals THW and E2 of engine ECU connector.**



PREPARATION:

(a) Remove the cover from the engine ECU.

(b) Turn ignition switch ON.

CHECK:

Measure voltage between terminals THW and E2 of engine ECU connector.

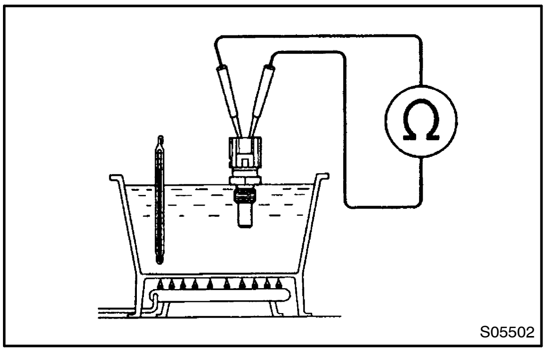
OK:

Water temp. °C (°F)	Voltage
20 (68)	0.5 – 3.4 V
60 (140)	0.2 – 1.0 V

OK	**Check for intermittent problems (See page DI–24).**

NG

2	**Check water temp. sensor.**



PREPARATION:

Disconnect the water temp. sensor connector.

CHECK:

Measure resistance between terminals.

OK:

Resistance is within acceptable zone on chart.

Water Temp.	Resistance
20°C (68°F)	2 – 3 kΩ
80°C (176°F)	0.2 – 0.4 kΩ

NG	**Replace water temp. sensor.**

OK

3	Check for open and short in harness and connector between engine ECU and water temp. sensor (See page FI–55).

NG → **Repair or replace harness or connector.**

OK

Check and replace engine ECU.

DI6TR–01

DTC	P0116/22	Engine Coolant Temp. Circuit Range/ Performance Problem

CIRCUIT DESCRIPTION

Refer to DTC P0115/22 (Engine Coolant Temp. Circuit Malfunction) on page DI–39.

DTC No.	DTC Detecting Condition	Trouble Area
P0116/22	When the engine starts, the water temp. is –7°C (20°F) or less. And, 20 min. or more after the engine starts, the engine temp. sensor value is 20°C (68°F) or less (2 trip detection logic)	• Engine coolant temp. sensor • Cooling system
	When the engine starts, the water temp. is between –7°C (20°F) and 10°C (50°F) And, 5 min. or more after the engine starts, the engine coolant temp. sensor value is 20°C (68°F) or less (2 trip detection logic)	

INSPECTION PROCEDURE

HINT:

- If DTC "P0115/22" (Engine Coolant Temp. Circuit Malfunction) and "P0116/22" (Engine Coolant Temp. Circuit Range/Performance Problem) are output simultaneously, engine coolant temp. sensor circuit may be open. Perform troubleshooting of DTC P0115/22 first.
- Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	Are there any other codes (besides DTC P0116/22) being output?

YES → **Go to relevant DTC chart.**

NO

2	Check thermostat (See page CO–10).

NG → **Replace thermostat.**

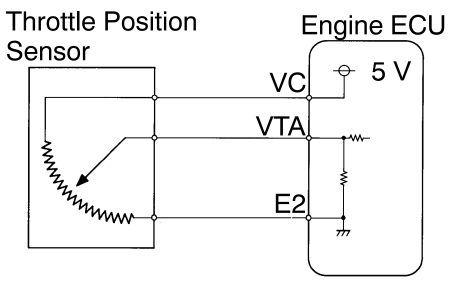
OK

Replace engine coolant temp. sensor.

DI6TS–01

DTC	P0120/41	Throttle/Pedal Position Sensor/Switch ”A” Circuit Malfunction

CIRCUIT DESCRIPTION



P24296

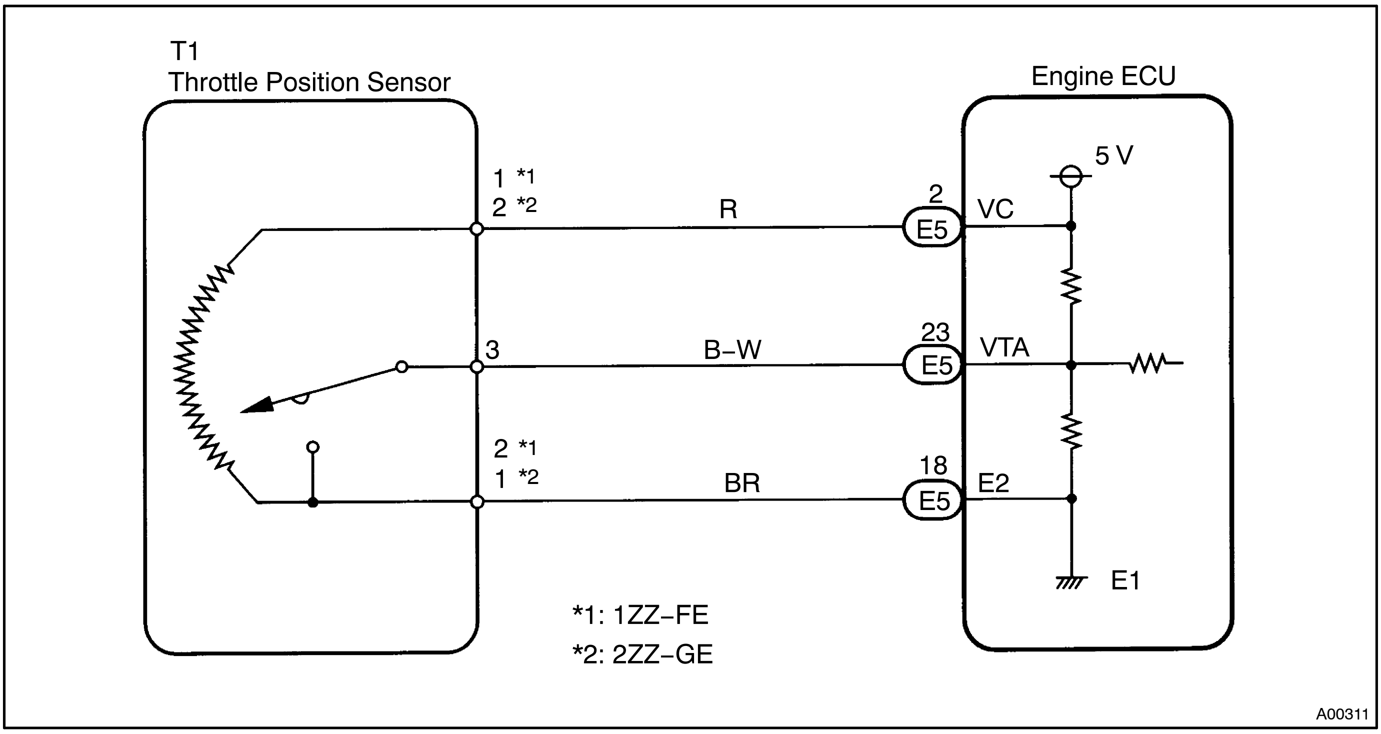
The throttle position sensor is mounted in the throttle body and detects the throttle valve opening angle.
When the throttle valve is fully closed, a voltage of approximately 0.7 V is applied to terminal VTA of the engine ECU. The voltage applied to the terminals VTA of the engine ECU increases in proportion to the opening angle of the throttle valve and becomes approximately 3.5 – 5.0 V when the throttle valve is fully opened. The engine ECU judges the vehicle driving conditions from these signals input from terminal VTA, uses them as one of the conditions for deciding the air–fuel ratio correction, power increase correction and fuel–cut control etc.

DTC No.	DTC Detecting Condition	Trouble Area
P0120/41	Condition (1) or (2) continues with more than 5 sec.: 1. VTA < 0.1 V 2. VTA > 4.9 V	• Open or short in throttle position sensor • Throttle position senor • Engine ECU

HINT:
After confirming ”DTC P0120/41”, use the hand–held tester to confirm the throttle valve opening percentage and closed throttle position switch condition.

Throttle valve opening position expressed as percentage		Trouble Area
Throttle valve fully closed	Throttle valve fully open	
0 %	0 %	VC line open VTA line open or short
Approx. 100 %	Approx. 100 %	E2 line open

WIRING DIAGRAM



INSPECTION PROCEDURE

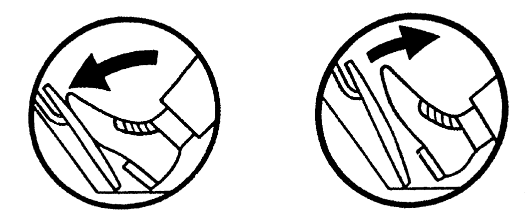
HINT:

- Read freed frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.
- If DTC P0110/24 (Intake Air Temp. Circuit Malfunction), P0115/22 (Water Temp. Circuit Malfunction), P0120/41 (Throttle/Pedal Position Sensor/Switch "A" Malfunction), P0550/75 (Power Steering Pressure Sensor Circuit Malfunction) are output simultaneously, E2 (Sensor Ground) may be open.

When using hand–held tester

1	**Connect the hand–held tester and read the throttle valve opening percentage.**

PREPARATION:
(a) Connect the hand–held tester to DLC3.
(b) Turn ignition switch ON and push the hand–held tester main switch ON.
CHECK:


FI7052

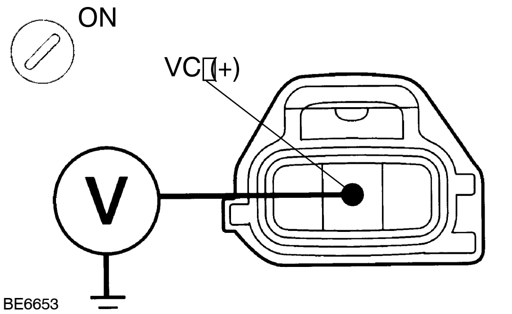
Read the throttle valve opening percentage.
OK:

Throttle valve	Throttle valve opening position expressed as percentage
Fully open	Approx. 75 %
Fully closed	Approx. 10 %

OK → **Check for intermittent problems (See page DI–4).**

NG

2	**Check voltage between terminal VC of wire harness side connector and body ground.**



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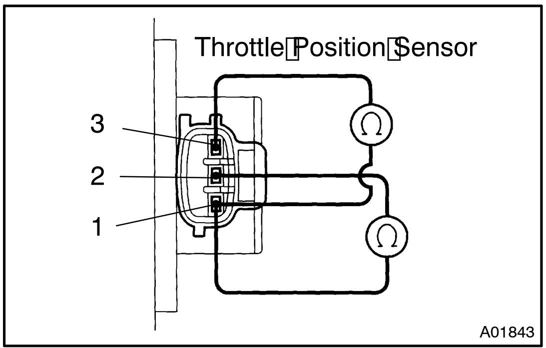
PREPARATION:
(a) Disconnect the throttle position sensor connector.
(b) Turn ignition switch ON.
CHECK:
Measure voltage between terminals VC of wire harness side connector and body ground.
OK:
Voltage: 4.5 – 5.5 V

NG → **Go to step 5.**

OK

3	Check throttle position sensor.



PREPARATION:

Disconnect the throttle position sensor connector.

CHECK:

Measure resistance between terminals 1, 3 and 2 of the throttle position sensor.

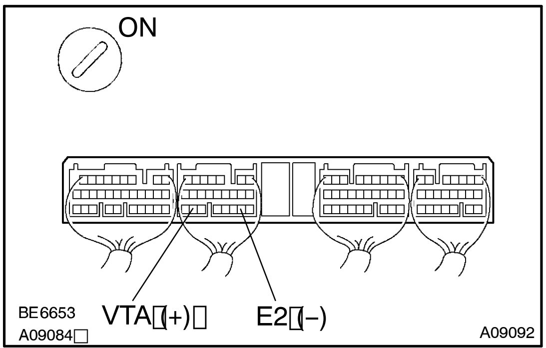
OK:

Terminals	Throttle valve	Resistance kΩ
1 – 2	—	2.5 – 5.9
1 – 3	Fully closed	0.2 – 5.7
	Fully open	2.0 – 10.2

NG → **Replace throttle position sensor.**

OK

4	Check voltage between terminals VTA and E2 of engine ECU connector.



PREPARATION:

(a) Remove the cover from the engine ECU.

(b) Turn ignition switch ON.

CHECK:

Measure voltage between terminals VTA and E2 of engine ECU connector.

OK:

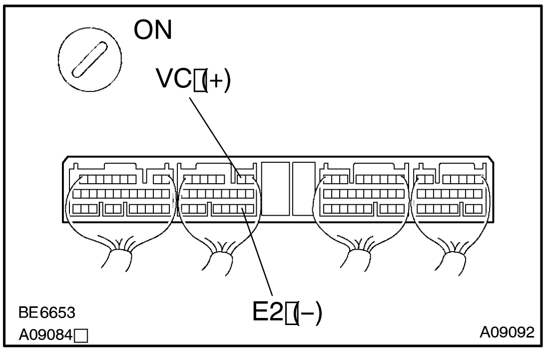
Throttle valve	Voltage V
Fully closed	0.3 – 1.0
Fully open	2.7 – 5.2

NG → **Check for open and short in harness and connector between engine ECU and throttle position sensor (VTA line) (See page IN–20).**

OK

Check and replace engine ECU (See page IN–20).

5	Check voltage between terminals VC and E2 of engine ECU connector.



PREPARATION:
(a) Remove the cover from the engine ECU.
(b) Turn ignition switch ON.
CHECK:
Measure voltage between terminals VC and E2 of engine ECU connector.
OK:
Voltage: 4.5 – 5.5 V

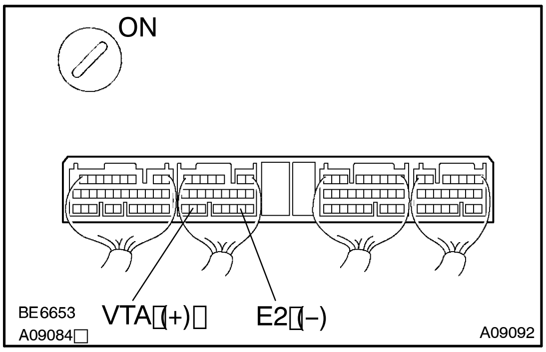
NG → **Check and replace engine ECU (See page IN–20).**

OK ↓

Check for open in harness and connector between engine ECU and sensor (VC line) (See page IN–20).

When not using hand–held tester

1	Check voltage between terminals VTA and E2 of engine ECU connector.



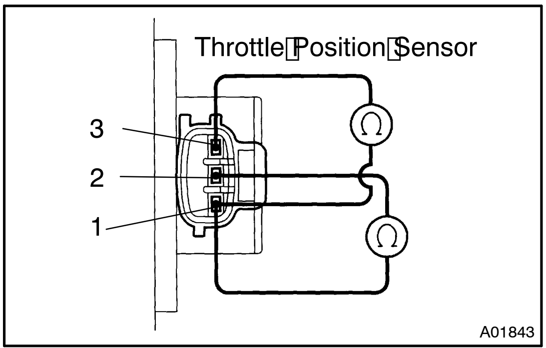
PREPARATION:
(a) Remove the cover from the engine ECU.
(b) Turn ignition switch ON.
CHECK:
Measure voltage between terminals VTA and E2 of engine ECU.
OK:

Throttle valve	Voltage V
Fully open	0.3 – 1.0
Fully closed	2.7 – 5.2

OK → **Check for intermittent problems (See page DI–4).**

NG ↓

2 Check throttle position sensor.



PREPARATION:
Disconnect the throttle position sensor connector.
CHECK:
Measure resistance between terminals 1, 3 and 2 of throttle position sensor.
OK:

Terminals	Throttle valve	Resistance kΩ
1 – 2	–	2.5 – 5.9
2 – 3	Fully closed	0.2 – 5.7
	Fully open	2.0 – 10.2

NG — **Replace throttle position sensor.**

OK

3 Check for open and short in harness and connector between engine ECU and throttle position sensor (VC, VTA, E2 line) (See page IN–20).

NG — **Repair or replace harness or connector.**

OK

Check and replace engine ECU (See page IN–20).

DI1LI–05

DTC	P0121/41	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance Problem

CIRCUIT DESCRIPTION

Refer to DTC P0120/41 (Throttle/Pedal Position Sensor/Switch "A" Circuit Malfunction) on page DI–46.

DTC No.	DTC Detecting Condition	Trouble Area
P0121/41	While vehicle speed drops from 30 km/h (19 mph) or more to 0 km/h (0 mph), output value of throttle position sensor is out of applicable range. (2 trip detection logic)	• Throttle position sensor • Engine ECU

INSPECTION PROCEDURE

HINT:

Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

Replace throttle body (See page FI–31).

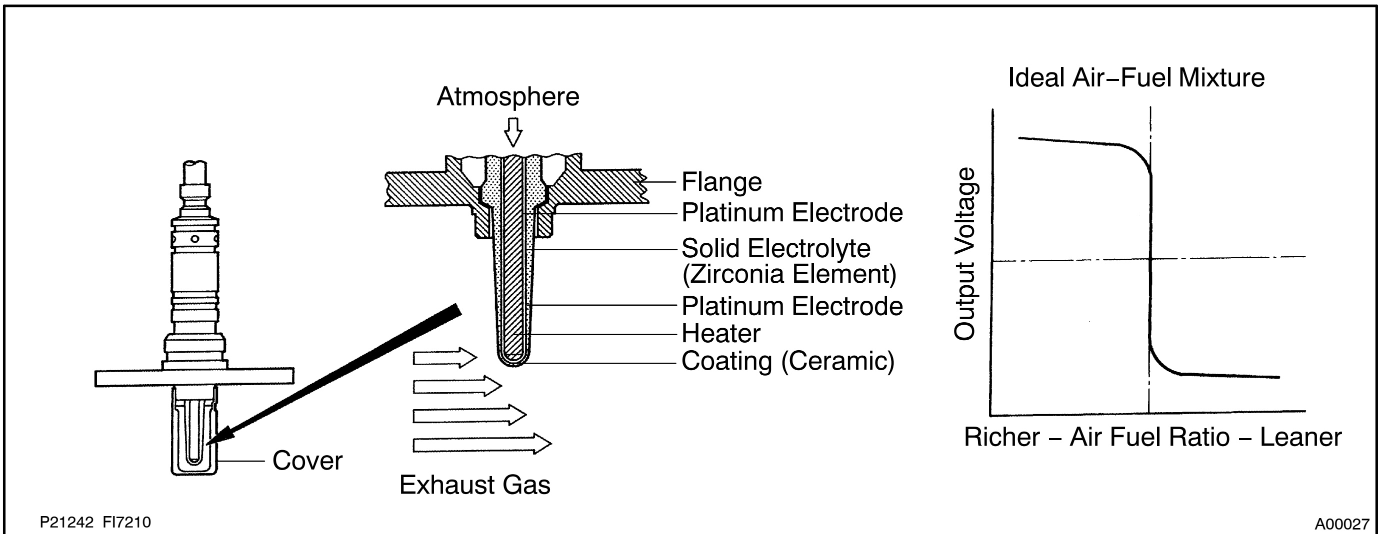
DI68N–02

DTC	P0125/91	Insufficient Coolant Temp. for Closed Loop Fuel Control

DTC	P0130/21	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)

CIRCUIT DESCRIPTION

To obtain a high purification rate for the CO, HC and NOx components of the exhaust gas, a three–way catalytic converter is used, but for the most efficient use of the three–way catalytic converter, the air–fuel ratio must be precisely controlled so that it is always close to the stoichiometric air–fuel ratio.
The oxygen sensor has the characteristic whereby its output voltage changes suddenly in the vicinity of the stoichiometric air–fuel ratio. This is used to detect the oxygen concentration in the exhaust gas and provide feedback to the computer for control of the air–fuel ratio.
When the air–fuel ratio becomes LEAN, the oxygen concentration in the exhaust increases and the oxygen sensor informs the engine ECU of the LEAN condition (small electromotive force: < 0.45 V).
When the air–fuel ratio is RICHER than the stoichiometric air–fuel ratio the oxygen concentration in the exhaust gas is reduced and the oxygen sensor informs the engine ECU of the RICH condition (large electromotive force: > 0.45 V). The engine ECU judges by the electromotive force from the oxygen sensor whether the air–fuel ratio is RICH or LEAN and controls the injection time accordingly. However, if malfunction of the oxygen sensor causes output of abnormal electromotive force, the engine ECU is unable to perform accurate air–fuel ratio control.
The main heated oxygen sensors include a heater which heats the zirconia element. The heater is controlled by the engine ECU. When the intake air volume is low (the temperature of the exhaust gas is low) current flows to the heater to heat the sensor for accurate oxygen concentration detection.

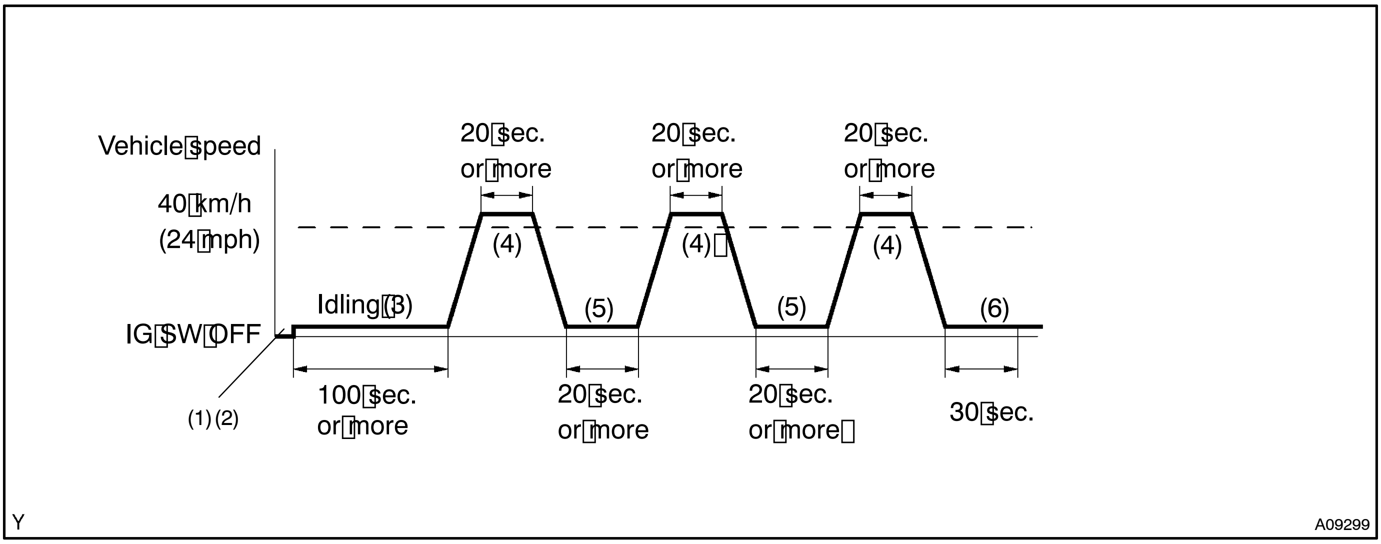


DTC No..	DTC Detecting Condition	Trouble Area
P0125/91	After engine is warmed up, oxygen sensor (bank 1 sensor 1) output does not indicate RICH (≧ 0.45 V) even once when conditions (a), (b), (c) and (d) continue for at least 90 sec.: (a) Engine speed: 1,400 rpm or more (b) Vehicle speed: 40 – 100 km/h (25 – 62 mph) (c) Closed throttle position switch: OFF (d) 180 sec. or more after starting engine	• Air induction system • Fuel pressure • Injector injection • Gas leakage on exhaust system • Open or short in heated oxygen sensor (bank 1 sensor 1) circuit • Oxygen sensor (bank 1 sensor 1)
P0130/21	Condition (a) and (b) continues for 60 secs. or more: (a) Voltage output of oxygen sensor remains at 0.35 V or more, or 0.55 V or less, during idling after engine is warmed up. (b) Oxygen sensor output voltage amplitude is less than 0.3 V.	• Oxygen sensor • Fuel trim malfunction

HINT:

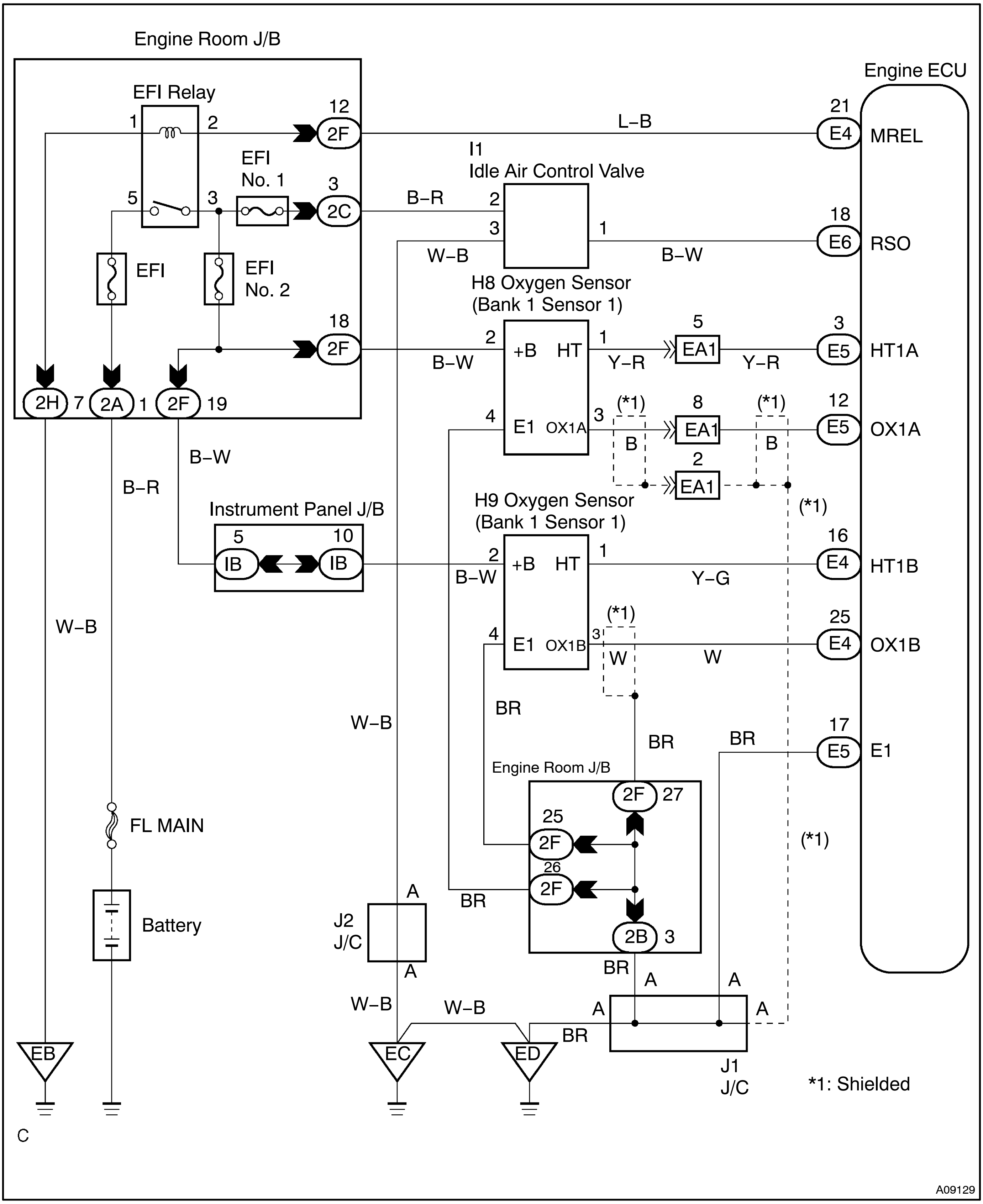
- After confirming DTC P0125/91, use the hand–held tester to confirm voltage output of the heated oxygen sensor (bank 1 sensor 1) from the CURRENT DATA.
  If voltage output of the oxygen sensor (bank 1 sensor 1) is less than 0.1 V, oxygen sensor (bank 1 sensor 1) circuit may be open or short.
- Sensor 1 refers to the sensor closer to the engine body.
  The oxygen sensor's output voltage and the short–term fuel trim value can be read using the hand–held tester.

CONFIRMATION DRIVING PATTERN



(1) Connect the hand–held tester to the DLC3.
(2) Switch the hand–held tester from normal mode to check mode (See page DI–4).
(3) Start the engine and let the engine idle for 100 seconds or more.
(4) Drive the vehicle at 40 km/h (24 mph) or more for 20 seconds or more.
(5) Let the engine idle for 20 seconds or more.
(6) Let the engine idle for 30 seconds.
HINT:
If a malfunction exists, the MIL 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. If you do not have a hand–held tester, turn the ignition switch OFF after performing steps (3) to (6), then perform steps (3) to (6) again.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If the vehicle run out of fuel, the air–fuel ratio is LEAN and DTC P0125/91 will be recorded. The check engine warning light then comes on.
- Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	**Are there any other codes (besides DTC P0125/91, P0130/21) being output?**

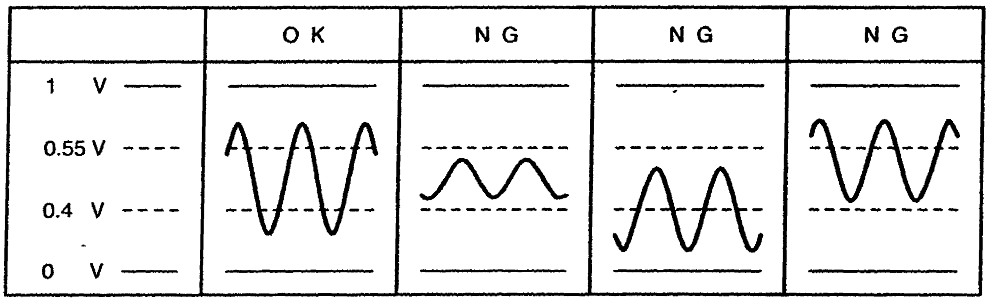
YES → **Go to relevant DTC chart.**

NO

2	**Check the output voltage of oxygen sensor during idling.**

PREPARATION:
Warm up the oxygen sensor with the engine at 2,500 rpm for approx. 90 sec.
CHECK:
Use the hand–held tester read the output voltage of the oxygen sensor during idling.
OK:

Oxygen sensor output voltage:
Alternates repeatedly between less than 0.4 V and more than 0.55 V (See the following table).



P18349

OK → **Perform confirmation driving pattern.**

NG

3	Check for open and short in harness and connector between engine ECU and oxygen sensor (bank 1 sensor 1) (See page IN–20).

NG → Repair or replace harness or connector.

OK ↓

4	Check whether misfire is occurred or not by monitoring DTC and data list.

NG → Perform troubleshooting for misfire (See page DI–24).

OK ↓

5	Check air induction system (See page FI–1).

NG → Repair or replace induction system.

OK ↓

6	Check fuel pressure (See page FI–6).

NG → Check and repair fuel pump, fuel pipe line and filter (See page FI–6).

OK ↓

7	Check injector injection (See page FI–18).

NG → Replace injector.

OK

8	Check gas leakage on exhaust system.

NG → Repair or replace.

OK

Replace oxygen sensor (bank 1 sensor 1).

9	Perform confirmation driving pattern.

Go

10	Are there DTC P0125/91, P0130/21 being output again?

YES → Check for intermittent problems (See page DI–4).

No

11	Did vehicle runs out of fuel in the past?

NO → **Check for intermittent problems.**

YES ↓

Check and replace engine ECU.

DI57S–06

DTC P0133/21 Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)

CIRCUIT DESCRIPTION

Refer to DTC P0125/91 (Insufficient Coolant Temp. for Closed Loop Fuel Control) on page DI–53.

DTC No.	DTC Detecting Condition	Trouble Area
P0133/21	Response time for heated oxygen sensor voltage output to change from rich to lean, or from lean to rich, is 120 sec. or more during idling after engine is warmed up (2 trip detection logic)	• Air induction system • Fuel pressure • Injector injection • Open or short in heated oxygen sensor circuit • Heated oxygen sensor • Engine ECU

HINT:
Sensor 1 refers to the sensor closer to the engine body.

WIRING DIAGRAM

Refer to DTC P0125/91 (Insufficient Coolant Temp. for Closed Loop Fuel Control) on page DI–53.

INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	**Are there any other codes (besides DTC P0133/21) being output?**

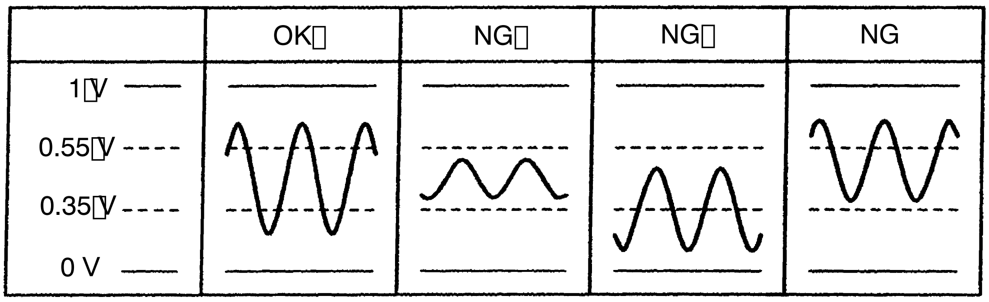
YES → Go to relevant DTC chart (See page DI–18).

NO

2 Check output voltage of oxygen sensor during idling.

PREPARATION:
Warm up the oxygen sensor with the engine speed at 2,500 rpm for approx. 90 sec.
CHECK:
Use the hand-held tester to read the output voltage of the heated oxygen sensor during idling.
OK:

Oxygen sensor output voltage:
Alternates repeatedly between less than 0.35 V and more than 0.55 V (See the following table).



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OK → **Go to step 8.**

NG

3 Check for open and short in harness and connector between engine ECU and oxygen sensor (See page IN-20).

NG → **Repair or replace harness or connector.**

OK

4 Check air induction system (See page FI-1).

NG → **Repair or replace.**

OK

5	Check fuel pressure (See page FI–6).

NG → Check and repair fuel pump, pressure regulator, fuel pipe line and filter (See page FI–1).

OK

6	Check injector injection (See page FI–22).

NG → Replace injector.

OK

Replace oxygen sensor.

7	Perform confirmation driving pattern (See page DI–53).

GO

8	Is there DTC P0133/21 being output again?

NO → Check for intermittent problems (See page DI–4).

YES

Check and replace engine ECU (See page IN–20).

DI2S8–05

DTC	P0135/21	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)

DTC	P0141/21	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)

CIRCUIT DESCRIPTION

Refer to DTC P0125/91 (Insufficient Coolant Temp. for Closed Loop Fuel Control) on page DI–53.

DTC No.	DTC Detecting Condition	Trouble Area
P0135/21 P0141/21	When the heater operates, heater current exceeds 2 A (2 trip detection logic)	• Open or short in heater circuit of oxygen sensor • Oxygen sensor heater • Engine ECU
	Heater current of 0.2 A or less when the heater operates (2 trip detection logic)	

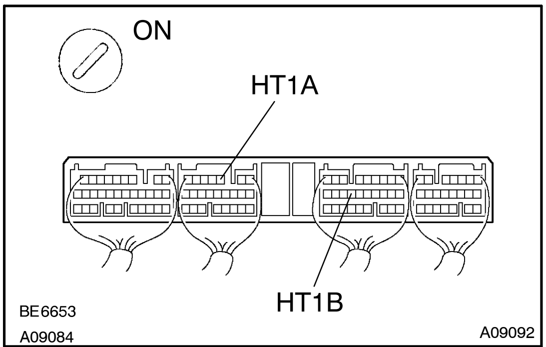
WIRING DIAGRAM

Refer to DTC P0125/91 (Insufficient Coolant Temp. for Closed Loop Fuel Control) on page DI–53.

INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	**Check voltage between terminals HT1A, HT1B of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the engine ECU cover.

(b) Turn the ignition switch ON.

CHECK:

Measure voltage between terminals HT, HT2 of the engine ECU connector and body ground.

HINT:

- Connect terminal HT1A to bank 1 sensor 1.
- Connect terminal HT1B to bank 1 sensor 2.

OK:

Voltage: 9 – 14 V

OK	**Check and replace engine ECU (See page IN–20).**

NG

2	Check resistance of oxygen sensor heater (See page FI–60).

NG → Replace oxygen sensor.

OK

Check and repair harness or connector between main relay and oxygen sensor and engine ECU (See page IN–20).

DI68O–02

DTC	P0136/27	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)

CIRCUIT DESCRIPTION

Refer to DTC P0125/91 (Insufficient Coolant Temp. for Closed Loop Fuel Control) on page DI–53.

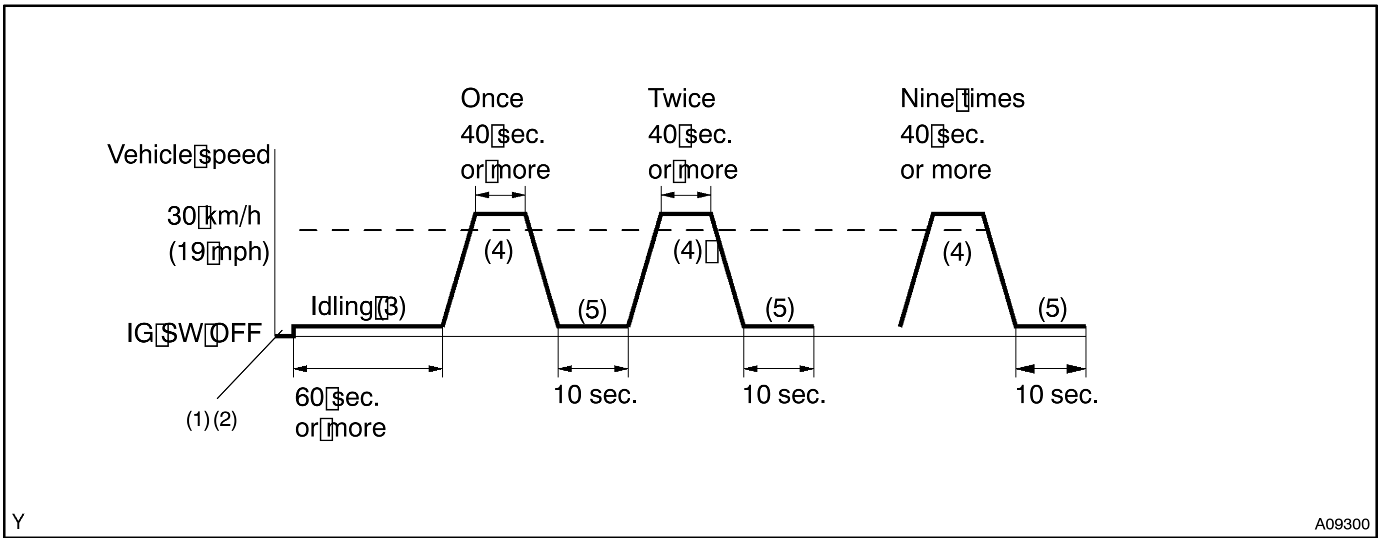
DTC No.	DTC Detecting Condition	Trouble Area
P0136/27	Voltage output of heated oxygen sensor remains at 0.4 V or more or 0.5 V or less when vehicle is driven at 100 km/h (62 mph) or more after engine is warmed up (2 trip detection logic)	• Open or short in heated oxygen sensor circuit • Oxygen sensor

HINT:
Sensor 2 refers to the sensor farther away from the engine body.

WIRING DIAGRAM

Refer to DTC P0125/91 (Insufficient Coolant Temp. for Closed Loop Fuel Control) on page DI–53.

CONFIRMATION DRIVING PATTERN



(1) Connect the hand–held tester to the DLC3.
(2) Switch the hand–held tester from the Normal Mode to the Check (Test) Mode (See page DI–4).
(3) Start the engine and let the engine idle for 60 seconds or more.
(4) Drive the vehicle at 30 km/h (18 mph) or more for 40 seconds or more.
(5) Let the engine idle for 10 seconds or more.
(6) Preform steps (4) to (5) 9 times.

HINT:
If a malfunction exists, the CHK ENG (MIL) will be indicated on the multi information display during step (6).

NOTICE:
If the conditions in this test are not strictly followed, detection of the malfunction will not be possible. If you do not have a hand–held tester, turn the ignition switch OFF after performing steps (3) to (6), then perform steps (3) to (6) again.

INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	**Are there any other codes (besides DTC P0136/27) being output?**

YES → **Go to relevant DTC chart (See page DI–18).**

NO

2	**Check for open and short in harness and connector between engine ECU and oxygen sensor (See page IN–20).**

NG → **Repair or replace harness or connector.**

OK

3	**Check output voltage of heated oxygen sensor.**

PREPARATION:
(a) Connect the hand–held tester to the DLC3.
(b) Warm up the engine to normal operating temperature.

CHECK:
Read voltage output of the heated oxygen sensor when the engine suddenly raced.
HINT:
Perform quick racing to 4,000 rpm 3 min. using the accelerator pedal.

OK:
Oxygen sensor output voltage: Alternates from 0.4 V or less to 0.5 V or more.

OK → **Check that each connector is properly connected.**

NG

Replace heated oxygen sensor.

DI6TT–01

DTC	P0171/25	System too Lean (Fuel Trim)

DTC	P0172/26	System too Rich (Fuel Trim)

CIRCUIT DESCRIPTION

”Fuel” trim refers to the feedback compensation value compared against the basic injection time. Fuel trim includes short–term fuel trim and long–term fuel trim.

”Short–term fuel trim” is the short–term fuel compensation used to maintain the air–fuel ratio at its ideal theoretical value. The signal from the heated oxygen sensor indicates whether the air–fuel ratio is RICH or LEAN compared to the ideal theoretical value, triggering a reduction in fuel volume if the air–fuel ratio is rich, and an increase in fuel volume if it is lean.

”Long–term fuel trim” is overall fuel compensation carried out long–term to compensate for continual deviation of the short–term fuel trim form the central value due to individual engine differences, wear over time and changes in the usage environment.

If both the short–term fuel trim and long–term fuel trim are LEAN or RICH beyond a certain value, it is detected as a malfunction and the MIL lights up.

DTC No.	DTC Detecting Condition	Trouble Area
P0171/25	When the air–fuel ratio feedback is stable after engine warming up, the fuel trim is considerably in error on the RICH side (2 trip detection logic)	• Gas leakage on exhaust system • Fuel line pressure • Injector blockage • Heated oxygen sensor (bank 1 sensor 1) malfunction • Manifold absolute pressure sensor • Engine coolant temp. sensor
P0172/26	When the air–fuel ratio feedback is stable after engine warming up, the fuel trim is considerably in error on the LEAN side. (2 trip detection logic)	• Gas leakage on exhaust system • Fuel line pressure • Injector leak, blockage • Heated oxygen sensor (bank 1 sensor 1) malfunction • Manifold absolute pressure sensor • Engine coolant temp. sensor

HINT:

- When the DTC P0171/25 is recorded, the actual air–fuel ratio is on the LEAN side. When DTC P0172/26 is recorded, the actual air–fuel ratio is on the RICH side.
- If the vehicle runs out of fuel, the air–fuel ratio is LEAN and DTC P0171/25 is recorded. The check engine indicator then comes on.
- If the total of the short–term fuel trim value and long–term fuel trim value is within ± 25 %, the system is functioning normally.
- The heated oxygen sensor (bank 1 sensor 1) output voltage and the short–term fuel trim value can be read using the hand–held tester.

INSPECTION PROCEDURE

HINT:
Read freed frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

When using hand–held tester:

1	Check air induction system (See page FI–1).

NG → Repair or replace.

OK

2	Check injector injection (See page FI–18).

NG → Replace injector.

OK

3	Check air flow meter and water temperature sensor (See page FI–28, FI–55).

NG → Repair or replace.

OK

4	Check for spark and ignition (See page IG–1).

NG → Repair or replace.

OK

5	Check fuel pressure (See page FI–6).

NG → Check and repair fuel pump, pressure regulator, fuel pipe line and filter.

OK ↓

6	Check gas leakage on exhaust system.

NG → Repair or replace.

OK ↓

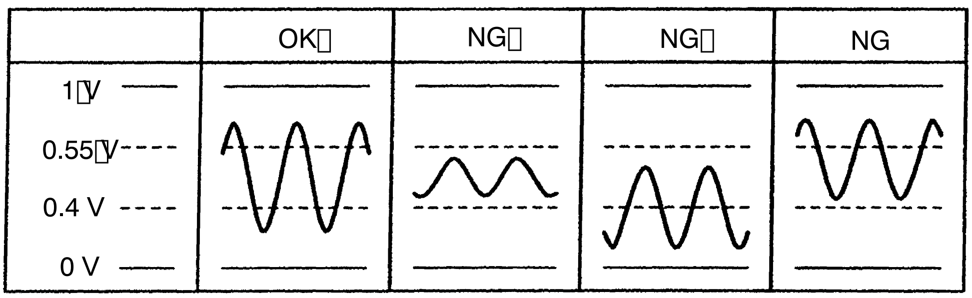
7	Check output voltage of oxygen sensor (bank 1 sensor 1) during idling.

PREPARATION:
Warm up the oxygen sensor with the engine speed at 2,500 rpm for approx. 90 sec.

CHECK:
Used the hand–held tester to read the output voltage of the oxygen sensor during idling.

OK:

Oxygen sensor output voltage:
Alternates repeatedly between less than 0.4 V and more than 0.5 V (See the following table).



A00292

OK → Go to step 9.

NG ↓

8	Check for open and short in harness and connector between engine ECU and oxygen sensor (bank 1 sensor 1) (See page IN–20).

NG → Repair or replace harness or connector.

OK ↓

Replace oxygen sensor.

9	Perform confirmation driving pattern (See page DI–53).

Go ↓

10	Is there DTC P0171/25 being output again?

YES → Check and replace engine ECU (See page IN–20).

NO ↓

11	Did vehicle runs out of fuel in past?

NO → Check for intermittent problems (See page DI–24).

YES ↓

DTC P0171/25 is caused by running out of fuel.

When not using hand–held tester:

1	Check air induction system (See page FI–1).

NG → Repair or replace.

OK

2	Check fuel pressure (See page FI–6).

NG → Check and repair fuel pump, fuel pipe line and filter.

OK

3	Check injector injection (See page FI–22).

NG → Replace injector.

OK

4	Check air flow meter and water temperature sensor (See page FI–28, FI–55).

NG → Repair or replace.

OK

5	Check for spark and ignition (See page IG–1).

NG — Repair or replace.

OK

6	Does malfunction disappear when a good oxygen sensor (bank 1 sensor 1) installed?

YES — Repair oxygen sensor.

NO

Check and replace engine ECU (See page IN–20).

DI12T–09

DTC	P0300/93	Random/Multiple Cylinder Misfire Detected

DTC	P0301/93	Cylinder 1 Misfire Detected

DTC	P0302/93	Cylinder 2 Misfire Detected

DTC	P0303/93	Cylinder 3 Misfire Detected

DTC	P0304/93	Cylinder 4 Misfire Detected

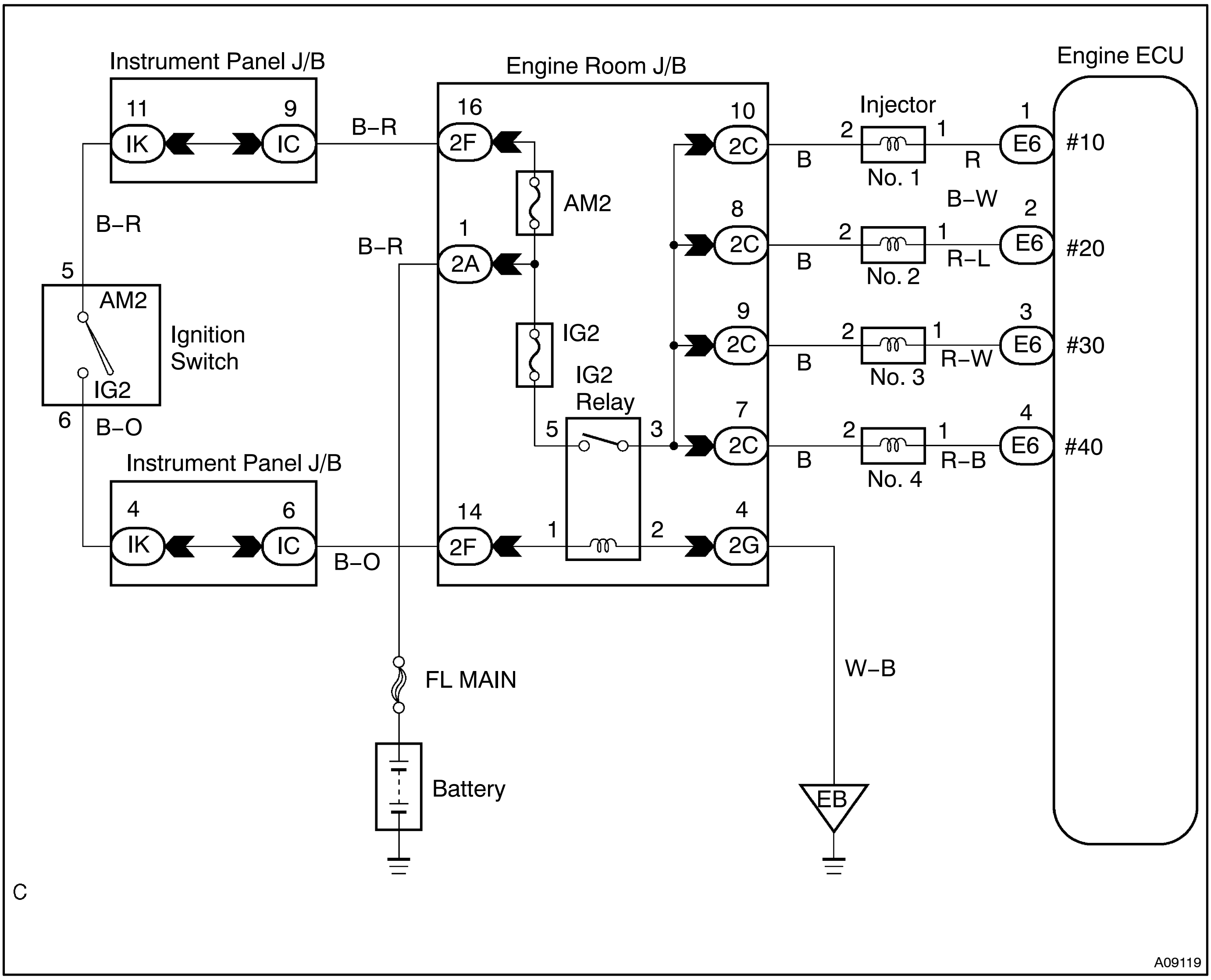
CIRCUIT DESCRIPTION

Misfire: The engine ECU uses the crankshaft position sensor and camshaft position sensor to monitor changes in the crankshaft rotation for each cylinder.
The engine ECU counts the number of times the engine speed change rate indicates that misfire has occurred. And when the misfire rate equals or exceeds the count indicating that the engine condition has deteriorated, the check engine warning light lights up.
If the misfire rate is high enough and the driving conditions will cause catalyst overheating, the check engine warning light blinks when misfiring occurs.

DTC No.	DTC Detecting Condition	Trouble Area
P0300/93	Misfiring of random cylinders is detected during any particular 200 or 1,000 revolutions	• Ignition system • Injector • Fuel pressure • Compression pressure • Valve clearance • Valve timing • Air flow meter • Water temp. sensor • Open or short in engine wire • Connector connection • Engine ECU
P0301/93 P0302/93 P0303/93 P0304/93	For any particular 200 revolutions for engine, misfiring is detected which can cause catalyst overheating (This causes MIL to blink) (2 trip detection logic)	
	For any particular 1,000 revolutions of engine, misfiring is detected which causes a deterioration in emissions (2 trip detection logic)	

HINT:
When the 2 or more codes for a misfiring cylinder are recorded repeatedly but no random misfire code is recorded, it indicates that the misfires were detected and recorded at different times.

WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN

(a) Connect the hand–held tester.
(b) Record DTC and the freeze frame data.
(c) Use the hand–held tester to set to Check Mode. (See page DI–4)
(d) Drive the vehicle several times with the engine speed, load and its surrounding range shown with ENGINE SPD, CALC LOAD in the freeze frame data or MISFIRE RPM, MISFIRE LOAD in the data list.

If you have no hand–held tester, turn the ignition switch OFF after the symptom is simulated the first time. Then repeat the simulation process again.

HINT:
In order to memorize DTC of misfire, it is necessary to drive around MISFIRE RPM, MISFIRE LOAD in the data list for the following period of time.

Engine Speed	Time
Idling	3 minutes 30 seconds or more
1000 rpm	3 minutes or more
2000 rpm	1 minutes 30 seconds or more
3000 rpm	1 minutes or more

(e) Check whether there is misfire or not by monitoring DTC and the freeze frame data. After that, record them.
(f) Turn ignition switch OFF and least 5 seconds.

INSPECTION PROCEDURE

HINT:
- If is the case that DTC besides misfire is memorized simultaneously, first perform the troubleshooting for them.
- Read freeze frame data using hand–held tester. Because freeze frame data records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.
- When the vehicle is brought to the workshop and the misfire is not occurred, misfire can be confirmed by reproducing the condition or freeze frame data. Also, after finishing the repair, confirm that there is no misfire. (See the confirmation driving pattern)
- When either of SHORT FT #1, LONG FT #1, SHORT FT #2 or LONG FT #2 in the freeze frame data is besides the range of ±20 %, there is a possibility that the air–fuel ratio is inclining either to RICH (–20 % or less) or LEAN (+20 % or more).
- When COOLANT TEMP in the freeze frame data is less than 80°C (176°F), there is a possibility of misfire only during warning up.
- In the case that misfire cannot be reproduced, the reason may be because of the driving with lack of fuel, the use of improper fuel, a stain of ignition plug, and etc.

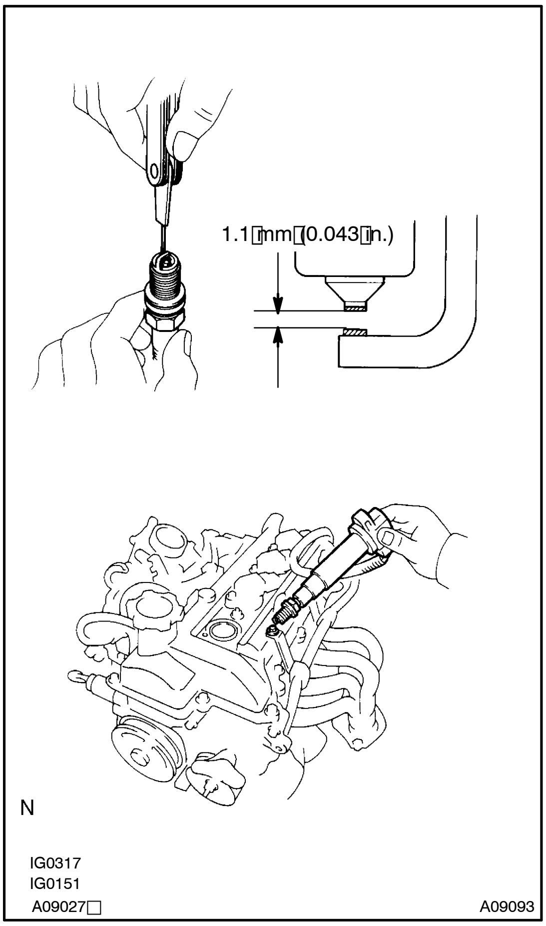
1	**Check wire harness, connector and vacuum hose in engine room.**

CHECK:
(a) Check the connection conditions of wire harness and connector.
(b) Check the disconnection, piping and break or vacuum hose.

NG → **Repair or replace, then confirm that there is no misfire (See confirmation driving pattern)**

OK

2	**Check spark plug and spark of misfiring cylinder.**



PREPARATION:
Remove the spark plug (See page IG–1).

CHECK:
(a) Check the electrode of carbon deposits electrode.
(b) Check the electrode gap.

OK:
(a) No large carbon deposit present.
Not wet with gasoline or oil.
(b) Electrode gap: 1.1 mm (0.043 in.)

PREPARATION:
(a) Install the spark plug to the ignition coil.
(b) Disconnect the injector connector.
(c) Ground the spark plug.

CHECK:
Check if spark occurs while the engine is being cracked.

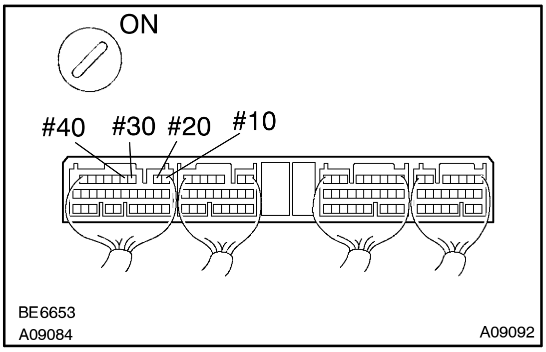
NOTICE:
To prevent excess fuel being injected from the injectors during this test, don't crank the engine for more than 5 ~ 10 seconds at a time.

OK:
Spark jumps across electrode gap.

NG → **Replace or check ignition system (See page IG–1).**

OK

3	**Check voltage of engine ECU terminals for injector of failed cylinder.**



PREPARATION:

(a) Remove the cover from the engine ECU.

(b) Turn the ignition switch ON.

CHECK:

Measure voltage between applicable terminal of the engine ECU connector and body ground.

OK:

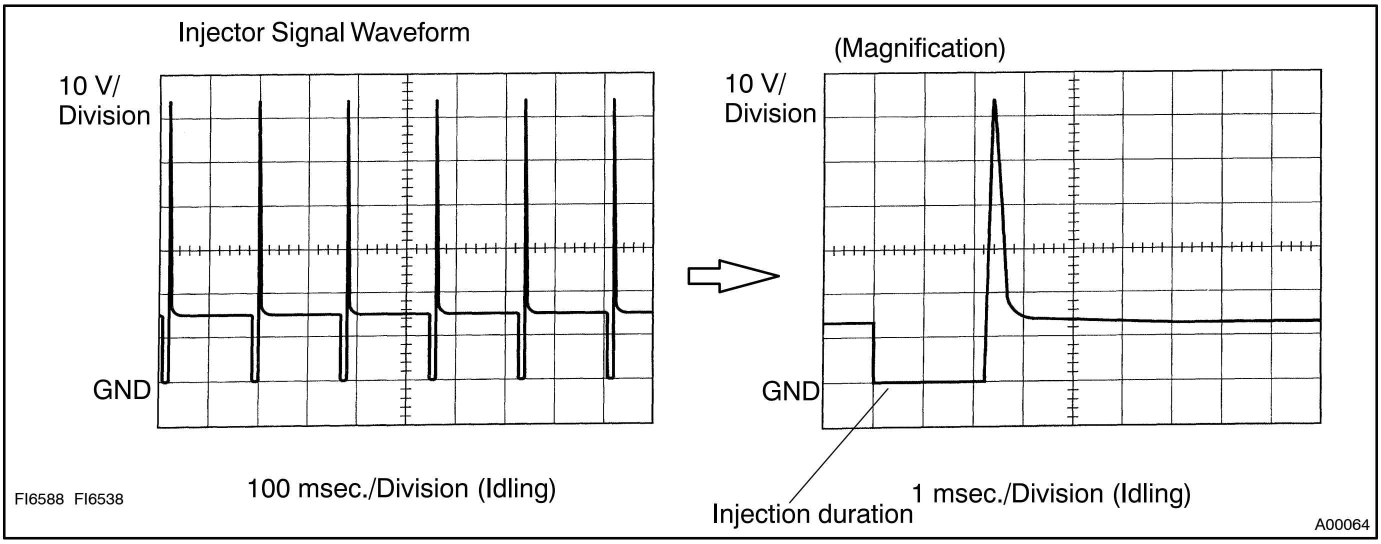
Voltage: 9 – 14 V

Reference: INSPECTION USING OSCILLOSCOPE

With the engine idling, measure between terminals #10 – #40 and E01 of the engine ECU connector.

HINT:

The correct waveforms are as shown.



OK → **Go to step 5.**

NG

4	Check resistance of injector of misfiring cylinder (See page FI–18).

NG → Replace injector.

OK

Check for open and short in harness and connector between injector and engine ECU (See page IN–20).

5	Check fuel pressure (See page FI–6).

NG → Check and repair fuel pump, pressure regulator, fuel pipe line and filter (See page FI–1).

OK

6	Check injector injection (See page FI–22).

NG → Replace injector.

OK

7	Check air flow meter and water temp. sensor (See pages FI–28 and FI–55).

NG → Repair or replace.

OK

Check compression pressure, valve clearance and valve timing.

DI4EA–03

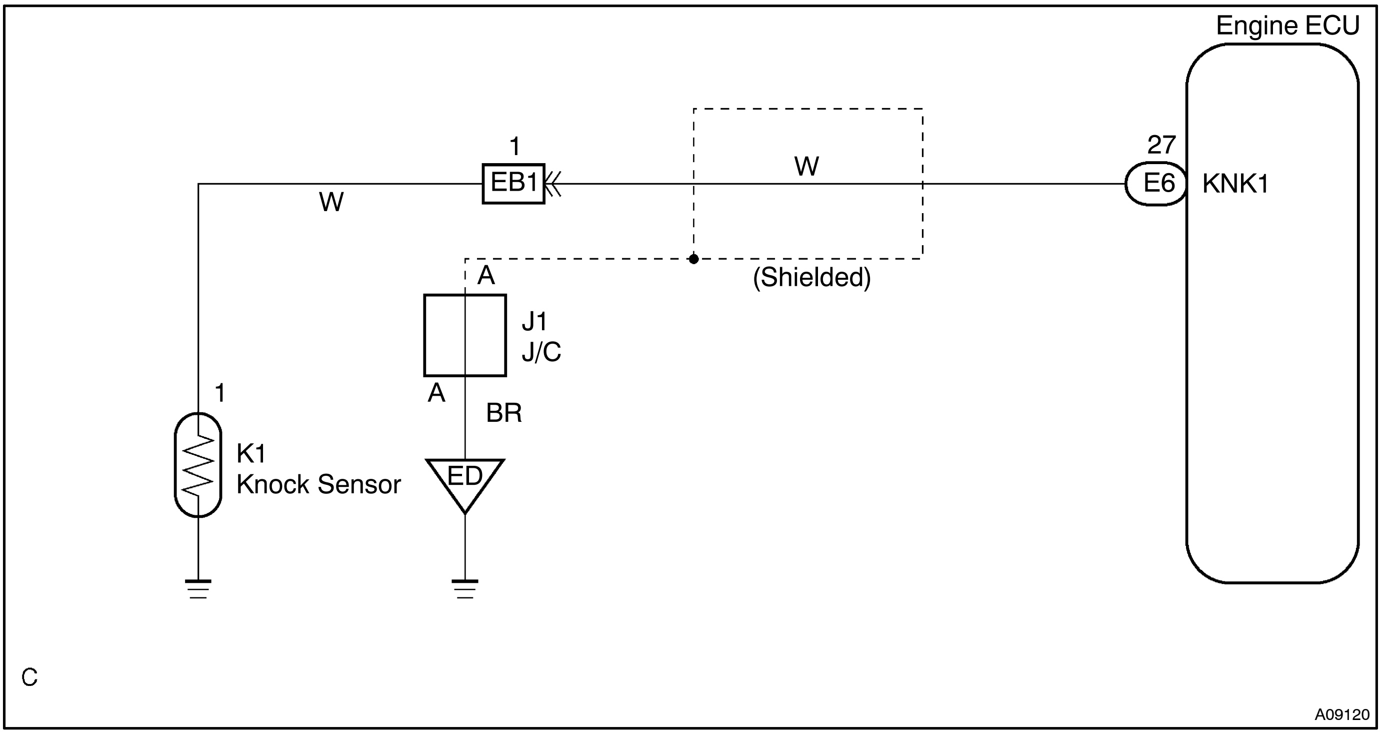
DTC	P0325/52, 55	Knock Sensor Circuit Malfunction

CIRCUIT DESCRIPTION

Knock sensor are fitted to the cylinder block to detect engine knocking. This sensor contains a piezoelectric element which generates a voltage when it becomes deformed, which occurs when the cylinder block vibrates due to knocking. If engine knocking occurs, ignition timing is retarded to suppress it.

DTC No.	DTC Detecting Condition	Trouble Area
P0325/52, 55	No knock sensor signal to engine ECU with engine speed 1,280 rpm or more	• Open or short in knock sensor circuit • Knock sensor (looseness) • Engine ECU

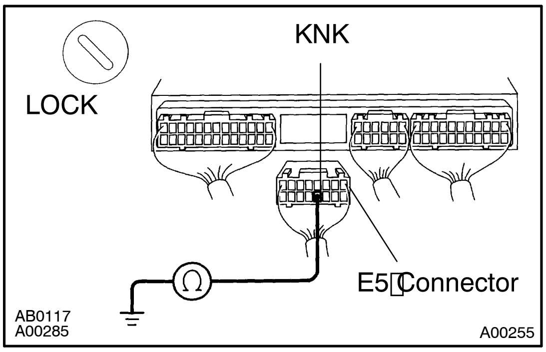
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	Check continuity between terminal KNK of engine ECU connector and body ground.



PREPARATION:

(a) Remove the cover from the engine ECU.

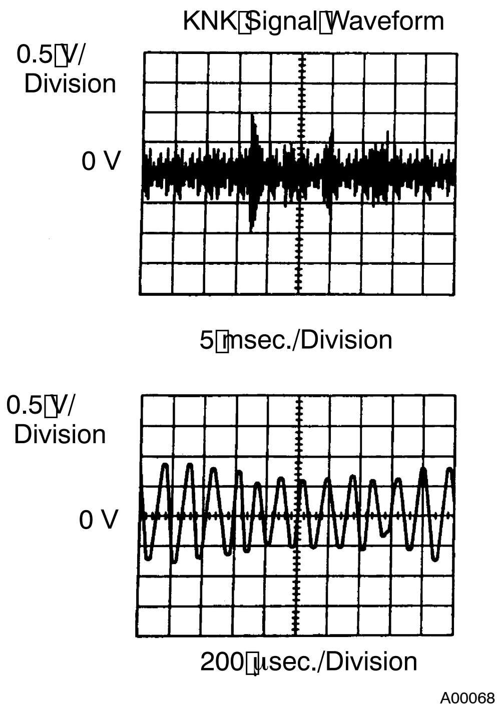
(b) Disconnect the E5 connector of engine ECU.

CHECK:

Measure resistance between terminal KNK of engine ECU connector and body ground.

OK:

Resistance: 1 MΩ or higher



Reference: INSPECTION USING OSCILLOSCOPE

- With the engine racing (4,000 rpm) measure between terminal KNK of engine ECU and body ground.

HINT:

The correct waveform is as shown.

- Spread the time on the horizontal axis, and confirm that period of the wave is 80 μsec.
  (Normal mode vibration frequency of knock sensor: 12.5 kHz (1ZZ–FE), 7.1 kHz (2ZZ–GE)).

HINT:

If normal mode vibration frequency is not 12.5 kHz (1ZZ–FE), 7.1 kHz (2ZZ–GE) the sensor is malfunctioning.

OK → **Go to step 3 .**

NG

2	Check knock sensor (See page FI–58).

NG → **Replace knock sensor.**

OK

3	**Check for open and short in harness and connector between engine ECU and knock sensor (See page IN–20).**

NG → **Repair or replace harness or connector.**

OK

4	**Does malfunction disappear when a good knock sensor is installed?**

YES → **Replace knock sensor.**

NO

Check and replace engine ECU (See page IN–20).

DI4EB–03

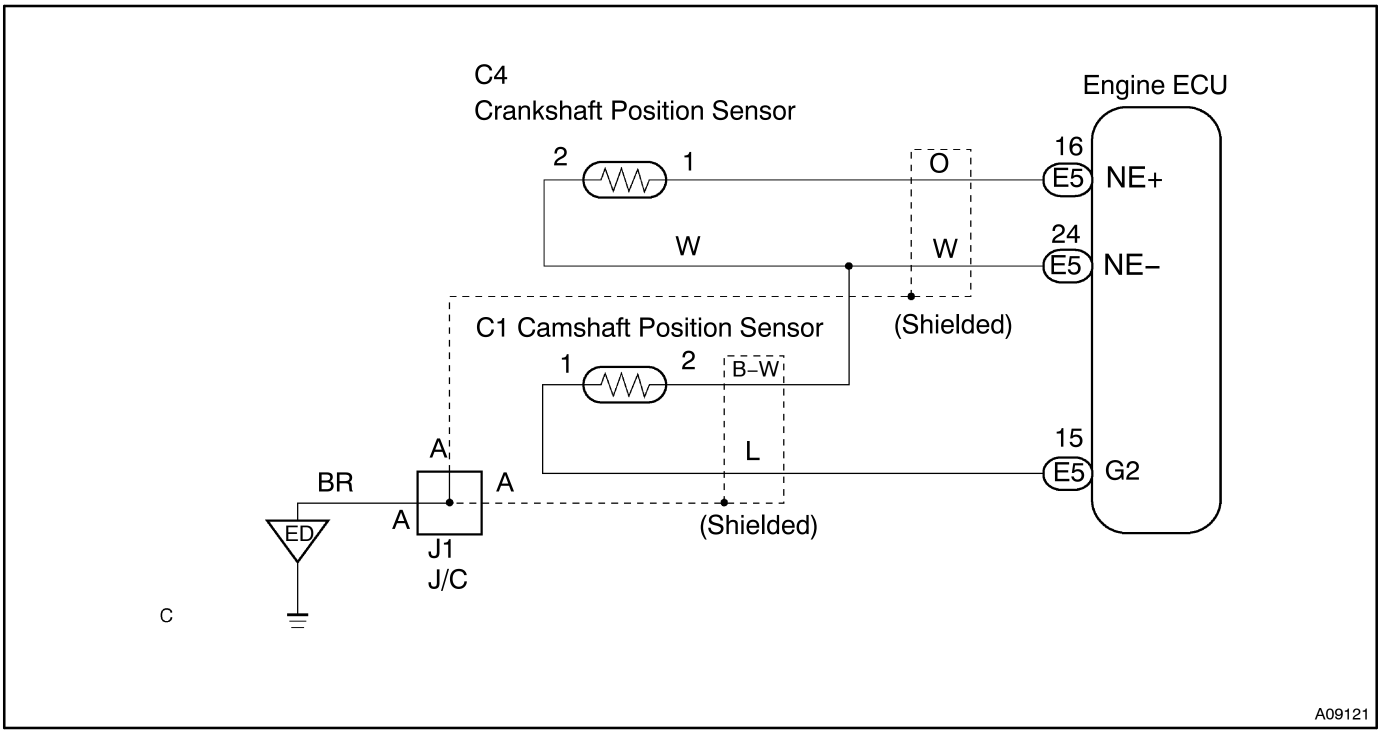
DTC	P0335/12, 13	Crankshaft Position Sensor Circuit Malfunction

CIRCUIT DESCRIPTION

Crankshaft position sensor (NE signal) consist of a signal plate and pick up coil.
The NE signal plate has 34 teeth and is mounted on the crankshaft. The NE signal sensor generates 34 signals of every engine revolution. The engine ECU detects the standard crankshaft angle based on the G2+ signals, and the actual crankshaft angle the engine speed by the NE signals.

DTC No.	DTC Detecting Condition	Trouble Area
P0335/12, 13	No crankshaft position sensor signal to engine ECU during cranking. (2 trip detection logic)	• Open or short in crankshaft position sensor circuit. • Crankshaft position sensor • Signal plate (Timing belt guide) • Crankshaft timing pulley • Engine ECU
	No crankshaft position sensor signal to engine ECU with engine speed 600 rpm or more. (2 trip detection logic)	

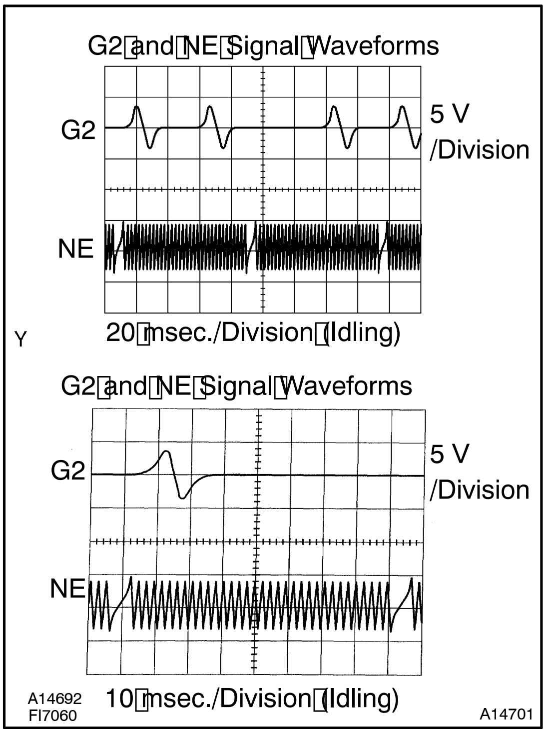
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
- Perform troubleshooting of DTC P0335/12 first. If no trouble is found, troubleshoot the following mechanical system.
- Read freed frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	**Check resistance of crankshaft position sensor (See page IG–15).**



Reference: INSPECTION USING OSCILLOSCOPE

During cranking or idling, check between terminals G2 and NE–, NE+ and NE– of engine ECU.

HINT:

The correct waveforms are as shown.

NG → **Replace crankshaft position sensor.**

OK

2	**Check for open and short in harness and connector between engine ECU and crankshaft position sensor (See page IN–20).**

NG → **Repair or replace harness or connector.**

OK

3	**Inspect sensor installation and teeth of signal plate.**

NG → **Tighten the sensor. Replace signal plate.**

OK

Check and replace engine ECU (See page IN–20).

DI6TU–01

DTC	P0340/12	Camshaft Position Sensor Circuit Malfunction

CIRCUIT DESCRIPTION

Camshaft position sensor (G2+ signal) consist of a signal plate and pick up coil. The G2+ signal plate has 3 tooth on its outer circumference and is mounted on the camshaft.
When the camshafts rotate, the protrusion on the signal plate and the air gap on the pick up coil change, causing fluctuations in the magnetic field and generating an electromotive force in the pick up coil.
The NE signal plate has 34 teeth and is mounted on the crankshaft. The NE signal sensor generates 34 signals for every engine revolution. The engine ECU detects the standard crankshaft angle based on the G2+ signals and the actual crankshaft angle and the engine speed by the NE signals.

DTC No.	DTC Detecting Condition	Trouble Area
P0340/12	No camshaft position sensor signal to engine ECU during cranking. (2 trip detection logic)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Camshaft timing pulley • Engine ECU
	No camshaft position sensor signal to engine ECU with engine speed 600 rpm or more	

WIRING DIAGRAM

Refer to DTC P0335/12, 13 on page DI–82.

INSPECTION PROCEDURE

HINT:
Read freed frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	**Check resistance of camshaft position sensor (Signal generator) (See page IG–1).**

Reference: INSPECTION USING OSCILLOSCOPE
Refer to DTC P0335/12, 13 (Crankshaft Position Sensor "A" Circuit Malfunction) on page DI–82 for the INSPECTION USING OSCILLOSCOPE.

NG → **Replace camshaft position sensor.**

OK

2	Check for open and short in harness and connector between engine ECU and camshaft position sensor (See page IN–20).

NG → Repair or replace harness or connector.

OK

3	Inspect sensor installation.

NG → Tighten the sensor.

OK

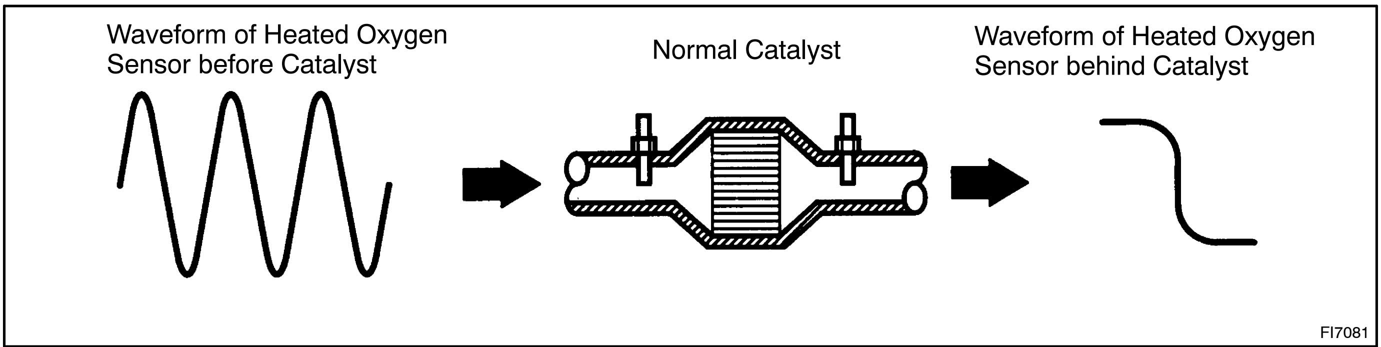
Check and replace engine ECU (See page IN–20).

DI1EE–07

DTC	P0420/94	Catalyst System Efficiency Below Threshold

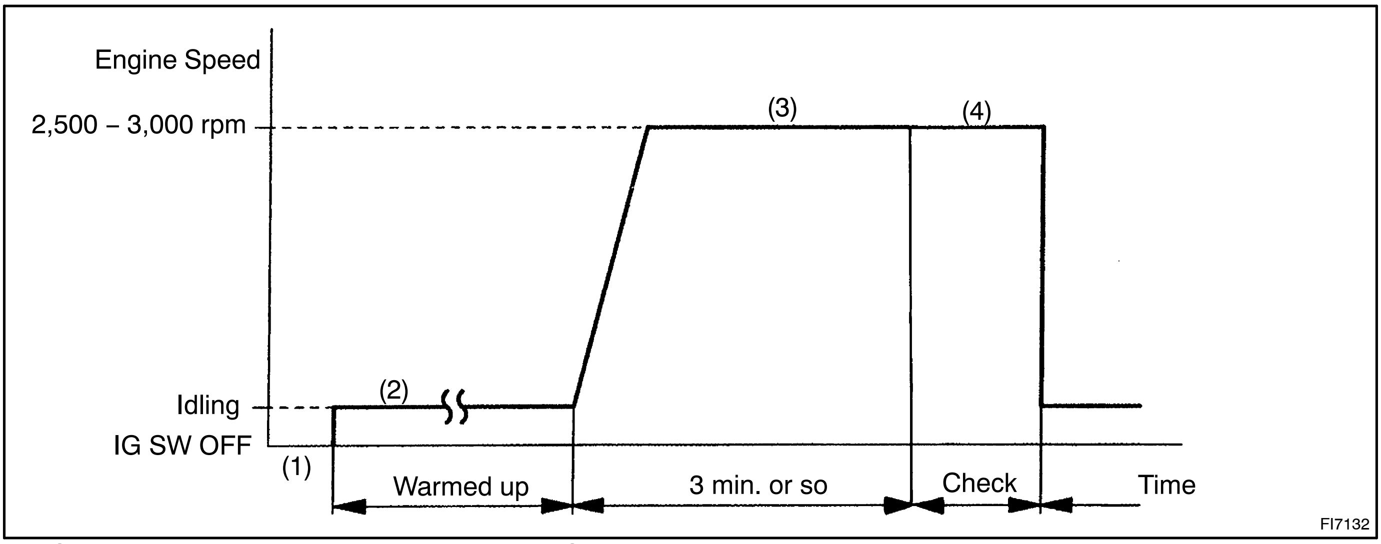
CIRCUIT DESCRIPTION

The engine ECU compares the waveform of the heated oxygen sensor located before the catalyst with the waveform of the heated oxygen sensor located behind the catalyst to determine whether or not catalyst performance has deteriorated.
Air–fuel ratio feedback compensation keeps the waveform of the heated oxygen sensor before the catalyst repeatedly changing back and forth from rich to lean.
If the catalyst is functioning normally, the waveform of the heated oxygen sensor behind the catalyst switches back and forth between rich and lean much more slowly than the waveform of the heated oxygen sensor before the catalyst.
But when both waveforms change at a similar rate, it indicates that catalyst performance has deteriorated.

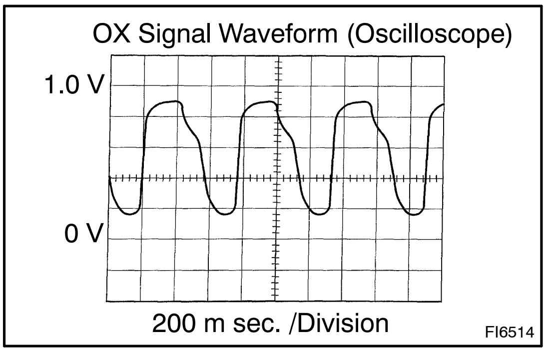


DTC No.	DTC Detecting Condition	Trouble Area
P0420/94	After the engine and the catalyst are warmed up, and while the vehicle is driven within the set vehicle and engine speed range, the waveforms of the heated oxygen sensors (bank 1 sensor 1 and bank 1 sensor 2) have the same amplitude (2 trip detection logic)	• Three–way catalytic converter • Open or short in heated oxygen sensor (bank1 sensor2) circuit • Heated oxygen sensor (bank1 sensor2)

CONFIRMATION ENGINE RACING PATTERN



(1) Connect the hand–held tester to the DLC3, or connect the probe of the oscilloscope between terminals OX1, OX2 and E1 of engine ECU.
(2) Start engine and warm it up with all accessories switched OFF until water temp. is stable.
(3) Race the engine at 2,500 – 3,000 rpm for about 3 min.
(4) After confirming that the waveforms of the heated oxygen sensor, bank 1 sensor 1 (OX1), oscillate around 0.5 V during feedback to the engine ECU, check the waveform of the heated oxygen sensor, bank 1 sensor 2 (OX2).



HINT:
If there is a malfunction in the system, the waveform of the heated oxygen sensor, bank 1 sensor 2 (OX2), is almost the same as that of the heated oxygen sensor, bank 1 sensor 1 (OX1), on the left.
There are some cases where, even though a malfunction exists, the CEN indicator light may either light up or not light up.

INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1 **Are there any other codes (besides DTC P0420) being output?**

YES → **Go to relevant DTC chart (See page DI–18).**

NO ↓

2 **Check gas leakage on exhaust system.**

NG → **Repair or replace.**

OK ↓

3 **Check heated oxygen sensor (bank 1 sensor 1) (See page FI–60).**

NG → **Repair or replace.**

OK ↓

4 **Check heated oxygen sensor (bank 1 sensor 2) (See page FI–60).**

NG → **Repair or replace.**

OK ↓

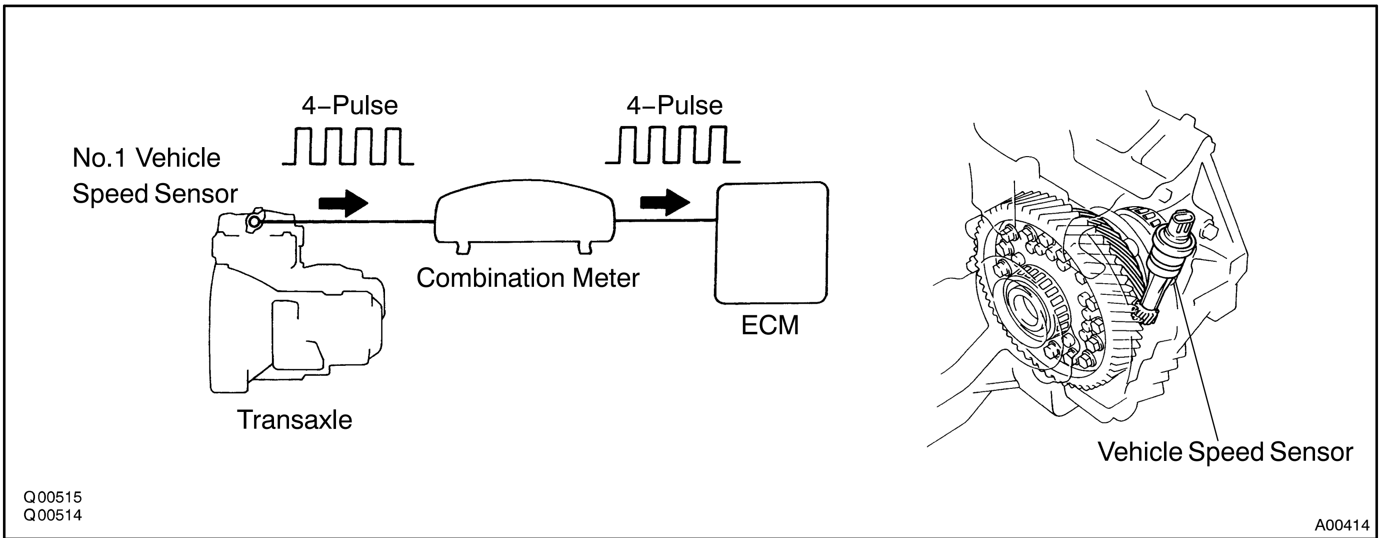
Replace three–way catalytic converter.

DI4ED-03

DTC	P0500/42	Vehicle Speed Sensor Malfunction

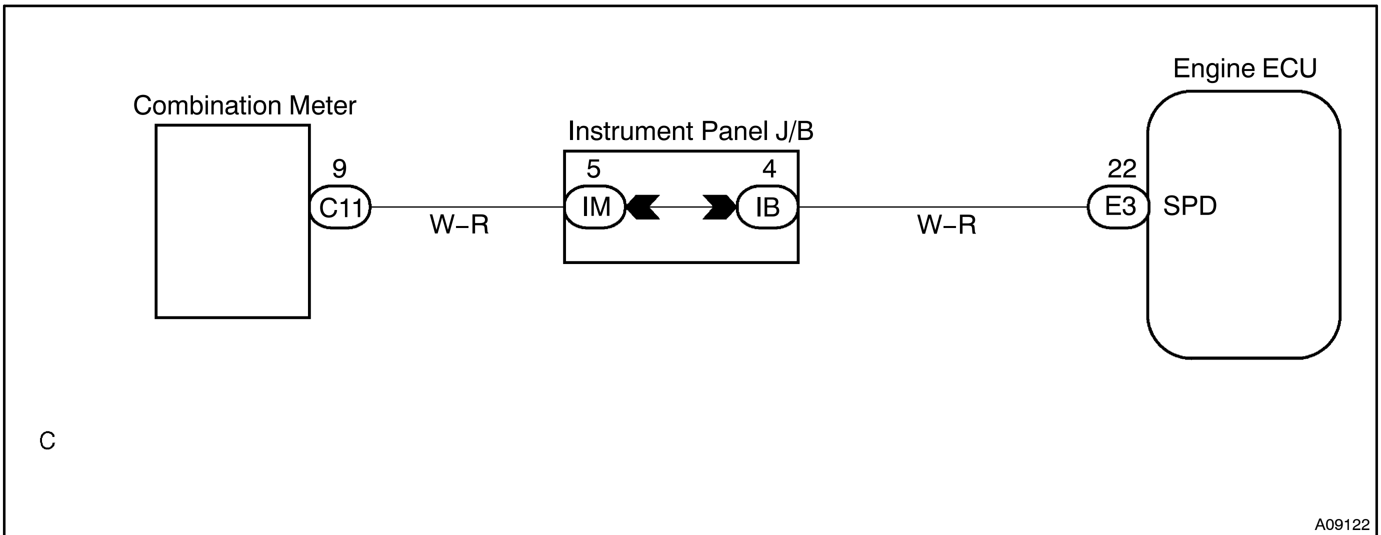
CIRCUIT DESCRIPTION

The vehicle speed sensor outputs a 4-pulse signal for every revolution of the rotor shaft, which is rotated by the transmission output shaft via the driven gear. After this signal is converted into a more precise rectangular waveform by the waveform shaping circuit inside the combination meter, it is then transmitted to the Engine ECU. The EngineECU determines the vehicle speed based on the frequency of these pulse signals.



DTC No.	DTC Detecting Condition	Trouble Area
P0500/42	During vehicle is being driven, no vehicle speed sensor signal to engine ECU (2 trip detection logic)	• Combination meter • Open or short in No.1 vehicle speed sensor circuit • No.1 vehicle speed sensor • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

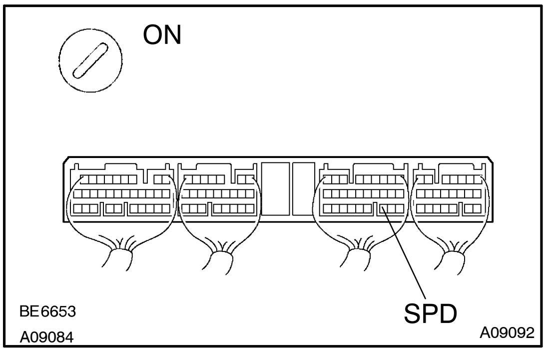
1	**Check operation of speedometer.**

CHECK:
Drive the vehicle and check if the operation of the speedometer in the combination meter is normal.
HINT:
The vehicle speed sensor is operating normally if the speedometer display is normal.

NG → **Check speedometer (See Pub. NO. RM734E BE section).**

OK

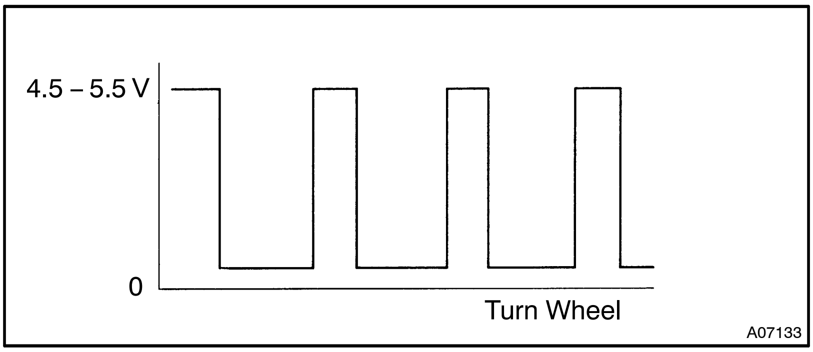
2	**Check voltage between terminal SPD of Engine ECU connector and body ground.**



PREPARATION:
(a) Shift the shift lever to neutral.
(b) Lift up the vehicle.
(c) Turn the ignition switch ON.

CHECK:
Measure voltage between terminal SPD of the Engine ECU connector and body ground when the wheel is turned slowly.

OK:
Voltage is generated intermittently.



NG

Check and repair harness and connector between combination meter and Engine ECU.

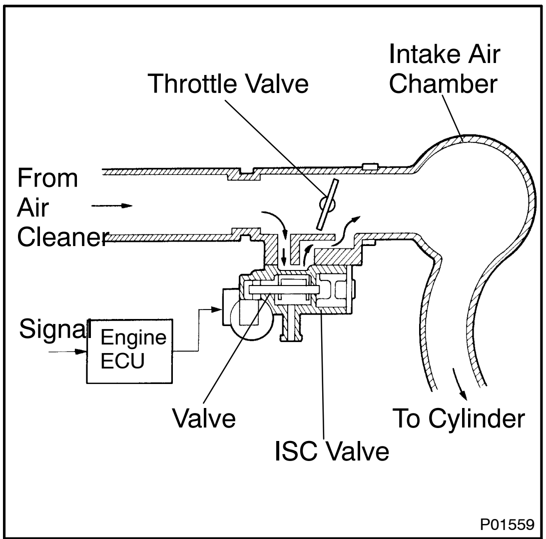
OK

Check and replace Engine ECU (See page IN–20).

DI6TV–01

DTC	P0505/33	Idle Control System Malfunction

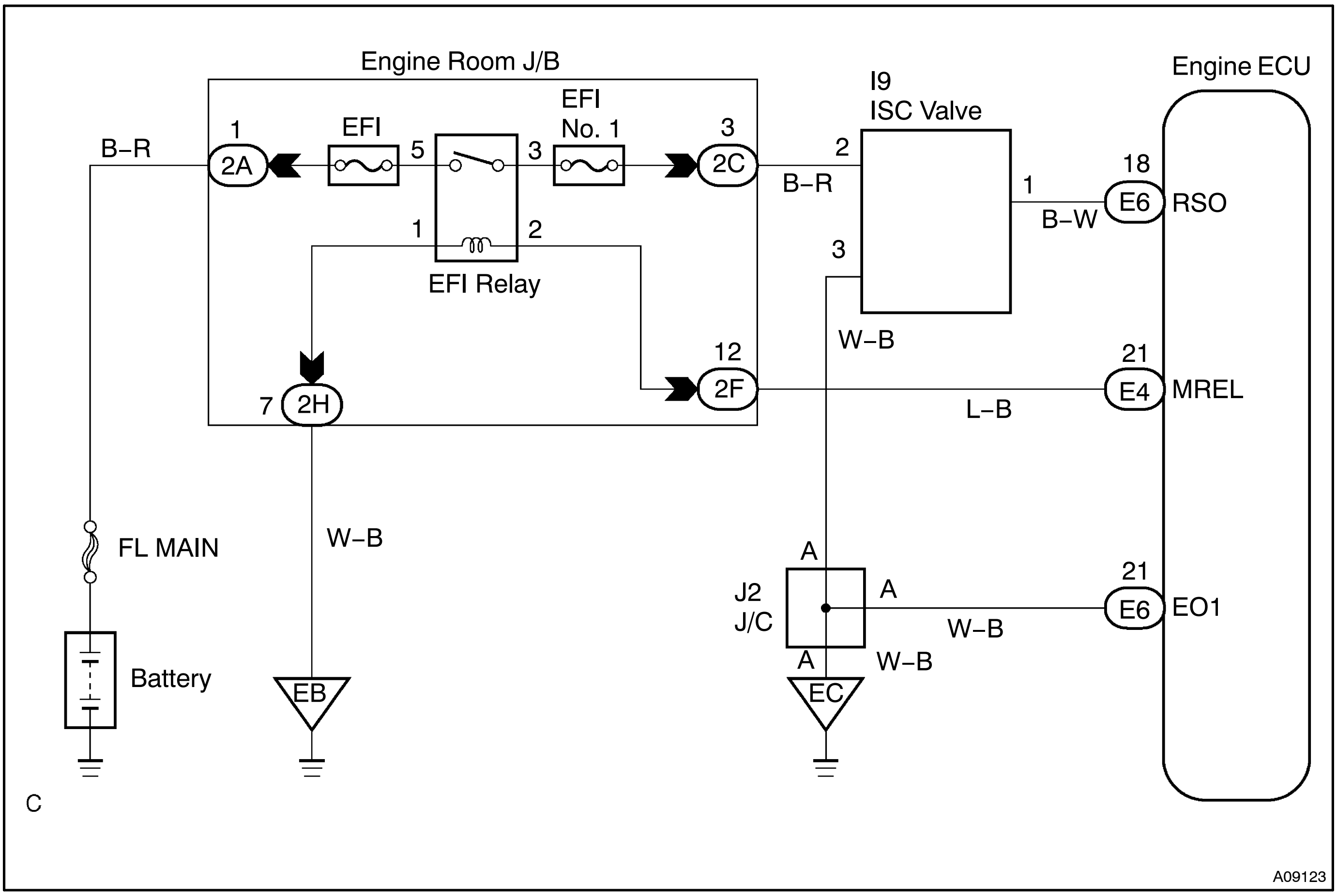
CIRCUIT DESCRIPTION



The rotary solenoid type ISC valve is located in front of the intake air chamber and intake air bypassing the throttle valve is directed to the ISC valve through a passage.
In this way the intake air volume bypassing the throttle valve is regulated, controlling the engine speed.
The engine ECU operates only the ISC valve to perform idle–up and provide feedback for the target idling speed.

DTC No.	DTC Detecting Condition	Trouble AreaTrouble Area
P0505/33	Idle speed continues to vary greatly from the target speed (2 trip detection logic)	• ISC valve is stuck or closed • Open or short in ISC valve circuit • Open or short in A/C switch circuit • Air induction system • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freed frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

When using hand–held tester

1	**Check operation of the ISC valve.**

PREPARATION:

(a) Connect the hand–held tester to the DLC3.

(b) Turn the ignition switch ON and push the hand–held tester main switch ON.

(c) Select the active test mode on the hand–held tester.

CHECK:

Check engine speed when the ISC valve operated by hand–held tester.

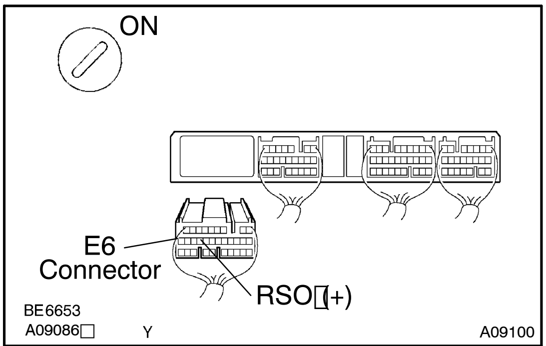
OK:

Engine speed is increased and decreased in response to change of ISC duty ratio.

OK → Check for intermittent problems (See page DI–4).

NG ↓

2 Check voltage between terminals RSO of engine ECU connector and body ground.



PREPARATION:

(a) Remove the engine ECU cover.

(b) Disconnect the E6 connector of engine ECU.

(c) Turn the ignition switch ON.

CHECK:

Measure voltage between terminals RSO of the engine ECU connector and body ground,

OK:

Voltage: 9 – 14 V

OK → **Go to step 4.**

NG ↓

3 Check ISC valve (See page FI–48).

NG → **Replace ISC valve.**

OK ↓

Check for open and short in harness and connector between engine room J/B and ISC valve and engine ECU (See page IN–20).

4 Check operation of the ISC valve (See page FI–44).

NG → **Repair or replace ISC valve.**

OK ↓

5	Check the blockage of ISC valve and the passage to bypass the throttle valve.

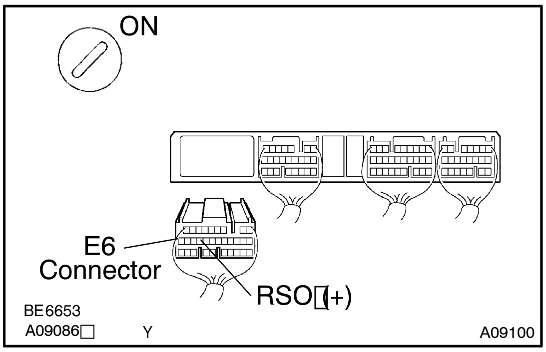
NG → Repair or replace ISC valve.

OK

Check and replace engine ECU (See page IN–20).

When not using hand–held tester

1	Check voltage between terminals RSO of engine ECU connector and body ground.



PREPARATION:

(a) Remove the engine ECU cover.
(b) Disconnect the E6 connector of engine ECU.
(c) Turn the ignition switch ON.

CHECK:

Measure voltage between terminals RSO of the engine ECU connector and body ground,

OK:

Voltage: 9 – 14 V

OK → Go to step 3.

NG

2	Check ISC valve (See page FI–48).

NG → Replace ISC valve.

OK

Check for open and short in harness and connector between engine room J/B and ISC valve and engine ECU (See page IN–20).

3	Check operation of the ISC valve (See page FI–44).

NG → Repair or replace ISC valve.

OK

4	Check the blockage of ISC valve and the passage to bypass the throttle valve.

NG → Repair or replace ISC valve.

OK

Check and replace engine ECU
(See page IN–20).

DI68S–02

DTC	P1300/14	Igniter Circuit Malfunction (No.1)

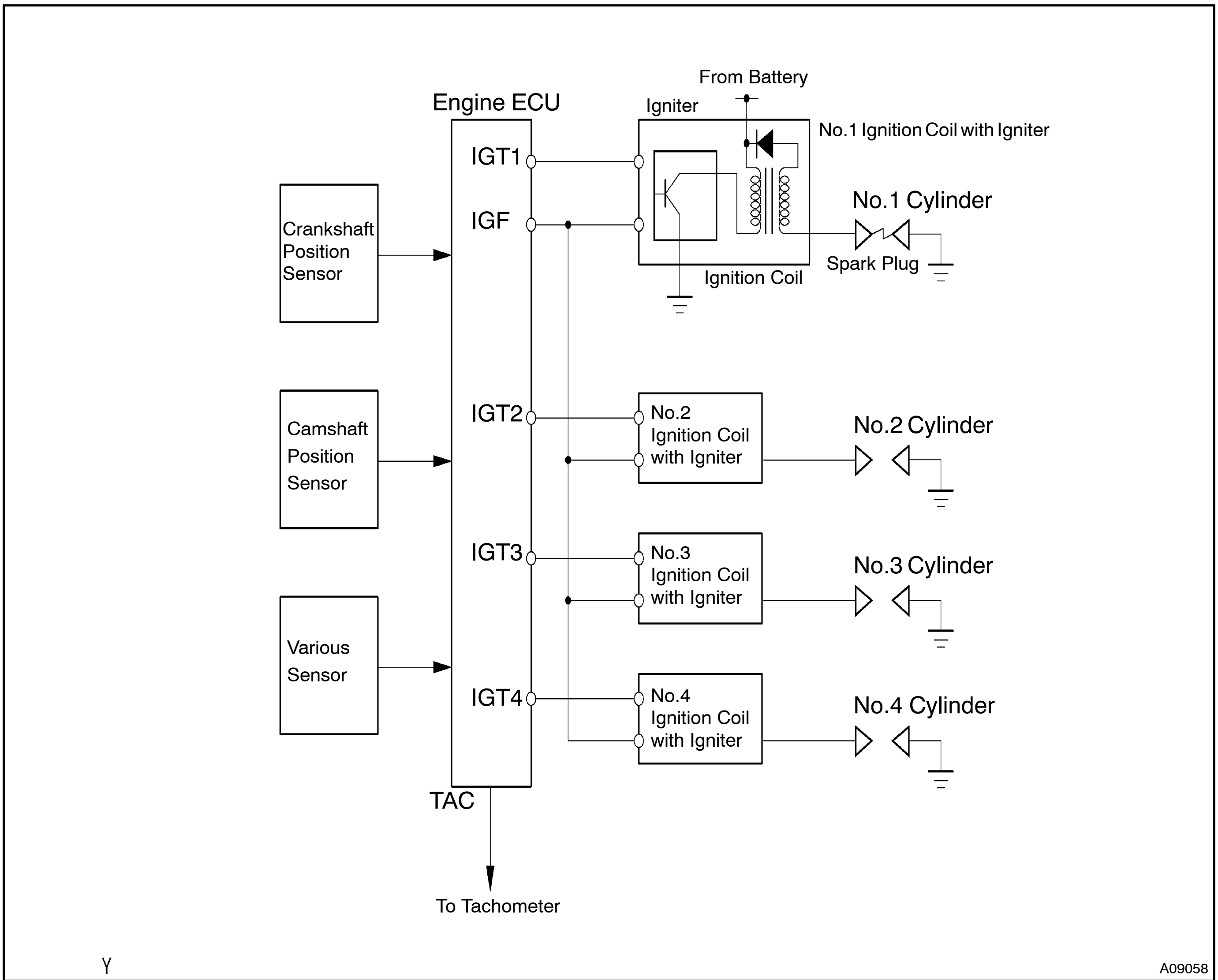
DTC	P1305/15	Igniter Circuit Malfunction (No.2)

DTC	P1310/14	Igniter Circuit Malfunction (No.3)

DTC	P1315/15	Igniter Circuit Malfunction (No.4)

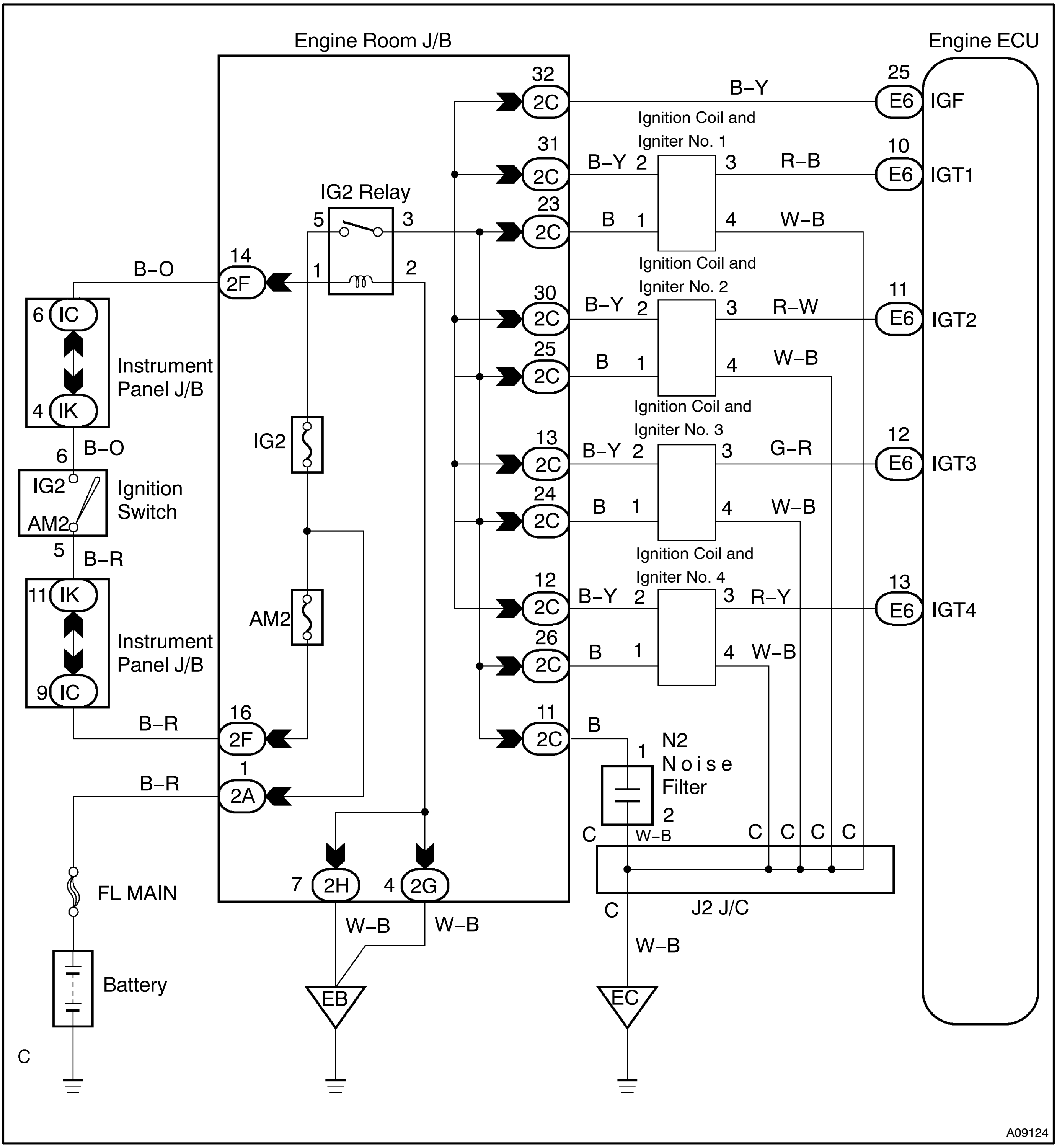
CIRCUIT DESCRIPTION

A Direct Ignition System (DIS) has been adopted. The DIS improves the ignition timing accuracy, reduces high–voltage loss, and enhances the the overall reliability of the ignition system by eliminating the distributor. The DIS is a 1–cylinder ignition system which ignites one cylinder with one ignition coil. In the 1–cylinder ignition system, the one spark plug is connected to the end of the secondary winding. High voltage generated in the secondary winding is applied directly to the spark plug. The spark of the spark plug pass from the center electode to the ground electrode.
The engine ECU determines ignition timing and outputs the ignition signals (IGT) for each cylinder. Based on IGT signals, the power transistors in the igniter cuts off the current to the primary coil in the ignition coil is supplied to the spark plug that are connected to the end of the secondary coil. At the same time, the igniter also sends an ignition confirmation signal (IGF) as a fail–safe measure to the engine ECU.



DTC No.	DTC Detecting Condition	Trouble Area
P1300/14 P1305/15 P1310/14 P1315/15	No IGF signal to engine ECU while engine is running	• Open or short in IGF or IGT1 – 4 circuit from ignition coil with igniter • No.1 – No.4 ignition coil with igniter • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTC P1300/14 is displayed, check No.1 ignition coil with igniter circuit.
- If DTC P1305/15 is displayed, check No.2 ignition coil with igniter circuit.
- If DTC P1310/14 is displayed, check No.3 ignition coil with igniter circuit.
- If DTC P1315/15 is displayed, check No.4 ignition coil with igniter circuit.
- Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	**Check spark plug and spark (See page IG–1).**

NG → **Go to step 4.**

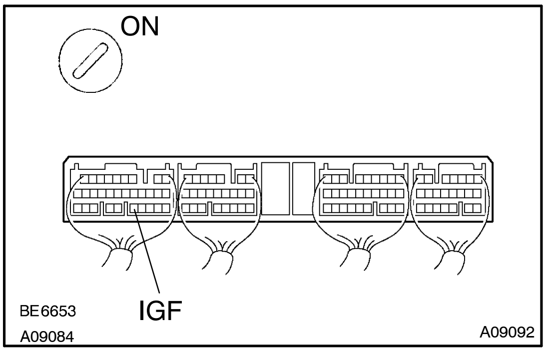
OK

2	**Check for open and short in harness and connector in IGF and IGT signal circuit between engine ECU and ignition coil with igniter (See page IN–20).**

NG → **Repair or replace harness or connector.**

OK

3	**Disconnect ignition coil with igniter connector, and check voltage between terminals IGF of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the engine ECU cover.

(b) Disconnect the ignition coil with the igniter connector.

(c) Turn the ignition switch ON.

CHECK:

Measure voltage between terminals IGF of the engine ECU connector and body ground.

OK:

Voltage: 4.5 – 5.5 V

OK → **Replace ignition coil with igniter.**

NG

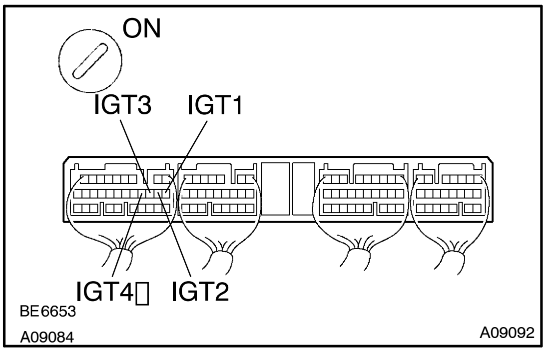
Check and replace engine ECU (See page IN–20).

4	**Check for open and short in harness and connector in IGT signal circuit between engine ECU and ignition coil with igniter (See page IN–20).**

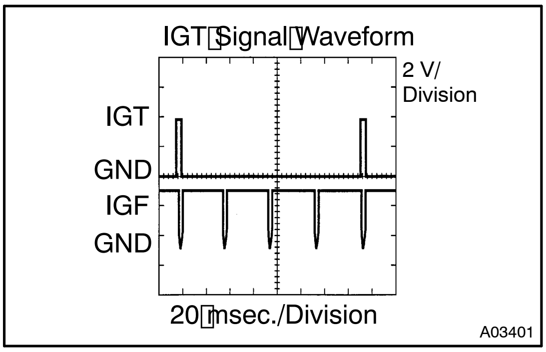
NG → **Repair or replace harness or connector.**

OK

5	**Check voltage between terminals IGT1 – 4 of engine ECU connector and body ground.**



PREPARATION:
Remove the engine ECU cover.
CHECK:
Measure voltage between terminals IGT1 – 4 of the engine ECU connector and body ground when the engine is cranked.
OK:
Voltage: More than 0.1 V and less than 4.5 V

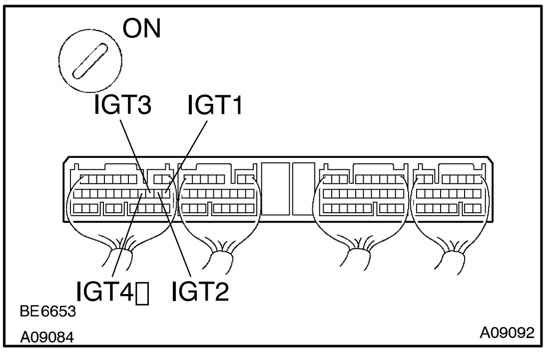


Reference: INSPECTION USING OSCILLOSCOPE
During cranking or idling, check waveform between terminals IGT1 – 4 and E1 of the engine ECU connector.
HINT:
Correct waveform appears as shown, with rectangle waves.

NG → **Check and replace engine ECU (See page IN–20).**

OK

6	**Disconnect ignition coil with igniter connector, and check voltage between terminals IGT1 – 4 of engine ECU connector and body ground.**



PREPARATION:

(a) Remove the engine ECU cover.

(b) Disconnect the ignition coil with the igniter connector.

CHECK:

Measure voltage between terminals IGT1 – 4 of the engine ECU connector and body ground when the engine is cranked.

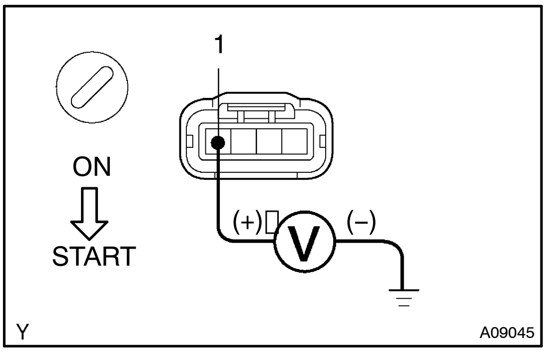
OK:

Voltage: More than 0.1 V and less than 4.5 V

NG → **Check and replace engine ECU (See page IN–20).**

OK

7	**Check ignition coil with igniter power source circuit.**



PREPARATION:

Disconnect the ignition coil the with the igniter connector.

CHECK:

Measure voltage between terminal 1 of the ignition coil with the igniter connector and body ground when the ignition switch is turned to ON and START position.

OK:

Voltage: 9 – 14 V

OK → **Repair ignition coil with igniter power source circuit.**

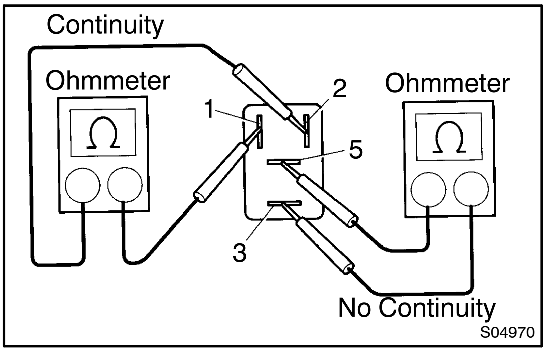
NG

8	**Check for open and short in harness and connector between ignition switch and ignition coil with igniter (See page IN–20).**

NG → **Repair or replace harness or connector.**

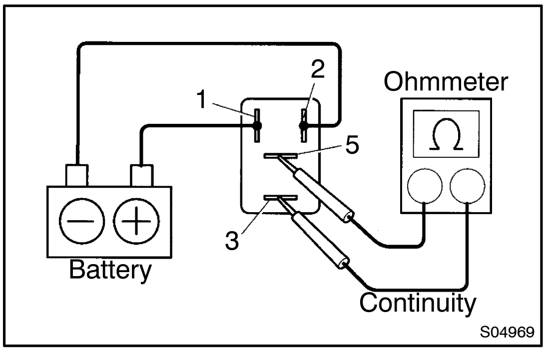
OK

9	Check ignition relay No.2 (Marking: IG2) relay.



PREPARATION:
Remove the ignition relay No.2 from the engine room J/B.
CHECK:
Check continuity between each terminal of ignition relay.
OK:

Terminal 1 and 2	Continuity
Terminal 3 and 5	Open



CHECK:
(a) Apply battery voltage between terminal 1 and 2.
(b) Check continuity between terminal 3 and 5.
OK:
Continuity

NG → **Replace ignition relay No.2 relay.**

OK

Replace ignition coil with igniter.

DI1EH–06

DTC	P1335/13	Crankshaft Position Sensor Circuit Malfunction (During engine running)

CIRCUIT DESCRIPTION

Refer to DTC P0335/12, 13 (Crankshaft Position Sensor "A" Circuit Malfunction) on page DI–82.

DTC No.	DTC Detecting Condition	Trouble Area
P1335/13	If conditions (a) through (c) are met: (a) NE ≧ 1,000 rpm (b) NE signal is not detected for over 50 m sec. (c) Not during cranking	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Engine ECU

See DTC P0335/12, 13 for Wiring Diagram and Inspection Procedure.

DI6TW–01

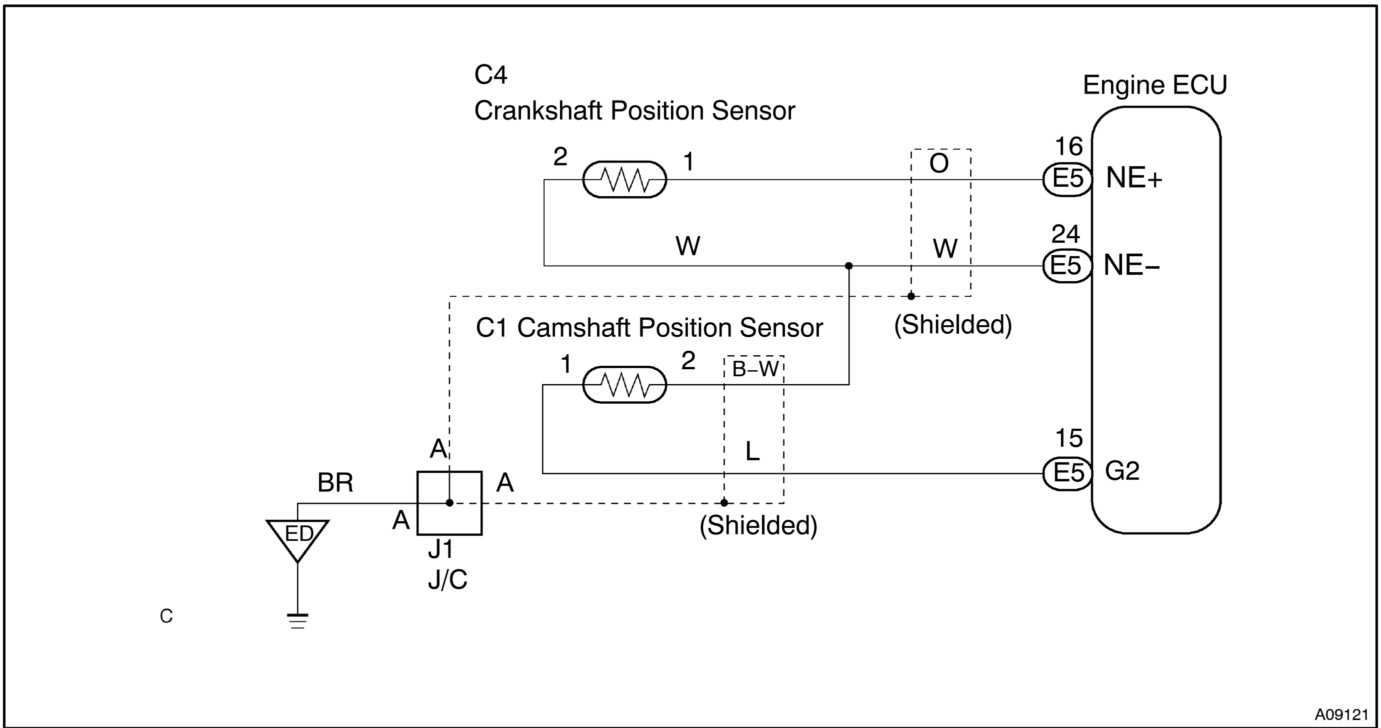
DTC	P1346/18	VVT Sensor (Camshaft Position Sensor) Circuit Range/Performance Problem

CIRCUIT DESCRIPTION

VVT sensor consist of a signal plate and pickup coil.
The signal plate has 1 tooth on its outer circumference and is mounted on the intake camshafts.
When the camshafts rotate, the protrusion on the signal plate and the air gap on the pickup coil change, causing fluctuations in the magnetic field and generating an electromotive force in the pickup coil.
The actual camshaft angle is detected by the VVT sensor and it provides feedback to the engine ECU to control the intake valve timing in response to during condition.

DTC No.	Detection Item	Trouble Area
P1346/18	Deviation in crankshaft position sensor signal and VVT sensor signal (2 trip detection logic)	• Mechanical system malfunction (Skipping teeth of timing chain, chain stretched) • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	**Check valve timing (Check for loose and jumping teeth of timing chain) (See page EM–26).**

NG → **Adjust valve timing (Repair or replace timing chain).**

OK

Check and replace engine ECU (See page IN–20).

DI3HE–07

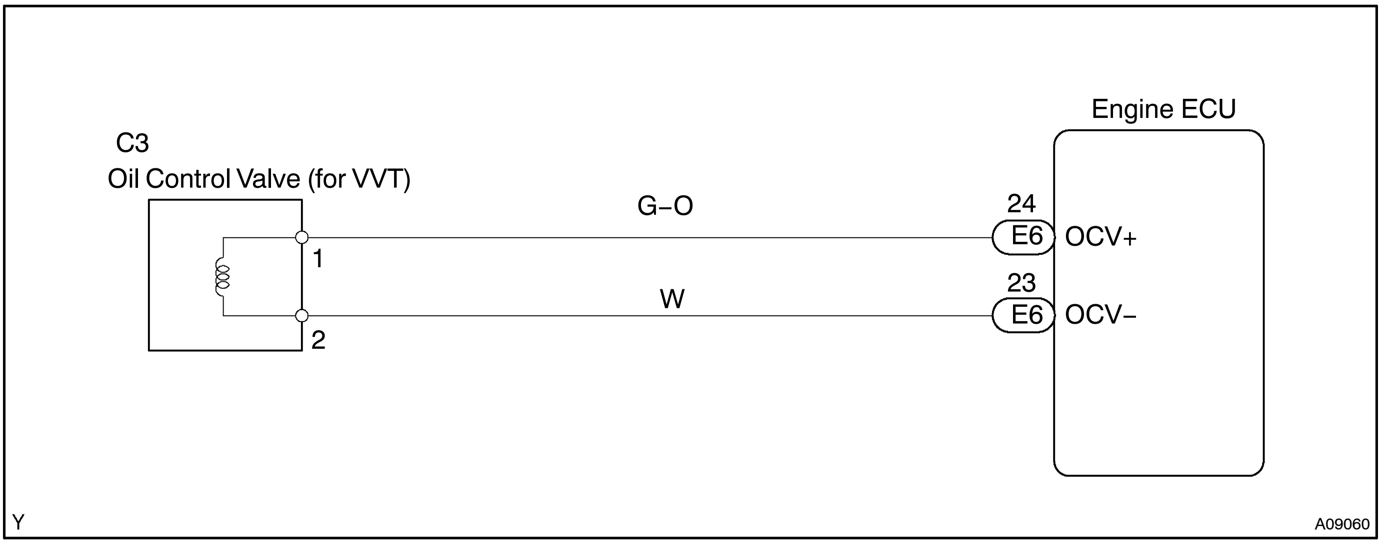
DTC	P1349/59	VVT System Malfunction

CIRCUIT DESCRIPTION

VVT system controls the intake valve timing to proper timing in response to driving condition.
Engine ECU controls OCV (Oil Control Valve) for VVT to make the intake valve timing properly, and, oil pressure controlled with OCV for VVT is supplied to the VVT controller, and then, VVT controller changes relative position between the camshaft and the crankshaft.

DTC No.	DTC Detecting Condition	Trouble Area
P1349/59	Condition (a) or (b) continues for after the engine is warmed up and engine speed at 400 ~ 4,000 rpm: (a) Valve timing does not change from of current valve timing (b) Current valve timing is fixed	• Valve timing • Oil control valve for VVT • VVT controller assembly • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

When using hand–held tester

1	**Check valve timing (See page EM–26).**

NG → **Repair valve timing.**

OK ↓

2	**Check operation of OCV for VVT.**

PREPARATION:

(a) Start the engine and warmed it up.

(b) Connect the hand–held tester and select VVT from ACTIVE TEST menu.

CHECK:

Check the engine speed when operate the OCV for VVT by the hand–held tester.

OK:

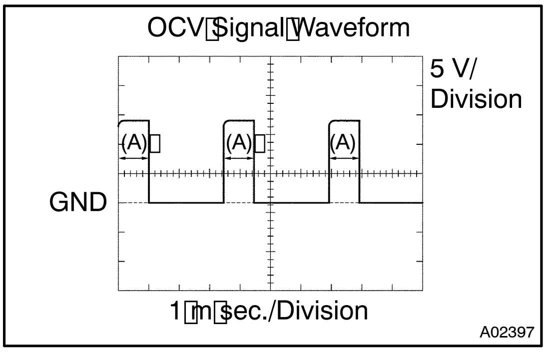
OCV is OFF:
Normal engine speed
OCV is ON:
Rough idle or engine stall

OK → **VVT system is OK.***

*: DTCs P1349/59 are also output after the foreign object is caught in some part of the system in the engine oil and the system returns to normal in a short time. As engine ECU controls so that foreign objects are ejected, there is no problem about VVT. There is also no problem since the oil filter should get the foreign object in the engine oil.

NG ↓

3	**Check voltage between terminals OCV+ and OCV– of engine ECU connector.**



Reference: INSPECTION USING OSCILLOSCOPE
Turn the ignition switch ON, and check waveform between terminals OCV+ and OCV– of the engine ECU connector.
HINT:
- The correct waveform is as shown.
- The waveform frequency (A) is lengthened as the engine speed becomes higher.

NG → **Check and replace engine ECU (See page IN–20).**

OK

4	**Check valve timing controller assembly (See page EM–49).**

NG → **Replace VVT controller assembly, and then go to step 5.**

OK

5	**Check OCV for VVT (See page FI–42).**

NG → **Replace OCV for VVT, and then go to step 6.**

OK

6	**Check blockage of OCV for VVT and oil filter.**

NG → **Repair or replace.**

OK

7	**Check whether or not DTC P1349/59 is stored.**

PREPARATION:
(a) Clear the DTC (See page DI–4).
(b) Perform simulation test.
CHECK:
Check whether or not DTC P1349/59 is stored (See page DI–4).
OK:
DTC P1349/19 is not stored

OK → **VVT system is OK.***

*: DTCs P1349/59 are also output after the foreign object is caught in some part of the system in the engine oil and the system returns to normal in a short time. As engine ECU controls so that foreign objects are ejected, there is no problem about VVT. There is also no problem since the oil filter should get the foreign object in the engine oil.

NG

Replace engine ECU

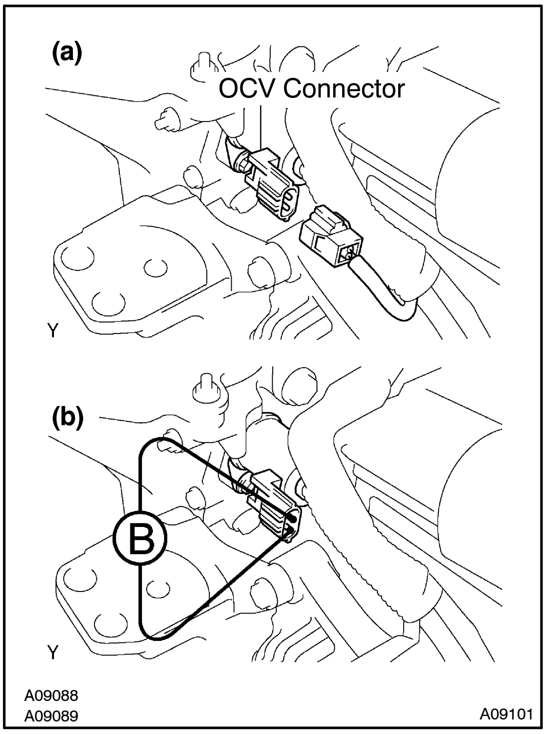
When not using hand–held tester

1	**Check valve timing (See page EM–26).**

NG → **Repair valve timing.**

OK

2	Check operation of OCV for VVT.



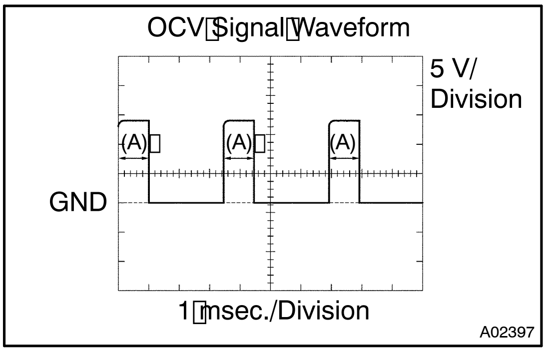
PREPARATION:
Start the engine.
CHECK:
(a) Check the engine speed when disconnecting the OCV connector.
(b) Check the engine speed when applying battery positive voltage between terminals of OCV.
RESULT:

Result	Check (a)	Check (b)
1	Normal engine speed	Rough idle or engine stall
2	Except 1	

2	Go to step 4.

1

3	**Check voltage between terminals OCV+ and OCV– of engine ECU connector.**



Reference: INSPECTION USING OSCILLOSCOPE

Turn the ignition switch ON, check waveform between terminals OCV+ and OCV– of the engine ECU connector.

HINT:

- The correct waveform is as shown.
- The waveform frequency (A) is lengthened as the engine speed becomes higher.

OK → **VVT system is OK.***

*: DTCs P1349/59 are also output after the foreign object is caught in some part of the system in the engine oil and the system returns to normal in a short time. As engine ECU controls so that foreign objects are ejected, there is no problem about VVT. There is also no problem since the oil filter should get the foreign object in the engine oil.

NG

Check and replace engine ECU (See page IN–20).

4	**Check valve timing controller assembly.**

NG → **Replace VVT controller assembly, and then go to step 5.**

OK

5	**Check OCV for VVT (See page FI–42).**

NG → **Replace oil control valve, and then go to step 6.**

OK

6	Check blockage of OCV for VVT and oil filter.

NG → **Repair or replace.**

OK

7	Check whether or not DTC P1349/59 is stored.

PREPARATION:

(a) Clear the DTC (See page DI–4).

(b) Perform simulation test.

CHECK:

Check whether or not DTC P1349/19 is stored (See page DI–4).

OK:

DTC P1349/19 is not stored

OK → **VVT system is OK.***

*: DTCs P1349/59 are also output after the foreign object is caught in some part of the system in the engine oil and the system returns to normal in a short time. As engine ECU controls so that foreign objects are ejected, there is no problem about VVT. There is also no problem since the oil filter should get the foreign object in the engine oil.

NG

Replace engine ECU.

DI01H–15

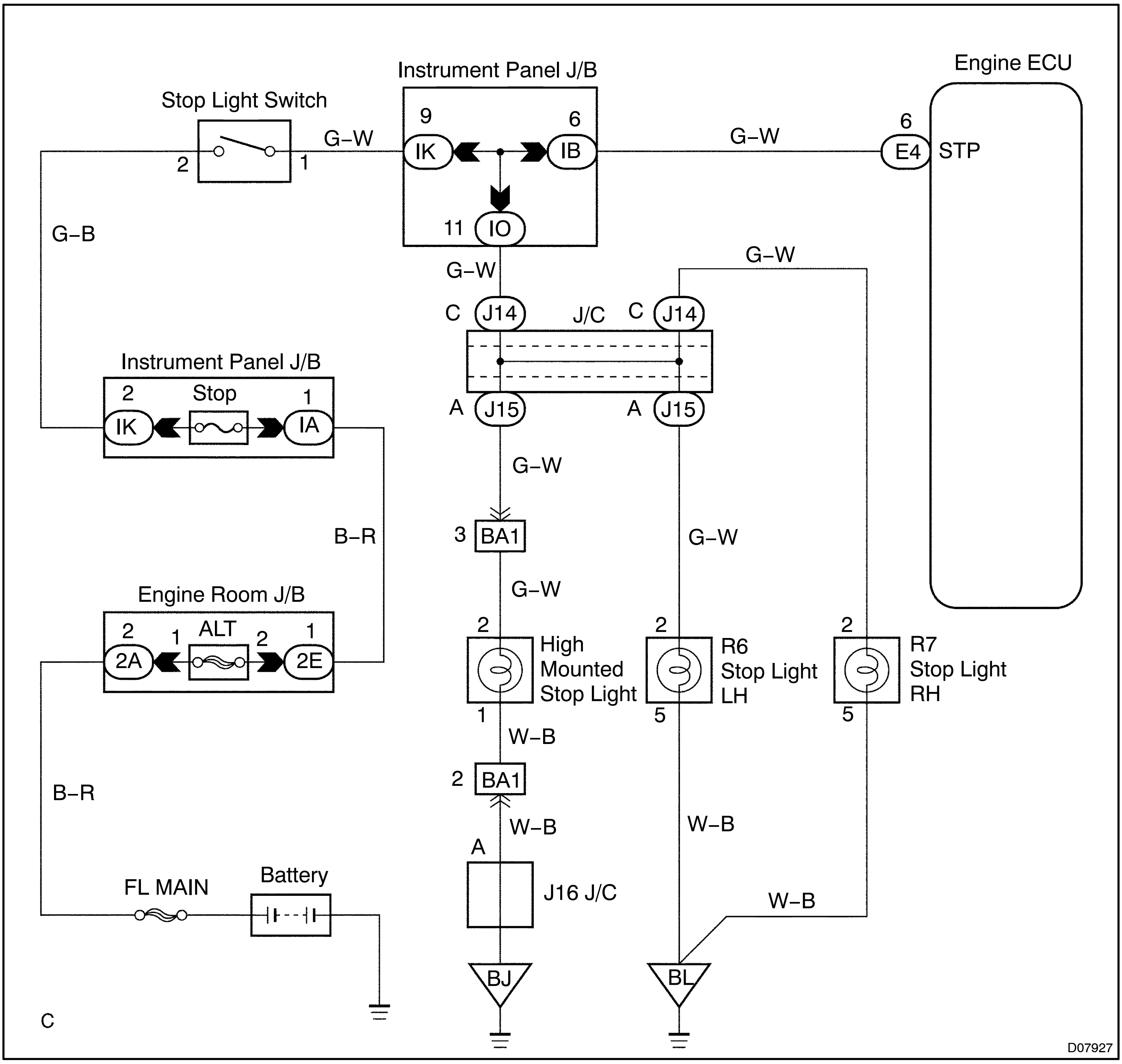
DTC	P1520/95	Stop Light Switch Signal Malfunction

CIRCUIT DESCRIPTION

This signal is used to detect when the brakes have been applied. The STP signal voltage is the same as the voltage supplied to the stop lights. The STP signal is used mainly to control the fuel cut–off engine speed. (The fuel cut–off engine speed is reduced slightly when the vehicle is braking.)

DTC No.	DTC Detecting Condition	Trouble Area
P1520/95	After the vehicle speed has been exceeded 30 km/h (19 mph) even once, the stop light switch does not turn off even once (2 trip detection logic)	• Short in stop light switch signal circuit • Stop light switch • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand–held testerl scan tool. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

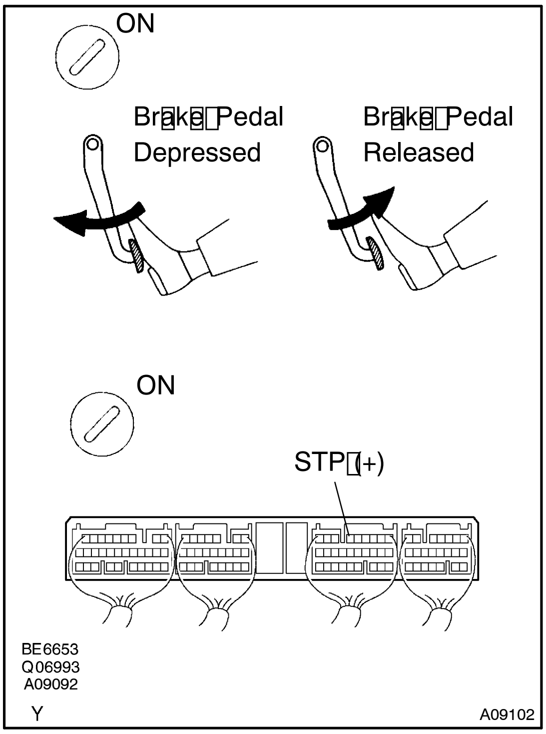
1	**Check operation of stop light.**

PREPARATION:
Check if the stop lights go on and off normally when the brake pedal is operated and released.

NG → **Check and repair stop light circuit (See page Pub. No. RM734E BE section).**

OK

2	**Check STP signal.**



When using TOYOTA hand–held tester:

PREPARATION:

(a) Connect the to the DLC3.

(b) Turn the ignition switch ON and hand–held tester main switch ON.

CHECK:
Read the STP signal on the hand–held tester.

OK:

Brake pedal is depressed: STP ... ON
Brake pedal is released: STP ... OFF

When not using TOYOTA hand–held tester:

PREPARATION:
Turn the ignition switch ON.

CHECK:
Check voltage between terminal STP of ECM and body ground.

OK:

Brake pedal	Voltage
Depressed	7.5 – 14 V
Released	Below 1.5 V

OK → **Check for intermittent problems (See page DI–4).**

NG

3	Check harness and connector between engine ECU and stop light switch (See page IN–20).

NG → Repair or replace harness or connector.

OK

Check and replace engine ECU (See page IN–20).

DI1ME–09

DTC	P1600/96	ECM BATT Malfunction

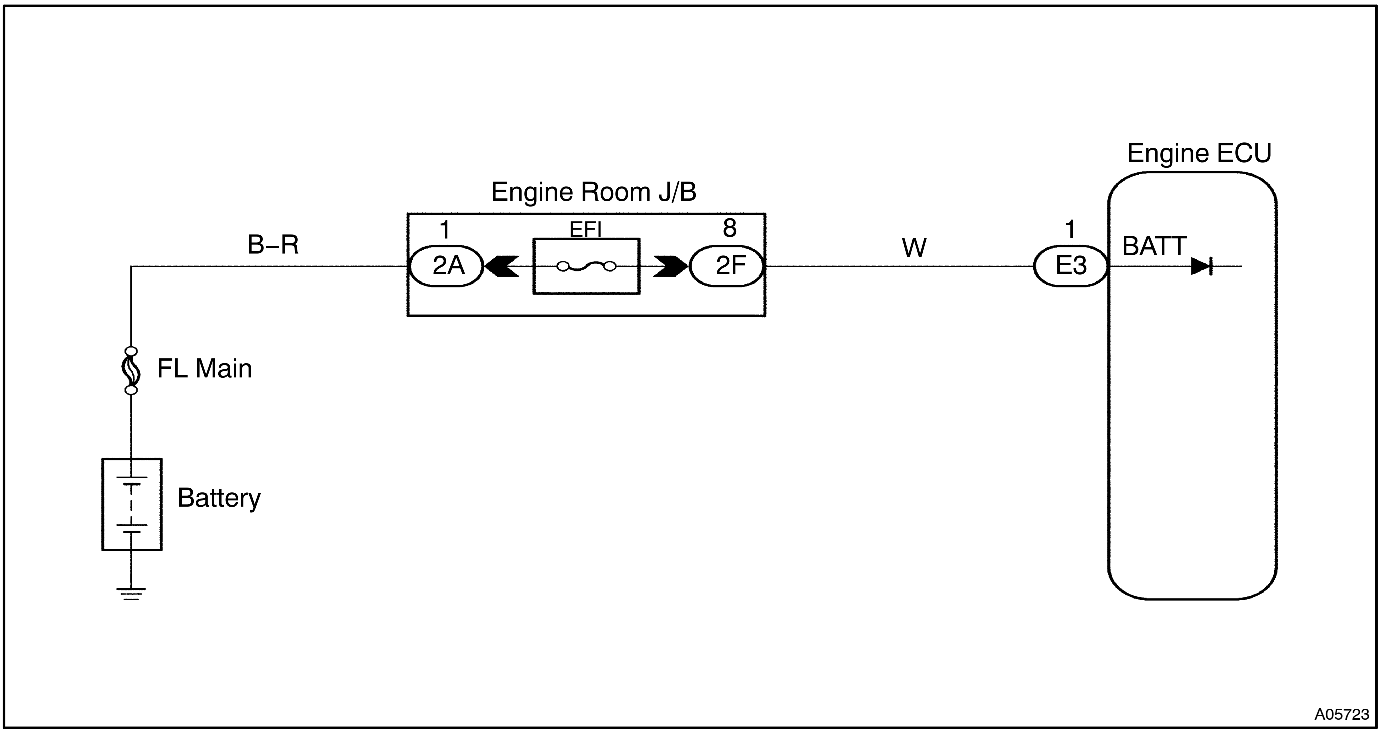
CIRCUIT DESCRIPTION

Battery positive voltage is supplied to terminal BATT of the engine ECU even when the ignition switch is OFF for use by the DTC memory and air–fuel ratio adaptive control value memory, etc.

DTC No.	DTC Detecting Condition	Trouble Area
P1600/96	Open in back up power source circuit	• Open in back up power source circuit • Engine ECU

HINT:
If DTC P1600/96 appear, the engine ECU does not store another DTC.

WIRING DIAGRAM

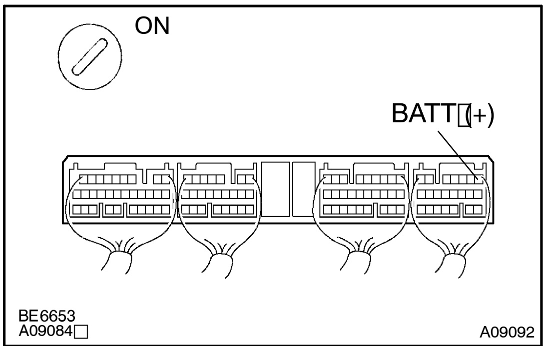


INSPECTION PROCEDURE

HINT:

Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

1	**Check voltage between terminal BATT of engine ECU connector and body ground.**



PREPARATION:

Remove the engine ECU cover.

CHECK:

Measure voltage between terminal BATT of the engine ECU connector and body ground.

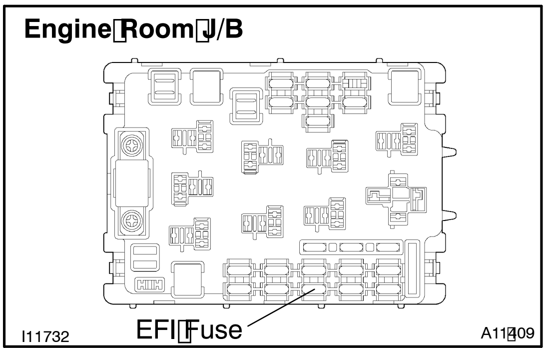
OK:

Voltage: 9 – 14 V

OK → **Check and replace engine ECU (See page IN–20).**

NG ↓

2	**Check EFI fuse of engine room R/B No. 1.**



PREPARATION:

Remove the EFI fuse from the engine room J/B.

CHECK:

Check continuity of the EFI fuse.

OK:

Continuity

NG → **Check for short in all harness and components connected to EFI fuse.**

OK ↓

Check and repair harness or connector between battery and EFI fuse, and EFI fuse and engine ECU (See page IN–20).

DI64J–02

DTC	P1645/82	Body ECU Malfunction

CIRCUIT DESCRIPTION

ECU receives the operating condition (ON/OFF) of A/C from A/C ECU and it also receives the electrical load information from the body ECU.
ECU uses these information to control the engine (idle up, etc.).

DTC No.	DTC Detecting Condition	Trouble Area
P1645/82	Condition (a) or (b) continues for 5.0 seconds or more: (a) No communication from body ECU (b) No communication from A/C ECU	• Body ECU • A/C ECU • Communication bus

INSPECTION PROCEDURE

Perform troubleshooting the Multiplex Communication System (See Pub. No. RM734E DI section).

DI1MH–10

DTC	P1656/39	OCV for VVT Circuit Malfunction

CIRCUIT DESCRIPTION

Refer to DTC P1349/59 (VVT System Malfunction) on page DI–107.

DTC No.	DTC Detecting Condition	Trouble Area
P1656/39	Open or short in oil control valve circuit	• Open or short in oil control valve circuit • Oil control valve for VVT • Engine ECU

WIRING DIAGRAM

Refer to DTCs P1349/59 (VVT System Malfunction) on page DI–107.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

When using hand–held tester

1	Check OCV for VVT circuit.

PREPARATION:

(a) Start the engine and warmed it up.

(b) Connect the hand–held tester and select VVT from ACTIVE TEST menu.

CHECK:

Check the engine speed when operate the OCVfor VVT by the hand–held tester.

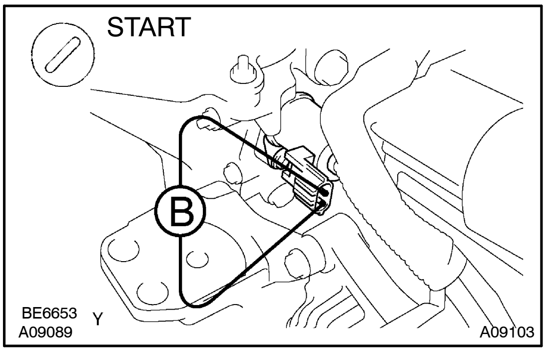
OK:

VVT system is OFF (OCV is OFF):
Normal engine speed
VVT system is ON (OCV is ON):
Rough idle or engine stalled

OK → **Check for intermittent problems (See page DI–4).**

NG

2	Check operation of OCV for VVT.



PREPARATION:
(a) Start the engine and warmed it up.
(b) Disconnect the OCV connector.
(c) Apply battery positive voltage between terminals of the OCV.

CHECK:
Check the engine speed.

OK:
Rough idle or engine stalled.

NG → **Replace OCV.**

OK

3	Check voltage between terminals OCV+ and OCV– of engine ECU connector (See page DI–107).

NG → **Check and replace engine ECU (See page IN–20).**

OK

4	Check for open and short in harness and connector between OCV and engine ECU (See page IN–20).

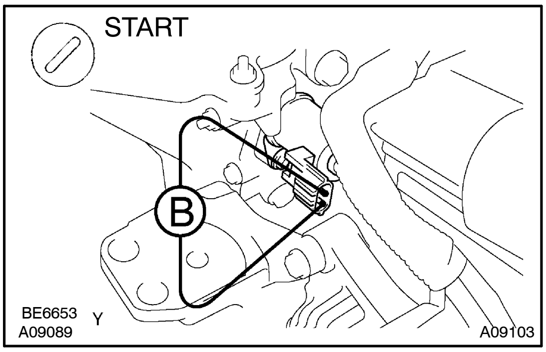
NG → **Repair or replace.**

OK

Check for intermittent problems (See page DI–4).

When not using hand-held tester

1	Check operation of OCV for VVT.



PREPARATION:

(a) Start the engine and warmed it up.

(b) Disconnect the OCV connector.

(c) Apply battery positive voltage between terminals of the OCV.

CHECK:

Check the engine speed.

OK:

Rough idle or engine stalled

NG → **Replace OCV.**

OK

2	Check voltage between terminals OCV+ and OCV– of engine ECU connector (See page DI-107).

NG → **Check and replace engine ECU (See page IN-20).**

OK

3	Check for open and short in harness and connector between OCV and engine ECU (See page IN-20).

NG → **Repair or replace.**

OK

Check for intermittent problems (See page DI-4).

DI6TX–01

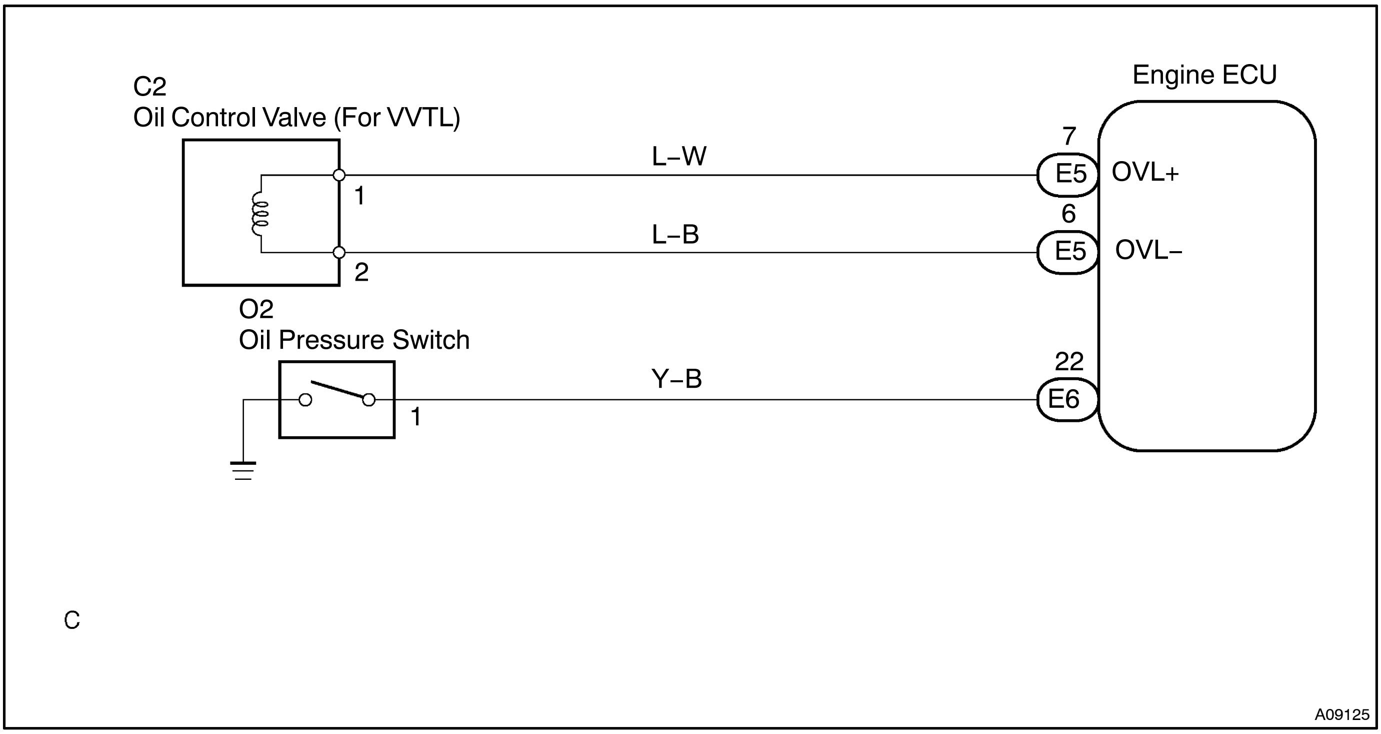
DTC	P1690/39	OCV for VVTL Circuit Malfunction

CIRCUIT DESCRIPTION

When the engine speed reaches 6,000 rpm, the VVTL system switches the locker arm from low speed to high speed. The engine ECU control the OCV to apply hydraulic pressure to the piston in the locker arm and switch the locker arm by locking the slipper for high speed.

DTC No.	DTC Detecting Condition	Trouble Area
P1690/39	Open or short in oil control valve (for VVTL) circuit	• Open or short in oil control valve (for VVTL) circuit • Oil control valve (for VVTL) • Engine ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using hand–held tester. Because freeze frame records the engine conditions when the malfunction is detected, when troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.

When using hand–held tester

1	**Check OCV (for VVTL) circuit.**

PREPARATION:
(a) Start the engine and warmed it up.
(b) Connect the hand–held tester and select VVTL from ACTIVE TEST menu.
(c) Maintain engine speed at 1,500 – 2,500 rpm.

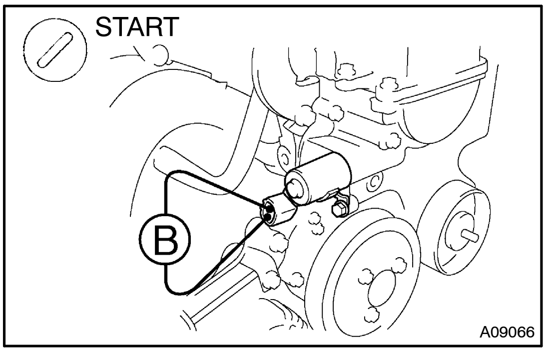
CHECK:
Check the engine speed when operate the OCVfor VVTL by the hand–held tester.

OK:
VVTL system is OFF (OCV is OFF):
Normal engine speed
VVTL system is ON (OCV is ON):
Rough engine speed or engine stalled

OK → **Check for intermittent problems (See page DI–4).**

NG ↓

2	**Check operation of OCV for VVTL.**



PREPARATION:
(a) Start the engine and warmed it up.
(b) Disconnect the OCV connector.
(c) Maintain engine speed at 1,500 – 2,500 rpm.
(d) Apply battery positive voltage between terminals of the OCV.

CHECK:
Check the engine speed.

OK:
Rough engine speed or engine stalled.

NG → **Replace OCV for VVTL.**

OK ↓

3	Check voltage between terminals OVL+ and OVL– of engine ECU connector (See page DI–22).

NG → **Check and replace engine ECU (See page IN–20).**

OK

4	Check for open and short in harness and connector between OCV for VVTL and engine ECU (See page IN–20).

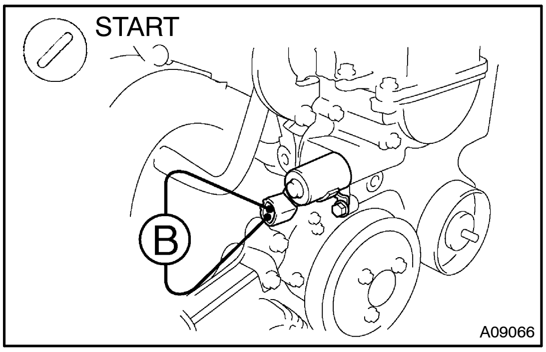
NG → **Repair or replace.**

OK

Check for intermittent problems (See page DI–4).

When not using hand–held tester

1	Check operation of OCV for VVTL.



PREPARATION:
(a) Start the engine and warmed it up.
(b) Disconnect the OCV connector.
(c) Maintain engine speed at 1,500 – 2,500 rpm.
(d) Apply battery positive voltage between terminals of the OCV.

CHECK:
Check the engine speed.

OK:
Rough engine speed or engine stalled

NG → **Replace OCV for VVTL.**

OK

2	Check voltage between terminals OVL+ and OVL– of engine ECU connector (See page DI–22).

NG → Check and replace engine ECU (See page IN–20).

OK

3	Check for open and short in harness and connector between OCV for VVTL and engine ECU (See page IN–20).

NG → Repair or replace.

OK

Check for intermittent problems (See page DI–4).

DI6TY–01

DTC	P1692/39	OCV for VVTL Open Malfanction

DTC	P1693/39	OCV for VVTL Close Malfunction

CIRCUIT DESCRIPTION

Refer to DTC P1690/39 (OCV for VVTL Circuit Malfunction) on page DI–123.

DTC No.	DTC Detecting Condition	Trouble Area
P1692/39	In the condition that the engine speed is 6,000 rpm or less and the oil pressure switch on for 5 sec. or more.	• Open or short in oil control valve circuit • Oil control valve (for VVTL) • Oil pressure switch for VVTL • Engine ECU
P1693/39	In the condition that the water temperature is 60 °C or more, the engine speed is 6,000 rpm or more, and the oil pressure switch OFF for 1 sec. or more.	

WIRING DIAGRAM

Refer to DTC P1690/39 (OCV for VVTL Circuit Malfunction) on page DI–123.

INSPECTION PROCEDURE

1	Check oil pressure switch for VVTL.

When using hand–held tester:

PREPARATION:

(a) Start the engine and warmed it up.

(b) Connect the hand–held tester and select VVTL from ACTIVE TEST menu.

(c) Disconnect the oil pressure switch for VVTL connector.

(d) Maintain engine speed at 6,500 rpm.

CHECK:

Measure continuity between the oil pressure switch and body ground when operate the OCV by the hand–held tester.

OK:

VVTL system is OFF (OCV is OFF):
No continuity
VVTL system is ON (OCV is ON):
Continuity

When not using hand–held tester:

PREPARATION:

(a) Disconnect the oil pressure switch for VVTL connector.

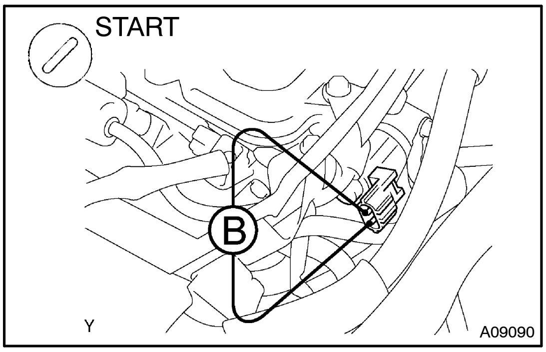
(b) Ignition switch OFF.

CHECK:

Measure continuity between the oil pressure switch and body ground.

OK:

No continuity



PREPARATION:
(a) Start the engine and warmed it up.
(b) Disconnect the OCV for VVTL connector.
(c) Maintain engine speed at 6,500 rpm.

CHECK:
Measure continuity between the oil pressure switch and body ground when apply battery voltage between terminals of the OCV.

OK:
Continuity

NG → **Replace oil pressure switch.**

OK

2	**Check for open and short in harness and connector between oil pressure switch for VVTL and engine ECU (See page IN–20).**

NG → **Repair or replace.**

OK

3	**Check OCV for VVTL (See page FI–42) and oil filter.**

NG → **Repair or replace OCV or filter.**

OK

4	**Check for open and short in harness and connector between OCV for VVTL and engine ECU (See page IN–20).**

NG → **Repair or replace.**

OK

Check and replace engine ECU (See page IN–20).

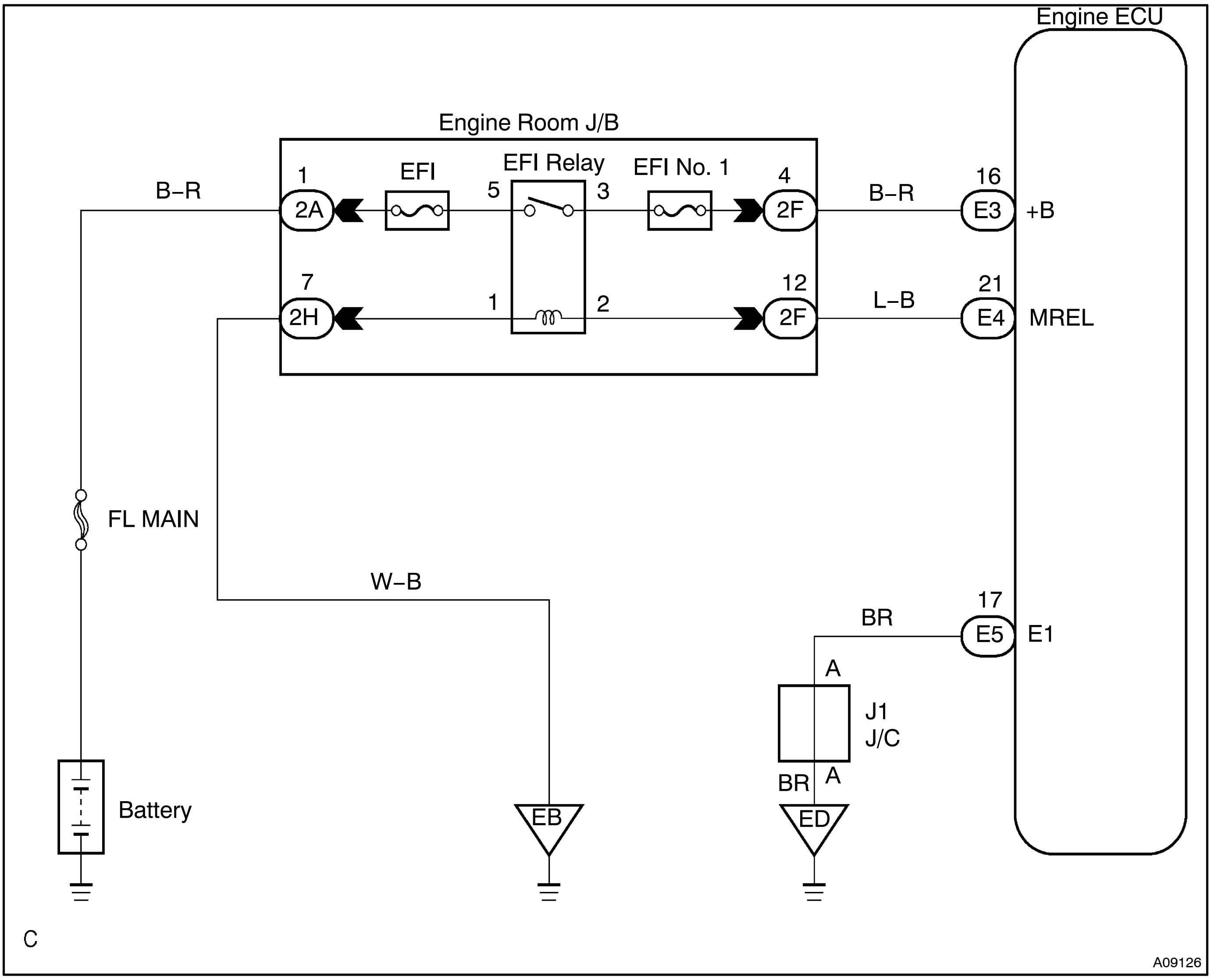
DI68T–02

ECU Power Source Circuit

CIRCUIT DESCRIPTION

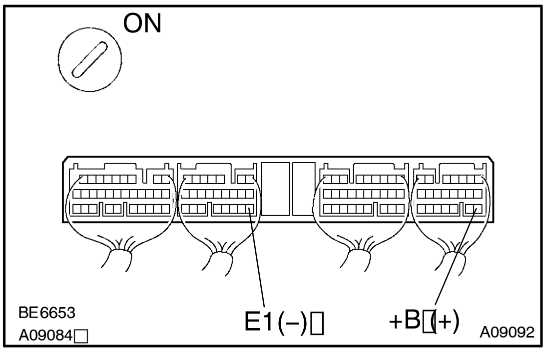
When the ignition switch is turned ON, battery positive voltage is applied to the coil, closing the contacts of the EFI main relay (Marking: EFI) and supplying power to the terminal +B of the engine ECU.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	Check voltage between terminals +B and E1 of engine ECU connector.



PREPARATION:

(a) Remove the cover from the engine ECU.

(b) Remove the 2 bolts from the engine ECU.

(c) Turn the ignition switch ON.

CHECK:

Measure voltage between terminals +B and E1 of engine ECU connector.

OK:

Voltage: 9 – 14 V

OK → **Proceed to next circuit inspection shown on problem symptoms table (See page DI–24).**

NG

2	Check for open in harness and connector between terminal E1 of engine ECU and body ground (See page IN–20).

NG → **Repair or replace harness or connector.**

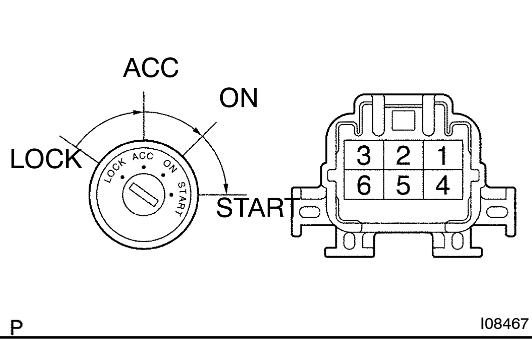
OK

3	Check EFI main relay (Marking: EFI) (See page FI–50).

NG → **Replace EFI main relay.**

OK

4	**Check ignition switch.**



PREPARATION:

(a) Remove the lower finish panel.

(b) Disconnect the ignition switch connector.

CHECK:

Check continuity between terminals shown below.

OK:

Switch Position	Terminal No. to continuity	
LOCK	–	–
ACC	1–3	–
ON	1–2–3	5–6
START	1–2	4–5–6

NG → **Replace ignition switch.**

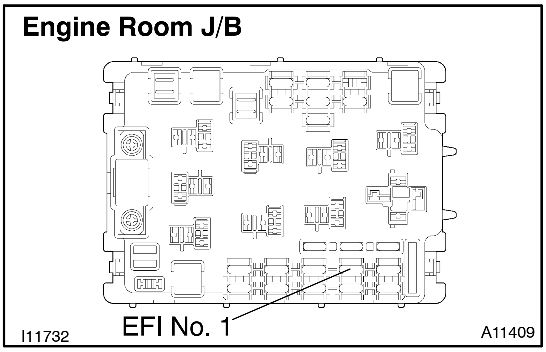
OK

5	**Check for open in harness and connector between ignition switch and EFI main relay, EFI main relay and body ground (See page IN–20).**

NG → **Repair or replace harness or connector.**

OK

6	**Check EFI fuse.**



PREPARATION:
Remove the EFI No.1 fuse from the engine room R/B No. 1.
CHECK:
Check continuity of EFI No.1 fuse.
OK:
Continuity

NG → **Check for short in all the harness and components connected to EFI No.1 fuse (See attached wiring diagram).**

OK

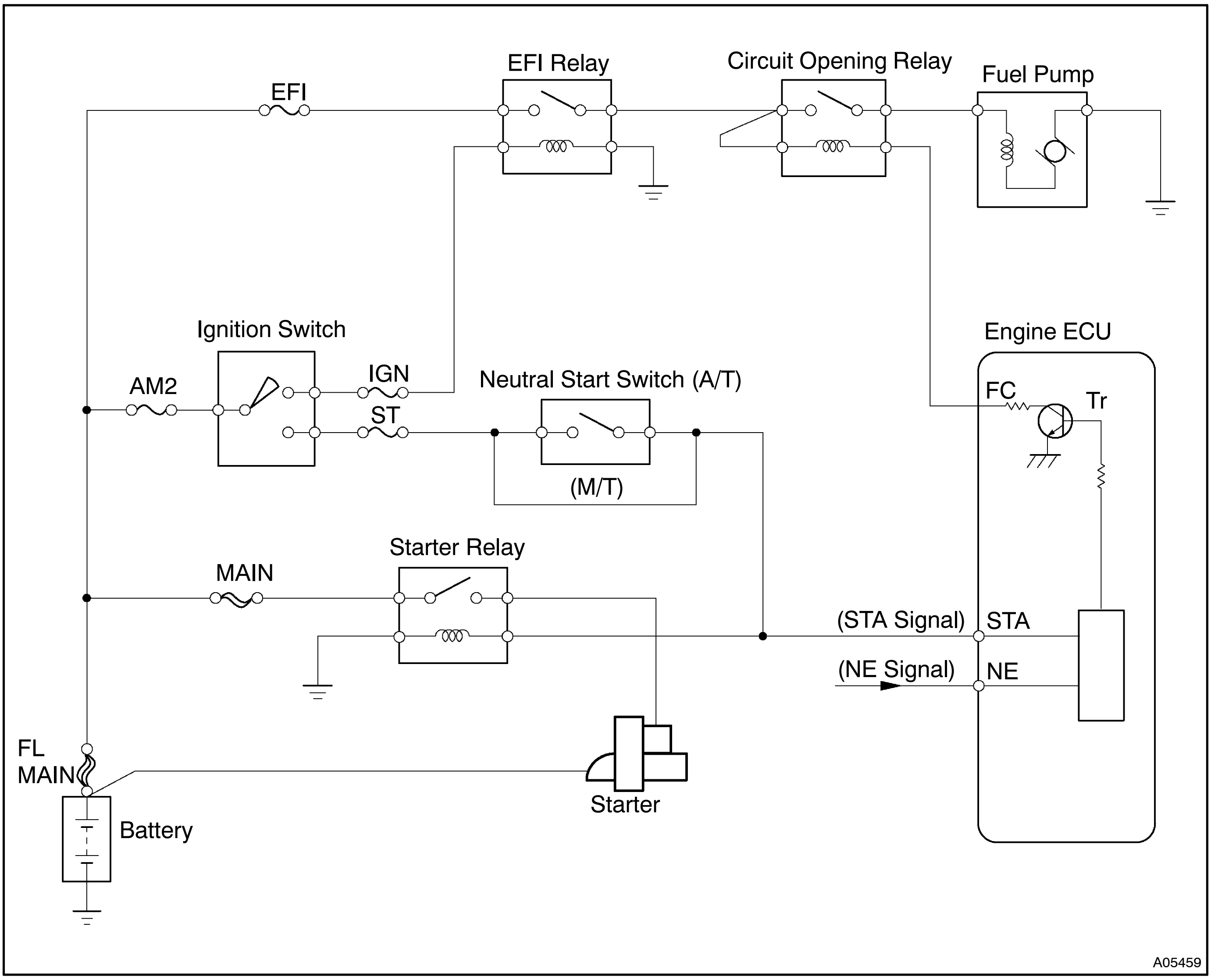
Check for open in harness and connector between EFI main relay and battery, EFI main relay and engine ECU.

DI32M–04

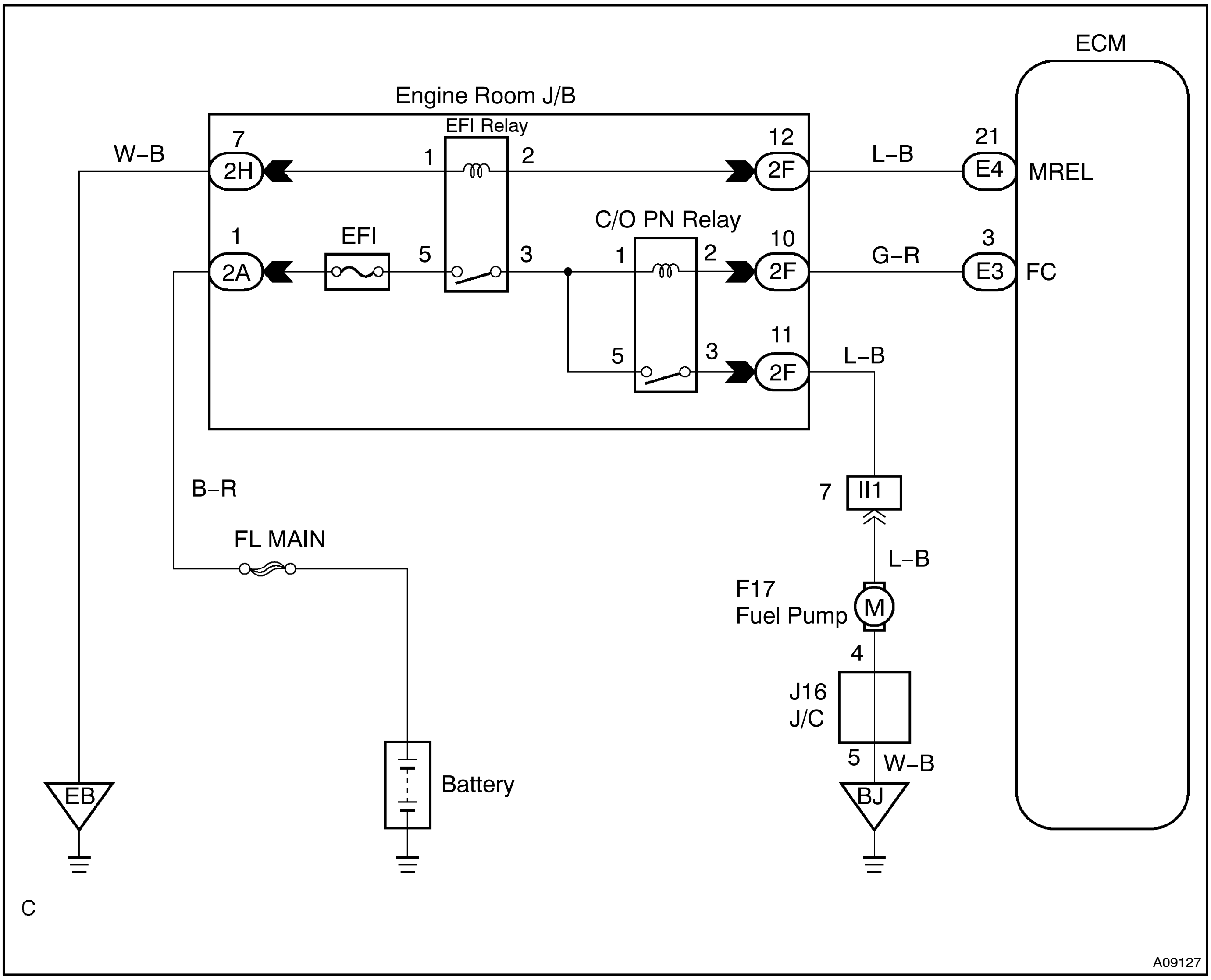
Fuel Pump Control Circuit

CIRCUIT DESCRIPTION

In the diagram below, when the engine is cranked, current flows from terminal ST of the ignition switch to the starter relay coil and also current flows to terminal STA of engine ECU (STA signal).
When the STA signal and NE signal are input to the engine ECU, Tr is turned ON, current flows to coil of the circuit opening relay, the relay switches on, power is supplied to the fuel pump and the fuel pump operates. While the NE signal is generated (engine running), the engine ECU keeps Tr ON (circuit opening relay ON) and the fuel pump also keeps operating.

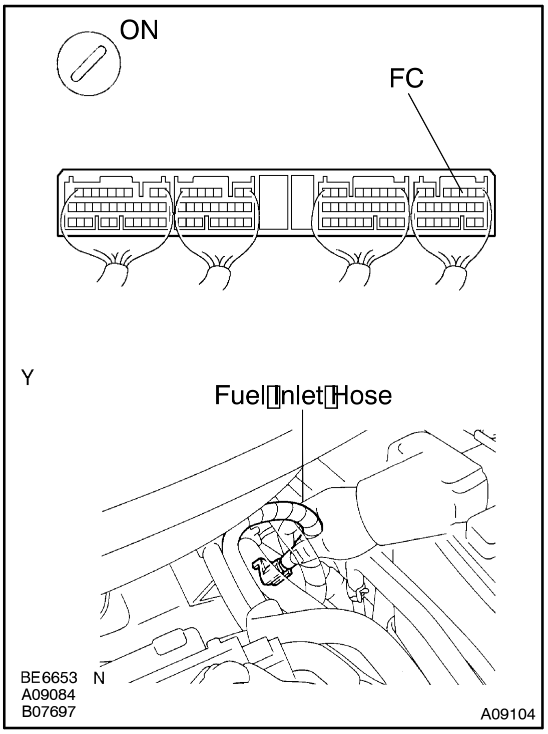


WIRING DIAGRAM



INSPECTION PROCEDURE

1	**Check fuel pump operation.**



PREPARATION:

(a) Connect the hand held tester to the DLC3.

(b) Turn the ignition switch ON and hand–held tester main switch ON.

(c) Select the active test mode on the hand–held tester.

(d) If you have no hand–held tester, connect the positive (+) and negative (–) leads from the battery to the fuel pump connector (See Page FI–6).

CHECK:

Check that the pulsation damper screw rises up when the fuel pump operates.

OK:

The pulsation damper screw rises up.

OK	**Proceed to next circuit inspection shown on problem symptoms table (See page DI–24).**

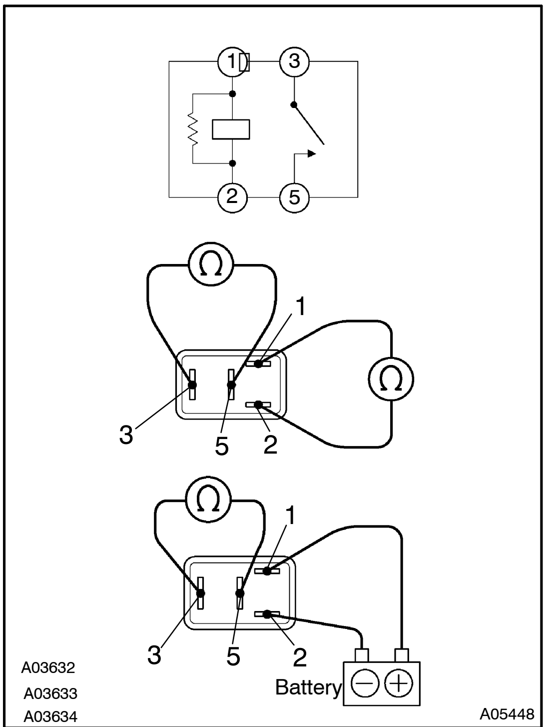
NG

2	**Check for engine ECU power source circuit (See page DI–129).**

NG	**Repair or replace.**

OK

3	Check circuit opening relay.



PREPARATION:

Remove the circuit opening relay from the instrument panel J/B.

CHECK:

Check continuity between terminals of circuit opening relay shown below.

OK:

Terminals 3 and 5	Open
Terminals 1 and 2	Continuity (Reference value 74 Ω)

CHECK:

(a) Apply battery positive voltage between terminals 1 and 2.

(b) Check continuity between terminals 3 and 5.

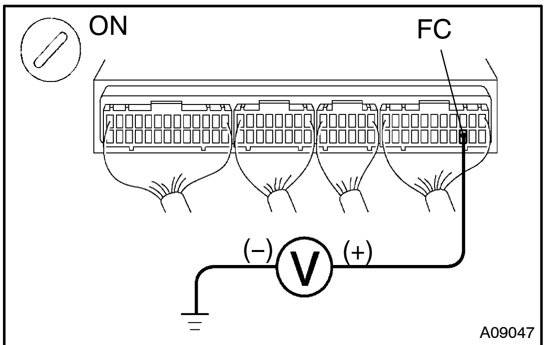
OK:

Terminals 3 and 5	Continuity

NG	Replace circuit opening relay.

OK

4	Check voltage between terminal FC of engine ECU and body ground.



PREPARATION:

(a) Remove glove compartment (See page FI–61).

(b) Turn ignition switch ON.

CHECK:

Measure voltage between terminal FC of engine ECU and body ground.

OK:

Voltage: 9 – 14 V

NG	Check for open in harness and connector between EFI main relay and circuit opening relay, circuit opening relay and engine ECU.

OK

5	Check fuel pump (See page FI–6).

NG → Repair or replace fuel pump.

OK

6	Check for open in harness and connector between circuit opening relay and fuel pump, fuel pump and body ground (See page IN–20).

NG → Repair or replace harness or connector.

OK

Check and replace engine ECU (See page IN–20).

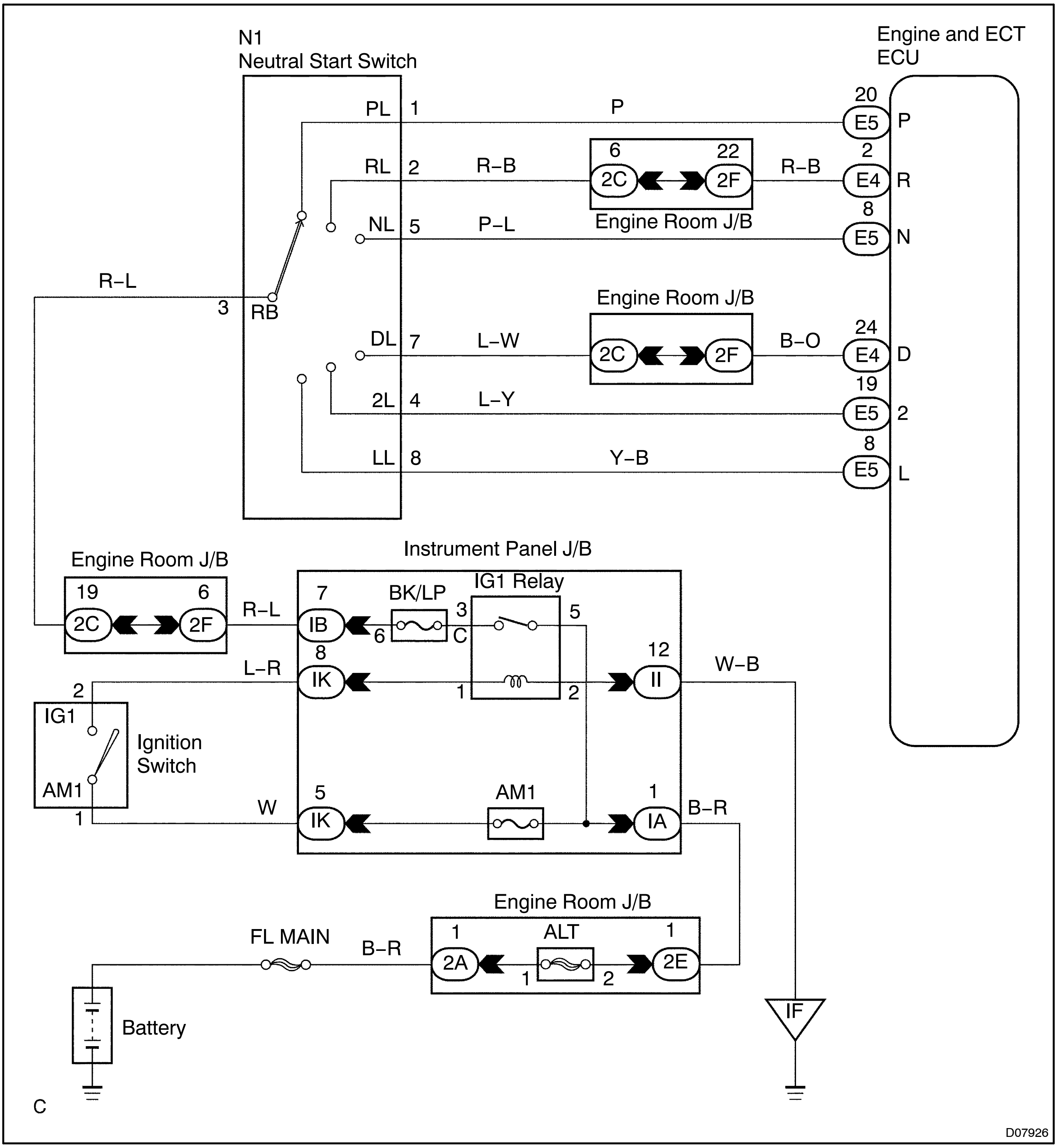
DI68U–02

Neutral Start Switch Malfunction

CIRCUIT DESCRIPTION

The neutral start switch detects the shift lever position and sends signals to the engine ECU.
The engine ECU receives signals (R, R, N, D 2 and L) from the neutral start switch.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	Read PNP, REVERSE, 2ND DRIVE and LOW signals.

When using hand–held tester:

PREPARATION:

(a) Remove the DLC3 cover.

(b) Connect a hand–held tester to the DLC3.

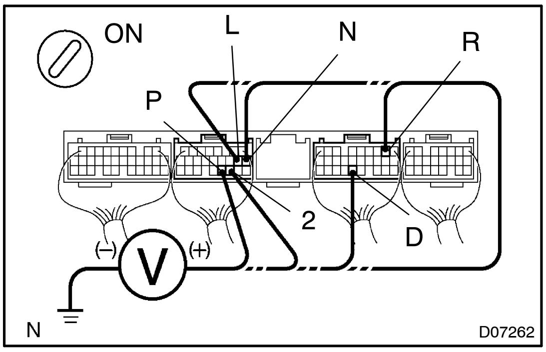
(c) Turn the ignition switch ON and hand–held tester main switch ON.

CHECK:

Shift lever into the P, R, N, D, 2 and L positions, and read the PNP, REVERSE, 2ND DRIVE and LOW signals on the hand–held tester.

OK:

Shift range	Signal
2	2ND OFF → ON
L	LOW OFF → ON
D	DRIVE OFF → ON
R	REVERSE OFF → ON
P, N	PNP OFF → ON



When not using hand–held tester:

PREPARATION:

Turn the ignition switch ON.

CHECK:

Measure voltage between terminals P. R. N. D. 2 and L of engine ECU and body ground when the shift lever is shifted to the following positions.

OK:

Shift range	Tester connection	Specified value
P	P – Body ground	Battery positive voltage
R	R – Body ground	*Battery positive voltage
N	N – Body ground	Battery positive voltage
D	D – Body ground	Battery positive voltage
2	2 – Body ground	Battery positive voltage
L	L– Body ground	Battery positive voltage

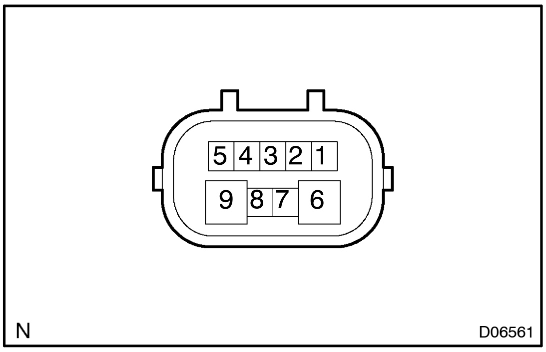
HINT:

*: The voltage will drop slightly due to lighting up of the back up light.

OK	Check and replace the engine ECU (See page IN–20).

NG

2	Check neutral start switch.



PREPARATION:
(a) Jack up the vehicle.
(b) Remove the neutral start switch.

CHECK:
Check continuity between each terminal shown below when the shift lever is moved to each position.

Shift range	Terminal No. to continuity	
P	6 – 9	1 – 2
R	2 – 3	–
N	6 – 9	3 – 5
D	3 – 7	–
2	3 – 4	–
L	3 – 8	–

OK:
There is continuity.

NG	Replace the neutral start switch.

OK

Repair or replace harness and connector between battery and neutral start switch, neutral start switch and engine ECU (See page IN–20).

EMISSION CONTROL SYSTEM

EC0DS–01

PURPOSE

The emission control systems are installed to reduce the amount of CO, HC and NOx exhausted from the engine ((3) and (4)), to prevent the atmospheric release of blow–by gas–containing HC (1) and evaporated fuel containing HC being released from the fuel tank (2).
The function of each system is shown in the table.

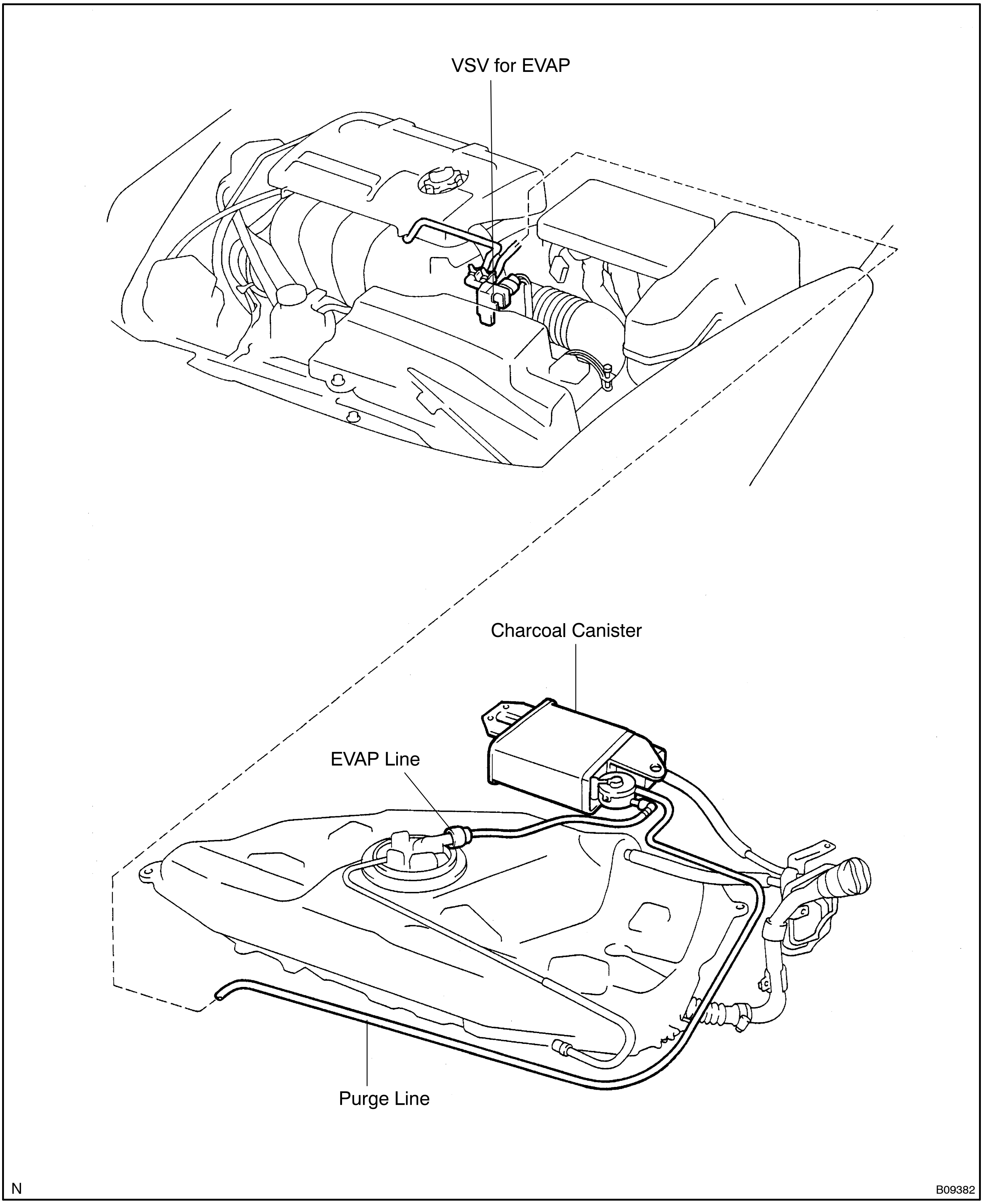
System	Abbreviation	Function
4. Positive Crankcase Ventilation	PCV	Reduces HC
5. Evaporative Emission Control	EVAP	Reduces evaporated HC
6. Three–way Catalytic Converter	TWC	Reduces HC, CO and NOx
7. Electronic Fuel injection*	EFI	Injects a precisely timed, optimum amount of fuel for reduced exhaust emissions

Remark: *For inspection and repair of the EFI system, refer to the FI section of this manual.

PARTS LAYOUT AND SCHEMATIC DRAWING

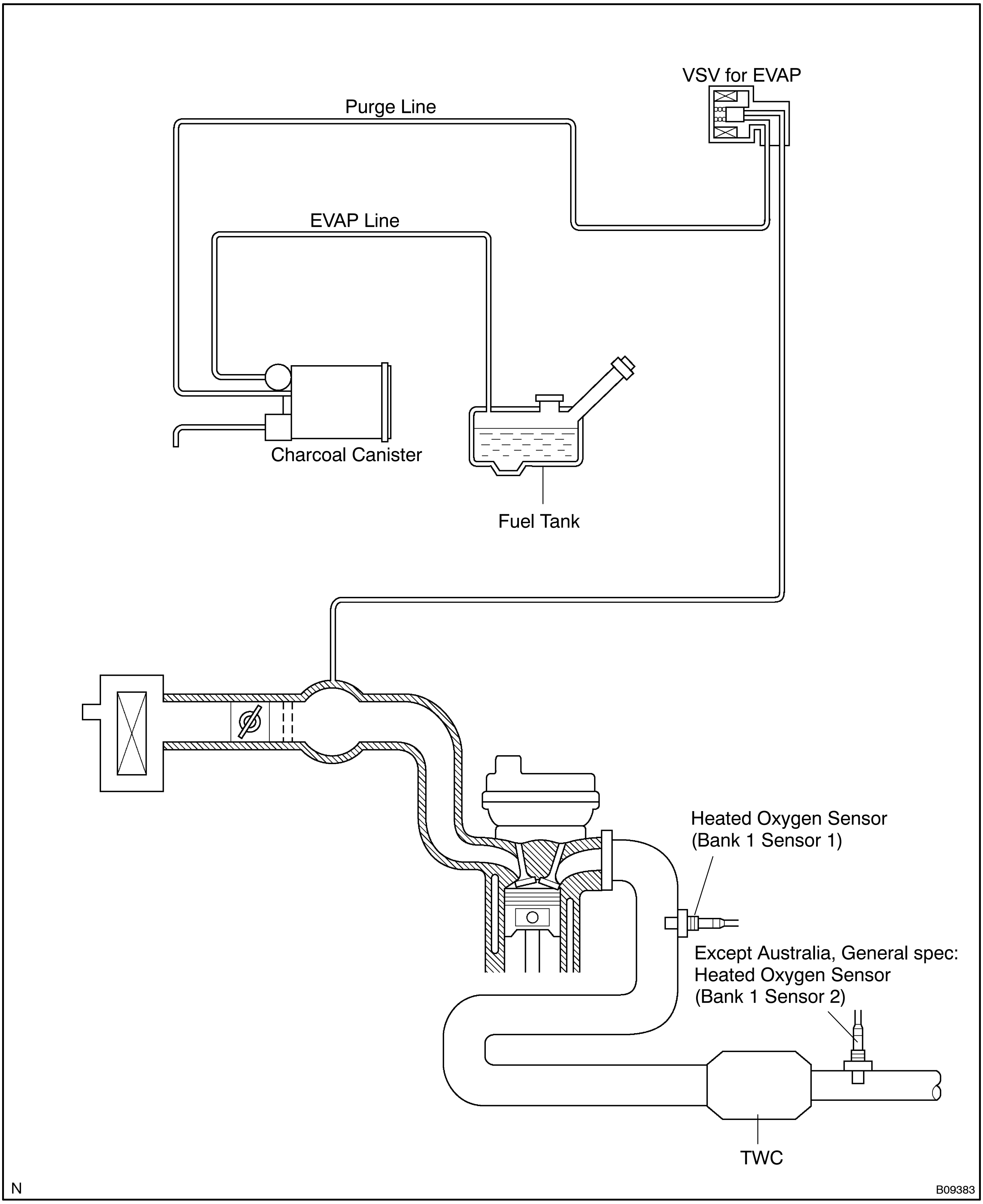
EC0DT–01

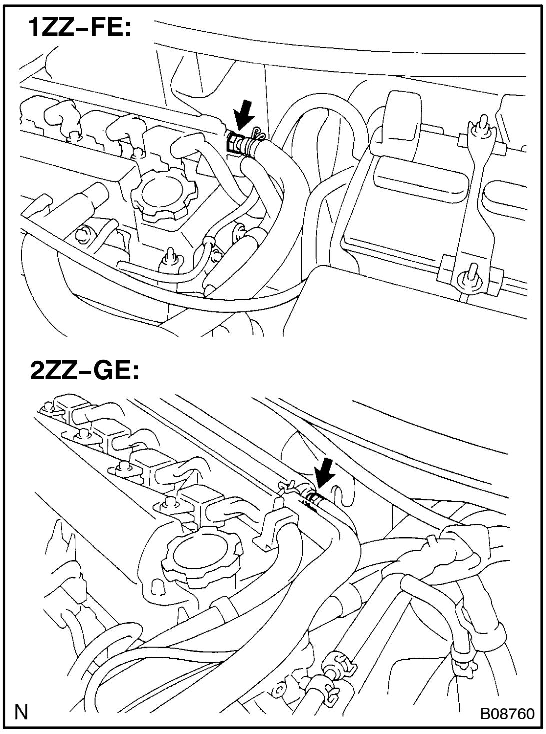
LOCATION



EC0DU–01

DRAWING





POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

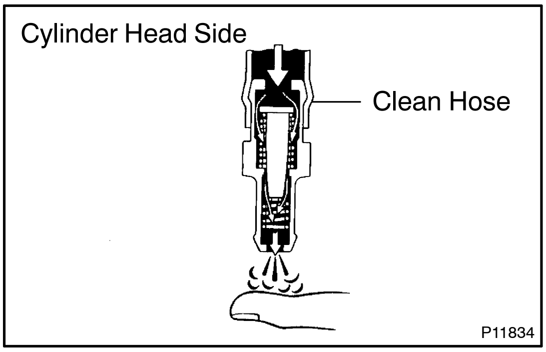
EC0DX–01

INSPECTION

1. REMOVE PCV VALVE

(a) Disconnect the PCV hose from the PCV valve.

(b) Remove the PCV valve.



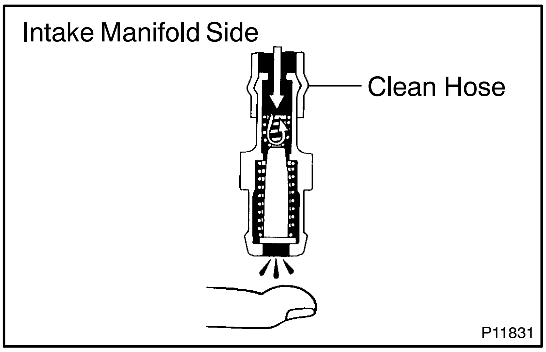
2. INSTALL CLEAN HOSE TO PCV VALVE

3. INSPECT PCV VALVE OPERATION

(a) Blow air into the cylinder head side, and check that air passes through easily.

CAUTION:

Do not suck air through the valve. Petroleum substances inside the valve are harmful.

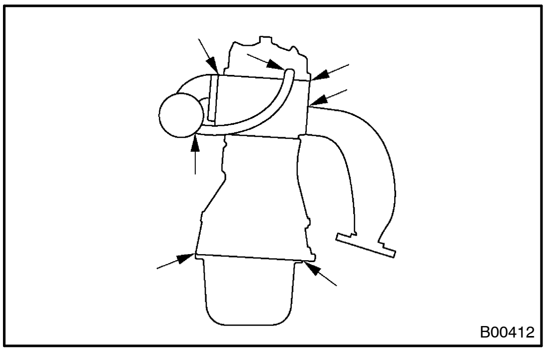


(b) Blow air into the intake manifold side, and check that air passes through with difficulty.

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

4. REMOVE CLEAN HOSE FROM PCV VALVE

5. REINSTALL PCV VALVE



6. VISUALLY INSPECT HOSES, CONNECTIONS AND GASKETS

Check for cracks, leaks or damage.

EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM

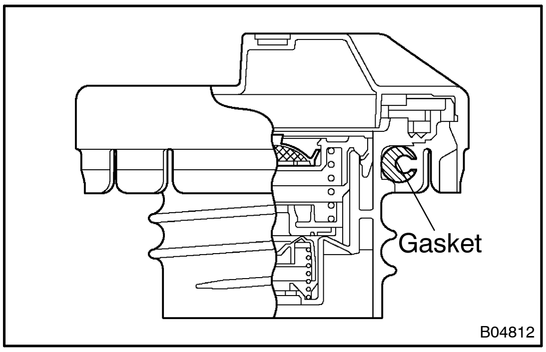
EC0DW–01

INSPECTION

1. REMOVE EXHAUST TAIL PIPE AND HEATED INSULATOR

2. INSPECT FUEL TANK FILLER PIPE

Visually check for deformation, cracks or fuel leakage.



B04812

3. INSPECT FUEL TANK CAP

Visually check if the cap and/or gasket are deformed or damaged.

If necessary, repair or replace the cap.

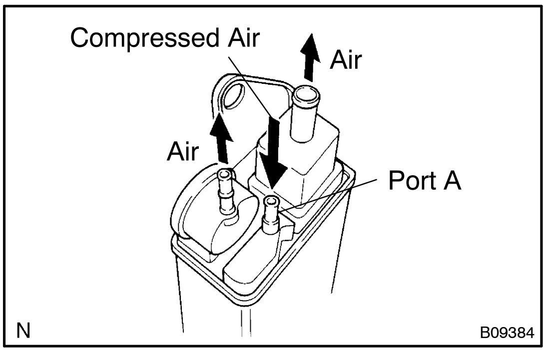
4. REMOVE CHARCOAL CANISTER ASSEMBLY

(a) Disconnect the 3 hoses.

(b) Remove the 2 bolts and charcoal canister assembly.

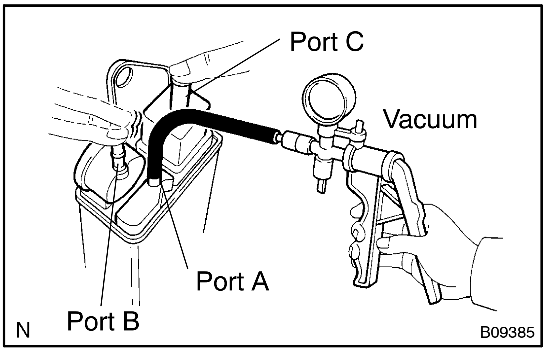
5. INSPECT CHARCOAL CANISTER

(a) Visually check the charcoal canister for cracks or damage.



N B09384

(b) Using low pressure compressed air (4.71 kPa (48 gf/cm^2,0.68 psi)), blow into port A and check that air flows without resistance from the other parts.



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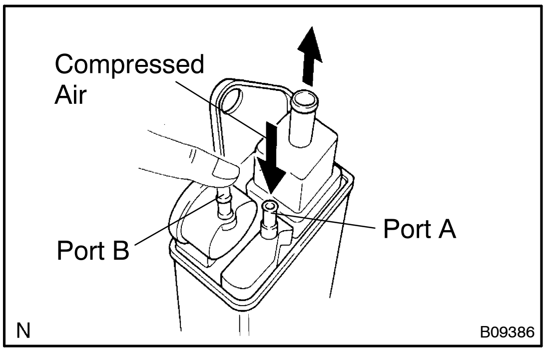
(c) Apply vacuum (1.96 kPa (20 gf/cm^2, 0.28 psi)) to port A, check that the vacuum does not decrease when port B and C are closed, and check that the vacuum does not decrease when port B is released.

If a problem is found, replace the charcoal canister.



6. CLEAN FILTER IN CANISTER

Clean the filter by blowing 19.6 kPa (0.2 kgf/cm^2, 2.8 psi) of compressed air into port A while holding port B closed.

NOTICE:

- **Do not attempt to wash the canister.**
- **No activated carbon should come out.**

7. REINSTALL CHARCOAL CANISTER

THREE–WAY CATALYTIC CONVERTER (TWC) SYSTEM

EC0DV–01

INSPECTION

1. CHECK TWC FOR DENTS OR DAMAGE

If any port of the heat insulator is damaged or dented to the extent that it contacts the three–way catalytic converter, repair or replace it.

2. CHECK EXHAUST PIPE CONNECTIONS FOR LOOSENESS OR DAMAGE

3. CHECK EXHAUST PIPE CLAMPS FOR WEAKNESS, CRACKS OR DAMAGE

4. CHECK HEAT INSULATOR FOR DAMAGE

5. CHECK FOR ADEQUATE CLEARANCE BETWEEN EXHAUST SYSTEM AND HEAT INSULATOR ON THE BODY

CO/HC

INSPECTION

EM05J–06

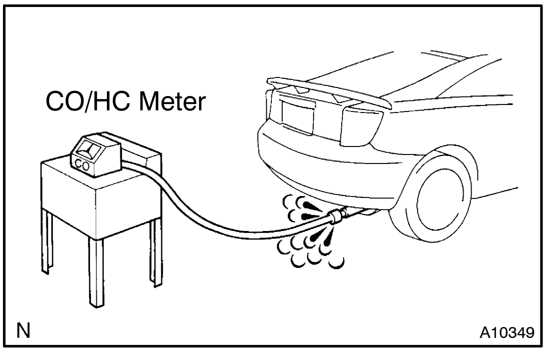
HINT:
This check is used only to determine whether or not the idle CO/HC complies with regulations.

1. INSTALL CONDITIONS

(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) Air pipes and hoses of air induction system connected
(d) All accessories switched OFF
(e) All vacuum lines properly connected
(f) EFI system wiring connectors fully plugged
(g) Ignition timing check correctly
(h) Transmission in neutral position
(i) Tachometer and CO/HC meter calibrated by hand

2. START ENGINE

3. RACE ENGINE AT 2,500 RPM FOR APPROX. 180 SECONDS



4. INSERT CO/HC METER TESTING PROBE AT LEAST 40 cm (1.3 ft) INTO TAILPIPE DURING IDLING

5. IMMEDIATELY CHECK CO/HC CONCENTRATION AT IDLE AND/OR 2,500 RPM

Complete the measuring with 3 minutes.
HINT:
When doing the 2 mode (idle and 2,500 rpm) test, these measurement order prescribed by the applicable local regulations.

If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.

- Check heated oxygen sensor operation.
(See page DI–53)
- See the table below for possible causes, and then inspect and correct the applicable causes if necessary.

CO	HC	Problems	Causes
Normal	High	Rough idle	3. Faulty ignitions: • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed high–tension cords 4. Incorrect valve clearance 5. Leaky intake and exhaust valves 6. Leaky cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: • PCV hoses • Intake manifold • Throttle body • IAC valve • Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty EFI systems: • Faulty pressure regulator • Defective water temperature sensor • Defective IAT sensor • Faulty Engine ECU • Faulty injectors • Faulty throttle position sensor

COMPRESSION

EM05K–05

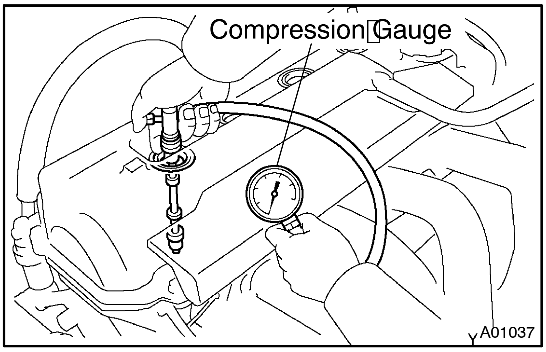
INSPECTION

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

1. **WARM UP AND STOP ENGINE**

Allow the engine to warm up to normal operating temperature.

2. **REMOVE IGNITION COIL (See page IG–6)**
3. **REMOVE SPARK PLUGS**
4. **INSPECT CYLINDER COMPRESSION PRESSURE**



(a) Insert a compression gauge into the spark plug hole.
(b) Fully open the throttle.
(c) While cranking the engine, measure the compression pressure.

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

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

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

Compression pressure:
1ZZ–FE 1,500 kPa (15.3 kgf/cm^2, 218 psi)
2ZZ–GE 1,400 kPa (14.3 kgf/cm^2, 203 psi) or more
Minimum pressure:
1ZZ–FE 1,000 kPa (10.2 kgf/cm^2, 145 psi)
2ZZ–GE 1,000 kPa (10.2 kgf/cm^2, 145 psi)
Difference between each cylinder:
1ZZ–FE 100 kPa (1.0 kgf/cm^2, 15 psi) or less
2ZZ–GE 110 kPa (1.1 kgf/cm^2, 16 psi) or less

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

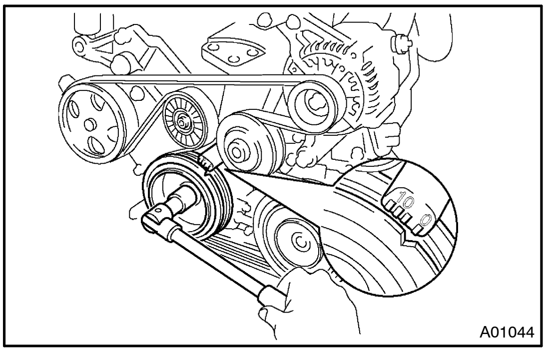
5. **REINSTALL SPARK PLUGS**
6. **INSTALL IGNITION COIL (See page IG–7)**

VALVE CLEARANCE ADJUSTMENT

EM15Q–01

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

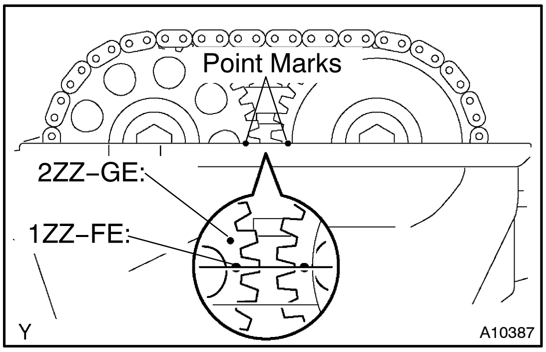
1. REMOVE CYLINDER HEAD COVER (See page EM–19)



A01044

2. SET NO. 1 CYLINDER TO TDC/COMPRESSION

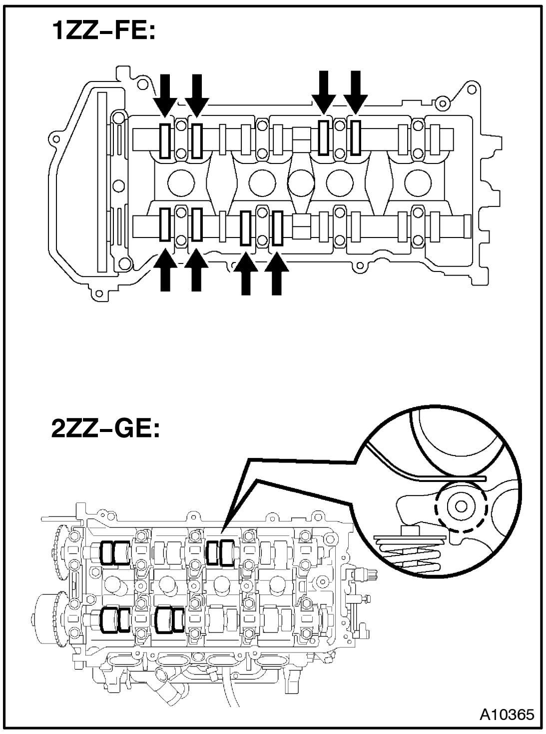
(a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.



A10387

(b) Check that the point marks of the camshaft timing sprockets are in straight line on the timing chain cover surface as shown in the illustration.

If not, turn the crankshaft 1 revolution (360°) and align the marks as above.



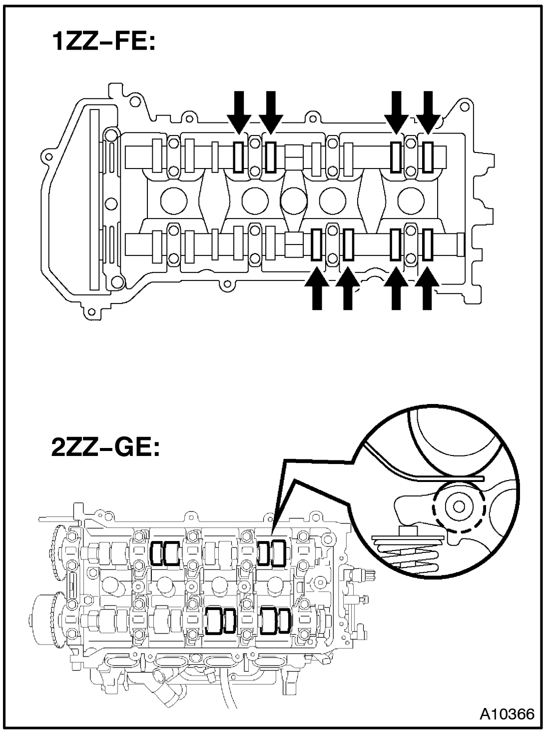
A10365

3. INSPECT VALVE CLEARANCE

(a) Check only the valves indicated.

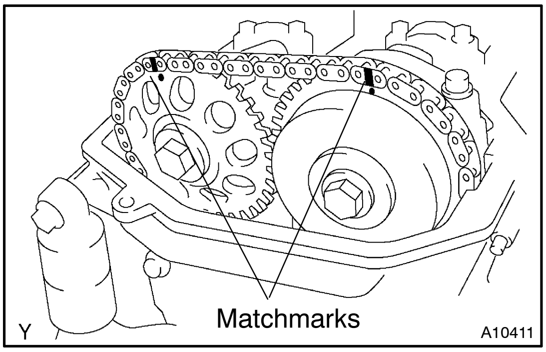
- Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
- Record the out–of–specification valve clearance measurements. They will be used later to determine the required replacement of adjusting shim.

Valve clearance (Cold):
1ZZ–FE:
Intake 0.15 – 0.25 mm (0.006 – 0.010 in.)
Exhaust 0.25 – 0.35 mm (0.010 – 0.014 in.)
2ZZ–GE:
Intake 0.08 – 0.18 mm (0.0031 – 0.0071 in.)
Exhaust 0.22 – 0.32 mm (0.0087 – 0.0126 in.)



(b) Turn the crankshaft 1 revolution (360°) and align the mark as above (See procedure in step 2).

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

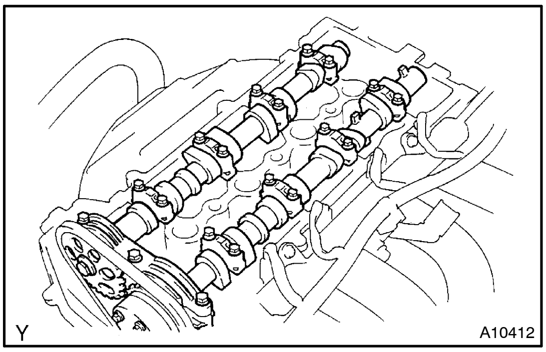


4. 1ZZ–FE:
ADJUST VALVE CLEARANCE

(a) Set the No. 1 cylinder to the TDC/compression (See procedure in step 2).

(b) Place matchmarks on the timing chain and camshaft timing sprockets.

(c) Remove the 2 bolts and chain tensioner.



(d) Remove the camshaft and timing sprocket assemblies (See page EM–43).

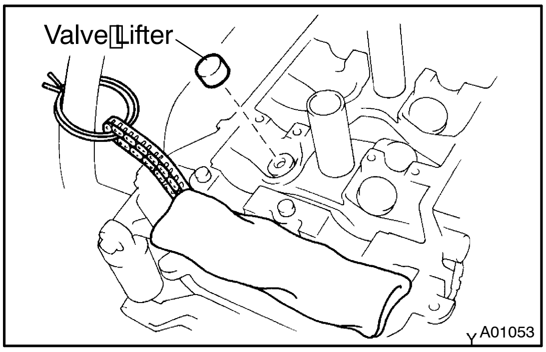
(1) 19 camshaft bearing cap bolts

(2) 9 camshaft bearing caps (No. 1 & No. 3)

(3) Exhaust camshaft and timing sprocket assembly

(4) Intake camshaft and timing sprocket assembly

HINT:
When holding the timing chain, disconnect the timing chain from the camshaft timing sprocket.

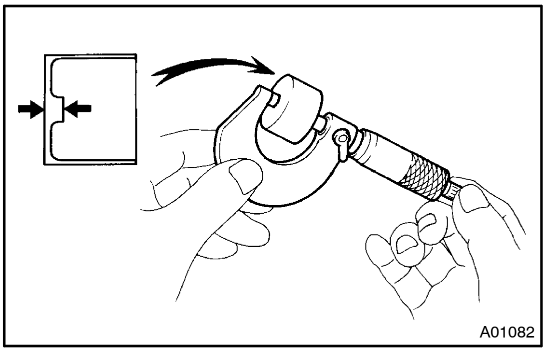


(e) Tie the timing chain with a string as shown in the illustration.

NOTICE:

- **Be careful not to drop anything inside the timing chain cover.**
- **Do not allow the chain to come into contact with water or dust.**

(f) Remove the valve lifters.

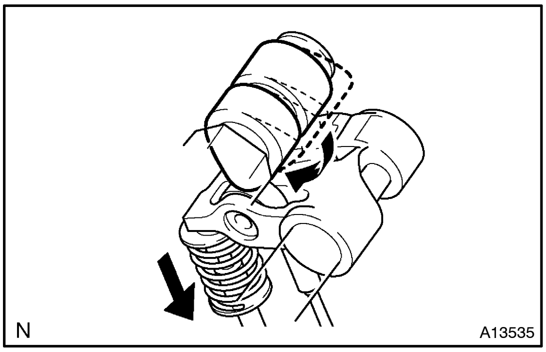


(g) Determine the size of the replaced valve lifter according to these Formula or Charts:
- Using a micrometer, measure the thickness of the removed lifter.
- Calculate the thickness of a new lifter so the valve clearance comes within the specified value.

T.......... Thickness of used lifter
A......... Measured valve clearance
N......... Thickness of new lifter
Intake: N = T + (A – 0.20 mm (0.008 in.))
Exhaust: N = T + (A – 0.30 mm (0.012 in.))

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

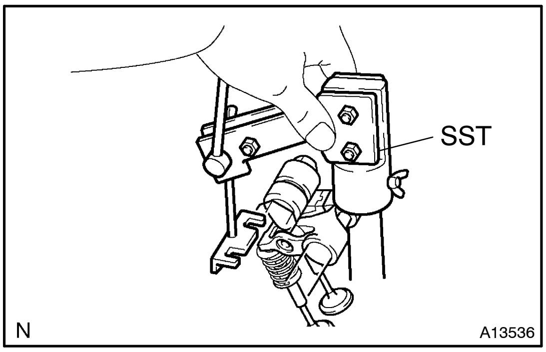
HINT:
Lifter are available in 35 sizes in increments of 0.020 mm (0.0008 in.), from 5.060 mm (0.1992 in.) to 5.740 mm (0.2260 in.).



5. 2ZZ–GE:
ADJUST VALVE CLEARANCE

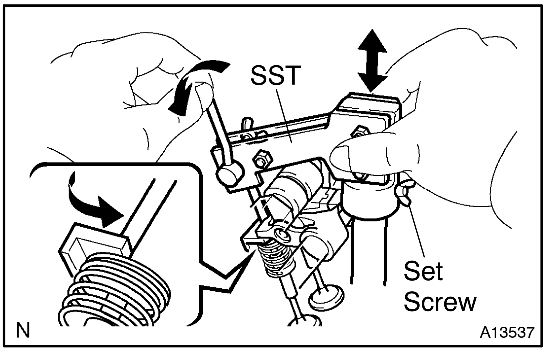
(a) Set the SST.
(1) Turn the crankshaft so that the related rocker arm, where the valve clearance is adjusted, is fully pushed down.

NOTICE:
Remove the spark plug and take off the compression.



(2) Insert SST into the plug tube.
SST 09248–77010 (09248–07010)

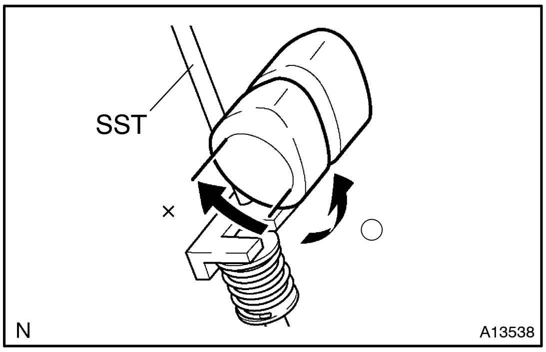
NOTICE:
- **SST cannot be inserted unless the set screw is loosened.**
- **Make sure that the camshaft is in the same condition as step (1).**



(3) Operate the lever so that SST's seat surface comes to contact with the valve retainer and lock them with the set screw.

NOTICE:
- **Clearance between the valve retainer and SST's seat surface is not allowed.**
- **Care should be taken not to make clearance when inserting SST, since a presence of clearance may unlock the keeper.**

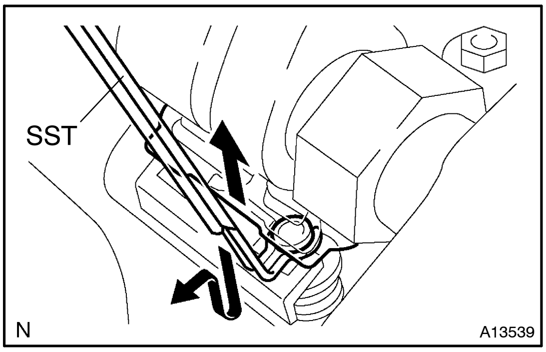
(4) Lock the set screw on the plug tube side of SST.



(5) Rotate the crankshaft so that the camshaft is positioned as shown in the illustration.

NOTICE:

- **Pay attention to the direction of the rotation to prevent the nose of the camshaft from interfering with the SST's shaft.**
- **Do not rotate the crankshaft excessively.**



(b) Remove the adjusting shim.

(1) Lift the rocker arm to make a room and remove the adjusting shim using SST.

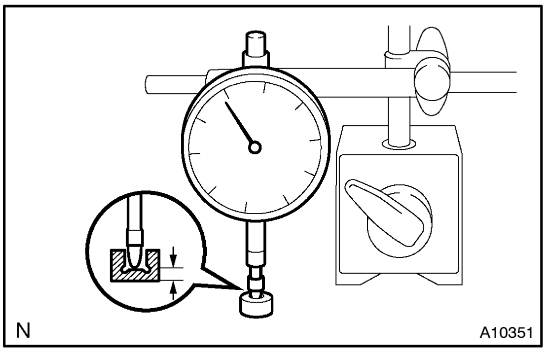
SST 09248–77010 (09248–07020)

NOTICE:

Do not remove SST in the condition that the adjusting shim is removed.

HINT:

- Setting SST from the right above makes the removal easy.
- If there is not enough room, reset SST.



(2) Determine the size of the replaced shim according to these Formula or Charts:

- Using dial indicator, measure the thickness of the removed shim.
- Calculate the thickness of a new shim so 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 – 0.13 mm (0.0051 in.)) x 1.5
Exhaust: N = T+ (A – 0.27 mm (0.0106 in.)) x 1.5

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

HINT:

Shim are available in 41 size in increments of 0.020 mm (0.0008 in.), from 2.000 mm (0.0787 in.) to 2.800 mm (0.1102 in.).

1ZZ–FE: Valve Lifter Selection Chart (Intake)

Measured clearance mm (in.) / Installed lifter thickness mm (in.)	5.060 (0.1992)	5.080 (0.2000)	5.100 (0.2008)	5.120 (0.2016)	5.140 (0.2024)	5.160 (0.2031)	5.180 (0.2039)	5.200 (0.2047)	5.210 (0.2051)	5.220 (0.2055)	5.230 (0.2059)	5.240 (0.2063)	5.250 (0.2067)	5.260 (0.2071)	5.270 (0.2075)	5.280 (0.2079)	5.290 (0.2083)	5.300 (0.2087)	5.310 (0.2091)	5.320 (0.2094)	5.330 (0.2098)	5.340 (0.2102)	5.350 (0.2106)	5.360 (0.2110)	5.370 (0.2114)	5.380 (0.2118)	5.390 (0.2122)	5.400 (0.2126)	5.410 (0.2130)	5.420 (0.2134)	5.430 (0.2138)	5.440 (0.2142)	5.450 (0.2146)	5.460 (0.2150)	5.470 (0.2154)	5.480 (0.2157)	5.490 (0.2161)	5.500 (0.2165)	5.510 (0.2169)	5.520 (0.2173)	5.530 (0.2177)	5.540 (0.2181)	5.550 (0.2185)	5.560 (0.2189)	5.570 (0.2193)	5.580 (0.2197)	5.590 (0.2201)	5.600 (0.2205)	5.620 (0.2213)	5.640 (0.2220)	5.660 (0.2228)	5.680 (0.2236)	5.700 (0.2244)	5.720 (0.2252)	5.740 (0.2260)
0.000 – 0.030 (0.0000 – 0.0012)									06	06	06	06	06	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	46	48	50	52	54	56
0.031 – 0.050 (0.0012 – 0.0020)							06	06	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	48	50	52	54	56	58
0.051 – 0.070 (0.0020 – 0.0028)						06	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	50	52	54	56	58	60
0.071 – 0.090 (0.0028 – 0.0035)					06	06	06	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	52	54	56	58	60	62
0.091 – 0.110 (0.0036 – 0.0043)				06	06	06	08	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	54	56	58	60	62	64
0.111 – 0.130 (0.0044 – 0.0051)			06	06	06	08	10	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	56	58	60	62	64	66
0.131 – 0.149 (0.0052 – 0.0059)		06	06	06	08	10	12	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	58	60	62	64	66	68
0.150 – 0.250 (0.0059 – 0.0098)																																																							
0.251 – 0.270 (0.0099 – 0.0106)	12	14	16	18	20	22	24	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	70	72	74	74	74	
0.271 – 0.290 (0.0107 – 0.0114)	14	16	18	20	22	24	26	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	72	74	74	74		
0.291 – 0.310 (0.0115 – 0.0122)	16	18	20	22	24	26	28	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	74	74	74			
0.311 – 0.330 (0.0122 – 0.0130)	18	20	22	24	26	28	30	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74				
0.331 – 0.350 (0.0130 – 0.0138)	20	22	24	26	28	30	32	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74					
0.351 – 0.370 (0.0138 – 0.0146)	22	24	26	28	30	32	34	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74						
0.371 – 0.390 (0.0146 – 0.0154)	24	26	28	30	32	34	36	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74							
0.391 – 0.410 (0.0154 – 0.0161)	26	28	30	32	34	36	38	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74	74								
0.411 – 0.430 (0.0162 – 0.0169)	28	30	32	34	36	38	40	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74											
0.431 – 0.450 (0.0170 – 0.0177)	30	32	34	36	38	40	42	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74													
0.451 – 0.470 (0.0178 – 0.0185)	32	34	36	38	40	42	44	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74															
0.471 – 0.490 (0.0185 – 0.0193)	34	36	38	40	42	44	46	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74																	
0.491 – 0.510 (0.0193 – 0.0201)	36	38	40	42	44	46	48	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74																			
0.511 – 0.530 (0.0201 – 0.0209)	38	40	42	44	46	48	50	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74																					
0.531 – 0.550 (0.0209 – 0.0217)	40	42	44	46	48	50	52	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74																							
0.551 – 0.570 (0.0217 – 0.0224)	42	44	46	48	50	52	54	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74																									
0.571 – 0.590 (0.0225 – 0.0232)	44	46	48	50	52	54	56	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74																											
0.591 – 0.610 (0.0233 – 0.0240)	46	48	50	52	54	56	58	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74																													
0.611 – 0.630 (0.0241 – 0.0248)	48	50	52	54	56	58	60	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74																															
0.631 – 0.650 (0.0248 – 0.0256)	50	52	54	56	58	60	62	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74																																	
0.651 – 0.670 (0.0256 – 0.0264)	52	54	56	58	60	62	64	66	68	68	70	70	72	72	74	74	74	74	74	74																																			
0.671 – 0.690 (0.0264 – 0.0272)	54	56	58	60	62	64	66	68	70	70	72	72	74	74	74	74	74	74																																					
0.691 – 0.710 (0.0272 – 0.0280)	56	58	60	62	64	66	68	70	72	72	74	74	74	74	74	74																																							
0.711 – 0.730 (0.0280 – 0.0287)	58	60	62	64	66	68	70	72	74	74	74	74	74	74																																									
0.731 – 0.750 (0.0288 – 0.0295)	60	62	64	66	68	70	72	74	74	74	74	74																																											
0.751 – 0.770 (0.0296 – 0.0303)	62	64	66	68	70	72	74	74	74	74																																													
0.771 – 0.790 (0.0304 – 0.0311)	64	66	68	70	72	74	74	74																																															
0.791 – 0.810 (0.0311 – 0.0319)	66	68	70	72	74	74	74																																																
0.811 – 0.830 (0.0319 – 0.0327)	68	70	72	74	74	74																																																	
0.831 – 0.850 (0.0327 – 0.0335)	70	72	74	74	74																																																		
0.851 – 0.870 (0.0335 – 0.0343)	72	74	74	74																																																			
0.871 – 0.890 (0.0343 – 0.0350)	74	74	74																																																				
0.891 – 0.910 (0.0351 – 0.0358)	74	74																																																					
0.911 – 0.930 (0.0359 – 0.0366)	74																																																						

New lifter thickness mm (in.)

Lifter No.	Thickness	Lifter No.	Thickness	Lifter No.	Thickness
06	5.060 (0.1992)	30	5.300 (0.2087)	54	5.540 (0.2181)
08	5.080 (0.2000)	32	5.320 (0.2094)	56	5.560 (0.2189)
10	5.100 (0.2008)	34	5.340 (0.2102)	58	5.580 (0.2197)
12	5.120 (0.2016)	36	5.360 (0.2110)	60	5.600 (0.2205)
14	5.140 (0.2024)	38	5.380 (0.2118)	62	5.620 (0.2213)
16	5.160 (0.2031)	40	5.400 (0.2126)	64	5.640 (0.2220)
18	5.180 (0.2039)	42	5.420 (0.2134)	66	5.660 (0.2228)
20	5.200 (0.2047)	44	5.440 (0.2142)	68	5.680 (0.2236)
22	5.220 (0.2055)	46	5.460 (0.2150)	70	5.700 (0.2244)
24	5.240 (0.2063)	48	5.480 (0.2157)	72	5.720 (0.2252)
26	5.260 (0.2071)	50	5.500 (0.2165)	74	5.740 (0.2260)
28	5.280 (0.2079)	52	5.520 (0.2173)		

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

EXAMPLE: The 5.250 mm (0.2067 in.) lifter is installed, and the measured clearance is 0.400 mm (0.0157 in.).
Replace the 5.250 mm (0.2067 in.) lifter with a new No. 48 lifter.

A01234

1ZZ–FE: Valve Lifter Selection Chart (Exhaust)

Measured clearance mm (in.) \ Installed lifter thickness mm (in.)	5.060 (0.1992)	5.080 (0.2000)	5.100 (0.2008)	5.120 (0.2016)	5.140 (0.2024)	5.160 (0.2031)	5.180 (0.2039)	5.200 (0.2047)	5.210 (0.2051)	5.220 (0.2055)	5.230 (0.2059)	5.240 (0.2063)	5.250 (0.2067)	5.260 (0.2071)	5.270 (0.2075)	5.280 (0.2079)	5.290 (0.2083)	5.300 (0.2087)	5.310 (0.2091)	5.320 (0.2094)	5.330 (0.2098)	5.340 (0.2102)	5.350 (0.2106)	5.360 (0.2110)	5.370 (0.2114)
0.000 – 0.030 (0.0000 – 0.0012)																			06	06	06	06	08	08	10
0.031 – 0.050 (0.0012 – 0.0020)																06	06	06	06	06	08	08	10	10	12
0.051 – 0.070 (0.0020 – 0.0028)														06	06	06	06	06	08	08	10	10	12	12	14
0.071 – 0.090 (0.0028 – 0.0035)												06	06	06	06	06	08	08	10	10	12	12	14	14	16
0.091 – 0.110 (0.0036 – 0.0043)											06	06	06	06	08	08	10	10	12	12	14	14	16	16	18
0.111 – 0.130 (0.0044 – 0.0051)									06	06	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20
0.131 – 0.150 (0.0052 – 0.0059)								06	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22
0.151 – 0.170 (0.0059 – 0.0067)						06	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24
0.171 – 0.190 (0.0067 – 0.0075)					06	06	06	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26
0.191 – 0.210 (0.0075 – 0.0083)				06	06	06	08	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28
0.211 – 0.230 (0.0083 – 0.0091)			06	06	06	08	10	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30
0.231 – 0.249 (0.0091 – 0.0098)		06	06	06	08	10	12	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32
0.250 – 0.350 (0.0098 – 0.0138)																									
0.351 – 0.370 (0.0138 – 0.0146)	12	14	16	18	20	22	24	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44
0.371 – 0.390 (0.0146 – 0.0154)	14	16	18	20	22	24	26	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46
0.391 – 0.410 (0.0154 – 0.0161)	16	18	20	22	24	26	28	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48
0.411 – 0.430 (0.0162 – 0.0169)	18	20	22	24	26	28	30	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50
0.431 – 0.450 (0.0170 – 0.0177)	20	22	24	26	28	30	32	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52
0.451 – 0.470 (0.0178 – 0.0185)	22	24	26	28	30	32	34	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54
0.471 – 0.490 (0.0185 – 0.0193)	24	26	28	30	32	34	36	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56
0.491 – 0.510 (0.0193 – 0.0201)	26	28	30	32	34	36	38	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58
0.511 – 0.530 (0.0201 – 0.0209)	28	30	32	34	36	38	40	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60
0.531 – 0.550 (0.0209 – 0.0217)	30	32	34	36	38	40	42	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62
0.551 – 0.570 (0.0217 – 0.0224)	32	34	36	38	40	42	44	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64
0.571 – 0.590 (0.0225 – 0.0232)	34	36	38	40	42	44	46	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66
0.591 – 0.610 (0.0233 – 0.0240)	36	38	40	42	44	46	48	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68
0.611 – 0.630 (0.0241 – 0.0248)	38	40	42	44	46	48	50	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70
0.631 – 0.650 (0.0248 – 0.0256)	40	42	44	46	48	50	52	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72
0.651 – 0.670 (0.0256 – 0.0264)	42	44	46	48	50	52	54	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74
0.671 – 0.690 (0.0264 – 0.0272)	44	46	48	50	52	54	56	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74
0.691 – 0.710 (0.0272 – 0.0280)	46	48	50	52	54	56	58	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74
0.711 – 0.730 (0.0280 – 0.0287)	48	50	52	54	56	58	60	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74	
0.731 – 0.750 (0.0288 – 0.0295)	50	52	54	56	58	60	62	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74			
0.751 – 0.770 (0.0296 – 0.0303)	52	54	56	58	60	62	64	66	68	68	70	70	72	72	74	74	74	74	74	74					
0.771 – 0.790 (0.0304 – 0.0311)	54	56	58	60	62	64	66	68	70	70	72	72	74	74	74	74	74	74							
0.791 – 0.810 (0.0311 – 0.0319)	56	58	60	62	64	66	68	70	72	72	74	74	74	74	74	74									
0.811 – 0.830 (0.0319 – 0.0327)	58	60	62	64	66	68	70	72	74	74	74	74	74	74											
0.831 – 0.850 (0.0327 – 0.0335)	60	62	64	66	68	70	72	74	74	74	74	74													
0.851 – 0.870 (0.0335 – 0.0343)	62	64	66	68	70	72	74	74	74	74															
0.871 – 0.890 (0.0343 – 0.0350)	64	66	68	70	72	74	74	74																	
0.891 – 0.910 (0.0351 – 0.0358)	66	68	70	72	74	74	74																		
0.911 – 0.930 (0.0359 – 0.0366)	68	70	72	74	74	74																			
0.931 – 0.950 (0.0367 – 0.0374)	70	72	74	74	74																				
0.951 – 0.970 (0.0374 – 0.0382)	72	74	74	74																					
0.971 – 0.990 (0.0382 – 0.0390)	74	74	74																						
0.991 – 1.010 (0.0390 – 0.0398)	74	74																							
1.011 – 1.030 (0.0398 – 0.0406)	74																								

Measured clearance mm (in.) \ Installed lifter thickness mm (in.)	5.380 (0.2118)	5.390 (0.2122)	5.400 (0.2126)	5.410 (0.2130)	5.420 (0.2134)	5.430 (0.2138)	5.440 (0.2142)	5.450 (0.2146)	5.460 (0.2150)	5.470 (0.2154)	5.480 (0.2157)	5.490 (0.2161)	5.500 (0.2165)	5.510 (0.2169)	5.520 (0.2173)	5.530 (0.2177)	5.540 (0.2181)	5.550 (0.2185)	5.560 (0.2189)	5.570 (0.2193)	5.580 (0.2197)	5.590 (0.2201)	5.600 (0.2205)	5.620 (0.2213)	5.640 (0.2220)	5.660 (0.2228)	5.680 (0.2236)	5.700 (0.2244)	5.720 (0.2252)	5.740 (0.2260)
0.000 – 0.030 (0.0000 – 0.0012)	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	36	38	40	42	44	46
0.031 – 0.050 (0.0012 – 0.0020)	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	38	40	42	44	46	48
0.051 – 0.070 (0.0020 – 0.0028)	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	40	42	44	46	48	50
0.071 – 0.090 (0.0028 – 0.0035)	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	42	44	46	48	50	52
0.091 – 0.110 (0.0036 – 0.0043)	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	44	46	48	50	52	54
0.111 – 0.130 (0.0044 – 0.0051)	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	46	48	50	52	54	56
0.131 – 0.150 (0.0052 – 0.0059)	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	48	50	52	54	56	58
0.151 – 0.170 (0.0059 – 0.0067)	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	50	52	54	56	58	60
0.171 – 0.190 (0.0067 – 0.0075)	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	52	54	56	58	60	62
0.191 – 0.210 (0.0075 – 0.0083)	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	54	56	58	60	62	64
0.211 – 0.230 (0.0083 – 0.0091)	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	56	58	60	62	64	66
0.231 – 0.249 (0.0091 – 0.0098)	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	58	60	62	64	66	68
0.250 – 0.350 (0.0098 – 0.0138)																														
0.351 – 0.370 (0.0138 – 0.0146)	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	70	72	74	74	74	
0.371 – 0.390 (0.0146 – 0.0154)	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	72	74	74	74		
0.391 – 0.410 (0.0154 – 0.0161)	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	74	74	74			
0.411 – 0.430 (0.0162 – 0.0169)	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74				
0.431 – 0.450 (0.0170 – 0.0177)	52	54	54	56	56	58	58	60	60	62	62	64	64	66	68	68	70	70	72	72	74	74	74	74	74					
0.451 – 0.470 (0.0178 – 0.0185)	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74						
0.471 – 0.490 (0.0185 – 0.0193)	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74							
0.491 – 0.510 (0.0193 – 0.0201)	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74									
0.511 – 0.530 (0.0201 – 0.0209)	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74											
0.531 – 0.550 (0.0209 – 0.0217)	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74													
0.551 – 0.570 (0.0217 – 0.0224)	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74															
0.571 – 0.590 (0.0225 – 0.0232)	66	68	68	70	70	72	72	74	74	74	74	74	74																	
0.591 – 0.610 (0.0233 – 0.0240)	68	70	70	72	72	74	74	74	74	74	74																			
0.611 – 0.630 (0.0241 – 0.0248)	70	72	72	74	74	74	74	74	74																					
0.631 – 0.650 (0.0248 – 0.0256)	72	74	74	74	74	74	74	74																						
0.651 – 0.670 (0.0256 – 0.0264)	74	74	74	74	74																									
0.671 – 0.690 (0.0264 – 0.0272)	74	74	74																											
0.691 – 0.710 (0.0272 – 0.0280)	74																													
0.711 – 0.730 (0.0280 – 0.0287)																														
0.731 – 0.750 (0.0288 – 0.0295)																														
0.751 – 0.770 (0.0296 – 0.0303)																														
0.771 – 0.790 (0.0304 – 0.0311)																														
0.791 – 0.810 (0.0311 – 0.0319)																														
0.811 – 0.830 (0.0319 – 0.0327)																														
0.831 – 0.850 (0.0327 – 0.0335)																														
0.851 – 0.870 (0.0335 – 0.0343)																														
0.871 – 0.890 (0.0343 – 0.0350)																														
0.891 – 0.910 (0.0351 – 0.0358)																														
0.911 – 0.930 (0.0359 – 0.0366)																														
0.931 – 0.950 (0.0367 – 0.0374)																														
0.951 – 0.970 (0.0374 – 0.0382)																														
0.971 – 0.990 (0.0382 – 0.0390)																														
0.991 – 1.010 (0.0390 – 0.0398)																														
1.011 – 1.030 (0.0398 – 0.0406)																														

New lifter thickness mm (in.)

Lifter No.	Thickness	Lifter No.	Thickness	Lifter No.	Thickness
06	5.060 (0.1992)	30	5.300 (0.2087)	54	5.540 (0.2181)
08	5.080 (0.2000)	32	5.320 (0.2094)	56	5.560 (0.2189)
10	5.100 (0.2008)	34	5.340 (0.2102)	58	5.580 (0.2197)
12	5.120 (0.2016)	36	5.360 (0.2110)	60	5.600 (0.2205)
14	5.140 (0.2024)	38	5.380 (0.2118)	62	5.620 (0.2213)
16	5.160 (0.2031)	40	5.400 (0.2126)	64	5.640 (0.2220)
18	5.180 (0.2039)	42	5.420 (0.2134)	66	5.660 (0.2228)
20	5.200 (0.2047)	44	5.440 (0.2142)	68	5.680 (0.2236)
22	5.220 (0.2055)	46	5.460 (0.2150)	70	5.700 (0.2244)
24	5.240 (0.2063)	48	5.480 (0.2157)	72	5.720 (0.2252)
26	5.260 (0.2071)	50	5.500 (0.2165)	74	5.740 (0.2260)
28	5.280 (0.2079)	52	5.520 (0.2173)		

Exhaust valve clearance (Cold):
0.25 – 0.35 mm (0.010 – 0.014 in.)

EXAMPLE: The 5.340 mm (0.2102 in.) lifter is installed, and the measured clearance is 0.440 mm (0.0173 in.).
Replace the 5.340 mm (0.2102 in.) lifter with a new No. 48 lifter.

A01235

2ZZ-GE: Valve Shim Selection Chart (Intake)

Installed shim thickness mm(in.) / Measure clearance mm(in.)	2.000 (0.0787)	2.020 (0.0795)	2.040 (0.0803)	2.060 (0.0811)	2.080 (0.0819)	2.100 (0.0872)	2.120 (0.0835)	2.140 (0.0843)	2.160 (0.0850)	2.180 (0.0858)	2.190 (0.0862)	2.200 (0.0866)	2.210 (0.0870)	2.220 (0.0874)	2.230 (0.0878)	2.240 (0.0882)	2.250 (0.0886)	2.260 (0.0890)	2.270 (0.0894)	2.280 (0.0898)	2.290 (0.0902)	2.300 (0.0906)	2.310 (0.0909)	2.320 (0.0913)	2.330 (0.0917)	2.340 (0.0921)	2.340 (0.0921)	2.350 (0.0925)	2.360 (0.0929)	2.370 (0.0933)	2.380 (0.0937)	2.390 (0.0941)	2.400 (0.0945)	2.410 (0.0949)	2.420 (0.0953)	2.430 (0.0957)	2.440 (0.0961)	2.450 (0.0965)	2.460 (0.0969)	2.470 (0.0972)	2.480 (0.0976)	2.490 (0.0980)	2.500 (0.0984)	2.510 (0.0988)	2.520 (0.0992)	2.530 (0.0996)	2.540 (0.1000)	2.550 (0.1004)	2.560 (0.1008)	2.580 (0.1016)	2.600 (0.1024)	2.620 (0.1031)	2.640 (0.1039)	2.660 (0.1047)	2.680 (0.1055)	2.700 (0.1063)	2.720 (0.1071)	2.740 (0.1079)	2.760 (0.1087)	2.780 (0.1094)	2.800 (0.1102)
0.000 - 0.030 (0.0000 - 0.0012)										00	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	42	44	46	48	50	52	54	56	58	60	62	64
0.031 - 0.050 (0.0012 - 0.0020)								00	02	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	46	48	50	52	54	56	58	60	62	64	66	68
0.051 - 0.070 (0.0020 - 0.0028)							00	02	04	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	48	50	52	54	56	58	60	62	64	66	68	70
0.071 - 0.079 (0.0028 - 0.0031)					00	02	04	06	08	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	52	54	56	58	60	62	64	66	68	70	72	74
0.080 - 0.180 (0.0031 - 0.0071)																																																													
0.181 - 0.200 (0.0071 - 0.0079)	06	08	10	12	14	16	18	20	22	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	66	68	70	72	74	76	78	80				
0.201 - 0.220 (0.0097 - 0.0087)	10	12	14	16	18	20	22	24	26	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	70	72	74	76	78	80						
0.221 - 0.240 (0.0087 - 0.0094)	12	14	16	18	20	22	24	26	28	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	72	74	76	78	80							
0.241 - 0.260 (0.0095 - 0.0102)	16	18	20	22	24	26	28	30	32	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	76	78	80	82								
0.261 - 0.280 (0.0103 - 0.0110)	18	20	22	24	26	28	30	32	34	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	78	80										
0.281 - 0.300 (0.0111 - 0.0118)	22	24	26	28	30	32	34	36	38	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80												
0.301 - 0.320 (0.0119 - 0.0126)	24	26	28	30	32	34	36	38	40	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80													
0.321 - 0.340 (0.0126 - 0.0134)	28	30	32	34	36	38	40	42	44	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																	
0.341 - 0.360 (0.0134 - 0.0142)	30	32	34	36	38	40	42	44	46	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																			
0.361 - 0.380 (0.0142 - 0.0150)	34	36	38	40	42	44	46	48	50	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																							
0.381 - 0.400 (0.0150 - 0.0157)	36	38	40	42	44	46	48	50	52	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																									
0.401 - 0.420 (0.0158 - 0.0165)	40	42	44	46	48	50	52	54	56	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																													
0.421 - 0.440 (0.0166 - 0.0173)	42	44	46	48	50	52	54	56	58	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																															
0.441 - 0.460 (0.0174 - 0.0181)	46	48	50	52	54	56	58	60	62	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																																			
0.461 - 0.480 (0.0181 - 0.0189)	48	50	52	54	56	58	60	62	64	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																																					
0.481 - 0.500 (0.0189 - 0.0197)	52	54	56	58	60	62	64	66	68	70	72	72	74	74	76	76	78	78	80	80																																									
0.501 - 0.520 (0.0197 - 0.0205)	54	56	58	60	62	64	66	68	70	72	74	74	76	76	78	78	80	80																																											
0.521 - 0.540 (0.0205 - 0.0213)	58	60	62	64	66	68	70	72	74	76	78	78	80	80																																																	
0.541 - 0.560 (0.0213 - 0.0220)	60	62	64	66	68	70	72	74	76	78	80	80																																																			
0.561 - 0.580 (0.0221 - 0.0228)	64	66	68	70	72	74	76	78	80																																																								
0.581 - 0.600 (0.0229 - 0.0236)	66	68	70	72	74	76	78	80																																																									
0.601 - 0.620 (0.0237 - 0.0244)|70|72|74|76|78|80|																																																												
0.621 - 0.640 (0.0244 - 0.0252)|72|74|76|78|80|																																																													
0.641 - 0.660 (0.0252 - 0.0260)|76|78|80|																																																														
0.661 - 0.680 (0.0260 - 0.0268)|78|80|																																																															
0.681 - 0.700 (0.0268 - 0.0276)|80|																																																															

New Shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness	Shim No.	Thickness
00	2.000 (0.0787)	28	2.280 (0.0898)	56	2.560 (0.1008)
02	2.020 (0.0795)	30	2.300 (0.0906)	58	2.580 (0.1016)
04	2.040 (0.0803)	32	2.320 (0.0913)	60	2.600 (0.1024)
06	2.060 (0.0811)	34	2.340 (0.0921)	62	2.620 (0.1031)
08	2.080 (0.0819)	36	2.360 (0.0929)	64	2.640 (0.1039)
10	2.100 (0.0827)	38	2.380 (.0.0937)	66	2.660 (0.1047)
12	2.120 (0.0835)	40	2.400 (0.0945)	68	2.680 (0.1055)
14	2.140 (0.0843)	42	2.420 (0.0953)	70	2.700 (0.1063)
16	2.160 (0.0850)	44	2.440 (0.0961)	72	2.720 (0.1071)
18	2.180 (0.0858)	46	2.460 (0.0969)	74	2.740 (0.1079)
20	2.200 (0.0866)	48	2.480 (0.0976)	76	2.760 (0.1087)
22	2.220 (0.0874)	50	2.500 (0.0984)	78	2.780 (0.1094)
24	2.240 (0.0882)	52	2.520 (0.0992)	80	2.800 (0.1102)
26	2.260 (0.0890)	54	2.540 (0.1000)		

Intake valve clearance (Cold):
0.08 – 0.18 mm (0.0031 – 0.0071 in.)

EXAMPLE: The 2.200 mm (0.0826 in.) shim is installed, and the measured clearance is 0.400 mm (0.0157 in.).
Replace the 2.560 mm (0.1008 in.) shim with a new No. 56 shim.

A10466

2ZZ-GE: Valve Shim Selection Chart (Exhaust)

Measure clearance mm(in.) \ Installed shim thickness mm(in.)	2.000 (0.0787)	2.020 (0.0795)	2.040 (0.0803)	2.060 (0.0811)	2.080 (0.0819)	2.100 (0.0872)	2.120 (0.0835)	2.140 (0.0843)	2.160 (0.0850)	2.180 (0.0858)	2.190 (0.0862)	2.200 (0.0866)	2.210 (0.0870)	2.220 (0.0874)	2.230 (0.0878)	2.240 (0.0882)	2.250 (0.0886)	2.260 (0.0890)	2.270 (0.0894)	2.280 (0.0898)	2.290 (0.0902)	2.300 (0.0906)	2.310 (0.0909)	2.320 (0.0913)	2.330 (0.0917)	2.340 (0.0921)	2.340 (0.0921)	2.350 (0.0925)	2.360 (0.0929)	2.370 (0.0933)	2.380 (0.0937)	2.390 (0.0941)	2.400 (0.0945)	2.410 (0.0949)	2.420 (0.0953)	2.430 (0.0957)	2.440 (0.0961)	2.450 (0.0965)	2.460 (0.0969)	2.470 (0.0972)	2.480 (0.0976)	2.490 (0.0980)	2.500 (0.0984)	2.510 (0.0988)	2.520 (0.0992)	2.530 (0.0996)	2.540 (0.1000)	2.550 (0.1004)	2.560 (0.1008)	2.580 (0.1016)	2.600 (0.1024)	2.620 (0.1031)	2.640 (0.1039)	2.660 (0.1047)	2.680 (0.1055)	2.700 (0.1063)	2.720 (0.1071)	2.740 (0.1079)	2.760 (0.1087)	2.780 (0.1094)	2.800 (0.1102)
0.000 - 0.030 (0.0000 - 0.0012)																															00	00	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	20	22	24	26	28	30	32	34	36	38	40	42
0.031 - 0.050 (0.0012 - 0.0020)																												00	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	26	28	30	32	34	36	38	40	42	44	46	48
0.051 - 0.070 (0.0020 - 0.0028)																								00	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	28	30	32	34	36	38	40	42	44	46	48	50
0.071 - 0.090 (0.0028 - 0.0035)																					00	00	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	30	32	34	36	38	40	42	44	46	48	50	52
0.091 - 0.110 (0.0036 - 0.0043)																		00	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	34	36	38	40	42	44	46	48	50	52	54	56
0.111 - 0.130 (0.0044 - 0.0051)															00	00	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	36	38	40	42	44	46	48	50	52	54	56	58
0.131 - 0.150 (0.0052 - 0.0059)												00	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	40	42	44	46	48	50	52	54	56	58	60	62
0.151 - 0.170 (0.0059 - 0.0067)										00	02	02	04	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	42	44	46	48	50	52	54	56	58	60	62	64
0.171 - 0.190 (0.0067 - 0.0075)								00	02	04	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	46	48	50	52	54	56	58	60	62	64	66	68
0.191 - 0.210 (0.0075 - 0.0083)							00	02	04	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	48	50	52	54	56	58	60	62	64	66	68	70
0.221 - 0.219 (0.0083 - 0.0086)					00	02	04	06	08	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	52	54	56	58	60	62	64	66	68	70	72	74
0.220 - 0.320 (0.0087 - 0.0126)																																																													
0.321 - 0.340 (0.0126 - 0.0134)	06	08	10	12	14	16	18	20	22	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	66	68	70	72	74	76	78	80	80			
0.341 - 0.360 (0.0134 - 0.0142)	08	10	12	14	16	18	20	22	24	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	68	70	72	74	76	78	80					
0.361 - 0.380 (0.0142 - 0.0150)	12	14	16	18	20	22	24	26	28	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	72	74	76	78	80							
0.381 - 0.400 (0.0150 - 0.0157)	16	18	20	22	24	26	28	30	32	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	76	78	80									
0.401 - 0.420 (0.0158 - 0.0165)	18	20	22	24	26	28	30	32	34	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	78	80										
0.421 - 0.440 (0.0166 - 0.0173)	22	24	26	28	30	32	34	36	38	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80												
0.441 - 0.460 (0.0174 - 0.0181)	24	26	28	30	32	34	36	38	40	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80													
0.461 - 0.480 (0.0181 - 0.0189)	28	30	32	34	36	38	40	42	44	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																	
0.481 - 0.500 (0.0189 - 0.0197)	30	32	34	36	38	40	42	44	46	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																			
0.501 - 0.520 (0.0197 - 0.0205)	34	36	38	40	42	44	46	48	50	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																							
0.521 - 0.540 (0.0205 - 0.0213)	36	38	40	42	44	46	48	50	52	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																									
0.541 - 0.560 (0.0213 - 0.0220)	40	42	44	46	48	50	52	54	56	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																													
0.561 - 0.580 (0.0221 - 0.0228)	42	44	46	48	50	52	54	56	58	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																															
0.581 - 0.600 (0.0229 - 0.0236)	46	48	50	52	54	56	58	60	62	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																																			
0.601 - 0.620 (0.0237 - 0.0244)	48	50	52	54	56	58	60	62	64	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80																																					
0.621 - 0.640 (0.0244 - 0.0252)	52	54	56	58	60	62	64	66	68	70	72	72	74	74	76	76	78	78	80	80																																									
0.641 - 0.660 (0.0252 - 0.0260)	54	56	58	60	62	64	66	68	70	72	74	74	76	76	78	78	80	80																																											
0.661 - 0.680 (0.0260 - 0.0268)	58	60	62	64	66	68	70	72	74	76	78	78	80	80																																															
0.681 - 0.700 (0.0268 - 0.0276)	60	62	64	66	68	70	72	74	76	78	80	80																																																	
0.701 - 0.720 (0.0276 - 0.0283)	64	66	68	70	72	74	76	78	80																																																				
0.721 - 0.740 (0.0284 - 0.0291)	66	68	70	72	74	76	78	80																																																					
0.741 - 0.760 (0.0292 - 0.0299)	70	72	74	76	78	80																																																							
0.761 - 0.780 (0.0300 - 0.0307)	72	74	76	78	80																																																								
0.781 - 0.800 (0.0307 - 0.0315)	76	78	80																																																										
0.801 - 0.820 (0.0315 - 0.0323)	80																																																												
0.821 - 0.840 (0.0323 - 0.0331)	80																																																												

New Shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness	Shim No.	Thickness
00	2.000 (0.0787)	28	2.280 (0.0898)	56	2.560 (0.1008)
02	2.020 (0.0795)	30	2.300 (0.0906)	58	2.580 (0.1016)
04	2.040 (0.0803)	32	2.320 (0.0913)	60	2.600 (0.1024)
06	2.060 (0.0811)	34	2.340 (0.0921)	62	2.620 (0.1031)
08	2.080 (0.0819)	36	2.360 (0.0929)	64	2.640 (0.1039)
10	2.100 (0.0827)	38	2.380 (.0.0937)	66	2.660 (0.1047)
12	2.120 (0.0835)	40	2.400 (0.0945)	68	2.680 (0.1055)
14	2.140 (0.0843)	42	2.420 (0.0953)	70	2.700 (0.1063)
16	2.160 (0.0850)	44	2.440 (0.0961)	72	2.720 (0.1071)
18	2.180 (0.0858)	46	2.460 (0.0969)	74	2.740 (0.1079)
20	2.200 (0.0866)	48	2.480 (0.0976)	76	2.760 (0.1087)
22	2.220 (0.0874)	50	2.500 (0.0984)	78	2.780 (0.1094)
24	2.240 (0.0882)	52	2.520 (0.0992)	80	2.800 (0.1102)
26	2.260 (0.0890)	54	2.540 (0.1000)		

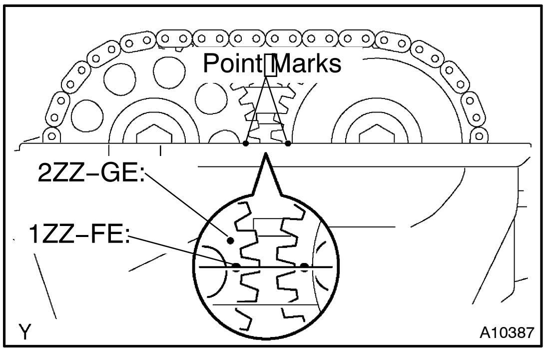
Exhaust valve clearance (Cold):
0.22 – 0.32 mm (0.0087 – 0.0126 in.)

EXAMPLE: The 2.200 mm (0.0862 in.) shim is installed, and the measured clearance is 0.500 mm (0.0197 in.).
Replace the 2.500 mm (0.0984 in.) shim with a new No. 50 shim.

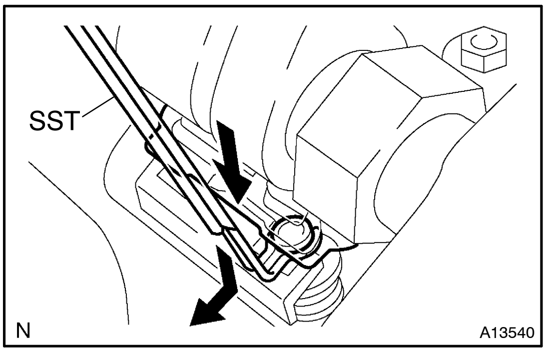
A10467

6. 1ZZ–FE:
REINSTALL CAMSHAFT

(a) Reinstall the valve lifters (See page EM–62).
(b) Align the crankshaft pulley groove with the timing mark "0" of the timing chain cover.
(c) Hold the timing chain, and place the intake camshaft and timing sprocket assembly.
(d) Align the matchmarks on the timing chain and camshaft timing sprocket.
(e) Reinstall the camshaft and timing sprocket assemblies (See page EM–66).



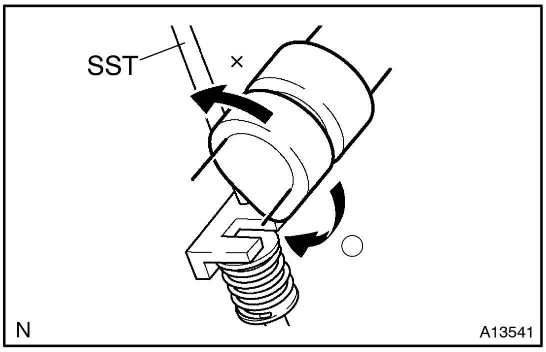
(f) Check that the point marks of the camshaft timing sprockets are in straight line on the timing chain cover surface as shown in the illustration.
(g) Check that the matchmarks are on the timing chain and camshaft timing sprockets.
(h) Install the chain tensioner (See page EM–26).
(i) Recheck the valve clearance (See procedure in step 3).
(j) Check the valve timing (See page EM–26).



7. 2ZZ–GE:
REINSTALL ADJUSTING SHIM

(a) Lift the rocker arm to make a room and use SST, install the adjusting shim.

HINT:
- Setting SST from the right above makes the removal easy.
- To remove SST from the adjusting shim, it is advisable to push down the rocker arm.



(b) Turn the crankshaft so that the related rocker arm, where the valve clearance is adjusted, is fully pushed down.

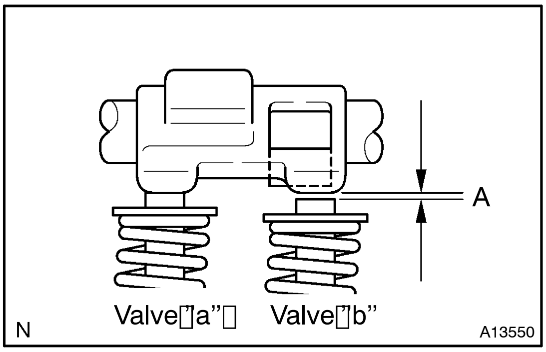
NOTICE:
- **Pay attention to the direction of the rotation to prevent the nose of the camshaft from interfering with the SST's shaft.**
- **Do not rotate the crankshaft excessively.**

(c) After loosening the 2 set screws of SST, remove SST itself.
SST 09248–77010 (09248–07010)

8. REINSTALL CYLINDER HEAD COVER
(See page EM–26)

9. IF VALVE OR ROCKER ARM IS REPLACED, REPLACE SHIM AS FOLLOWS

(a) Install a standard shim of 2.400 mm (0.0945 in.) thickness at low temperature and install the rocker arm.



(b) While pressing the rocker arm, measure the clearance "A" of valve "b" in the condition that a clearance of the other value is 0mm (0 in.).

(c) To adjust the valve hight, replace a shim of valve "b" with a shim that has thickness of t_1.

t_1 = A + 2.400

(d) After adjusting the valve hight, adjust the clearance as described from step 3.

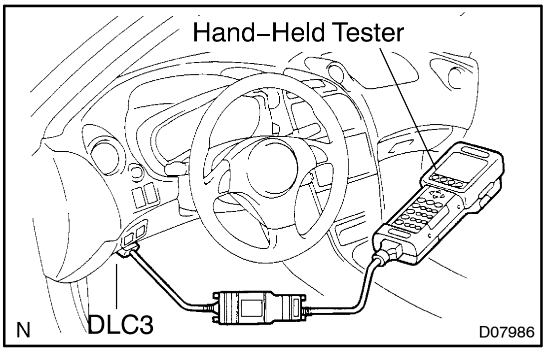
IGNITION TIMING

EM15P–03

INSPECTION

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

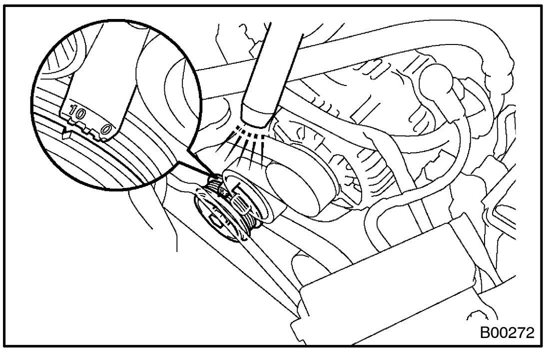


2. CONNECT HAND–HELD TESTER

(a) Connect the hand–held testerl to the DLC3.

(b) Please refer to the hand–held tester operator's for further details.

3. CONNECT TIMING LIGHT TO ENGINE



4. INSPECT IGNITION TIMING

Using a timing light, check the ignition timing.

Ignition timing:
1ZZ–FE:
10 – 18° BTDC @ idle
2ZZ–GE:
8 – 12° BTDC @ idle
(Transmission in neutral position)

HINT:

After engine rpm is kept at 1,000 – 1,300 rpm for 5 seconds, check that it returns to idle speed.

5. DISCONNECT TIMING LIGHT FROM ENGINE

6. DISCONNECT HAND–HELD TESTER

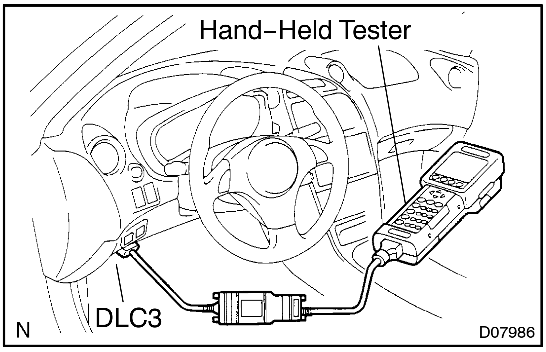
IDLE SPEED

EM05N–05

INSPECTION

1. INSTALL CONDITIONS

(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All vacuum lines properly connected
(e) EFI system wiring connectors fully plugged
(f) All operating accessories switched OFF
(g) Ignition timing check correctly
(h) Transmission in neutral range
(i) Air conditioning switched OFF



2. CONNECT TOYOTA HAND–HELD TESTER

(a) Connect the hand–held tester to the DLC3.
(b) Please refer to the hand–held tester operator's manual for further details.

3. INSPECT IDLE SPEED

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

Idle speed (w/ Cooling fan OFF):
1ZZ–FE
M/T 700 ± 50 rpm
A/T 750 ± 50 rpm
2ZZ–GE
M/T 800 ± 50 rpm
A/T 750 ± 50 rpm

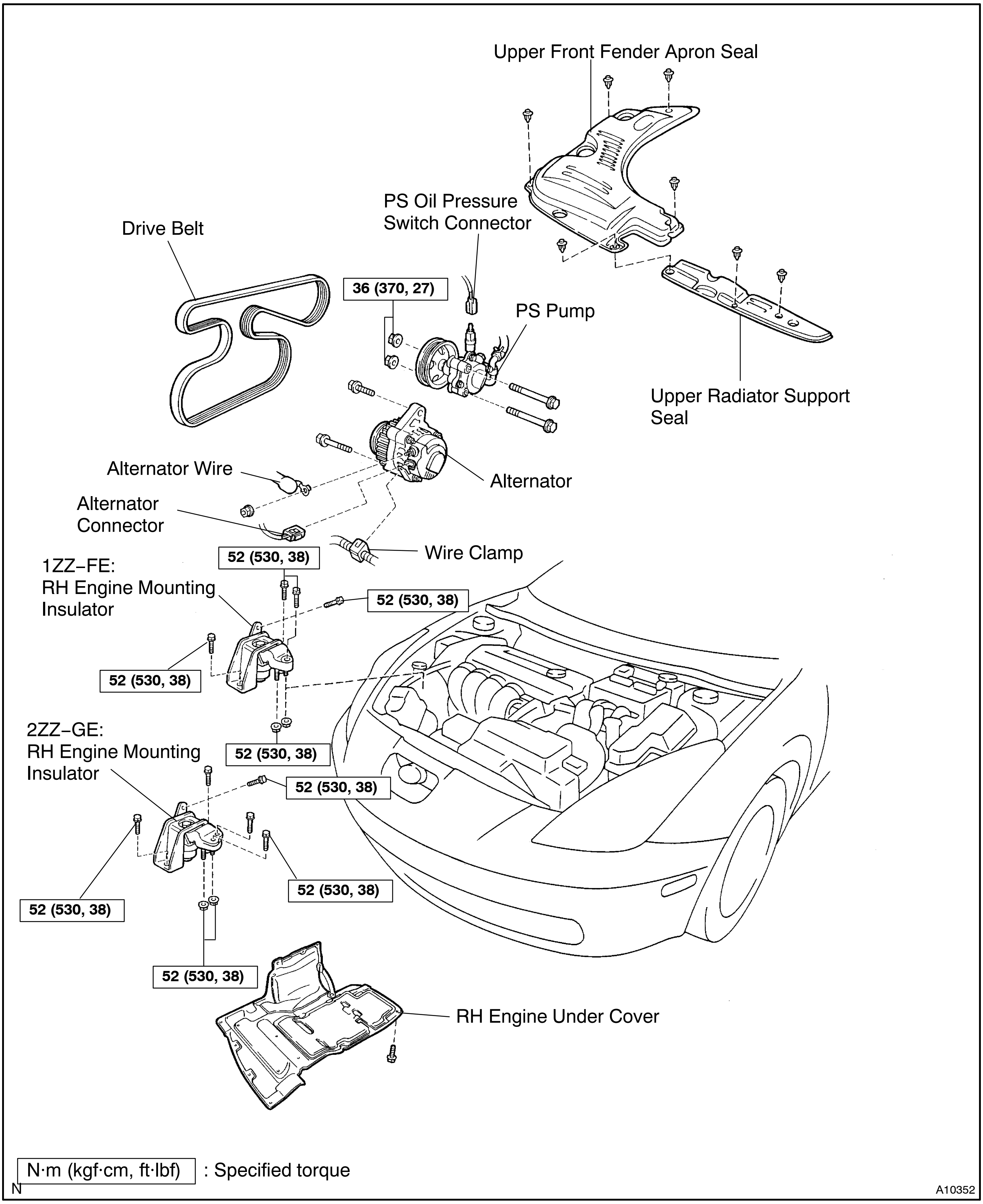
If the idle speed is not as specified, check the ISC valve and air intake system.

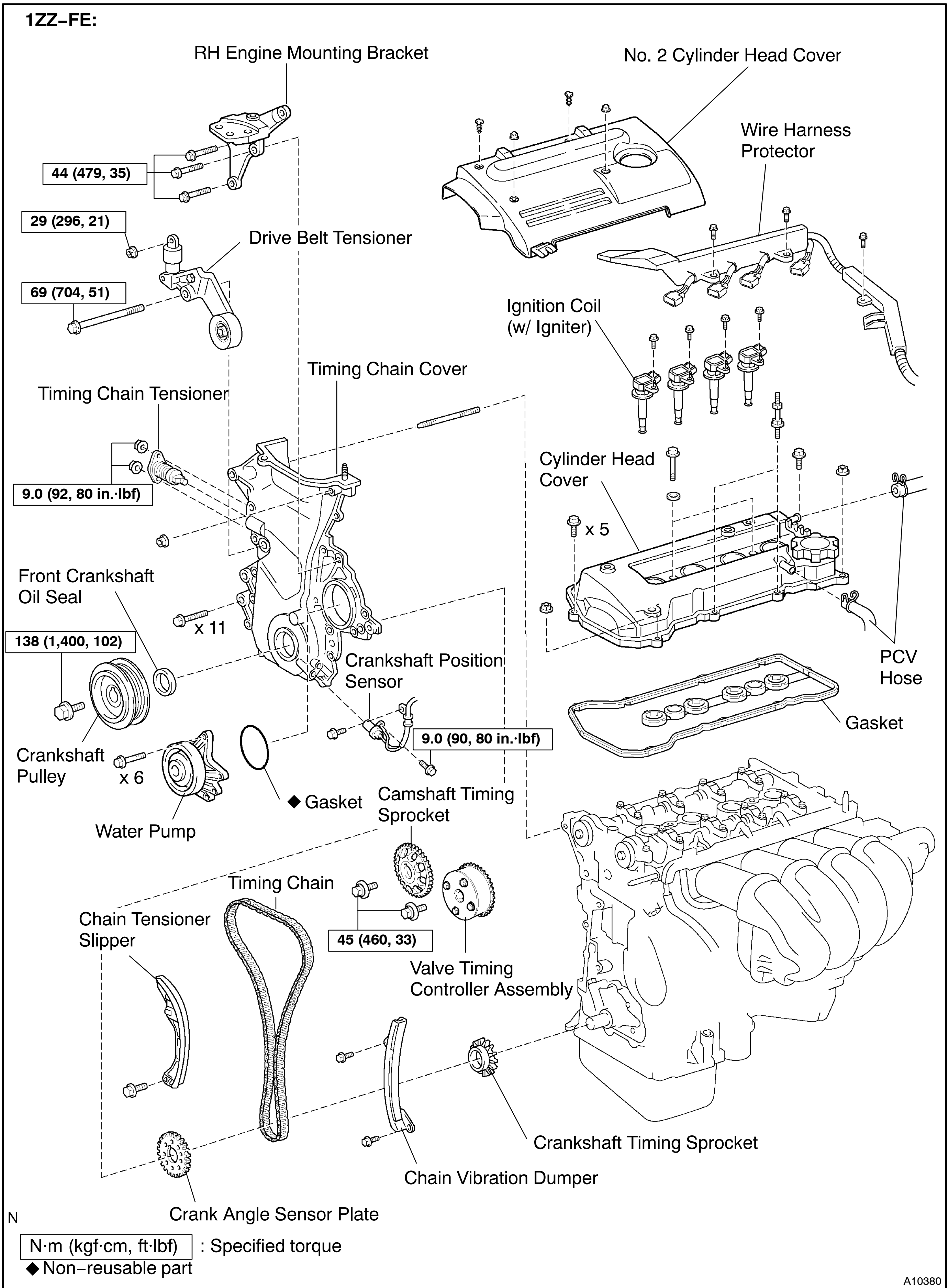
4. DISCONNECT HAND–HELD TESTER

TIMING CHAIN

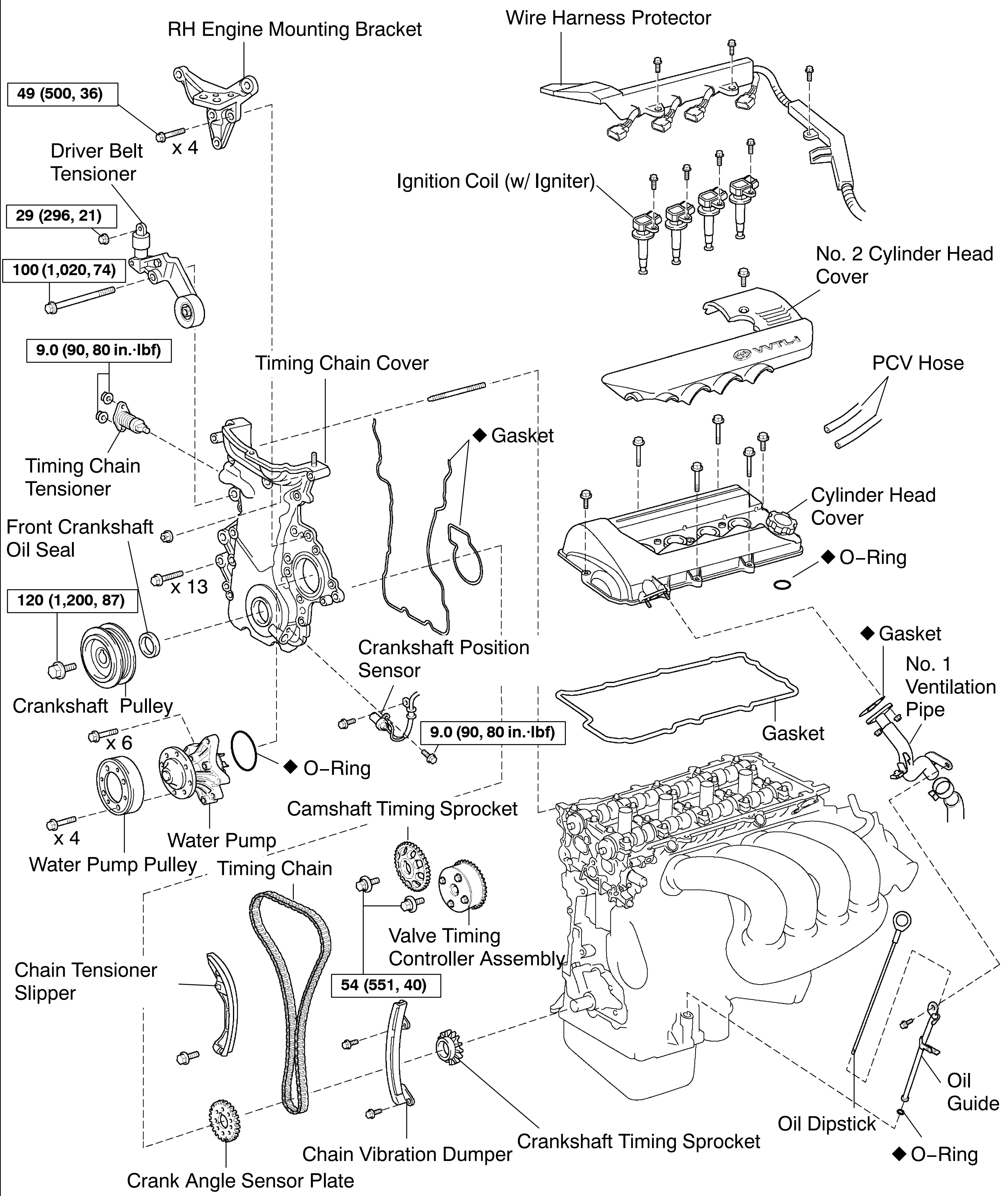
COMPONENTS

EM15R–02




1ZZ–FE:
RH Engine Mounting Bracket
No. 2 Cylinder Head Cover
44 (479, 35)
Wire Harness Protector
29 (296, 21)
Drive Belt Tensioner
69 (704, 51)
Ignition Coil (w/ Igniter)
Timing Chain Cover
Timing Chain Tensioner
9.0 (92, 80 in.·lbf)
Cylinder Head Cover
x 5
Front Crankshaft Oil Seal
x 11
138 (1,400, 102)
PCV Hose
Crankshaft Position Sensor
Gasket
9.0 (90, 80 in.·lbf)
Crankshaft Pulley
x 6
◆ Gasket
Camshaft Timing Sprocket
Water Pump
Timing Chain
Chain Tensioner Slipper
45 (460, 33)
Valve Timing Controller Assembly
Crankshaft Timing Sprocket
Chain Vibration Dumper
Crank Angle Sensor Plate
N
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
A10380

2ZZ–GE:



N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part

A10353

EM05P–06

REMOVAL

1. REMOVE UPPER FRONT FENDER APRON SEAL AND UPPER RADIATOR SUPPORT SEAL

2. DRAIN ENGINE COOLANT

3. REMOVE RH FRONT WHEEL

4. REMOVE RH ENGINE UNDER COVER

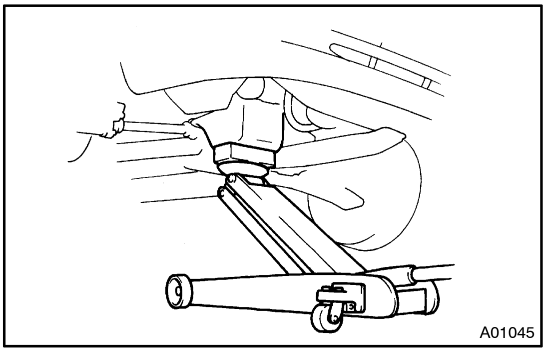
5. REMOVE DRIVE BELT AND ALTERNATOR
(See page CH–5)

6. DISCONNECT PS PUMP FROM ENGINE

(a) Disconnect the PS oil pressure switch connector.

(b) Remove the 2 nuts and through bolts, and disconnect the PS pump from the engine
(See Pub. No. RM734E on page SR section).

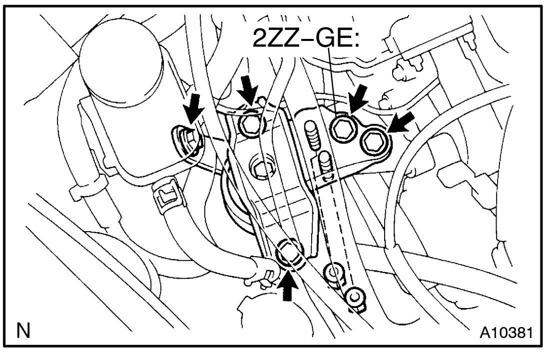
HINT:
Put aside the pump and suspend it to the cowl with a string.


A01045

7. REMOVE RH ENGINE MOUNTING INSULATOR

(a) Set the jack to the engine.

HINT:
Place a wooden block between the jack and engine.



A10381

(b) 1ZZ–FE:
Remove the 4 bolts, 2 nuts and RH engine mounting insulator.

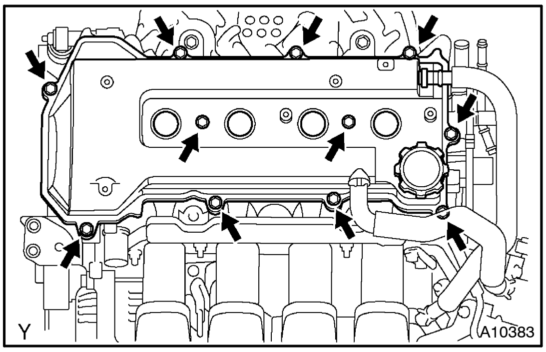
(c) 2ZZ–GE:
Remove the 5 bolts, 2 nuts and RH engine mounting insulator.

8. 1ZZ–FE:
REMOVE CYLINDER HEAD COVER

(a) Remove the 4 bolts and No. 2 cylinder head cover.

(b) Remove the 4 ignition coils (See page IG–6).

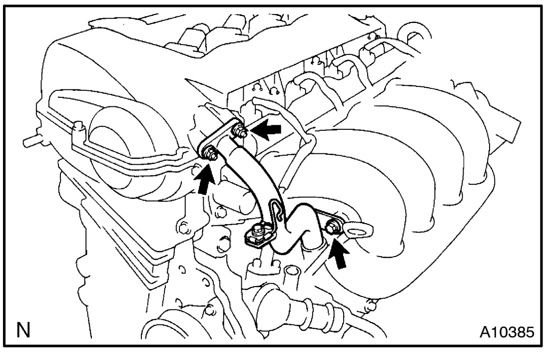
(c) Disconnect the 2 PCV hoses from the cylinder head.



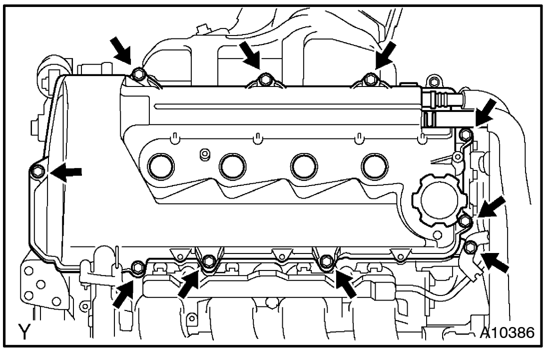
(d) Remove the 9 bolts, 2 seal washers, 2 nuts, cylinder head cover and gasket.

9. 2ZZ–GE:
REMOVE CYLINDER HEAD COVER

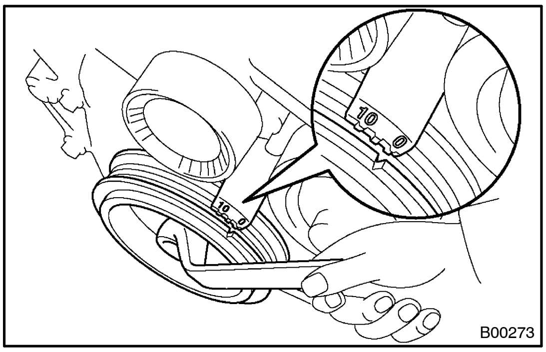
(a) Remove the 4 bolts and No. 2 cylinder head cover.
(b) Remove the ignition coils (See page IG–6).
(c) Disconnect the 2 PCV hoses from the cylinder head cover.



(d) Remove the 2 nuts, bolt and disconnect the No. 3 ventilation hose from the No. 1 ventilation pipe.
(e) Remove the No. 1 ventilation pipe and gasket.

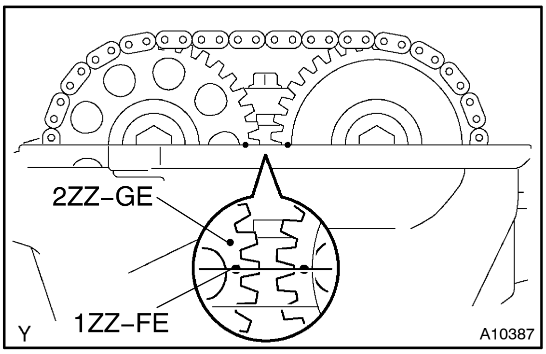


(f) Remove the 9 bolts, wire harness protector, cylinder head cover and gasket.
(g) Remove the O–ring from the cylinder head cover.



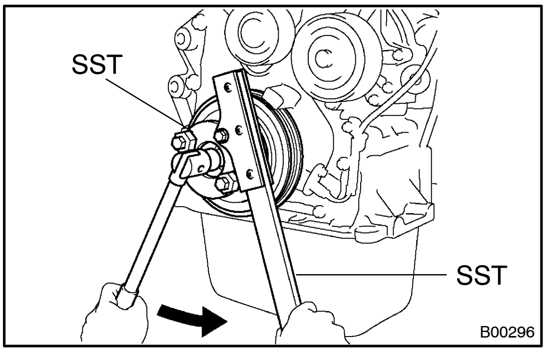
10. SET NO. 1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley, and align its groove with timing mark ”0” of the timing chain cover.



(b) Check that the point marks of the camshaft timing sprockets are in straight line on the timing chain cover surface as shown in the illustration.

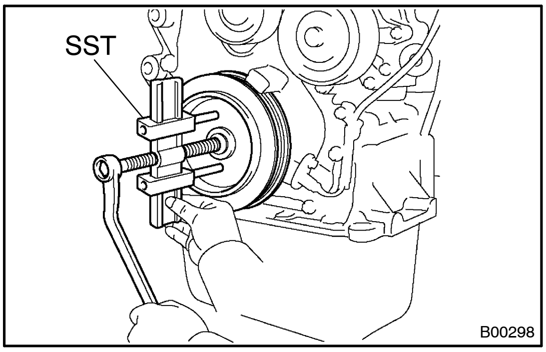
If not, turn the crankshaft 1 revolution (360°) and align the marks as above.



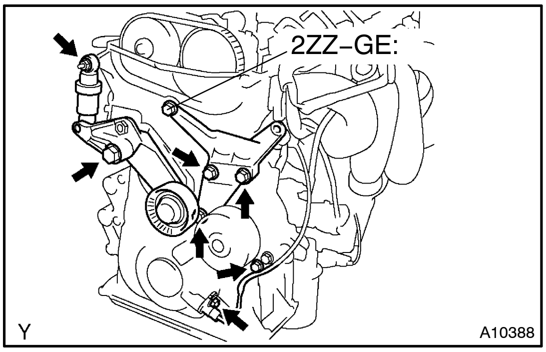
11. REMOVE CRANKSHAFT PULLEY

(a) Using SST and 2 nuts (width: 10 mm (0.25 in.)), remove the pulley bolt.
SST 09213–70010, 09330–00021

(b) Remove the crankshaft pulley.



HINT:
If necessary, remove the pulley with SST.
SST 09950–50012 (09951–05010, 09952–05010, 09953–05020, 09954–05020)



12. DISCONNECT CRANKSHAFT POSITION SENSOR FROM TIMING CHAIN COVER

Remove the 2 bolts and crankshaft position sensor.

13. REMOVE DRIVE BELT TENSIONER

Remove the bolt, nut and drive belt tensioner.

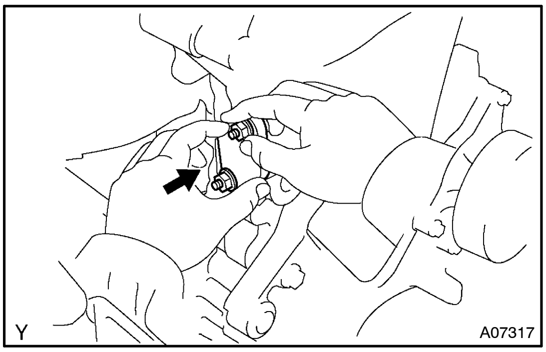
14. REMOVE RH ENGINE MOUNTING BRACKET

(a) 1ZZ–FE:
Remove the 3 bolts and mounting bracket.

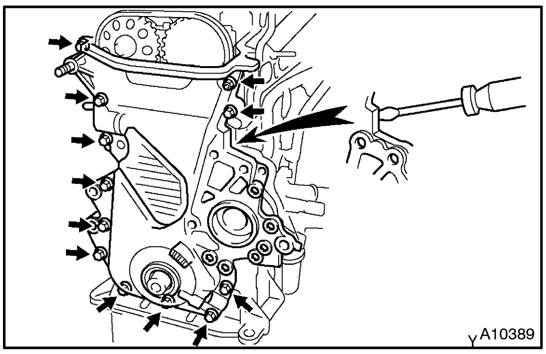
(b) 2ZZ–GE:
Remove the 4 bolts and mounting bracket.

15. REMOVE CHAIN TENSIONER

Remove the 2 nuts and chain tensioner.



16. REMOVE WATER PUMP (See page CO–5)



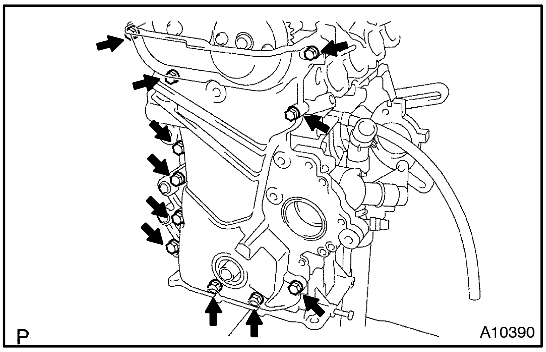
17. 1ZZ–FE:
REMOVE TIMING CHAIN COVER

(a) Remove the 11 bolts and nut.

(b) Using a torx wrench socket (E8), remove the stud bolt.

(c) Remove the timing chain cover by prying the portions between the cylinder head and cylinder block with a screwdriver.

NOTICE:
Be careful not to damage the contact surfaces of the timing chain cover, cylinder head and cylinder block.



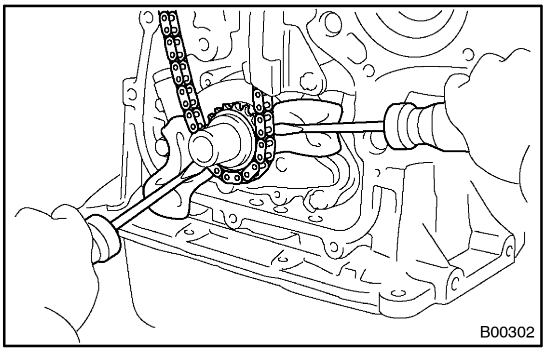
18. 2ZZ–GE:
REMOVE TIMING CHAIN COVER

(a) Remove the 12 bolts.
(b) Using a torx wrench socket (E8), remove the stud bolt.
(c) Remove the timing chain cover and 2 gaskets.

19. REMOVE CRANK ANGLE SENSOR PLATE

20. REMOVE CHAIN TENSIONER SLIPPER

Remove the bolt and slipper.



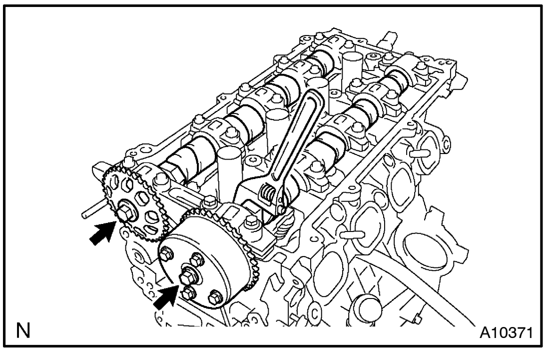
21. REMOVE TIMING CHAIN AND CRANKSHAFT TIMING SPROCKET

If the crankshaft timing sprocket cannot be removed by hand, use 2 screwdrivers.

NOTICE:
Position shop rags as shown to prevent damage.

22. REMOVE CHAIN VIBRATION DAMPER

Remove the 2 bolts and damper.

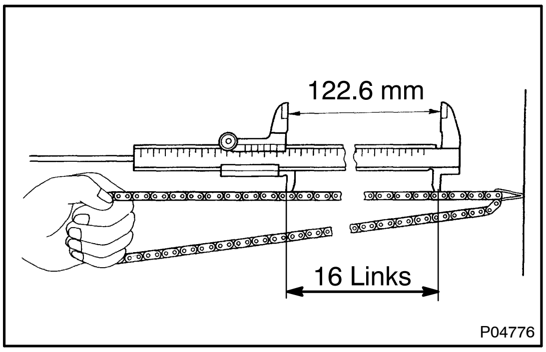


23. REMOVE VALVE TIMING CONTROL ASSEMBLY AND CAMSHAFT TIMING SPROCKET

Hold the hexagonal head wrench portion of the camshaft with a wrench, and remove the bolt, valve timing controller assembly and timing sprocket.

NOTICE:

- **Be careful not to damage the cylinder head and valve lifter with the wrench.**
- **Do not disassemble the valve timing controller assembly.**



EM05Q–04

INSPECTION

1. INSPECT TIMING CHAIN AND TIMING SPROCKETS

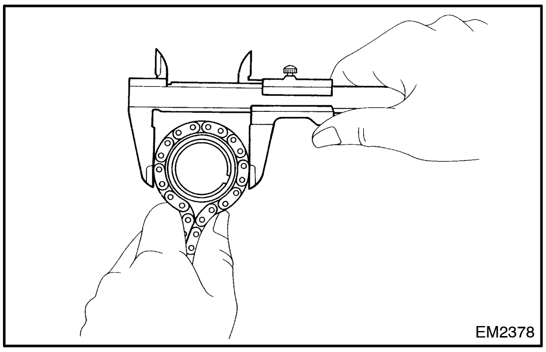
(a) Using a vernier calipers, measure the length of 16 links with the chain dully stretched.

Maximum chain elongation: 122.6 mm (4.827 in.)

If the elongation is greater than maximum, replace the chain.

HINT:

Make the same measurements pulling at 3 or more places selected at random.



(b) Wrap the chain around the timing sprocket.

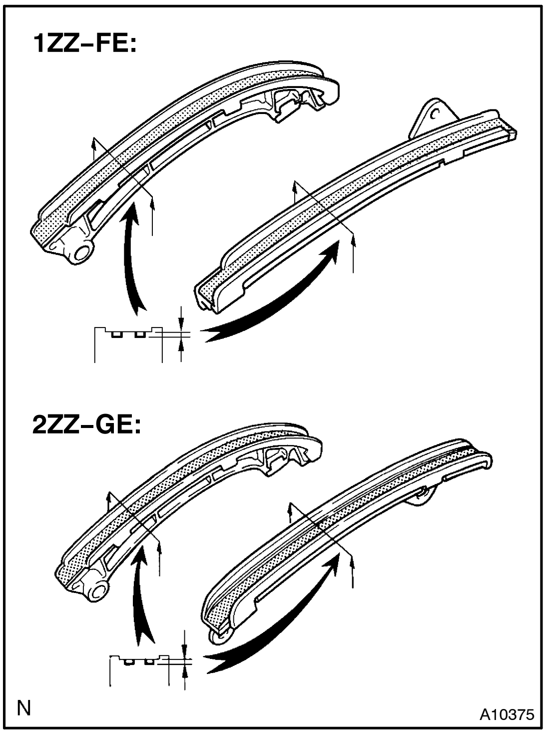
(c) Using a vernier calipers, measure the timing sprocket diameter with the chain.

NOTICE:

Vernier calipers must contact the chain rollers for measuring.

Minimum sprocket diameter (w/ Chain):
Camshaft 97.3 mm (3.831 in.)
Crankshaft 51.6 mm (2.031 in.)

If the diameter is less than minimum, replace the chain and sprockets.

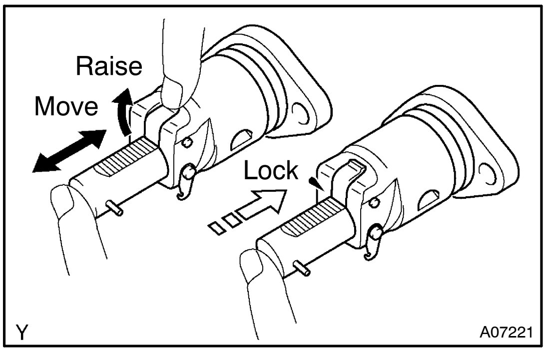


2. INSPECT CHAIN TENSIONER SLIPPER AND VIBRATION DAMPER

Measure the chain tensioner slipper and vibration damper wears.

Maximum wear: 1.0 mm (0.039 in.)

If the wear is greater than maximum, replace the slipper and/or damper.



3. INSPECT CHAIN TENSIONER

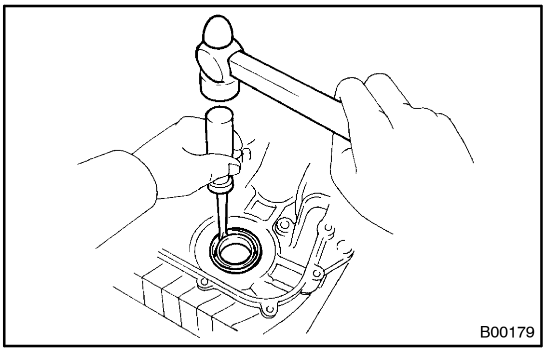
(a) Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.

(b) Release the ratchet pawl and check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.

4. INSPECT OIL JET (See page LU–11)

EM05R–04

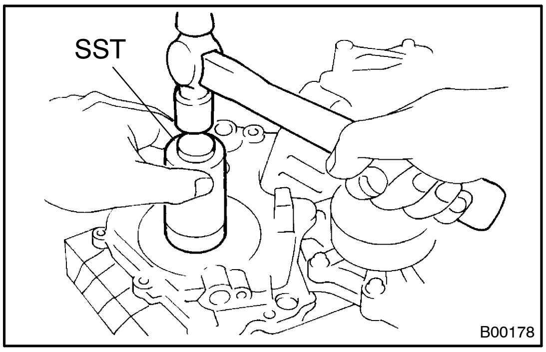
REPLACEMENT



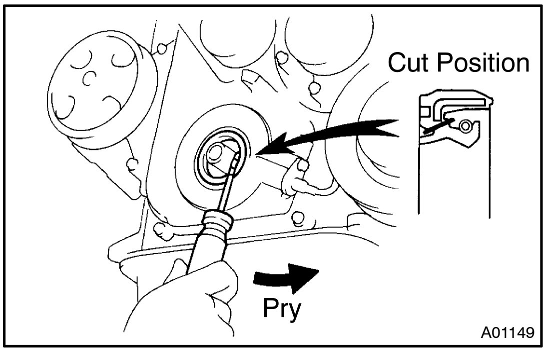
HINT:
There are 2 methods (A and B) to replace the oil seal which are as follows:

REPLACE CRANKSHAFT FRONT OIL SEAL

(a) If timing chain cover is removed from cylinder block.
  (1) Using a screwdriver and a hammer, tap out the oil seal.

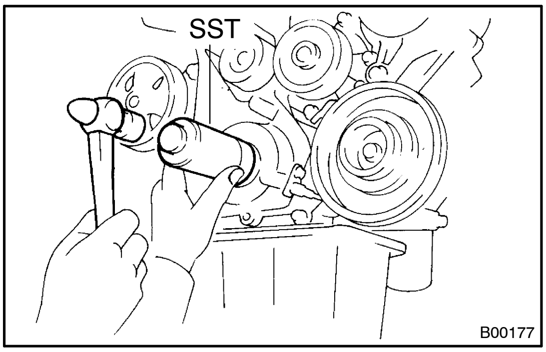


  (2) Using SST and a hammer, tap in a new oil seal until its surface is flush with the timing chain cover edge.
  SST 09309–37010
  (3) Apply MP grease to the oil seal lip.



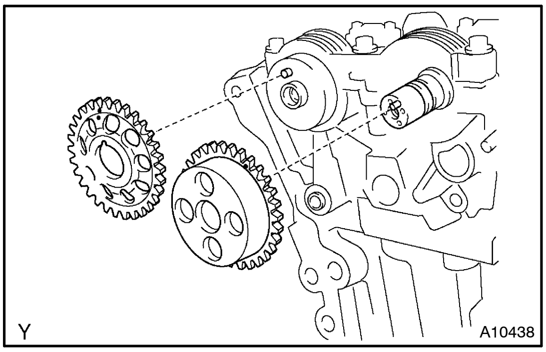
(b) If timing chain cover is installed to the cylinder block.
  (1) Using a knife, cut off the oil seal lip.
  (2) Using a screwdriver, pry out the oil seal.

NOTICE:
Be careful not to damage the crankshaft. Tape the screwdriver tip.



  (3) Using SST and a hammer, tap in the oil seal until its surface is flush with the timing chain cover edge.
  SST 09309–37010

EM15S–02



INSTALLATION

1. INSTALL VALVE TIMING CONTROLLER ASSEMBLY AND CAMSHAFT TIMING SPROCKET

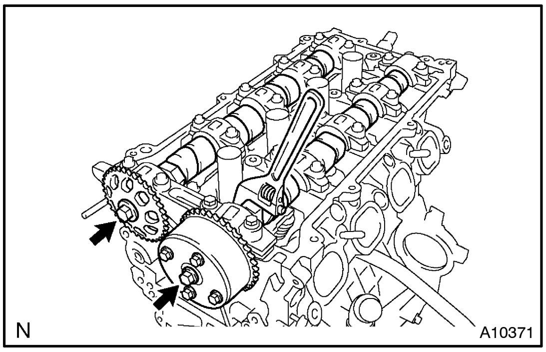
(a) Apply engine oil in the range from the tip of the intake camshaft to 16 mm from that tip.

(b) Align the timing mark on the value timing controller assembly with the knock pin, and install the value timing controller assembly to the cam shaft.

NOTICE:

Do not push valve timing controller assembly to the camshaft forcibly when installing it.

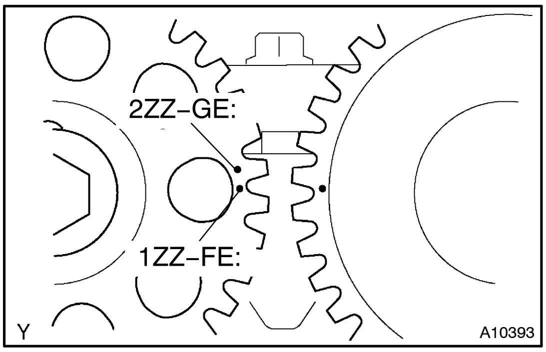
(c) Align the knock pin hole in the cam shaft timing sprocket with the knock pin of the cam shaft, and exhaust the sprocket to the cam shaft.



(d) Temporarily install the timing sprocket bolt.

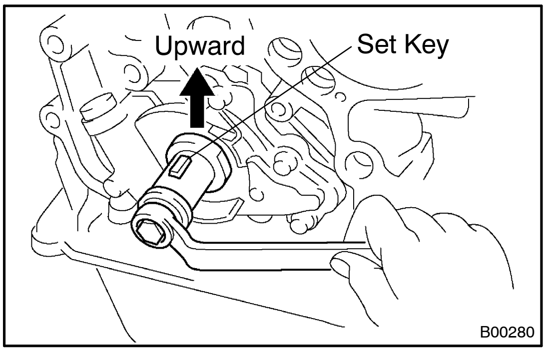
(e) Hold the hexagon wrench head portion of the camshaft with a wrench, and tighten the timing sprocket bolt.

Torque:
1ZZ–FE 45 N·m (460 kgf·cm, 33 ft·lbf)
2ZZ–GE 54 N·m (551 kgf·cm, 40 ft·lbf)

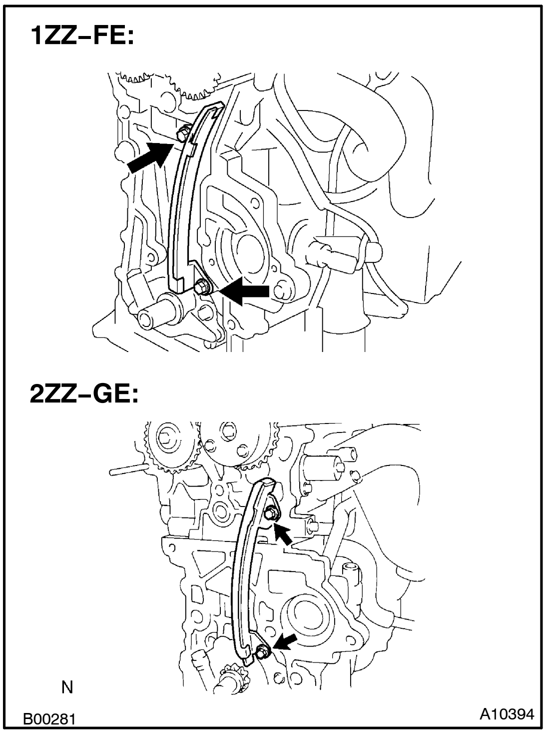


2. SET NO. 1 CYLINDER TO TDC/COMPRESSION

(a) Turn the hexagonal wrench head portion of the camshafts, and align the point marks of the camshaft timing sprockets.



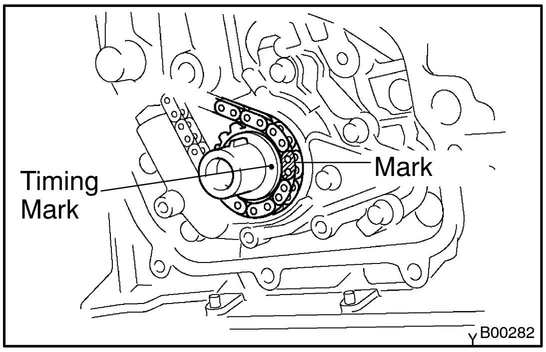
(b) Using a crankshaft pulley bolt, Turn the crankshaft and set the set key on the crankshaft upward.



3. INSTALL CHAIN VIBRATION DAMPER

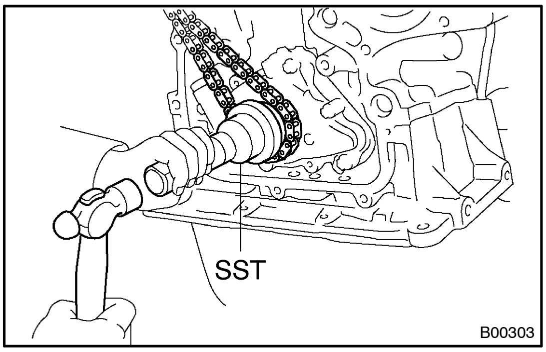
Install the damper with the 2 bolts.

Torque:
1ZZ–FE 11 N·m (113 kgf·cm, 8 ft·lbf)
2ZZ–GE 20.5 N·m (209 kgf·cm, 15 ft·lbf)

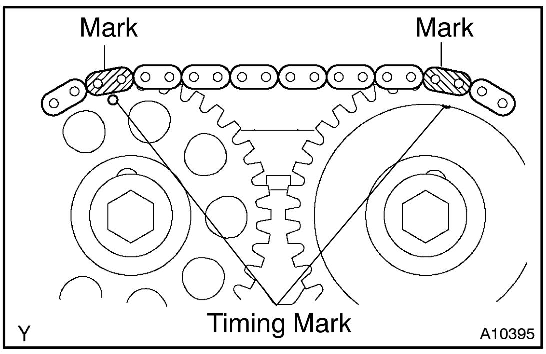


4. INSTALL TIMING CHAIN AND CRANKSHAFT TIMING SPROCKET

(a) Install the timing chain on the crankshaft timing sprocket with the yellow color link aligned with the timing mark on the crankshaft timing sprocket.

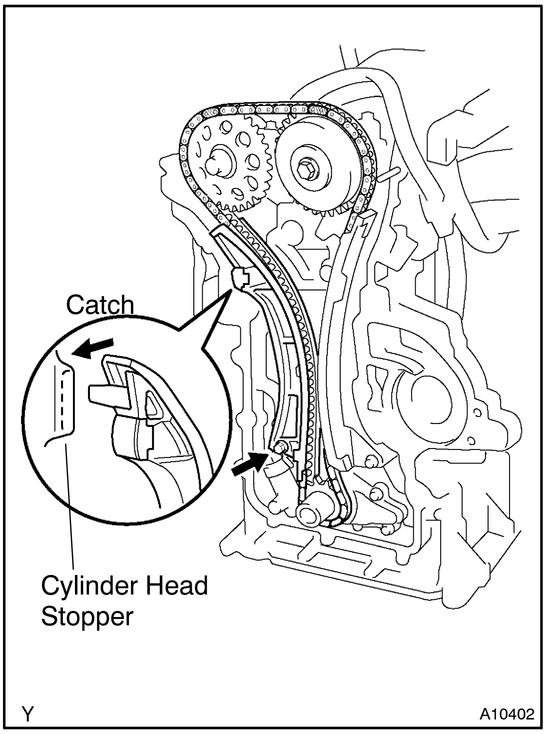


HINT:
If necessary, install the sprocket with SST.
SST 09223–22010



(b) 1ZZ–FE:
Install the timing chain on the camshaft timing sprockets with the yellow color links aligned with the timing marks on the camshaft timing sprockets.

(c) 2ZZ–GE:
Install the timing chain on the camshaft timing sprockets with the orange color links aligned with the timing marks on the camshaft timing sprockets.



(d) Check that the tension between the intake camshaft timing sprocket and crankshaft timing sprocket.

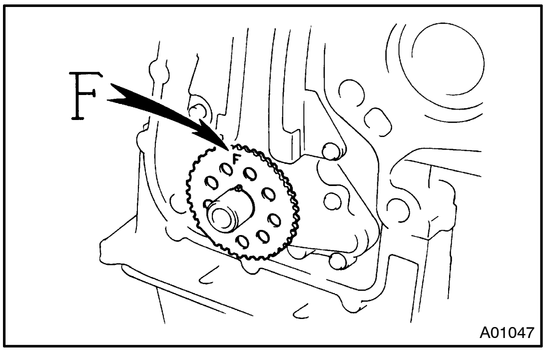
5. INSTALL CHAIN TENSIONER SLIPPER

(a) Install the slipper with the bolt.

Torque:
1ZZ–FE 18.5 N·m (189 kgf·cm, 14 ft·lbf)
2ZZ–GE 20.5 N·m (209 kgf·cm, 15 ft·lbf)

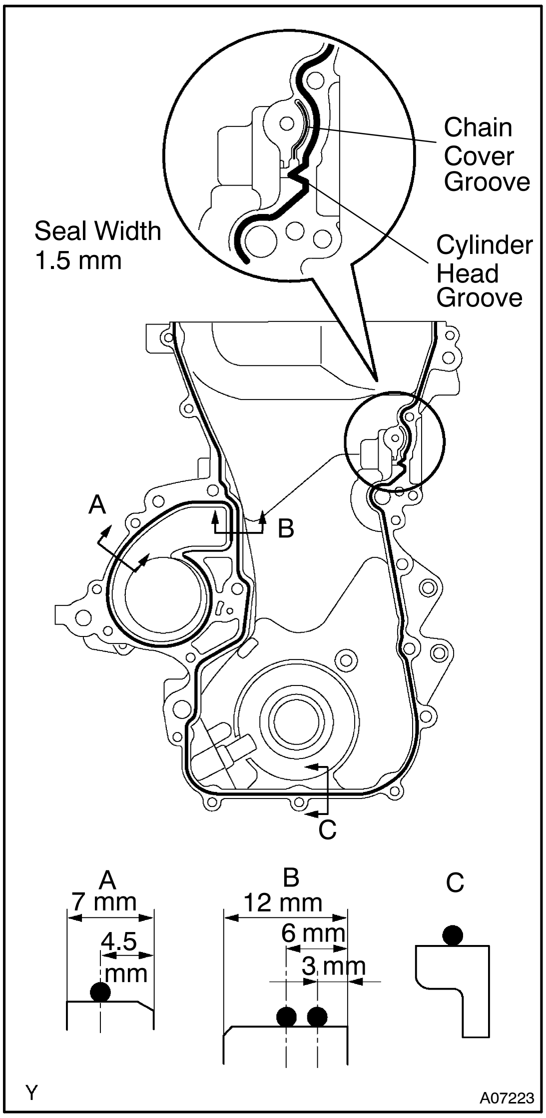
(b) Check that the slipper moves is caught on the cylinder head stopper.

NOTICE:
DO not turn the crankshaft.



6. INSTALL CRANK ANGLE SENSOR PLATE

Install the plate with the ”F” mark facing forward.

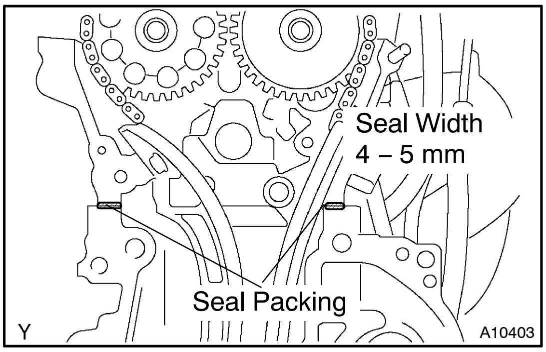


7. **1ZZ–FE:**
INSTALL TIMING CHAIN COVER AND WATER PUMP

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the timing chain cover, cylinder head and cylinder block.
- Using a razor blade and a gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

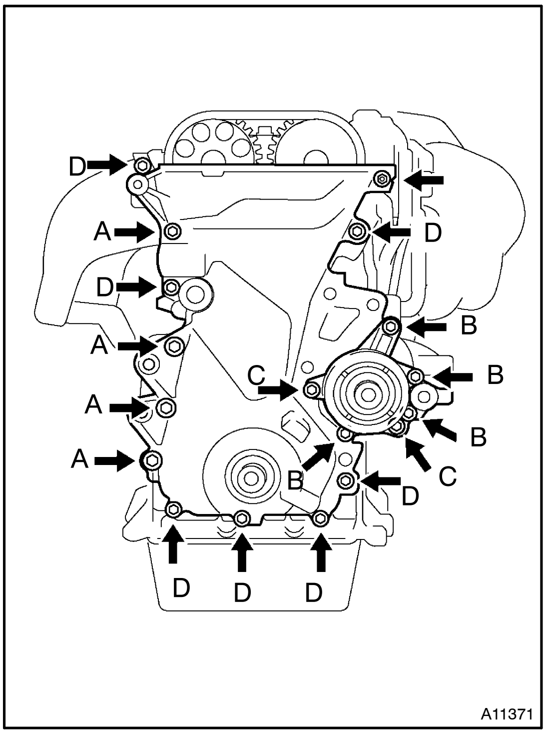
(b) Apply seal packing to the timing chain cover as shown in the illustration.
Seal packing:
Part No. 08826 – 00100 or equivalent
- Install a nozzle that has been cut to a 1.5 mm (0.16 – 0.20 in.) opening.

HINT:
Avoid applying an excessive amount to the surface.
- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



(c) Apply seal packing to 2 locations as shown in the illustration.
Seal packing:
Part No. 08826 – 00080 or equivalent
- Install a nozzle that has been cut to a 1.5 mm (0.16 – 0.20 in.) opening.

HINT:
Avoid applying an excessive amount to the surface.
- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



(d) Install the timing chain cover, O–ring and water pump with the 17 bolts and nut. Uniformly tighten the bolts and nut in several passes.

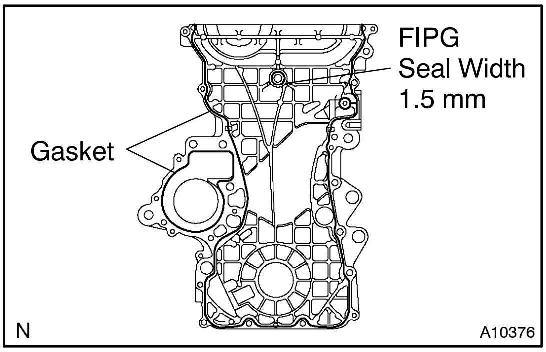
Torque:
10 mm head:
9 N·m (92 kgf·cm, 80 in.·lbf) for C
13 N·m (133 kgf·cm, 10 ft·lbf) for A
11 N·m (113 kgf·cm, 8 ft·lbf) for others
12 mm head:
18.5 N·m (189 kgf·cm, 14 ft·lbf)

NOTICE:

- **Pay attention not to wrap the chain and slipper over the chain cover seal line.**
- **After installing the chain cover, must install the mounting bracket and water pump within 15 minutes.**

HINT:
Each bolt length in indicated in the illustration.
A 45 mm (1.77 in.)
B 35 mm (1.38 in.)
C 30 mm (1.18 in.)
D 25 mm (0.98 in.)

(e) Using a torx wench socket (E8), install the stud bolt.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



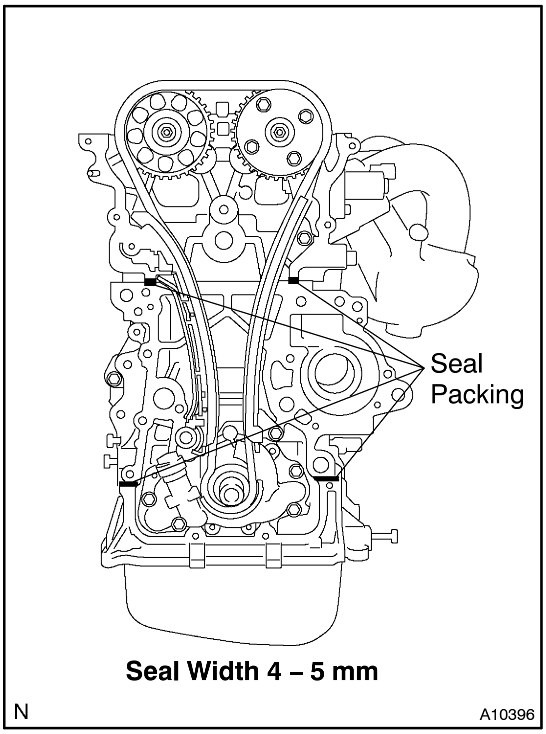
8. **2ZZ–GE:**
INSTALL TIMING CHAIN COVER AND WATER PUMP

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the timing chain cover, cylinder head and cylinder block.
- Using a razor blade and a gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

(b) Apply seal packing to the timing chain cover as shown in the illustration.
Seal packing:
Part No. 08826–00100 or equivalent
- Install a nozzle that has been cut to a 1.5 mm opening.

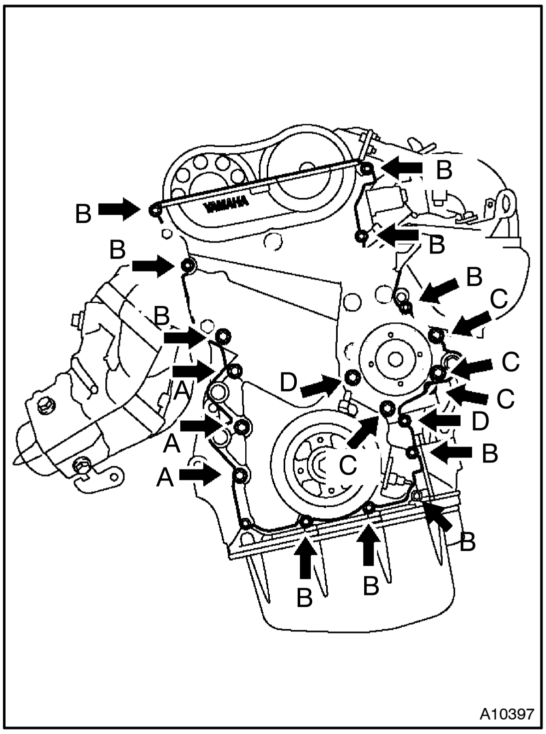
HINT:
Avoid applying an excessive amount to the surface.
- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

(c) Install the 2 gasket to the timing chain cover as shown in the illustration.



(d) Apply seal packing to 4 locations as shown in the illustration.
Seal packing:
Part No. 08826–00080 or equivalent
- Install a nozzle that has been cut to a 4 – 5 mm (0.16 – 0.20 in.) opening.

HINT:
Avoid applying an excessive amount to the surface.
- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

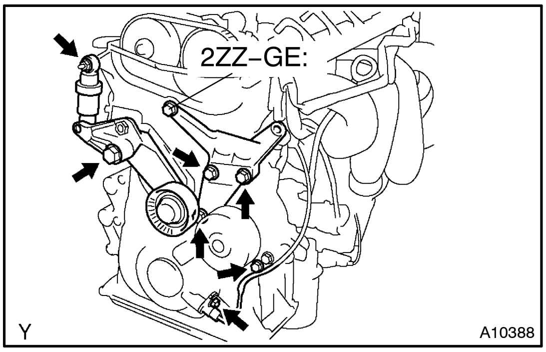


(e) Install the timing chain cover, O–ring and water pump with the 19 bolts. Uniformly tighten the bolts in several passes.
Torque:
A: 21 N·m (214 kgf·cm, 15 ft·lbf)
B: 11 N·m (113 kgf·cm, 8 ft·lbf)
C: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
D: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

NOTICE:

- **Pay attention not to wrap the chain and slipper over the chain cover seal line.**
- **After install the chain cover, must install the mounting bracket and water pump within 15 minutes.**

(f) Using a torx wrench socket (E8), install the stud bolt.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



9. 1ZZ–FE:
INSTALL RH ENGINE MOUNTING BRACKET

(a) Apply seal packing to threads of the mounting bolt.
Seal packing:
Part No. 08826 – 00080 or equivalent

HINT:
Do not apply seal packing to 2 or 3 threads of the bolt end.

(b) Install the mounting bracket with the 3 bolts.
Torque: 47 N·m (479 kgf·cm, 35 ft·lbf)

10. 2ZZ–GE:
INSTALL RH ENGINE MOUNTING BRACKET

Install the mounting bracket with the 4 bolts.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

11. INSTALL DRIVE BELT TENSIONER

(a) Check the appearance before installing the drive belt tensioner.

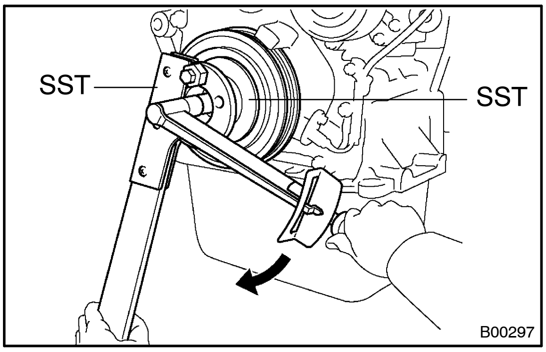
If in case of having the oil leakage, crack, and etc., replace the drive belt tensioner.

(b) Install the drive belt tensioner.
Torque:
Bolt
1ZZ–FE 69 N·m (704 kgf·cm, 51 ft·lbf)
2ZZ–GE 100 N·m (1,020 kgf·cm, 74 ft·lbf)
Nut 29 N·m (296 kgf·cm, 21 ft·lbf)

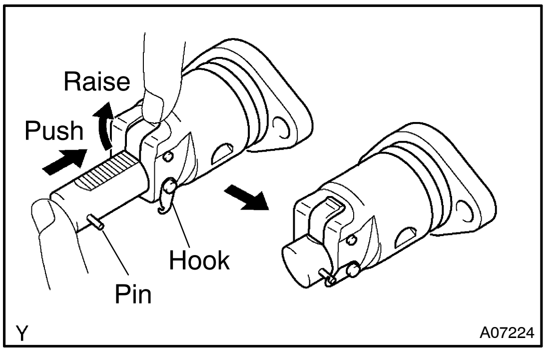
(c) Hook the tool on the hexagonal portion of the drive belt tensioner bracket and operate drive belt tensioner 3 times with full stroke.

HINT:
Take 3 seconds or more for 1 full stroke.

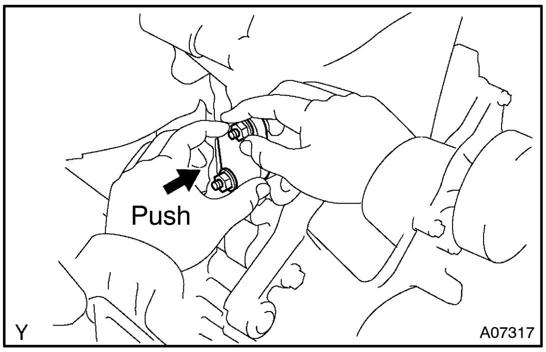
12. **INSTALL CRANKSHAFT POSITION SENSOR**
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



13. **INSTALL CRANKSHAFT PULLEY**
(a) Clean the crankshaft pulley inside.
(b) Align the pulley set key with the key groove of the pulley, and slide on the pulley.
(c) Using SST and 2 nuts (width: 10 mm (0.25 in.), install the pulley bolt.
SST 09213–70010, 09330–00021
Torque:
1ZZ–FE 138 N·m (1,409 kgf·cm, 102 ft·lbf)
2ZZ–GE 120 N·m (1,200 kgf·cm, 87 ft·lbf)



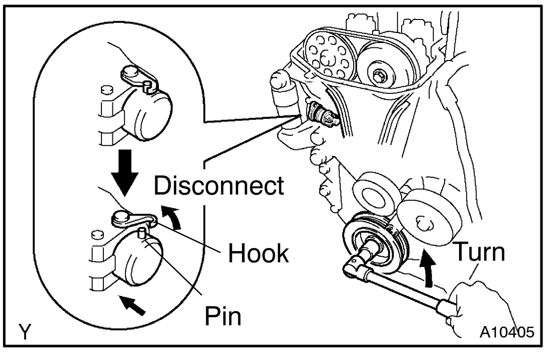
14. **INSTALL CHAIN TENSIONER**
(a) Check the chain tensioner.
(See page EM–16)
(b) Release the ratchet pawl, fully push in the plunger and apply the hook to the pin so that the plunger cannot spring out.



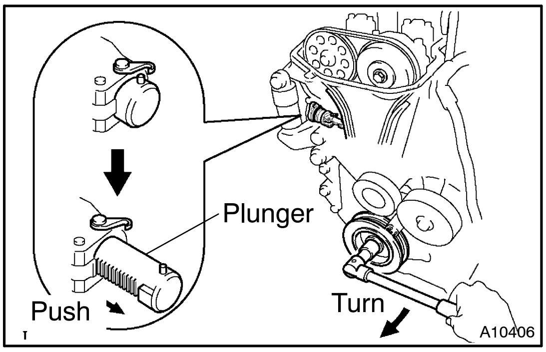
(c) Insert the O–ring with your hand until it reaches to the chamfering position and install nut temporally. Then, by tightening the nut, insert the chain tensioner to the installation position.

HINT:
- In the case that the hook is released while pushing in, apply the hook again and push the tensioner in.
- Pay attention not to catch the O–ring as it is built in the chain tensioner previously.

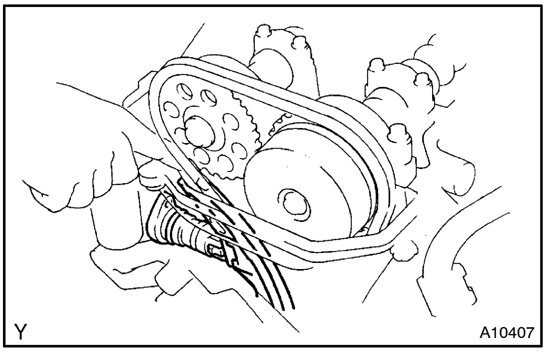
(d) Tighten the 2 nuts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



15. **SET CHAIN TENSION**
(a) Turn the crankshaft counterclockwise, and disconnect the plunger knock pin from the hook.



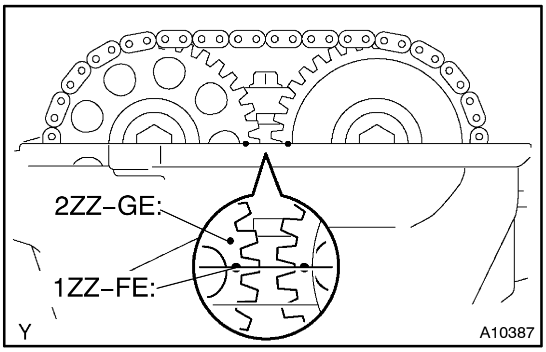
(b) Turn the crankshaft clockwise, and check that the slipper is pushed by the plunger.



HINT:
If the plunger does not spring out, press the slipper into the chain tensioner with a screwdriver or your finger so that the hook is released from the knock pin and the plunger springs out.

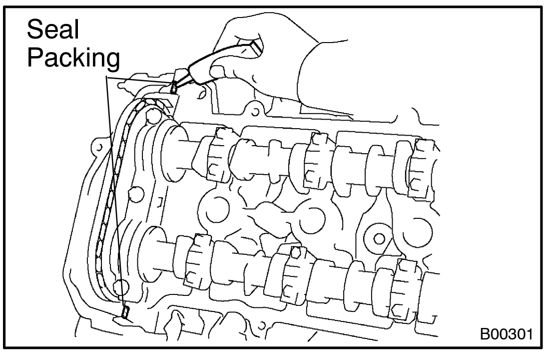
16. **CHECK VALVE TIMING**
(a) Turn the crankshaft pulley, and align its groove with timing mark ”0” of the timing chain cover.

NOTICE:
Always turn the crankshaft clockwise.



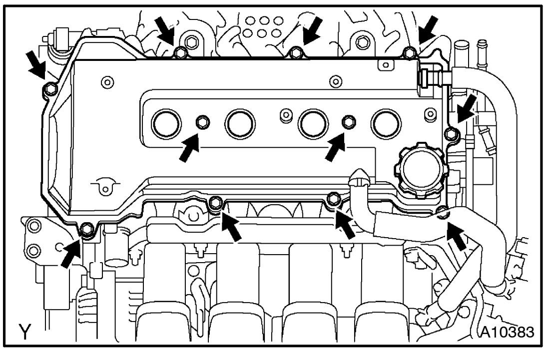
(b) Check that the point marks of the camshaft timing sprockets are in straight line on the timing chain cover surface as shown in the illustration.

If not, turn the crankshaft 1 revolution (360˚) and align the marks as above.

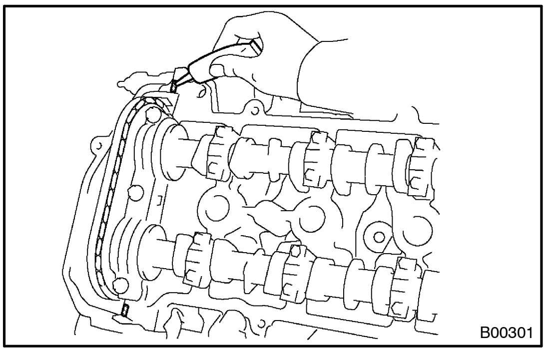


17. **1ZZ–FE:**
INSTALL CYLINDER HEAD COVER
(a) Remove any old packing (FIPG) material.
(b) Apply seal packing to 2 locations as shown in the illustration.
Seal packing:
Part No. 08826 – 00080 or equivalent

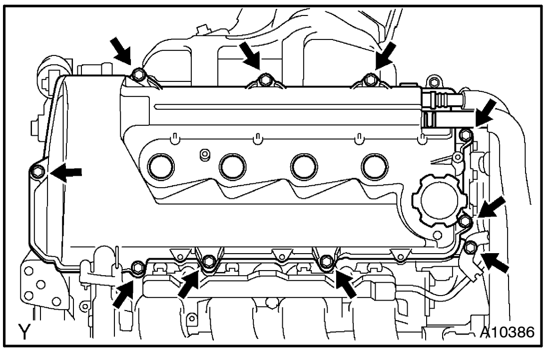
(c) Install the gasket to the cylinder head cover.
HINT:
Part must be assembled within 3 minutes of application. Otherwise the material must be remove and reapplied.



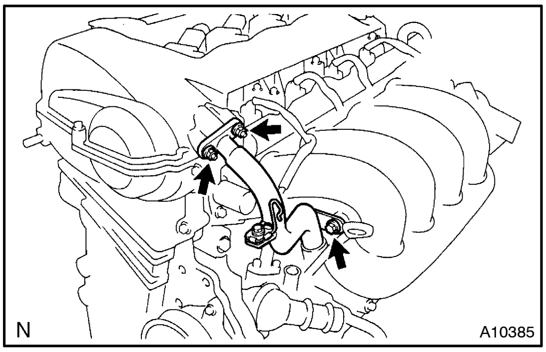
(d) Install the cylinder head cover with the 9 bolts, 2 seal washers and 2 nuts.
Uniformly tighten the bolts and nuts, in the several passes, in the sequence shown.
Torque:
w/o washer
11 N·m (113 kgf·cm, 8 ft·lbf)
w/ washer
9.0 N·m (92 kgf·cm, 80 in.·lbf)
(e) Connect the 2 PCV hoses to the cylinder head cover.
(f) Install the ignition coil (See page IG–7).



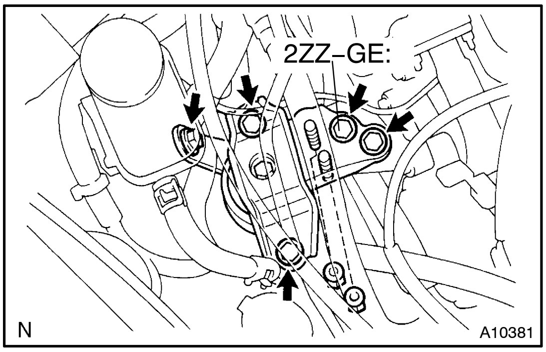
18. **2ZZ–GE:**
INSTALL CYLINDER HEAD COVER
(a) Remove any old packing (FIPG) material.
HINT:
When FIPG on the head cover gasket side cannot be eliminated completely, replace the gasket.
(b) Apply seal packing to 2 locations as shown in the illustration.
Seal packing:
Part No. 08826–00080 or equivalent
(c) Install the gasket to the cylinder head cover.
HINT:
Part must be assembled within 3 minutes of application. Otherwise the material must be remove and reapplied.
(d) Install a new O–ring to the cylinder head cover.



(e) Install the cylinder head cover and wire harness protector with the 9 bolts. Uniformly tighten the bolts, in the several passes, in the sequence shown.
Torque: 10 N·m (100 kgf·cm, 7 ft·lbf)
(f) Connect the 2 PCV hoses to the cylinder head cover.



(g) Install a new gasket and No. 1 ventilation pipe with 2 nuts and bolt.
Torque:
Nut 10 N·m (100 kgf·cm, 7 ft·lbf)
Bolt 25 N·m (255 kgf·cm, 18 ft·lbf)
(h) Connect the No. 3 ventilation hose to the No. 1 ventilation pipe.
(i) Install the ignition coil (See page IG–7).

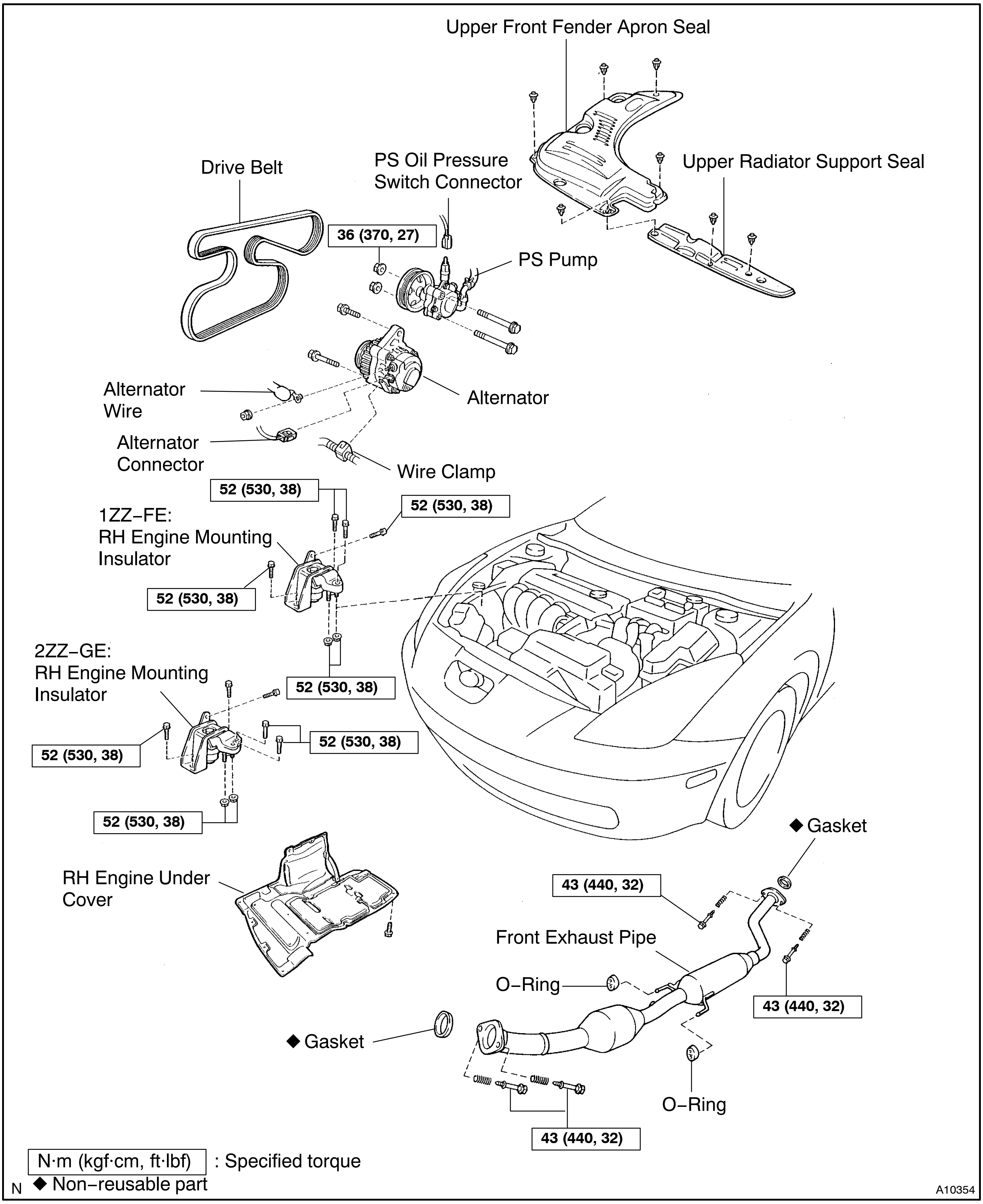


19. INSTALL RH ENGINE MOUNTING INSULATOR
(a) 1ZZ–FE:
Install the RH engine mounting insulator with the 4 bolts and 2 nuts.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)
(b) 2ZZ–GE:
Install the RH engine mounting insulator with the 5 bolts and 2 nuts.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)
20. INSTALL PS PUMP
(a) Install the PS pump with the 2 through bolts and nuts.
Torque: 36 N·m (370 kgf·cm, 27 ft·lbf)
(b) Install the PS pump pulley with the pulley nut.
(c) Connect the PS oil pressure switch connector.
21. INSTALL ALTERNATOR AND DRIVE BELT
(See page CH–5)
22. INSTALL RH ENGINE UNDER COVER
23. INSTALL RH FRONT WHEEL
24. FILL WITH ENGINE COOLANT (See page CO–2)
25. INSTALL FRONT FENDER APRON SEAL AND UPPER RADIATOR SUPPORT SEAL
26. START ENGINE AND CHECK FOR COOLANT LEAKS

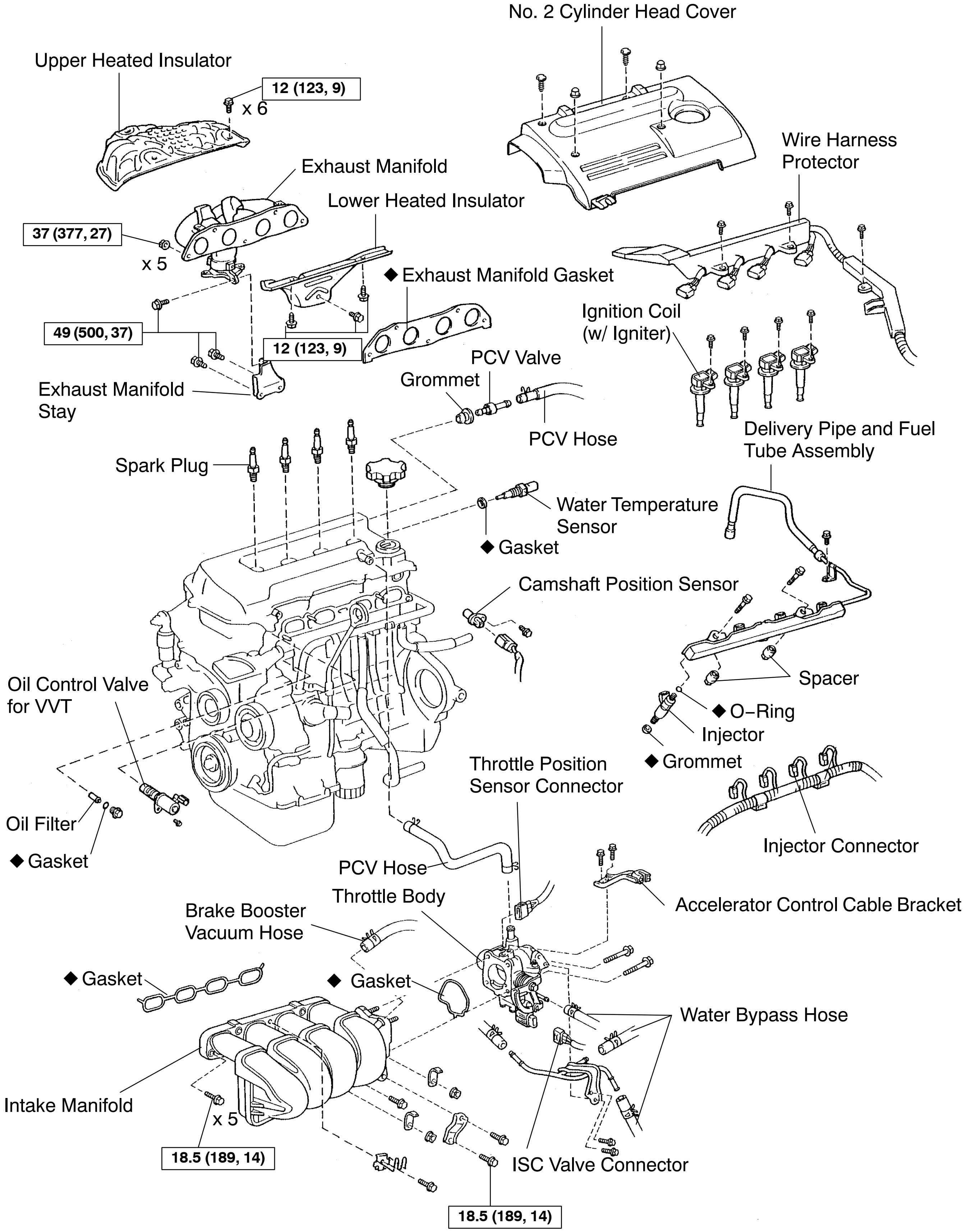
CYLINDER HEAD

COMPONENTS

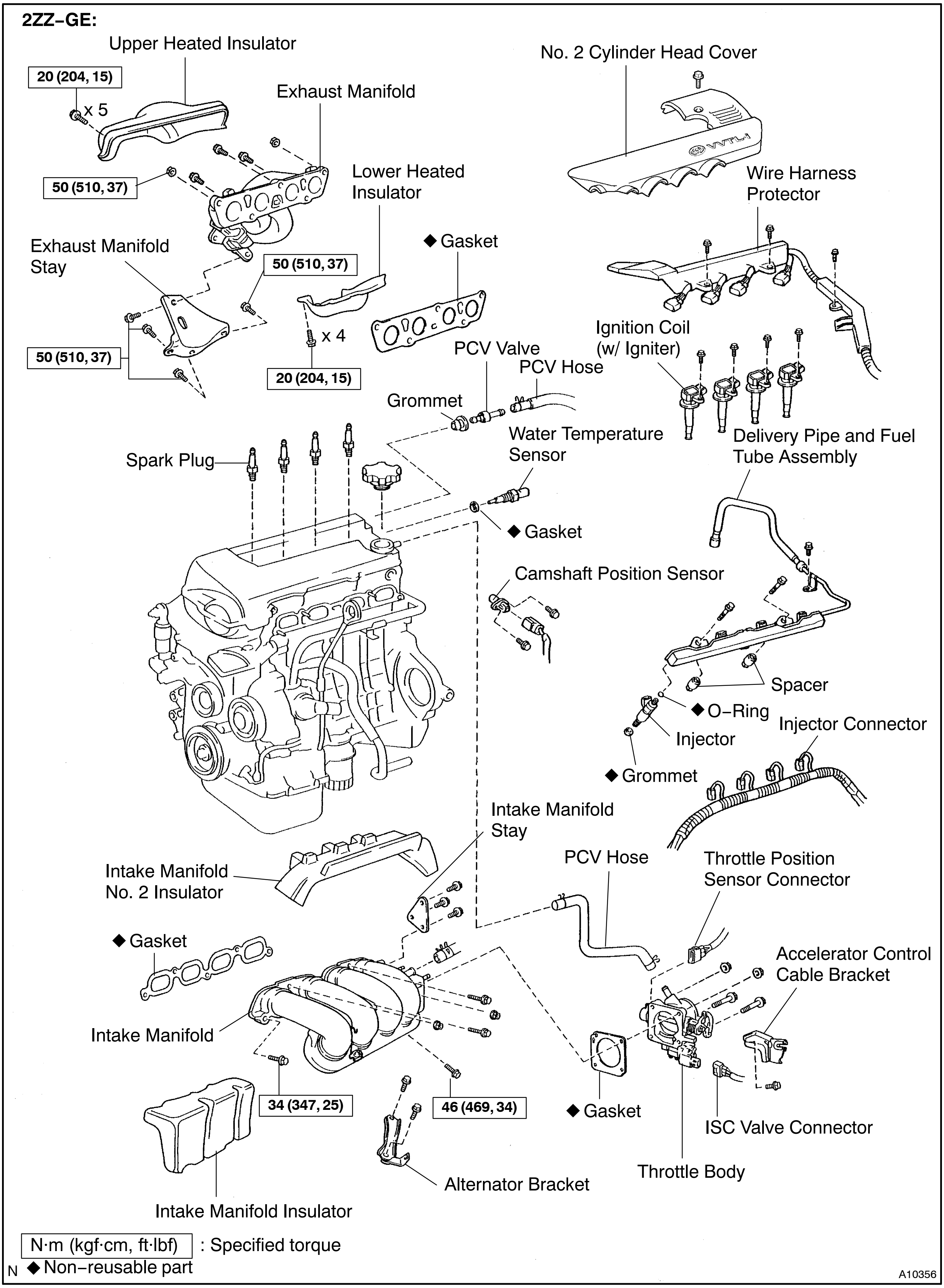
EM15T–02

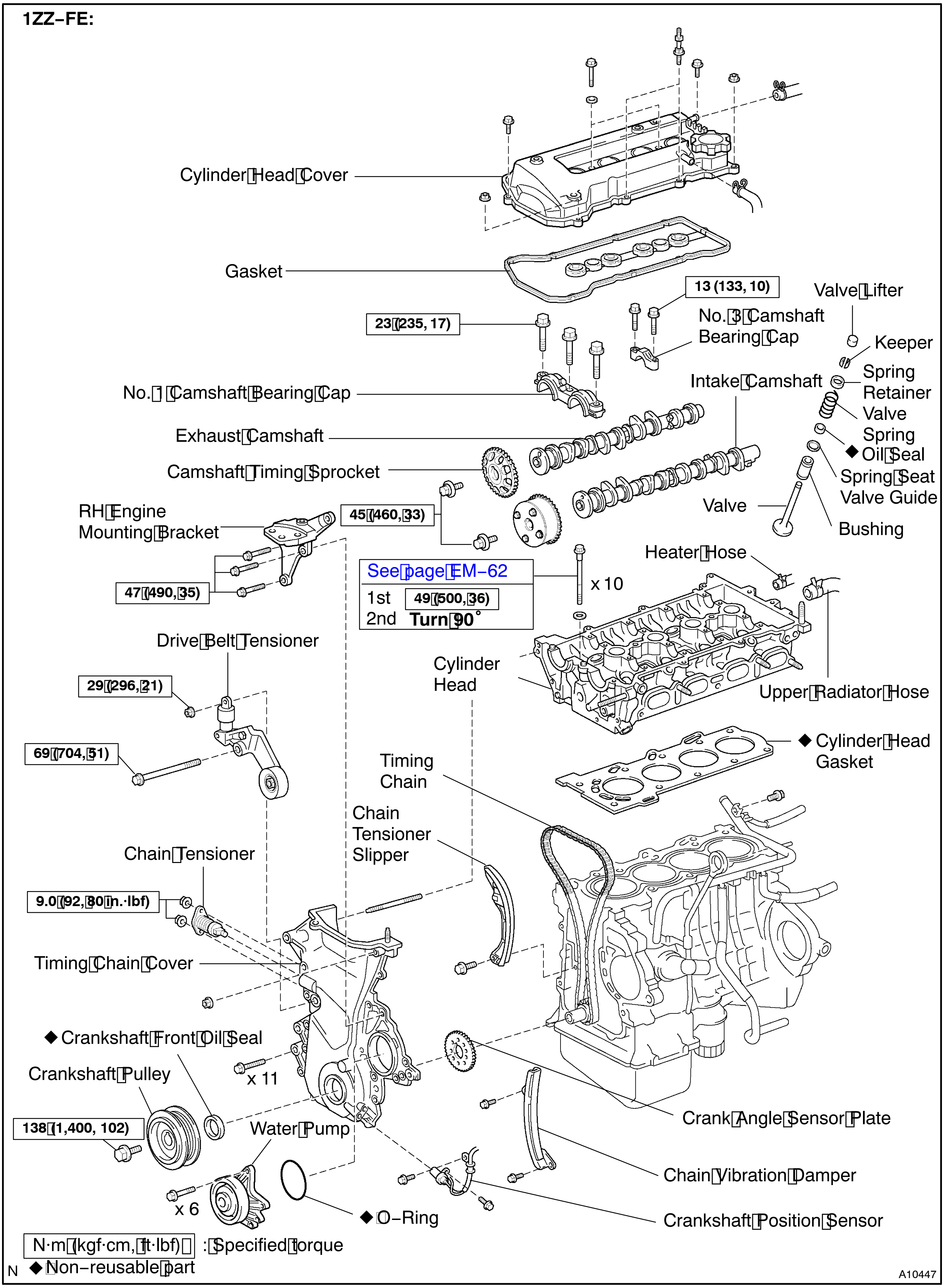


1ZZ–FE:

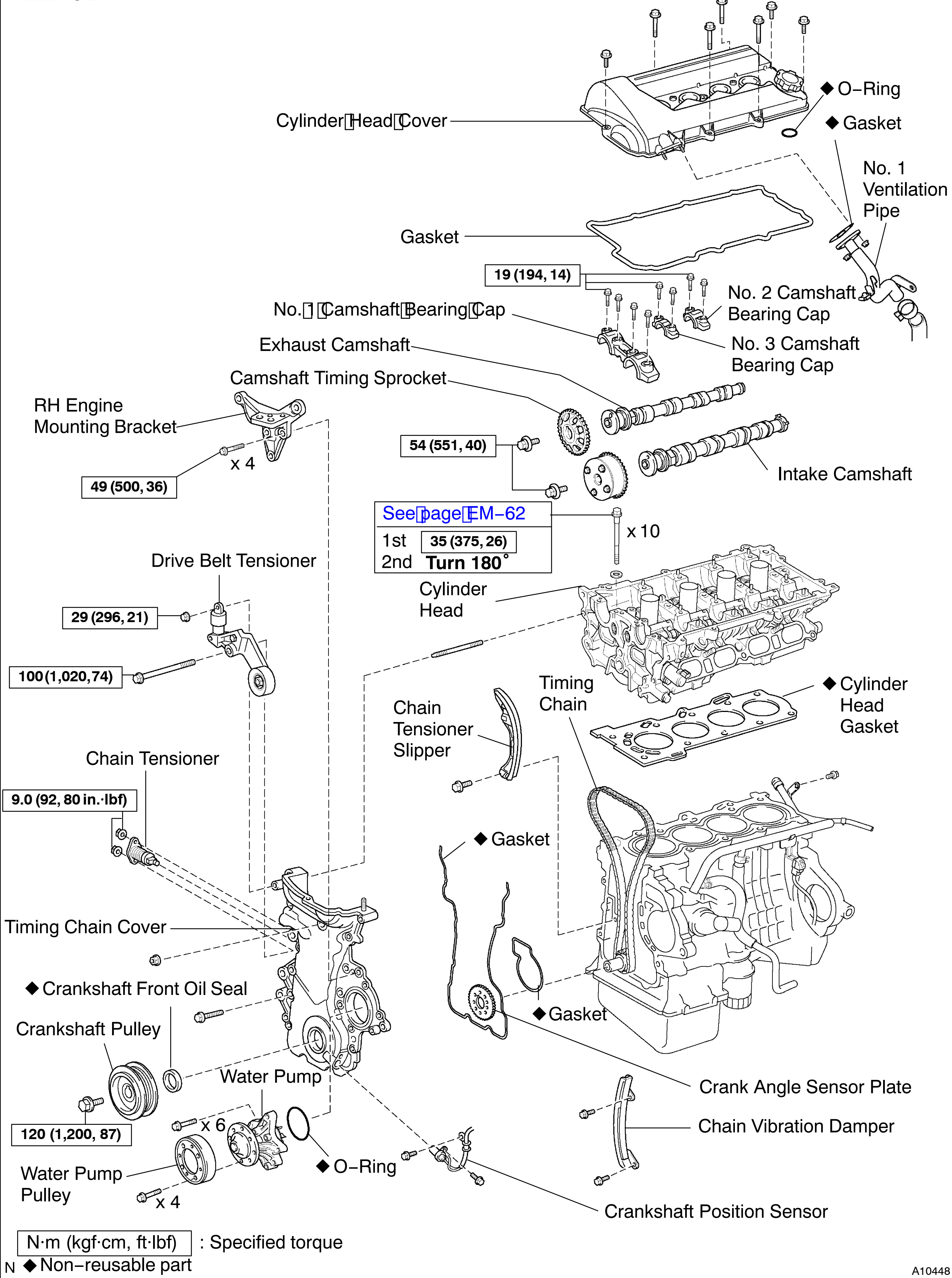


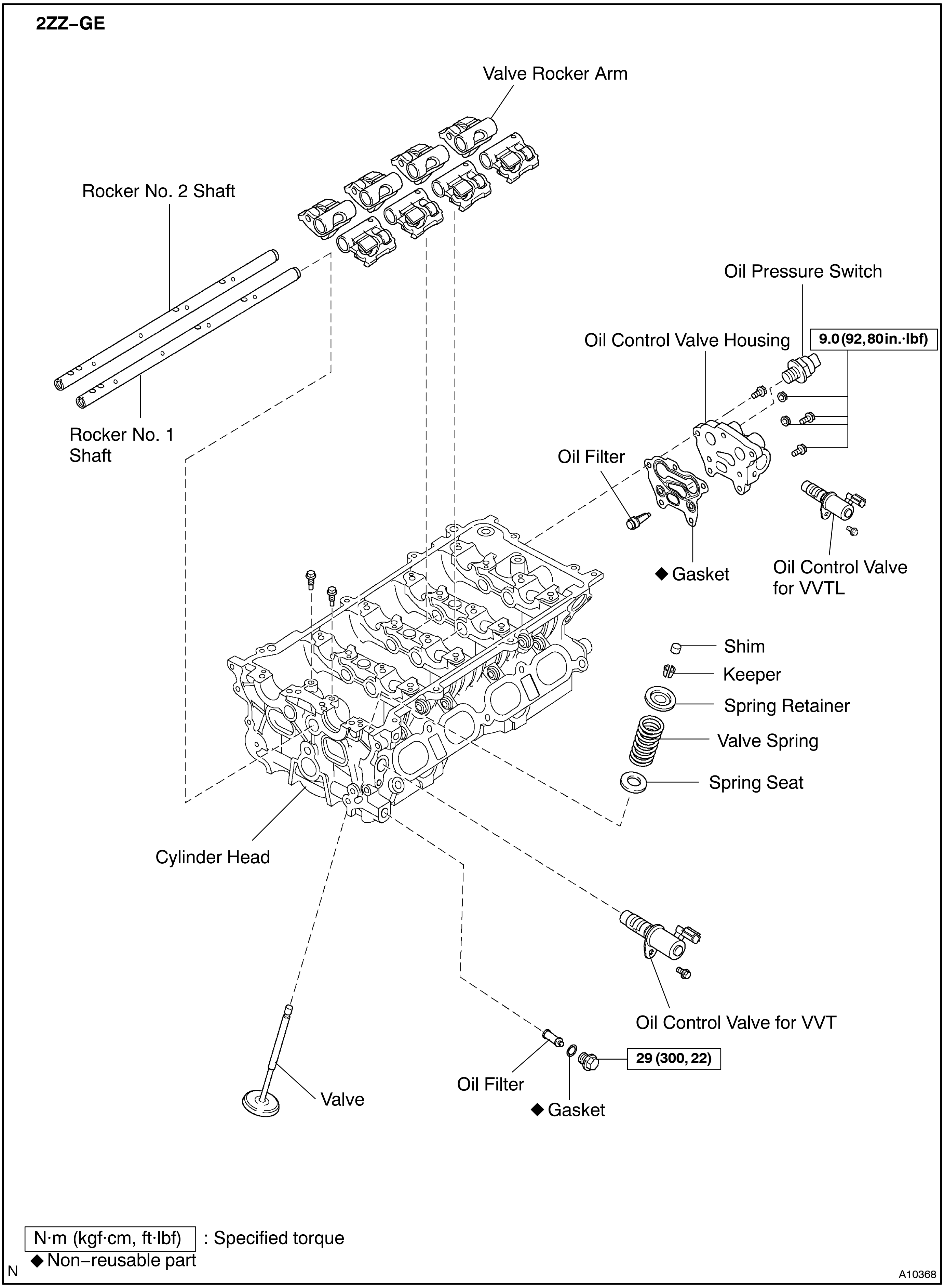
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
N


2ZZ–GE:
Upper Heated Insulator
20 (204, 15)
x 5
Exhaust Manifold
50 (510, 37)
Lower Heated Insulator
Exhaust Manifold Stay
50 (510, 37)
◆ Gasket
50 (510, 37)
x 4
20 (204, 15)
No. 2 Cylinder Head Cover
Wire Harness Protector
Ignition Coil (w/ Igniter)
PCV Valve
PCV Hose
Grommet
Water Temperature Sensor
Delivery Pipe and Fuel Tube Assembly
Spark Plug
◆ Gasket
Camshaft Position Sensor
Spacer
◆ O–Ring
Injector
Injector Connector
◆ Grommet
Intake Manifold Stay
PCV Hose
Throttle Position Sensor Connector
Intake Manifold No. 2 Insulator
◆ Gasket
Accelerator Control Cable Bracket
Intake Manifold
34 (347, 25)
46 (469, 34)
◆ Gasket
ISC Valve Connector
Throttle Body
Alternator Bracket
Intake Manifold Insulator
N·m (kgf·cm, ft·lbf) : Specified torque
N ◆ Non–reusable part
A10356


1ZZ–FE:
Cylinder Head Cover
Gasket
13 (133, 10)
Valve Lifter
No. 3 Camshaft Bearing Cap
Keeper
23 (235, 17)
Spring Retainer
Intake Camshaft
Valve Spring
No. 1 Camshaft Bearing Cap
◆ Oil Seal
Exhaust Camshaft
Spring Seat
Camshaft Timing Sprocket
Valve Guide
Valve
Bushing
RH Engine Mounting Bracket
45 (460, 33)
Heater Hose
47 (490, 35)
See page EM–62
1st 49 (500, 36)
2nd Turn 90°
x 10
Drive Belt Tensioner
Cylinder Head
Upper Radiator Hose
29 (296, 21)
◆ Cylinder Head Gasket
69 (704, 51)
Timing Chain
Chain Tensioner Slipper
Chain Tensioner
9.0 (92, 80 in.·lbf)
Timing Chain Cover
◆ Crankshaft Front Oil Seal
Crankshaft Pulley
x 11
138 (1,400, 102)
Water Pump
Crank Angle Sensor Plate
Chain Vibration Damper
x 6
◆ O–Ring
Crankshaft Position Sensor
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
N
A10447

2ZZ–GE:

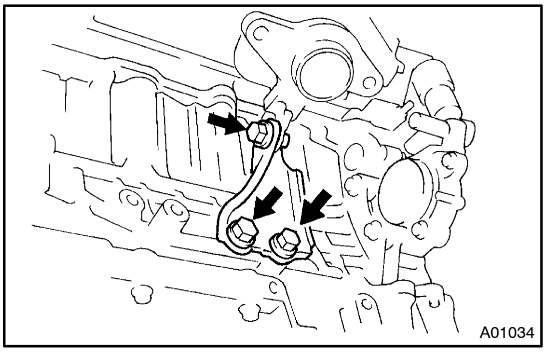

Cylinder Head Cover
◆ O–Ring
◆ Gasket
No. 1 Ventilation Pipe
Gasket
19 (194, 14)
No. 2 Camshaft Bearing Cap
No. 1 Camshaft Bearing Cap
Exhaust Camshaft
No. 3 Camshaft Bearing Cap
Camshaft Timing Sprocket
RH Engine Mounting Bracket
x 4
49 (500, 36)
54 (551, 40)
Intake Camshaft
See page EM–62
1st 35 (375, 26)
2nd Turn 180°
x 10
Drive Belt Tensioner
Cylinder Head
29 (296, 21)
100 (1,020, 74)
Timing Chain
◆ Cylinder Head Gasket
Chain Tensioner Slipper
Chain Tensioner
9.0 (92, 80 in.·lbf)
◆ Gasket
Timing Chain Cover
◆ Crankshaft Front Oil Seal
◆ Gasket
Crankshaft Pulley
Water Pump
Crank Angle Sensor Plate
120 (1,200, 87)
x 6
Chain Vibration Damper
◆ O–Ring
Water Pump Pulley
x 4
Crankshaft Position Sensor
N·m (kgf·cm, ft·lbf) : Specified torque
N ◆ Non–reusable part
A10448


2ZZ–GE
Valve Rocker Arm
Rocker No. 2 Shaft
Oil Pressure Switch
Oil Control Valve Housing
9.0 (92, 80 in.·lbf)
Rocker No. 1 Shaft
Oil Filter
◆ Gasket
Oil Control Valve for VVTL
Shim
Keeper
Spring Retainer
Valve Spring
Spring Seat
Cylinder Head
Oil Control Valve for VVT
29 (300, 22)
Oil Filter
Valve
◆ Gasket
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
N
A10368

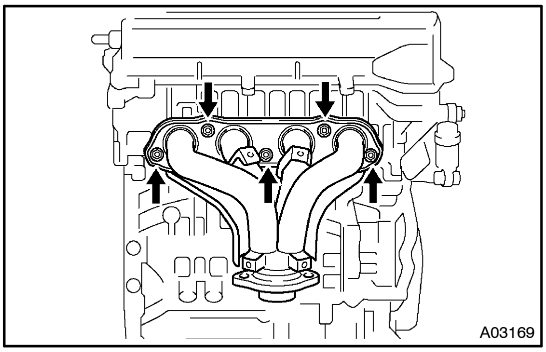
EM15U–02

REMOVAL

1. REMOVE BATTERY
2. REMOVE ENGINE ECU BOX
3. DRAIN ENGINE COOLANT
4. DISCONNECT ENGINE COOLANT RESERVOIR
5. REMOVE AIR CLEANER ASSEMBLY
6. DISCONNECT ACCELERATOR CABLE
7. REMOVE DRIVE BELT AND ALTERNATOR
(See page CH–5)
8. REMOVE EXHAUST PIPE

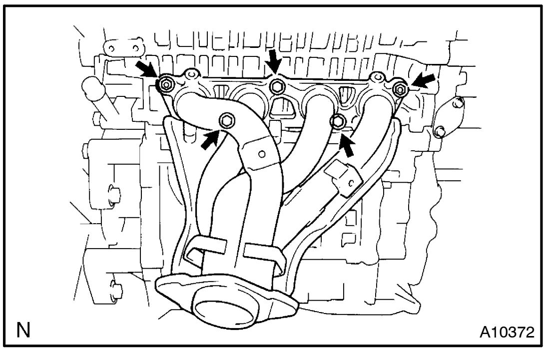

A01034

9. 1ZZ–FE:
REMOVE EXHAUST MANIFOLD
(a) Remove the 3 bolts and exhaust manifold stay.
(b) Remove the 6 bolts and upper heat insulator.


A03169

(c) Remove the 5 nuts, exhaust manifold and gasket.
(d) Remove the 3 bolts and lower heat insulator.

10. 2ZZ–GE:
REMOVE EXHAUST MANIFOLD
(a) Remove the 4 bolts and exhaust manifold stay.
(b) Remove the 5 bolts and upper heat insulator.



A10372

(c) Remove the 3 bolts, 2 nuts, exhaust manifold and gasket.
(d) Remove the 4 bolts and lower heat insulator.

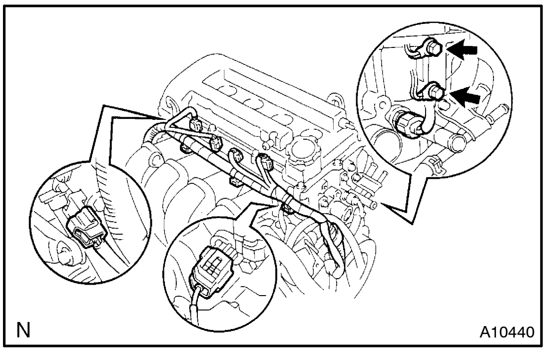
11. REMOVE IGNITION COIL (See page IG–6)

12. REMOVE SPARK PLUG (See page IG–1)

13. REMOVE PCV HOSES

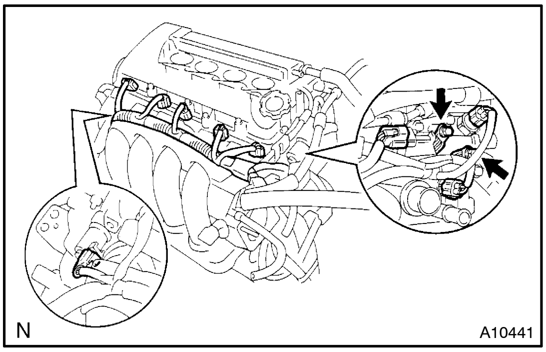
14. REMOVE THROTTLE BODY (See page FI–33)

15. REMOVE INJECTOR (See page FI–21)



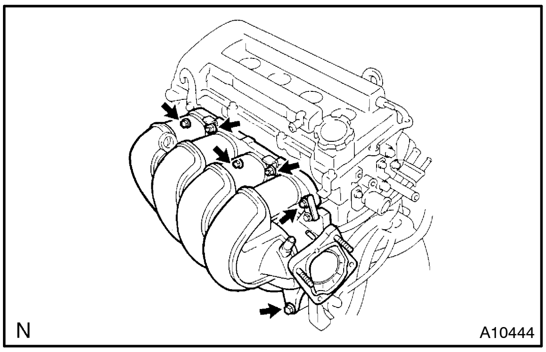
16. 1ZZ–FE:
DISCONNECT ENGINE WIRE FROM CYLINDER HEAD

(a) Disconnect the ECT sensor connector.
(b) Disconnect the camshaft position sensor connector.
(c) Disconnect the oil control valve for VVT connector.
(d) Disconnect the 2 ground wires.
(e) Disconnect the 2 clamps and engine wire protector from the intake manifold.



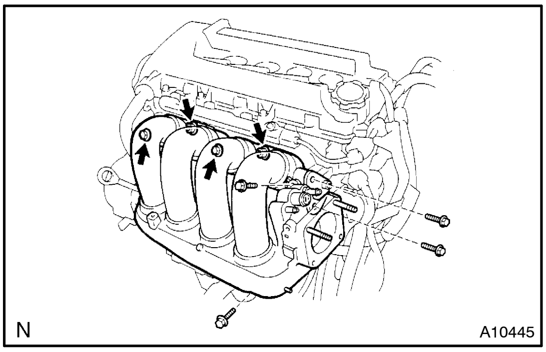
17. 2ZZ–GE:
DISCONNECT ENGINE WIRE FROM CYLINDER HEAD

(a) Disconnect the ECT sensor connector.
(b) Disconnect the camshaft position sensor connector.
(c) Disconnect the oil control valve for VVT connectors.
(d) Disconnect the oil control valve for VVTL connectors.
(e) Disconnect the oil pressure switch connector.
(f) Disconnect the 2 ground wires.
(g) Remove the 2 bolts, and disconnect the engine wire.
(h) Remove the intake manifold No. 2 insulator.



18. 1ZZ–FE:
REMOVE INTAKE MANIFOLD

(a) Disconnect the EVAP hose for ORVR.
(b) Disconnect the brake booster vacuum hose.
(c) Remove the 4 bolts, 2 nuts, intake manifold, 2 wire harness stays and gasket.



19. 2ZZ–GE:
REMOVE INTAKE MANIFOLD

(a) Disconnect the EVAP hose for ORVR.
(b) Disconnect the brake booster vacuum hose.
(c) Remove the bolt and disconnect the No. 1 ventilation pipe and oil dipstick and guide.
(d) Remove the 2 bolts, nut and stay.
(e) Remove the 4 bolts, 2 nuts, intake manifold and gasket.
(f) Remove the intake manifold insulator.

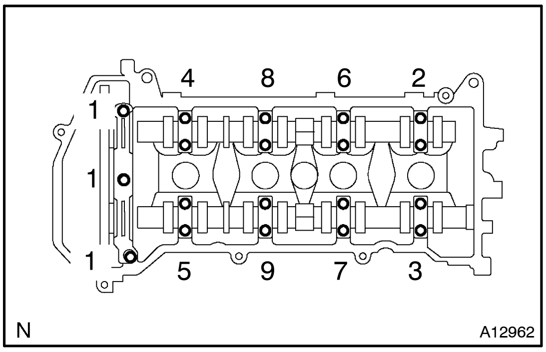
20. REMOVE CAMSHAFT POSITION SENSOR

21. REMOVE WATER TEMPERATURE SENSOR

22. REMOVE PCV VALVE AND GROMMET

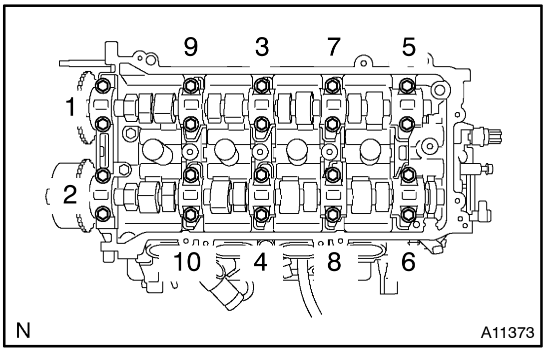
23. REMOVE OIL FILLER CAP

24. REMOVE CAMSHAFT TIMING SPROCKETS
(See page IG–9)



25. 1ZZ–FE:
REMOVE CAMSHAFT

Uniformly loosen and remove the 19 bearing cap bolts, in several passes, in the sequence shown, and remove the 9 bearing caps, intake and exhaust camshafts.



26. 2ZZ–GE:
REMOVE CAMSHAFT

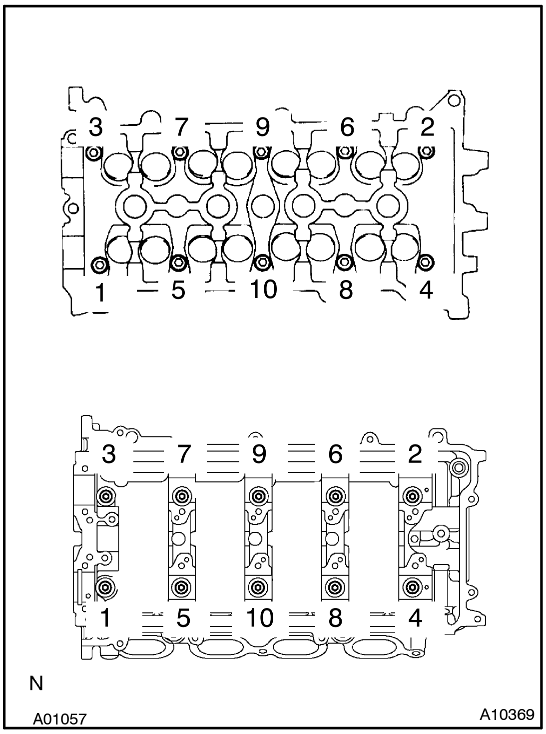
Uniformly loosen and remove the 20 bearing cap bolts, in several passes, in the sequence shown, and remove the 9 bearing caps intake and exhaust camshaft.

27. REMOVE CYLINDER HEAD

(a) Disconnect the upper radiator hoses from the water hose union.

(b) Disconnect the heater water hose from the water hose union.

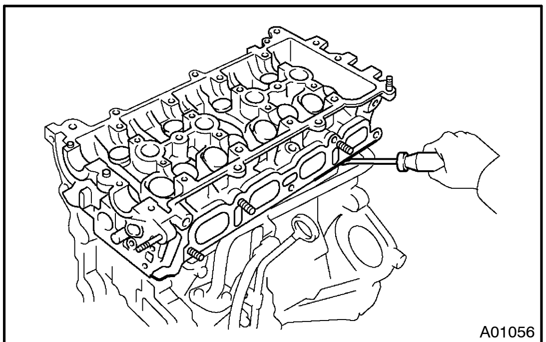
(c) Using a 12 mm bi–hexagon wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown. Remove the 10 cylinder head bolts and plate washers.



NOTICE:

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

(d) Remove the bolt holding the water bypass pipe to the cylinder head.


A01056

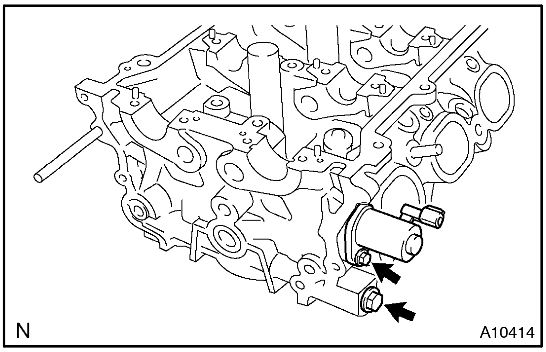
(e) Lift the cylinder from the dowels on the cylinder block and replace the cylinder head on wooden blocks on a bench.

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

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

EM15V−01

DISASSEMBLY

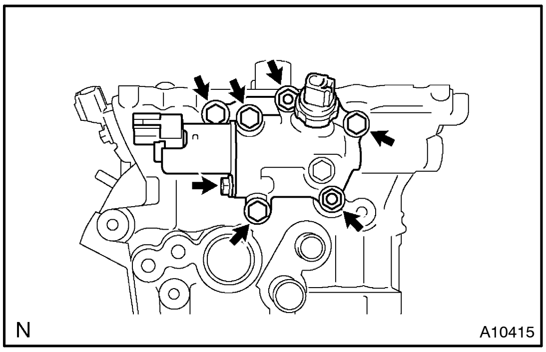


1. REMOVE OIL CONTROL VALVE for VVT

Remove the bolt and cam timing oil control valve.

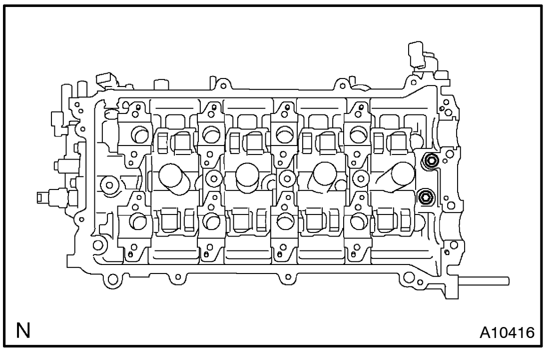
2. REMOVE OIL CONTROL VALVE FILTER

Remove the bolt, gasket and oil control valve filter.



**3. 2ZZ−GE:
REMOVE OIL CONTROL VALVE HOUSING**

(a) Remove the bolt and oil control valve for VVTL.
(b) Using SST, remove the oil pressure switch.
SST 09816−30010
(c) Remove the 3 bolts, 2 nuts, oil control valve housing and gasket.
(d) Remove the oil control valve filter.



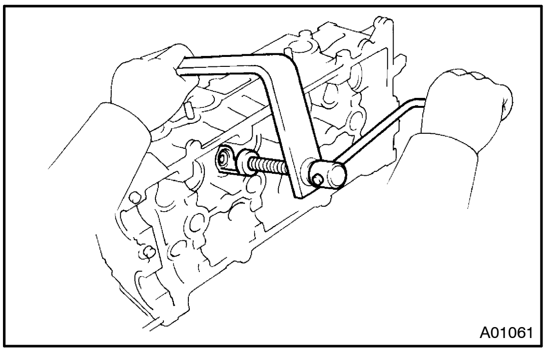
**4. 2ZZ−GE:
REMOVE VALVE ROCKER ARM**

(a) Remove the 2 bolts, rocker No. 1 and No. 2 shafts.
(b) Remove the 8 valve rocker arm.

HINT:
Arrange the rocker arms in the correct order.

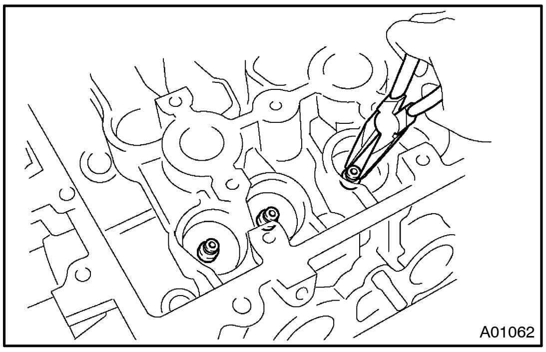
5. REMOVE VALVE LIFTERS

HINT:
Arrange the valve lifters in the correct order.

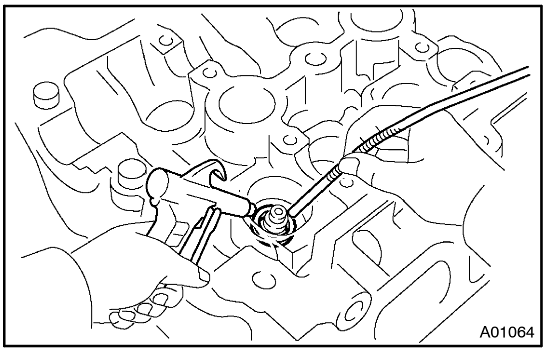


6. REMOVE VALVES

(a) Using SST, compress the valve spring and remove the 2 keepers.
SST 09202−70020 (09202−00020)
(b) Remove the spring retainer.
(c) Remove the valve spring.
(d) Remove the valve.



(e) Using needle−nose pliers, remove the oil seal.

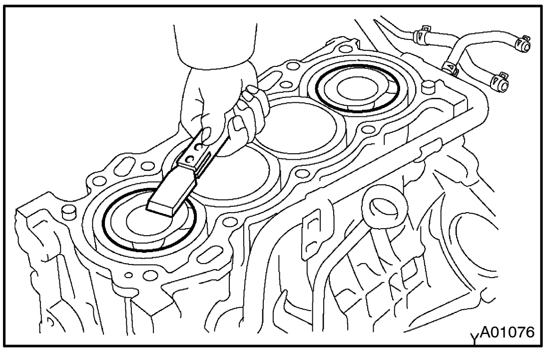


(f) Using compressed air and magnetic finger, remove the spring seat by blowing air.

HINT:

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

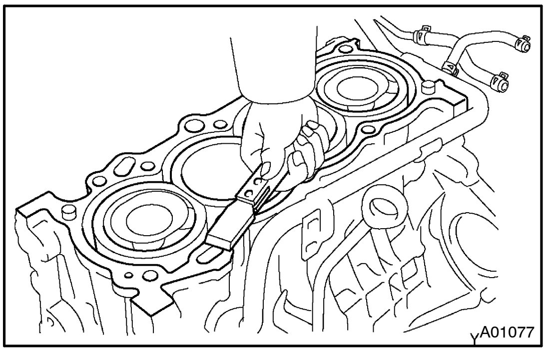
EM15W–01


A01076

INSPECTION

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

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

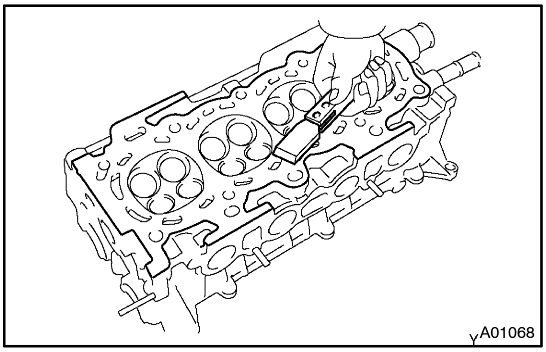

A01077

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

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

CAUTION:

Protect your eyes when using high pressure compressed air.

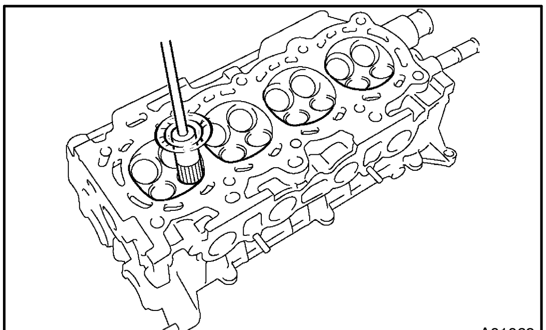

A01068

2. REMOVE GASKET MATERIAL

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

NOTICE:

Be careful not to scratch the cylinder block contact surface.

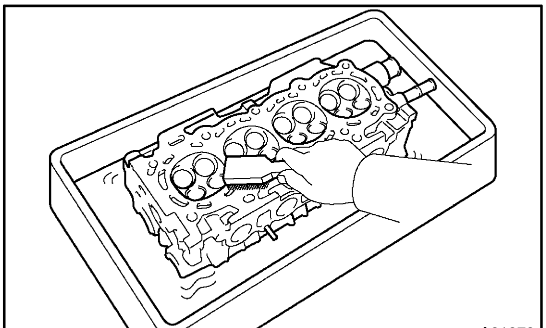

A01069

3. CLEAN COMBUSTION CHAMBERS

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

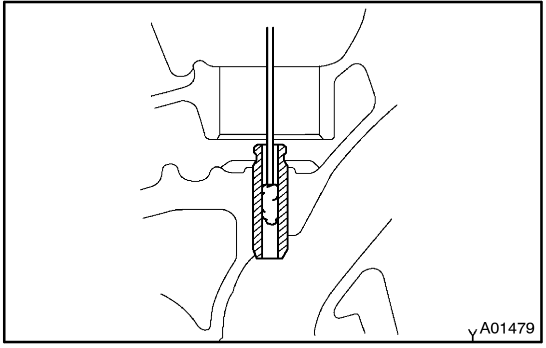
NOTICE:

Be careful not to scratch the cylinder block contact surface.


A01070

4. CLEAN CYLINDER HEAD

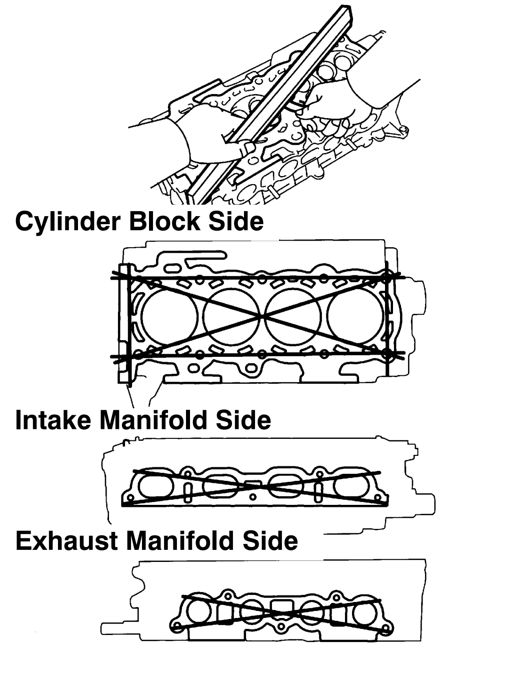
Using a soft brush and solvent, thoroughly clean the cylinder head.



A01479

5. CLEAN VALVE GUIDE BUSHINGS

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



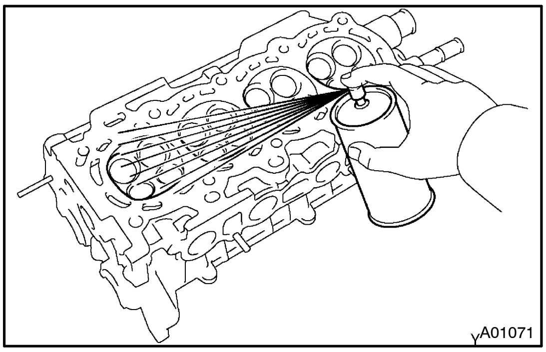
A01075

6. INSPECT FOR FLATNESS

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

Maximum warpage: 0.05 mm (0.0020 in.)

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

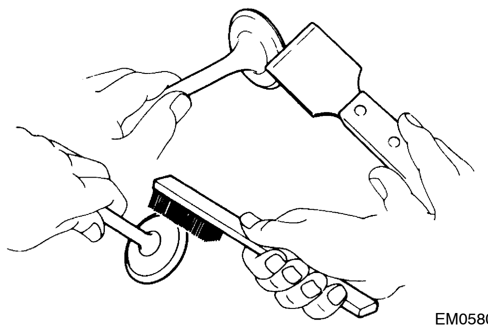


A01071

7. INSPECT FOR CRACKS

Using a dye penetrate, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.

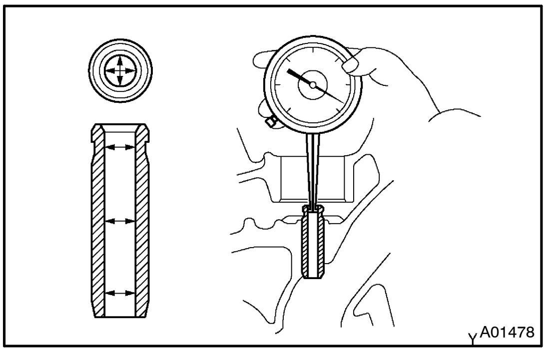


EM0580

8. CLEAN VALVES

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

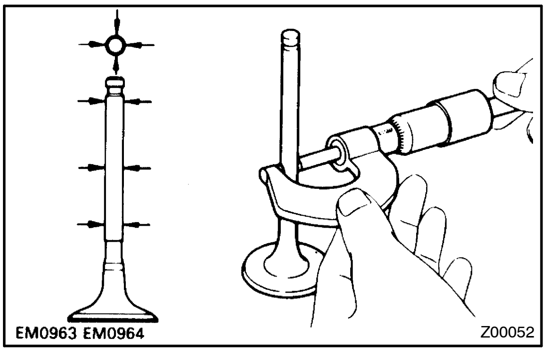
(b) Using a wire brush, thoroughly clean the valve.



9. **INSPECT VALVE STEMS AND GUIDE BUSHINGS**

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

Bushing inside diameter:
1ZZ–FE 5.510 – 5.530 mm (0.2169 – 0.2177 in.)
2ZZ–GE 5.500 – 5.518 mm (0.2165 – 0.2172 in.)



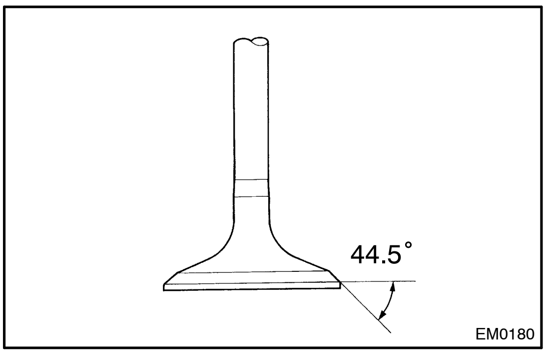
(b) Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:
1ZZ–FE
Intake 5.470 – 5.485 mm (0.2154 – 0.2159 in.)
Exhaust 5.465 – 5.480 mm (0.2152 – 0.2157 in.)
2ZZ–GE
Intake 5.460 – 5.475 mm (0.21496 – 0.21555 in.)
Exhaust 5.445 – 5.470 mm (0.21437 – 0.21535 in.)

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

Standard oil clearance:
1ZZ–FE
Intake 0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust 0.030 – 0.065 mm (0.0012 – 0.0026 in.)
2ZZ–GE
Intake 0.025 – 0.058 mm (0.00098 – 0.00228 in.)
Exhaust 0.030 – 0.063 mm (0.00118 – 0.00248 in.)
Maximum oil clearance:
1ZZ–FE
Intake 0.08 mm (0.0031 in.)
Exhaust 0.10 mm (0.0039 in.)
2ZZ–GE
0.10 mm (0.0039 in.)

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



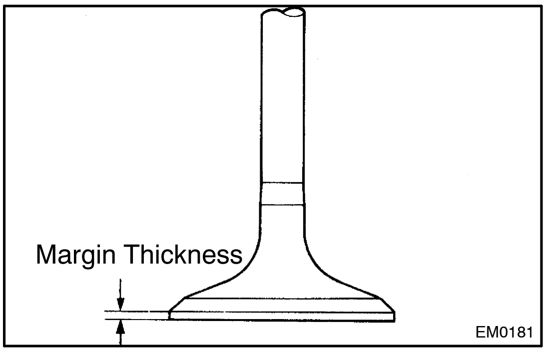
10. **INSPECT VALVES**

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

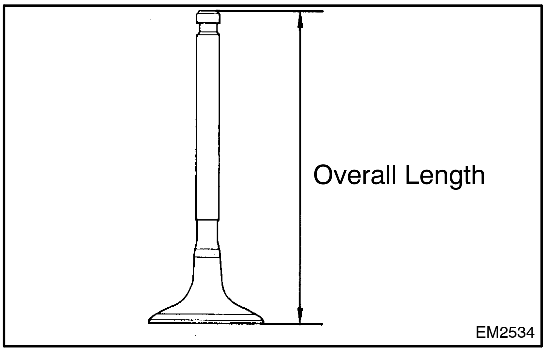
Valve face angle: 44.5°

(b) Check that the surface of the valve for wear.

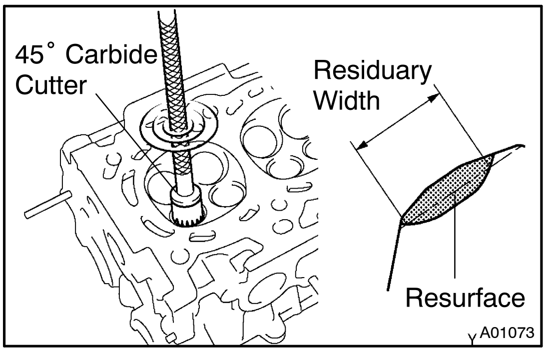
If the valve face is worn, replace the valve.



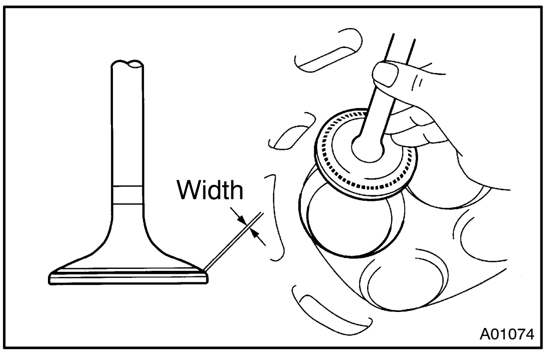
(c) Check the valve head margin thickness.
Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.7 mm (0.028 in.)
If the margin thickness is less than minimum, replace the valve.



(d) Check the valve overall length.
Standard overall length:
1ZZ–FE
Intake 88.65 mm (3.4902 in.)
Exhaust 88.69 mm (3.4917 in.)
2ZZ–GE
Intake 111.3 mm (4.382 in.)
Exhaust 111.7 mm (4.398 in.)
Minimum overall length:
1ZZ–FE
Intake 88.35 mm (3.4783 in.)
Exhaust 88.39 mm (3.4799 in.)
2ZZ–GE
Intake 110.9 mm (4.366 in.)
Exhaust 111.3 mm (4.382 in.)
If the overall length is less than minimum, replace the valve.
(e) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, replace the valve.



11. INSPECT AND CLEAN VALVE SEATS
(a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.
(b) After resurfacing the valve seat 45°, measure the residuary width of the valve seat 45°.
Minimum residuary length:
Intake 3.3 mm (0.130 in.)
Exhaust 3.2 mm (0.126 in.)

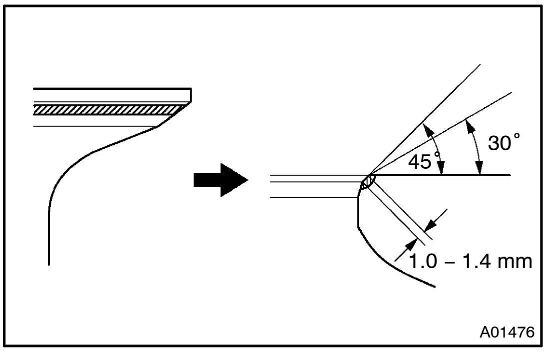


If the valve seat 45° residuary width less than minimum, replace the cylinder head.
(c) Check the valve seating position.
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.
(d) Check the valve face and seat for the following:
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.

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

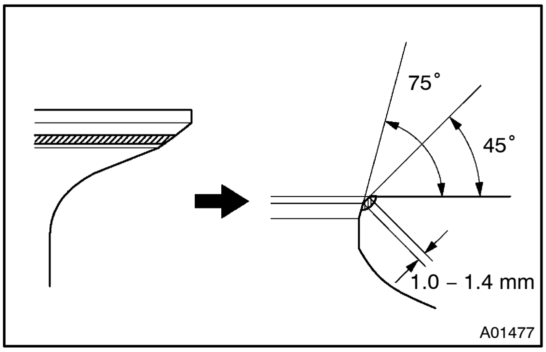
1.0 – 1.4 mm (0.039 – 0.055 in.)

If not, correct the valve seats as follows:



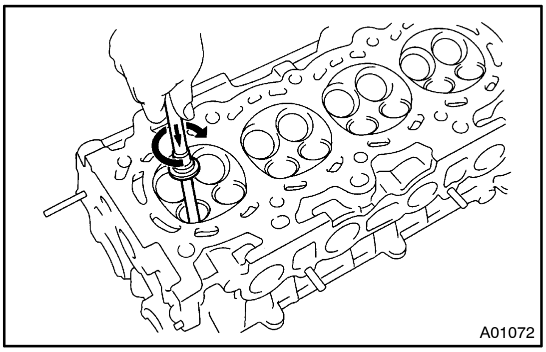
A01476

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

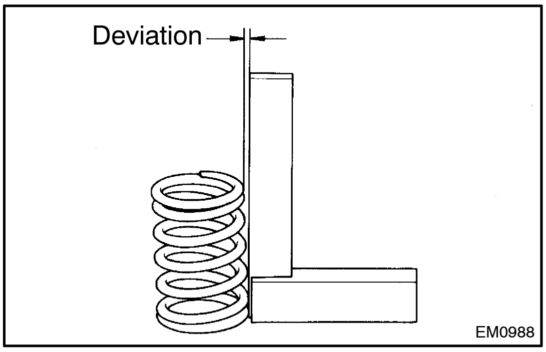


A01477

(2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.


A01072

(e) Hand–lap the valve and valve seat with an abrasive compound.
(f) After hand–lapping, clean the valve and valve seat.



EM0988

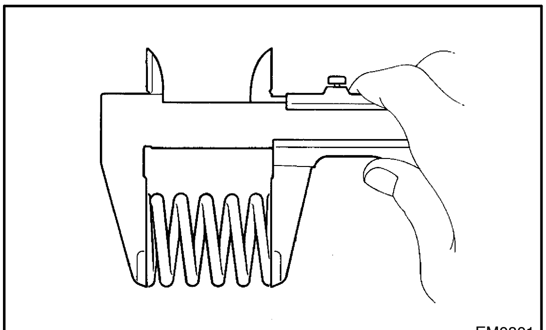
12. INSPECT VALVE SPRINGS

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

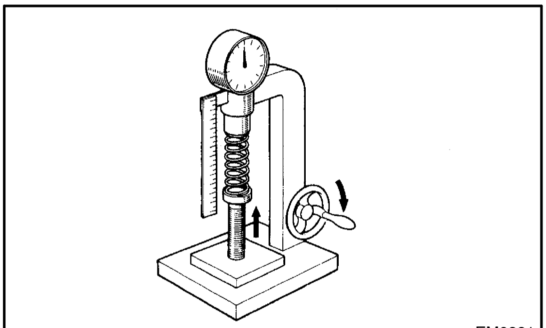
Maximum deviation: 1.6 mm (0.063 in.)

Maximum angle (reference): 2°

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

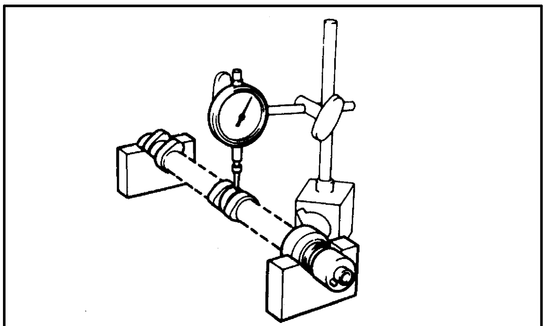

EM0801

(b) Using vernier calipers, measure the free length of the valve spring.
Free length:
1ZZ–FE 45.90 mm (1.8070 in.)
2ZZ–GE
Intake 46.4 mm (1.830 in.)
Exhaust 46.5 mm (1.831 in.)


EM0281

(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.
Installed tension:
1ZZ–FE
139.6 – 154.4 N (14.2 – 15.8 kgf, 31.3 – 34.8 lbf) at 33.6 mm (1.323 in.)
2ZZ–GE
Intake
220.2 – 243.8 N (22.5 – 24.7 kgf, 49.6 – 55.5 lbf) at 38.5 mm (1.516 in.)
Exhaust
208.2 – 229.8 N (21.2 – 23.4 kgf, 47.6 – 52.6 lbf) at 38.5 mm (1.516 in.)
Maximum working tension:
1ZZ–FE
244.9 – 276.1 N (25.5 – 28.1 kgf, 56.2 – 61.9 lbf) at 24.6 mm (0.969 in.)
2ZZ–GE
Intake
533 – 589 N (54.4 – 60.1 kgf, 119.9 – 132.5 lbf) at 27.3 mm (1.075 in.)
Exhaust
495.5 – 548.5 N (50.5 – 55.9 kgf, 111.3 – 123.2 lbf) at 28.5 mm (1.122 in.)

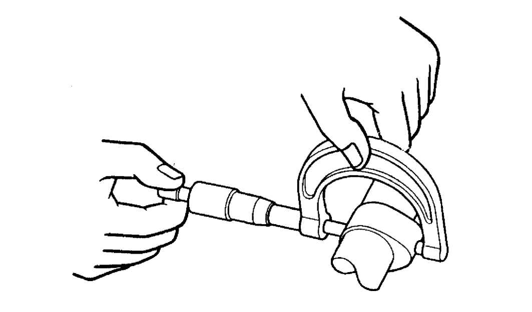
If the installed tension is not as specified, replace the valve spring


EM1628

13. INSPECT CAMSHAFT FOR RUNOUT

(a) Place the camshaft on V–blocks.
(b) Using a dial indicator, measure the circle runout at the center journal.
Maximum circle runout: 0.03 mm (0.0012 in.)

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

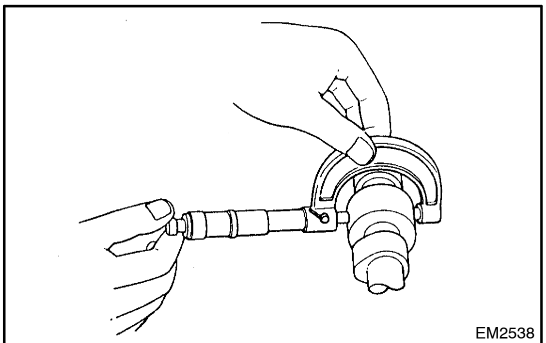

EM2011

14. INSPECT CAM LOBES

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:
1ZZ–FE:
Intake 44.333 – 44.433 mm (1.7454 – 1.7493 in.)
Exhaust 43.761 – 43.861 mm (1.7229 – 1.7268 in.)
2ZZ–GE:
INTAKE
No. 1 40.607 – 40.707 mm (1.59586 – 1.59979 in.)
No. 2 38.769 – 38.869 mm (1.52362 – 1.52755 in.)
2ZZ–GE:
EXHAUST
No. 1 40.019 – 40.119 mm (1.57275 – 1.57668 in.)
No. 2 38.863 – 38.963 mm (1.52732 – 1.53125 in.)
Minimum cam lobe height:
1ZZ–FE:
Intake 44.18 mm (1.7394 in.)
Exhaust 43.61 mm (1.7169 in.)
2ZZ–GE:
Intake
No.1 40.45 mm (1.5925 in.)
No.2 38.61 mm (1.5201 in.)
Exhaust
No.1 39.86 mm (1.5693)
No.2 38.71 mm (1.5240)

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

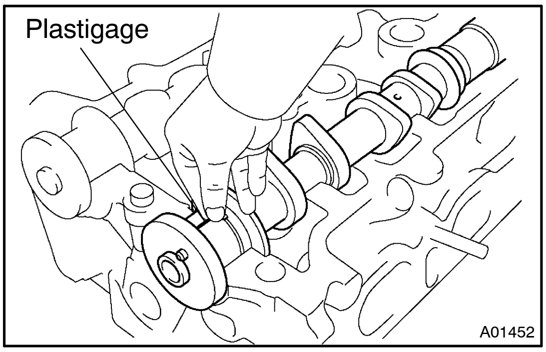

EM2538

15. INSPECT CAMSHAFT JOURNALS

Using a micrometer, measure the journal diameter.

1ZZ–FE:
No.1 journal diameter:
34.449 – 34.465 mm (1.3563 – 1.3569 in.)
Others journal diameter:
22.949 – 22.965 mm (0.9035 – 0.9041 in.)
2ZZ–GE:
No.1 journal diameter:
34.449 – 34.465 mm (1.35626 – 1.35689 in.)
Other journal diameter:
27.949 – 27.965 mm (1.10035 – 1.10098 in.)

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

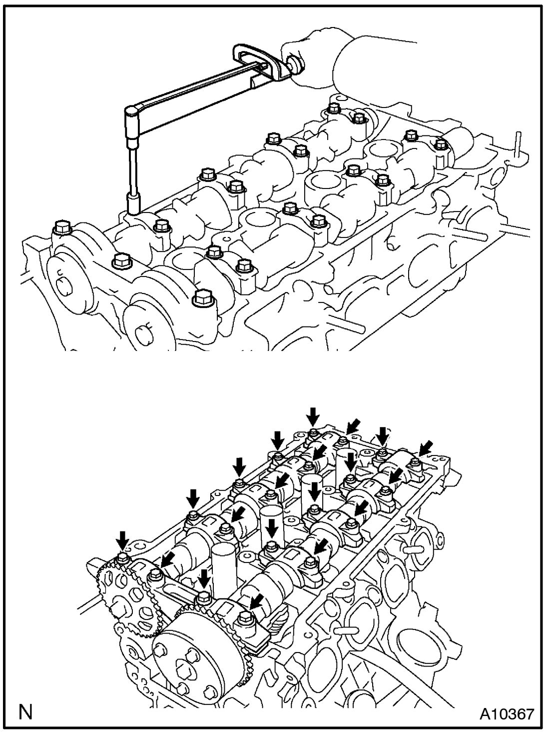


16. INSPECT CAMSHAFT JOURNAL CLEARANCE

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

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



(d) Install the bearing caps (See page EM–66).

Torque:

1ZZ–FE:

No.1 23 N·m (235 kgf·cm, 17 ft·lbf)

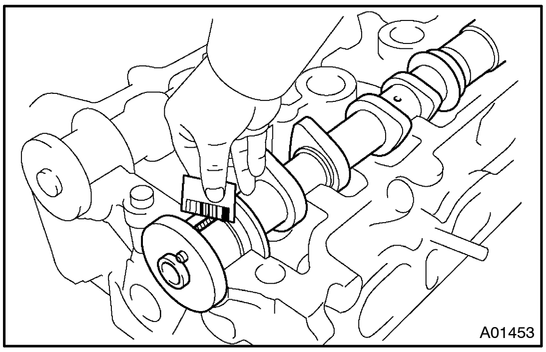
No.3 13 N·m (133 kgf·cm, 10 ft·lbf)

2ZZ–GE: 18.5 N·m (189 kgf·cm, 14 ft·lbf)

NOTICE:

Do not turn the camshaft.

(e) Remove the bearing caps.



(f) Measure the plastigage at its widest point.

1ZZ–FE:

Standard oil clearance:

0.035 – 0.072 mm (0.0014 – 0.0028 in.)

Maximum oil clearance:

0.10 mm (0.0039 in.)

2ZZ–GE:

Standard oil clearance:

No. 1 journal 0.035 – 0.076 mm (0.00138 – 0.00299 in.)

Other journal 0.035 – 0.072 mm (0.00138 – 0.00283 in.)

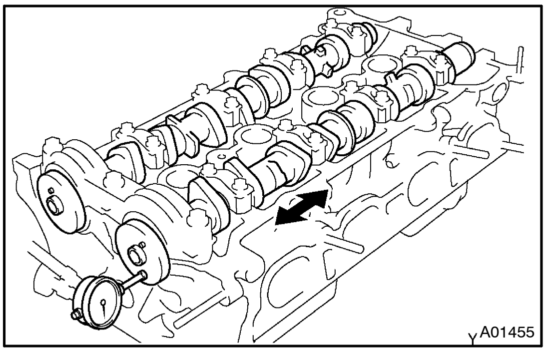
Maximum oil clearance:

0.10 mm (0.039 in.)

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

(g) Completely remove the Plastigage.

(h) Remove the camshafts.



17. INSPECT CAMSHAFT THRUST CLEARANCE

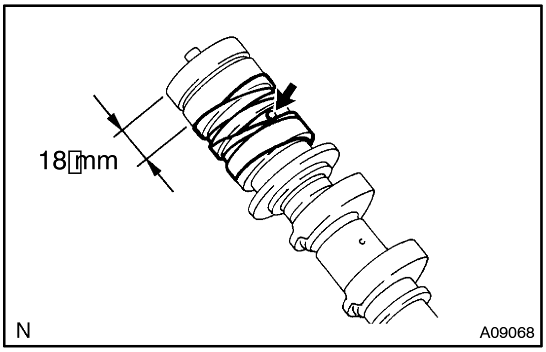
(a) Install the camshafts (See page EM–66).

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

1ZZ–FE:
Standard thrust clearance:
0.040 – 0.095 mm (0.0016 – 0.0037 in.)
Maximum thrust clearance:
0.11 mm (0.0043 in.)
2ZZ–GE:
Standard thrust clearance:
0.04 – 0.14 mm (0.0016 – 0.0055 in.)
Maximum thrust clearance:
0.15 mm (0.0059 in.)

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

(c) Remove the camshafts.



18. INSPECT VALVE TIMING CONTROLLER ASSEMBLY

(a) Apply vinyl tape to all the ports except the one indicated by the arrow in the illustration.

NOTICE:

Do not apply tape in the range from the tip of the camshaft to 18 mm from that tip.

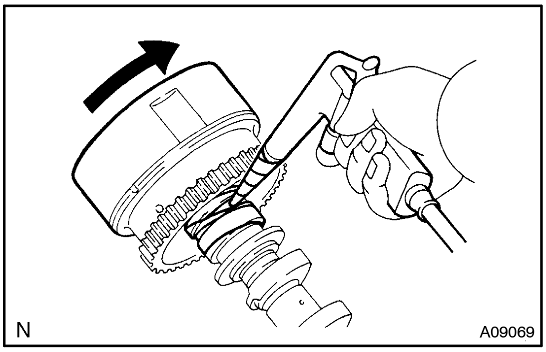
(b) Install the valve timing controller assembly.

Torque: 47 N·m (480 kgf·cm, 35 ft·lbf)

NOTICE:

Do not push valve timing controller assembly to the camshaft forcibly when installing it.

(c) Check that the valve timing controller assembly will not turn.



(d) Wind tape around the tip of the air gun and apply air of approx. 100 kPa (1 kgf/cm^2, 14 psi) to the port of the camshaft.

NOTICE:

When the oil splashes, wipe it off with a shop rag and the likes.

HINT:

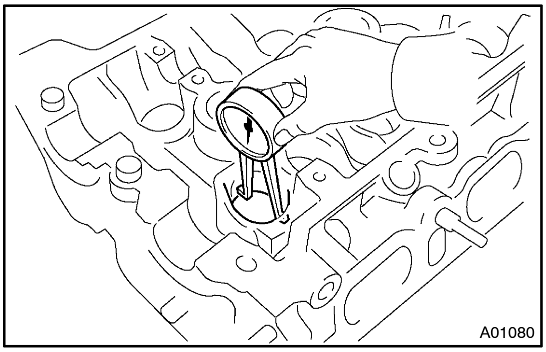
Perform this in order to release the lock pin for the maximum delay angle locking.

(e) Under the condition of (d), turn the valve timing controller assembly to the advance angel side (the arrow marked direction in the illustration) with your hand.
Standard: Must turn

HINT:
Depending on the air pressure, the valve timing controller assembly will turn to the advance angle side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.

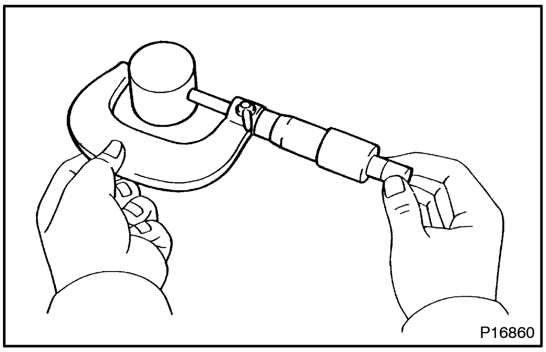
(f) Except the position where the lock pin meets at the maximum delay angle, let the valve timing controller assembly turn back and forth and check the movable range and that there is no disturbance.
Standard: Movable smoothly in the range about 30°

(g) Turn the valve timing controller assembly with your hand and lock it at the maximum delay angel position.


A01080

19. 1ZZ–FE:
INSPECT VALVE LIFTERS AND LIFTER BORES

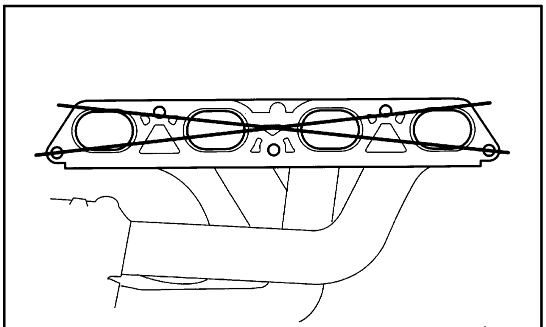
(a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.
Lifter bore diameter:
31.000 – 31.025 mm (1.2205 – 1.2215 in.)


P16860

(b) Using a micrometer, measure the lifter diameter.
Lifter diameter:
30.966 – 30.976 mm (1.2191 – 1.2195 in.)

(c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.
Standard oil clearance:
0.024 – 0.059 mm (0.0009 – 0.0023 in.)
Maximum oil clearance:
0.079 mm (0.0031 in.)

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

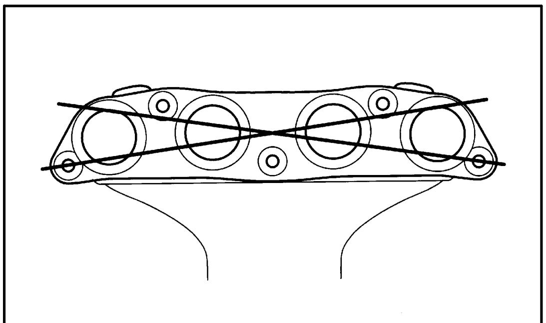

A01078

20. INSPECT INTAKE MANIFOLD

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

Maximum warpage: 0.10 mm (0.0039 in.)

If warpage is greater than maximum, replace the manifold.

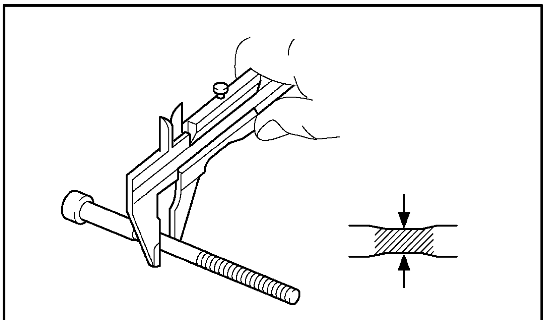

A01079

21. INSPECT EXHAUST MANIFOLD

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

Maximum warpage: 0.70 mm (0.0276 in.)

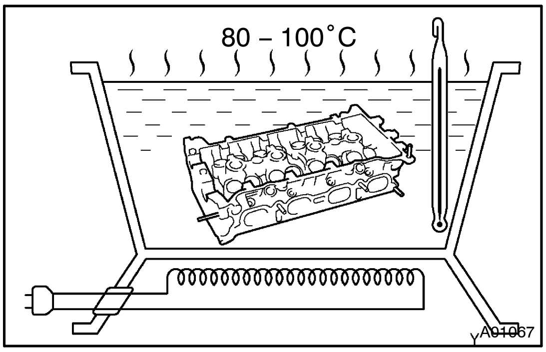
If warpage is greater than maximum, replace the manifold.


Y A01081

22. INSPECT CYLINDER HEAD BOLTS

Standard outside diameter:
9.0 – 9.2 mm (0.354 – 0.362 in.)
Minimum outside diameter:
9.0 mm (0.354 in.)

If the outer diameter is less than minimum, replace the bolt.

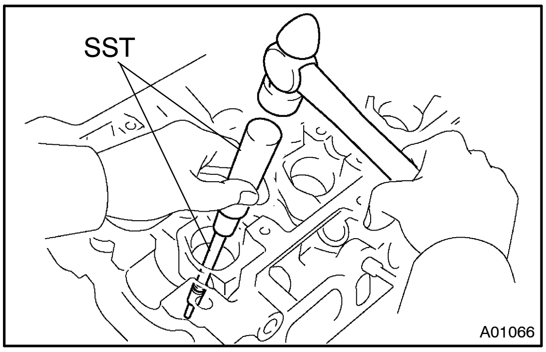


EM05X–04

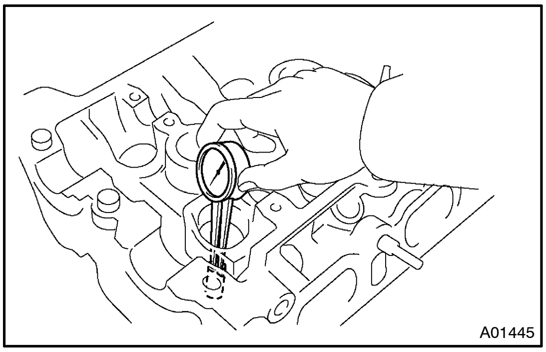
REPLACEMENT

REPLACE VALVE GUIDE BUSHINGS

(a) Gradually heat the cylinder head to 110 – 130 ˚C (230 – 266 ˚F).



(b) Using SST and a hammer, tap out the guide bushing.
SST 09201–01055, 09950–70010 (09951–07100)



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

Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
10.285 – 10.306 (0.4049 – 0.4057)	Use STD
10.335 – 10.356 (0.4068 – 0.4077)	Use O/S 0.05

(d) 1ZZ–FE:
Select the new guide bushing (STD or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bushing bore to the following dimension:
10.335 – 10.356 mm (0.4068 – 0.4077 in.)
If the bushing bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.

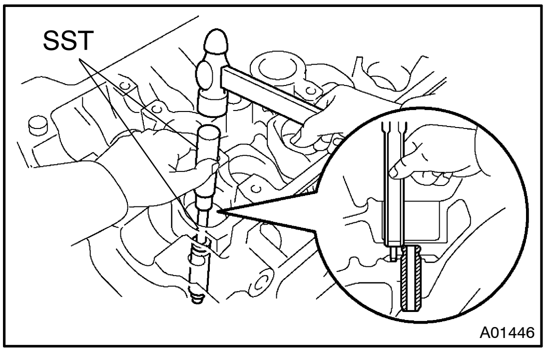
(e) 1ZZ–FE:
Gradually heat the cylinder head to 80 – 100 ˚C (176 – 212 ˚F).

Both intake and exhaust

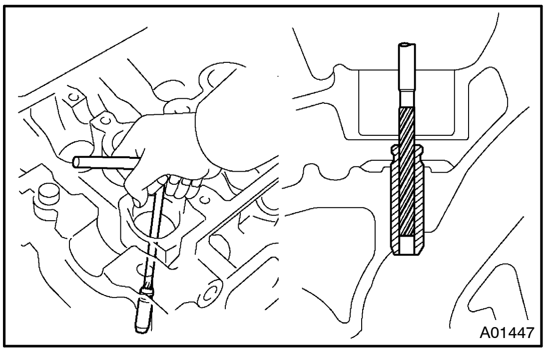
Bushing bore diameter mm (in.)	Bushing size
10.488 – 10.506 (0.4129 – 0.4136)	Use STD
10.538 – 10.556 (0.4149 – 0.4156)	Use O/S 0.05

(f) 2ZZ–GE:
Select the new guide bushing (STD or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 10.506 mm (0.4136 in.), machine the bushing bore to the following dimension:
10.538 – 10.556 mm (0.4149 – 0.4156 in.)
If the bushing bore diameter of the cylinder head is greater than 10.556 mm (0.4156 in.), replace the cylinder head.

(g) 2ZZ–GE:
Gradually heat the cylinder head to 110 – 130 °C (230 – 266 °F).



(h) Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.
SST 09201–01055, 09950–70010 (09951–07100)
Protrusion height:
1ZZ–FE 8.7 – 9.1 mm (0.342 – 0.358 in.)
2ZZ–GE 15.3 – 15.7 mm (0.602 – 0.618 in.)



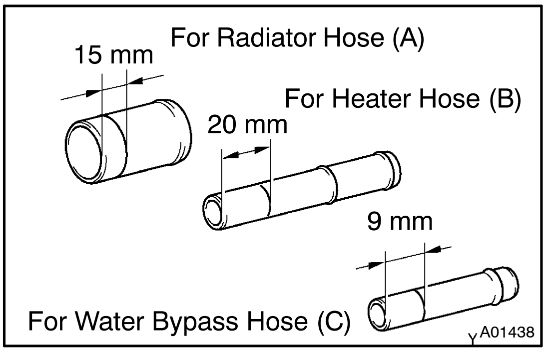
(i) Using a sharp 5.5 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM–49) between the guide bushing and valve stem.

EM15X–01

REASSEMBLY

HINT:

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

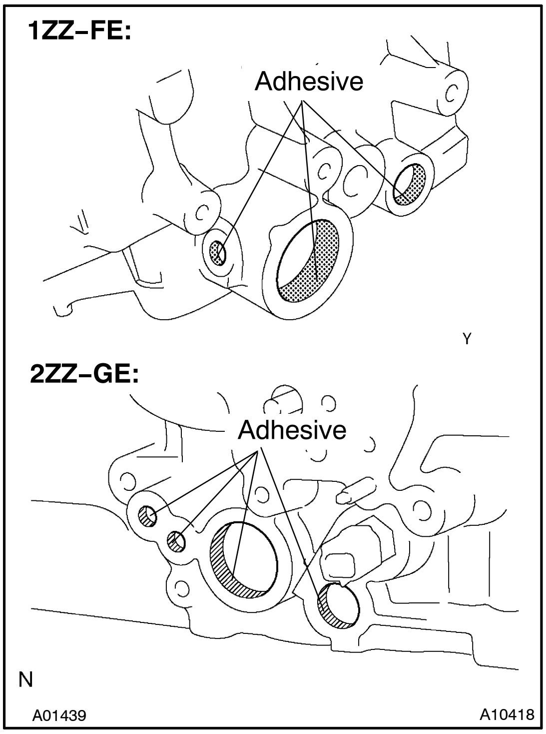


1. INSTALL WATER HOSE UNIONS

HINT:

When using a new cylinder head, water hose unions must be installed.

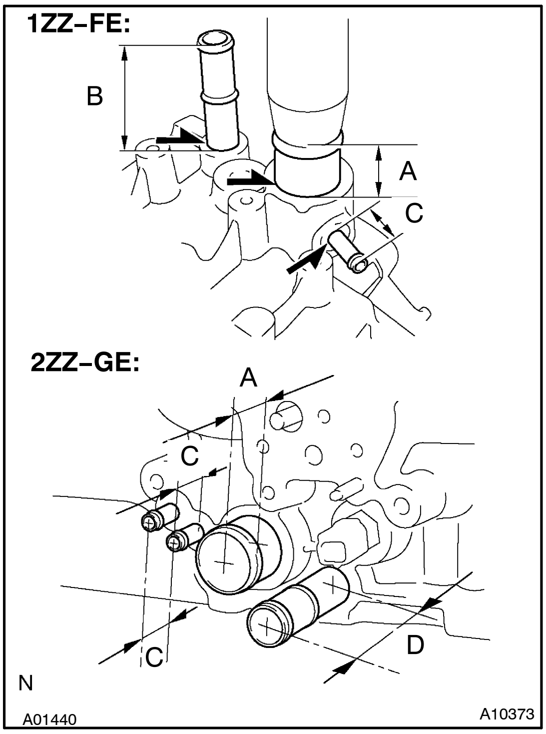
(a) Mark the standard position away from the edge, onto the water hose union.



(b) Apply adhesive to the water hose union hole of the cylinder head.

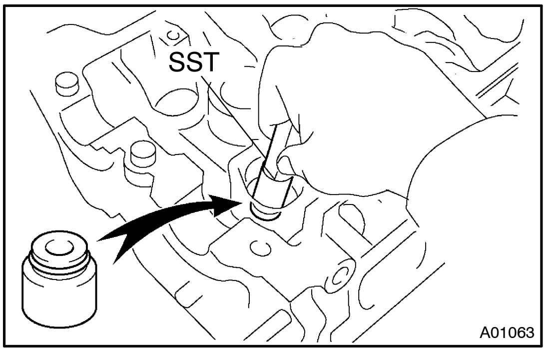
Adhesive:

Part No.08833–00070, THREE BOND 1324 or equivalent



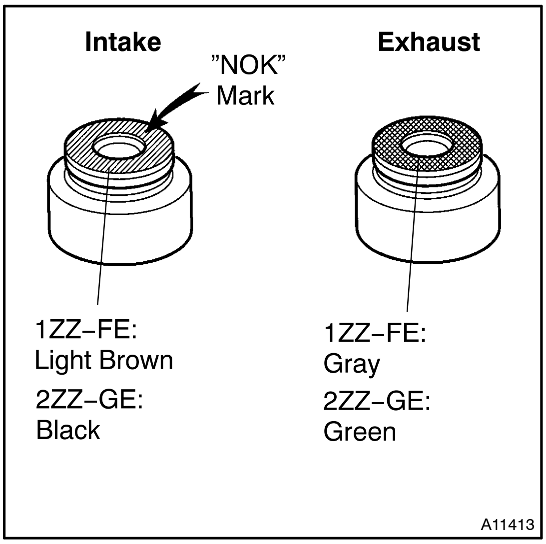
(c) Using a press, press in a new water hose union until there is protruding from the cylinder head.
Standard protrusion:
A 29 mm (1.14 in.)
B 66.5 mm (2.618 in.)
C 24 mm (0.95 in.)
D 69.8 mm (2.630 in.)

NOTICE:
Avoid pressing a new water hose union in too far by measuring the amount of protrusion while pressing.



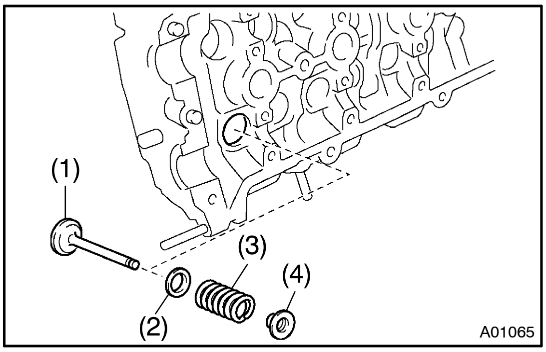
2. INSTALL VALVES

(a) Using SST, push in a new oil seal.
SST 09201–41020

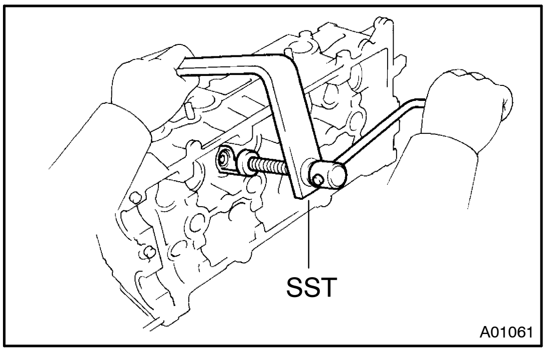


HINT:
- 1ZZ–FE:
  The intake valve oil seal is light brown and the exhaust valve oil seal is gray.
- 2ZZ–GE:
  The intake valve oil seal is black and the exhaust valve oil seal is green.

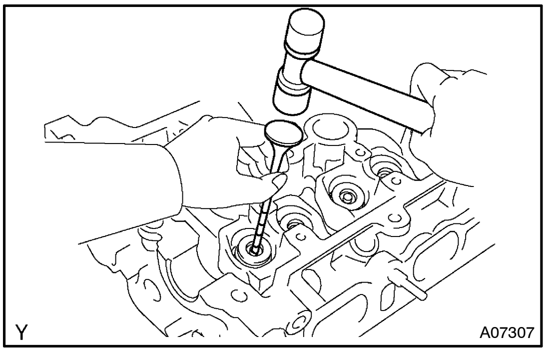
NOTICE:
Pay much attention assembling the oil seal for intake and exhaust. Assembling the wrong one may cause a failure.



(b) Install the valve (1), spring (2), valve spring (3), and spring retainer (4).



(c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202–70020 (09202–00020)



(d) Using a plastic–faced hammer and the valve stem (not in use) tip wound with vinyl tape, lightly tap the valve stem tip to ensure a proper fit.

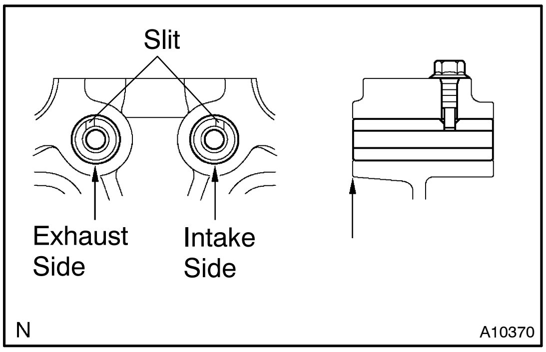
NOTICE:
Be careful not to damage the valve stem tip.

3. INSTALL VALVE LIFTERS

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

4. 2ZZ–GE:
INSTALL VALVE ROCKER ARM

(a) Set the 8 valve rocker arms.
(b) Install the rocker No. 1 and No. 2 shaft with the 2 bolts.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)

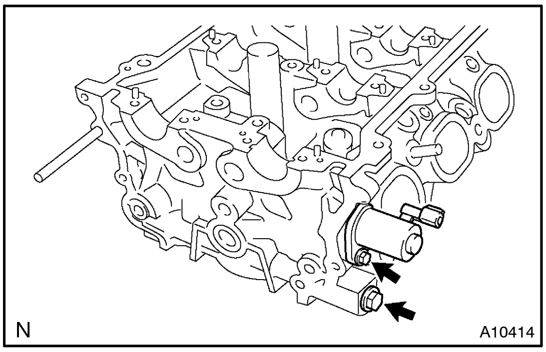


HINT:
- Position the slit of the locker shaft in the direction shown in the illustration.
- Align the locker shaft end with the cylinder head end.

5. 2ZZ–GE:
INSTALL OIL CONTROL VALVE HOUSING

(a) Install the oil control valve filter.
(b) Install the gasket and oil control valve housing with the 3 bolts and 2 nuts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

(c) Apply adhesive to 2 or 3 threads of the oil pressure switch.
Adhesive:
Part No. 08833−00080, THREE BOND 1344, LOCTITE 242 or equivalent
(d) Using SST, install the oil pressure switch.
SST 09816−30010
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)
(e) Install the oil control valve for VVTL with the bolt.



6. INSTALL CONTROL VALVE for VVT

Install the oil control valve for VVT with the bolt.

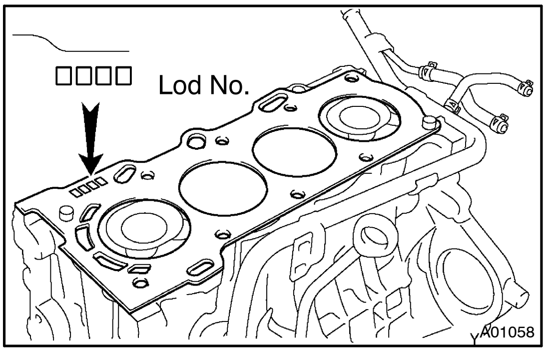
7. INSTALL OIL CONTROL VALVE FILTER

Install the oil control valve filter and new gasket with the bolt.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

EM15Y–02

INSTALLATION

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

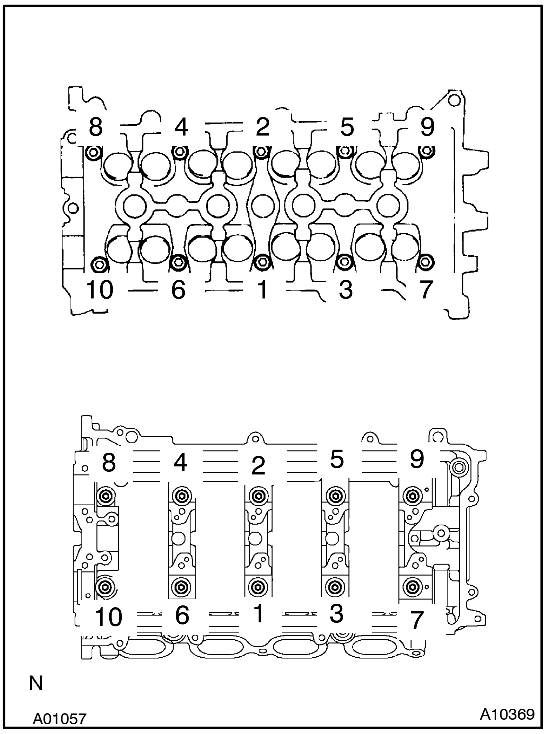


1. PLACE CYLINDER HEAD ON CYLINDER BLOCK

(a) Place a new cylinder head gasket on the cylinder block surface with the Lod No. stamp upward.

NOTICE:
Be careful of the installation direction.

(b) Place the cylinder head quietly in order not to damage the gasket with the bottom part of the head.



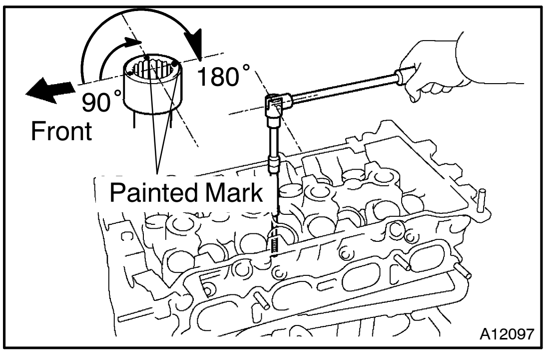
2. INSTALL CYLINDER HEAD BOLTS

HINT:
- The cylinder head bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any cylinder head bolt is broken or deformed, replace it.

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

(b) Using a 12 mm bi–hexagon wrench, install and uniformly tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.
Torque:
1ZZ–FE: 49 N·m (500 kgf·cm, 36 ft·lbf)
2ZZ–GE: 35 N·m (375 kgf·cm, 26 ft·lbf)

If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.



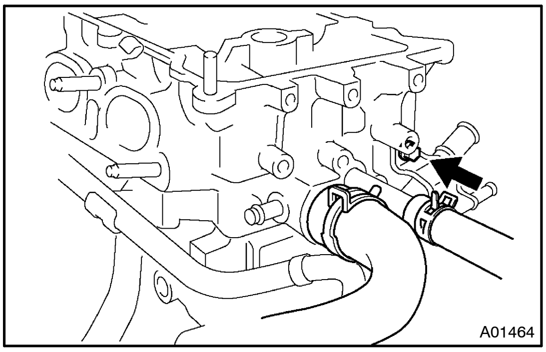
(c) Mark the front of the cylinder head bolt with paint.

(d) 1ZZ–FE:
Retighten the cylinder head bolts 90° in the numerical order shown.

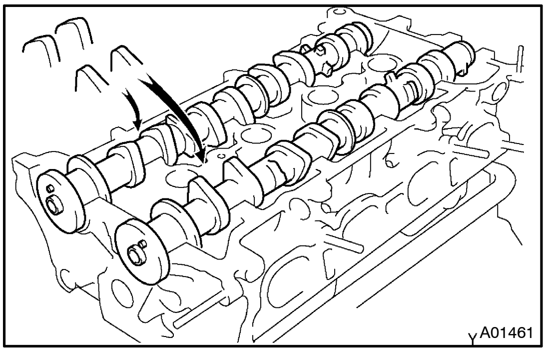
(e) 2ZZ–GE:
Retighten the cylinder head bolts 180° in the numerical order shown.

(f) 1ZZ–FE:
Check that the paint mark is not at a 90° angle to the front.

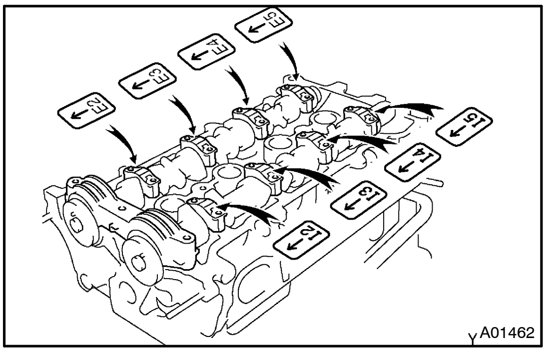
(g) 2ZZ−GE:
Check that the paint mark is not at a 180° angle to the front.



(h) Install the bolt holding the water bypass pipe to the cylinder head.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
(i) Connect the upper radiator hose to the water hose unions.
(j) Connect the heater hose to the water hose unions.

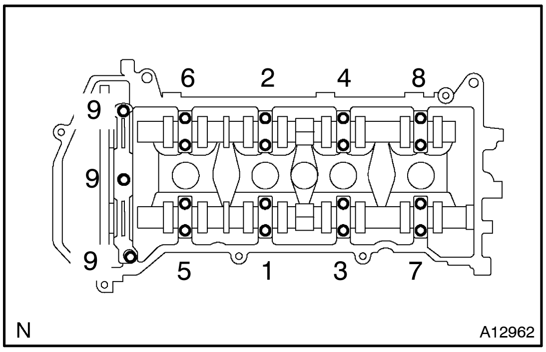


3. INSTALL CAMSHAFTS
(a) Place the 2 camshafts on the cylinder head with the No. 1 cam lobes facing as shown the illustration.

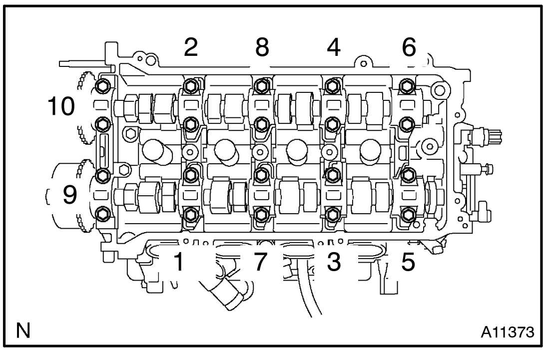


(b) Install the bearing caps in their proper locations.
HINT:
- 1ZZ−FE:
  No. 3 camshaft bearing cap has a number and front mark.
- 2ZZ−GE:
  No. 2, No.3 camshaft bearing cap has a number and front mark.

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



(d) 1ZZ−FE:
Install and uniformly tighten the 19 bearing cap bolts.
After tightening the No. 1 camshaft bearing cap, tighten then in several passes, in the sequence shown.
Torque:
No. 1 23 N·m (235 kgf·cm, 17 ft·lbf)
No. 3 13 N·m (133 kgf·cm, 10 ft·lbf)



(e) 2ZZ–GE:
Install and uniformly tighten the 20 bearing cap bolts.
After tightening the No. 1 camshaft bearing cap, tighten then in several passes, in the sequence shown.
Torque: 18.5 N·m (189 kgf·cm, 14 ft·lbf)

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

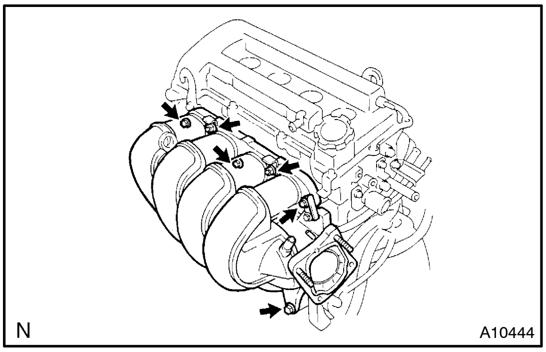
5. INSTALL CAMSHAFT TIMING SPROCKETS AND VALVE TIMING CONTROLLER ASSEMBLY
(See page EM–26)

6. INSTALL OIL FILTER CAP

7. INSTALL GROMMET AND PCV VALVE

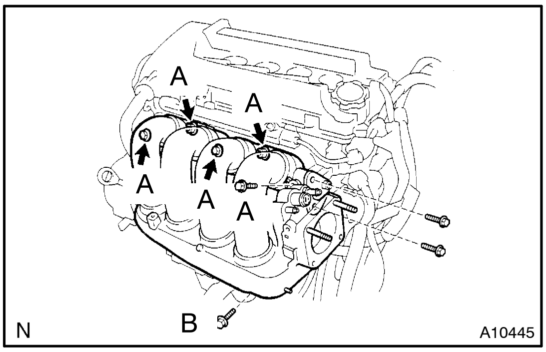
8. INSTALL WATER TEMPERATURE SENSOR
(See page FI–54)

9. INSTALL CAMSHAFT POSITION SENSOR
(See page IG–1)



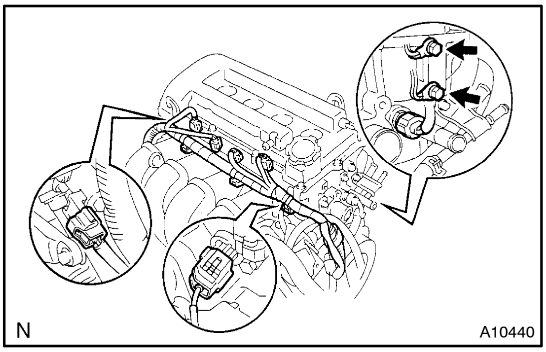
10. 1ZZ–FE:
INSTALL INTAKE MANIFOLD

(a) Install a new gasket, the intake manifold with the 4 bolts and 2 nuts.
Torque: 18.5 N·m (189 kgf·cm, 14 ft·lbf)
(b) Connect the brake booster vacuum hose.
(c) Connect the EVAP hose for ORVR.

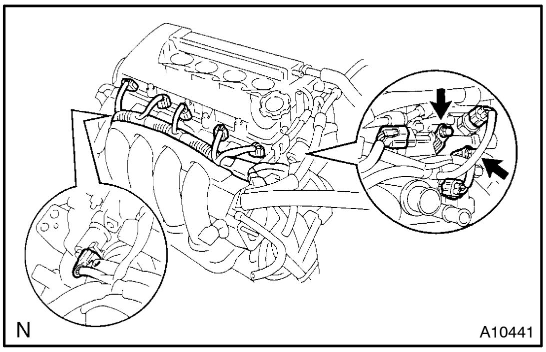


11. 2ZZ–GE:
INSTALL INTAKE MANIFOLD

(a) Install the intake manifold insulator to the cylinder block.
(b) Install a new gasket, the intake manifold with the 4 bolts and 2 nuts.
Torque:
A: 27 N·m (275 kgf·cm, 20 ft·lbf)
B: 46 N·m (469 kgf·cm, 34 ft·lbf)
(c) Install the stay with the 2 bolts and nut.
Torque: 24 N·m (245 kgf·cm, 18 ft·lbf)
(d) Install the oil dipstick and guide with the bolt.
Torque: 25 N·m (255 kgf·cm, 18 ft·lbf)
(e) Connect the brake booster vacuum hose.
(f) Connect the EVAP hose for ORVR.

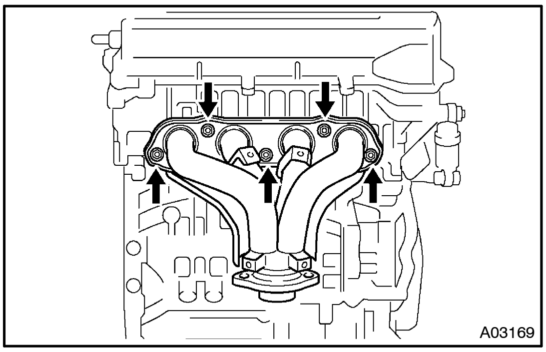


12. 1ZZ–FE:
CONNECT ENGINE WIRE TO CYLINDER HEAD
(a) Connect the 2 clamps of engine wire to the intake manifold.
(b) Connect the 2 ground cables.
(c) Connect the oil control valve for VVT connector.
(d) Connect the camshaft position sensor connector.
(e) Connect the ECT sensor connector.

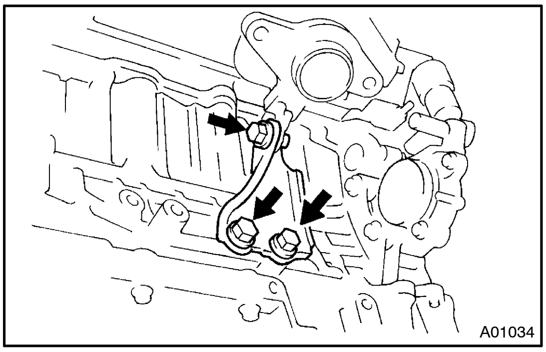


13. 2ZZ–GE:
CONNECT ENGINE WIRE TO CYLINDER HEAD
(a) Install the intake manifold insulator No. 2.
(b) Connect the 2 ground cables.
(c) Connect the oil pressure switch connector.
(d) Connect the oil control valve for VVT connector.
(e) Connect the oil control valve for VVTL connector.
(f) Connect the camshaft position sensor connector.
(g) Connect the ECT sensor connector.
(h) Install the accelerator cable bracket with the 2 bolts.

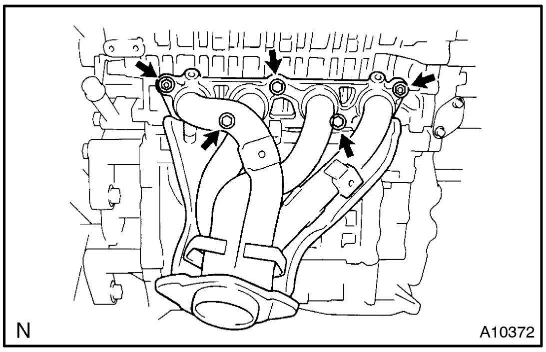
14. INSTALL INJECTORS (See page FI–24)
15. INSTALL THROTTLE BODY (See page FI–36)
16. INSTAL PCV HOSES
17. INSTALL SPARK PLUGS (See page IG–1)
18. INSTALL IGNITION COIL (See page IG–7)



19. 1ZZ–FE:
INSTALL EXHAUST MANIFOLD
(a) Install the lower heat insulator with the 3 bolts.
Torque: 12 N·m (123 kgf·cm, 9 ft·lbf)
(b) Install a new gasket, and the exhaust manifold with the 5 nuts. Uniformly tighten the nuts in several passes.
Torque: 37 N·m (377 kgf·cm, 27 ft·lbf)
(c) Install the upper heat insulator with the 6 bolts.
Torque: 12 N·m (123 kgf·cm, 9 ft·lbf)



(d) Install the exhaust manifold stay with the 3 bolts.
Torque: 49 N·m (500 kgf·cm, 37 ft·lbf)



20. 2ZZ–GE:
INSTALL EXHAUST MANIFOLD

(a) Install the lower heat insulator with the 4 bolts.
Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)

(b) Install the exhaust manifold with the 3 bolts and 2 nuts.
Torque: 50 N·m (510 kgf·cm, 37 ft·lbf)

(c) Install the upper heat insulator with the 5 bolts.
Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)

(d) Install the exhaust manifold stay withe 4 bolts.
Torque: 50 N·m (510 kgf·cm, 37 ft·lbf)

21. INSTALL EXHAUST PIPE

22. INSTALL ALTERNATOR AND DRIVE BELT
(See page CH–5)

23. CONNECT ACCELERATOR CABLE

24. INSTALL AIR CLEANER ASSEMBLY

25. INSTALL ENGINE ECU BOX

26. INSTALL BATTERY

27. FILL WITH ENGINE COOLANT (See page CO–2)

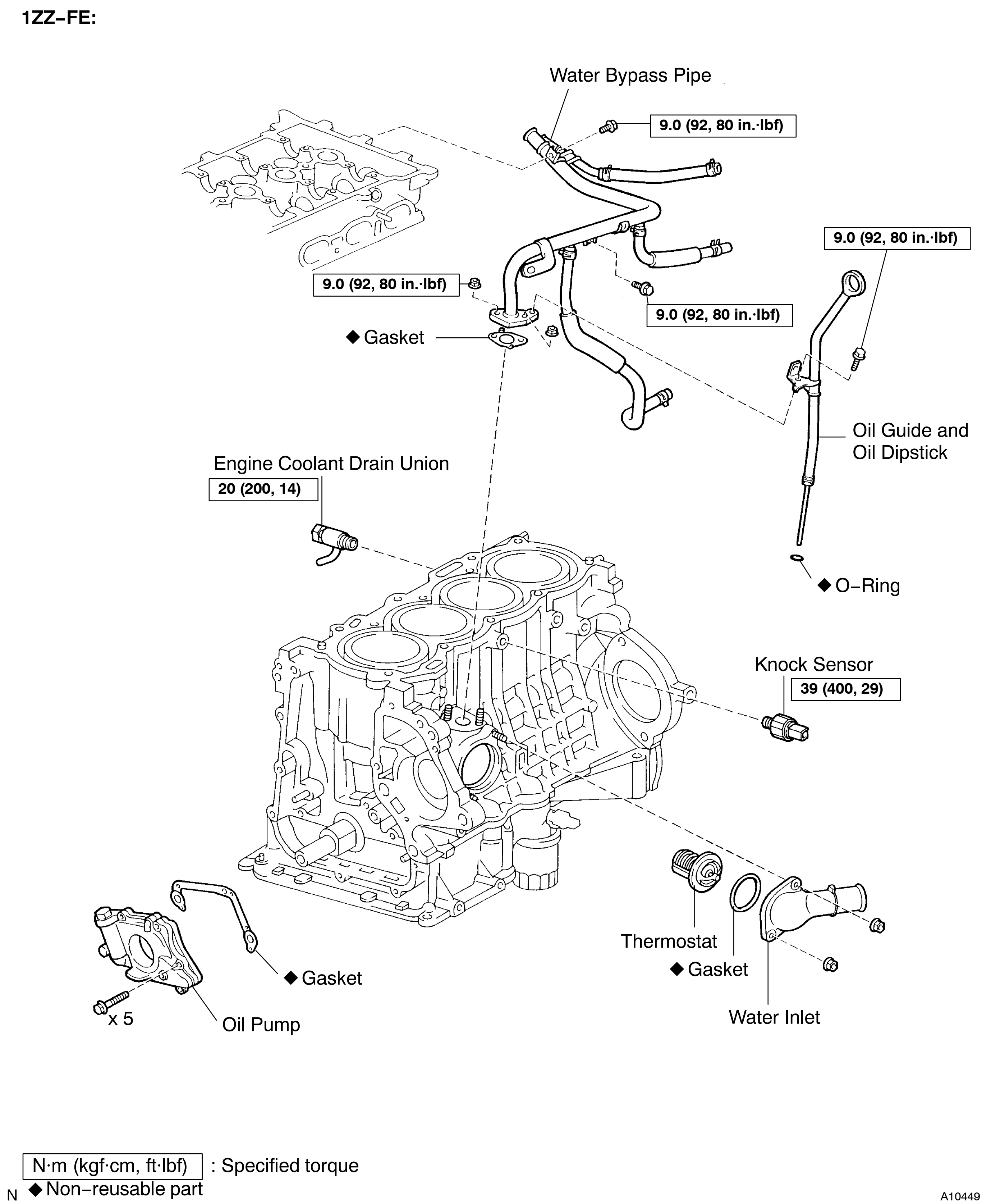
28. START ENGINE AND CHECK FOR LEAKS

29. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL

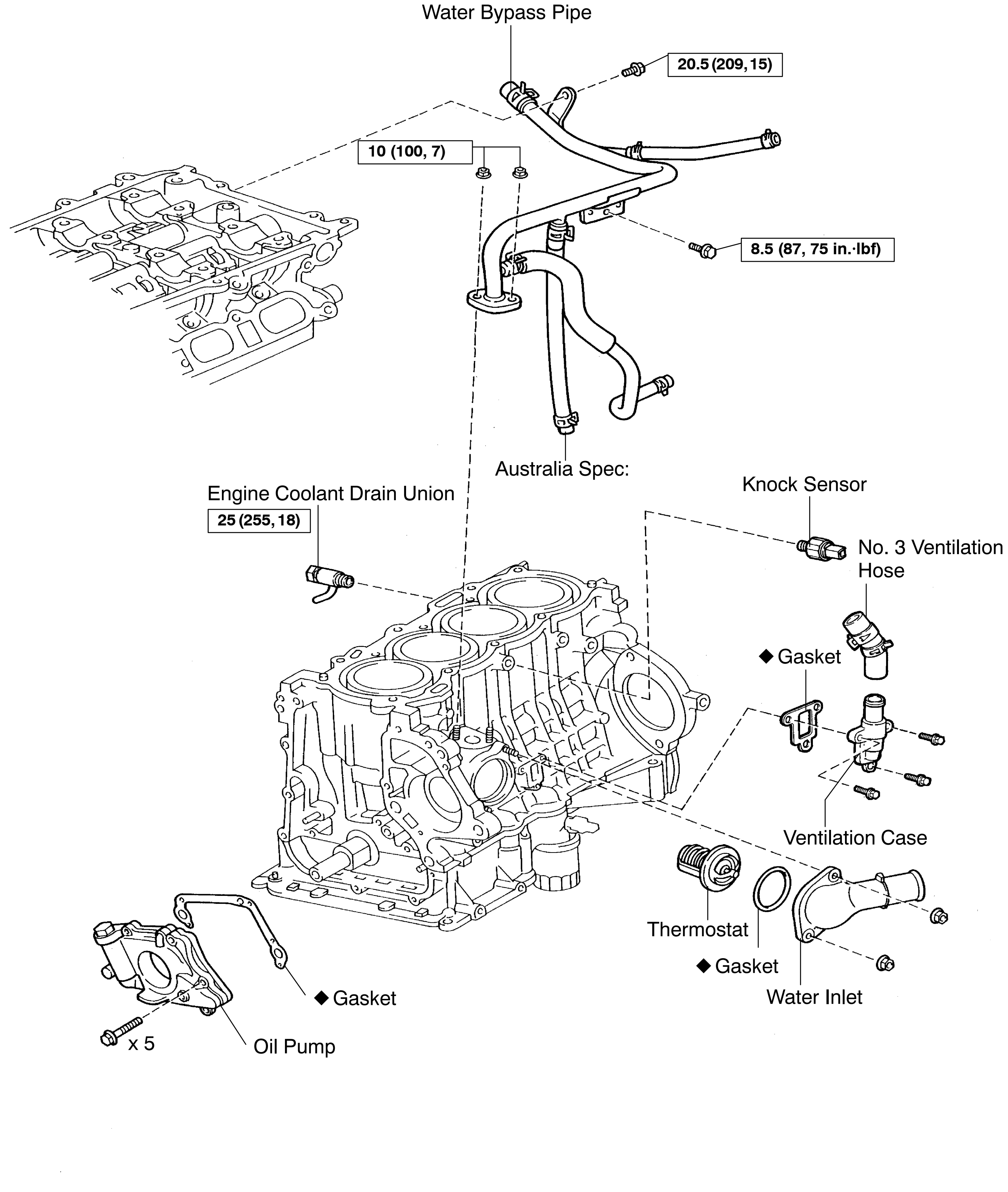
CYLINDER BLOCK

EM162–02

COMPONENTS



2ZZ–GE:

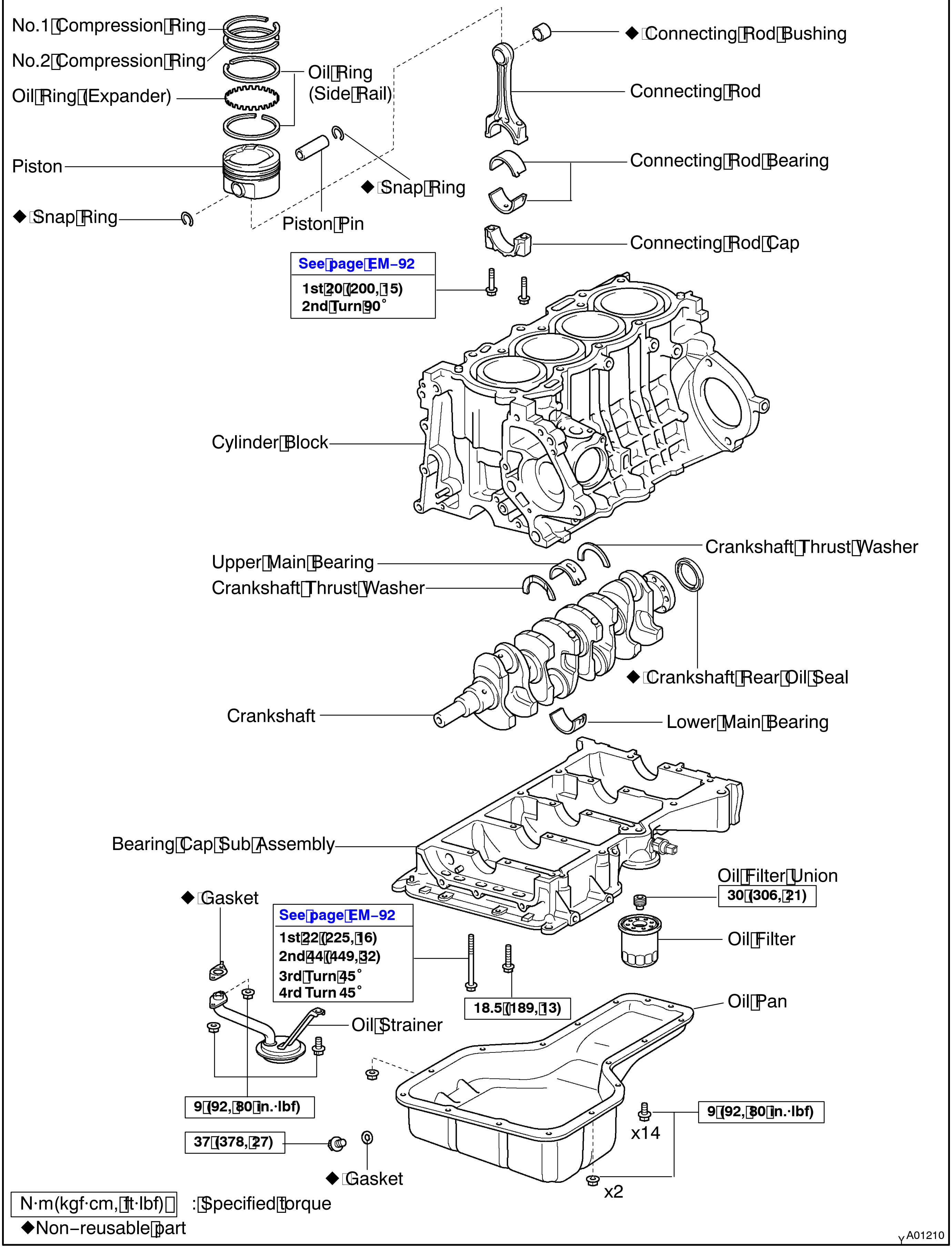


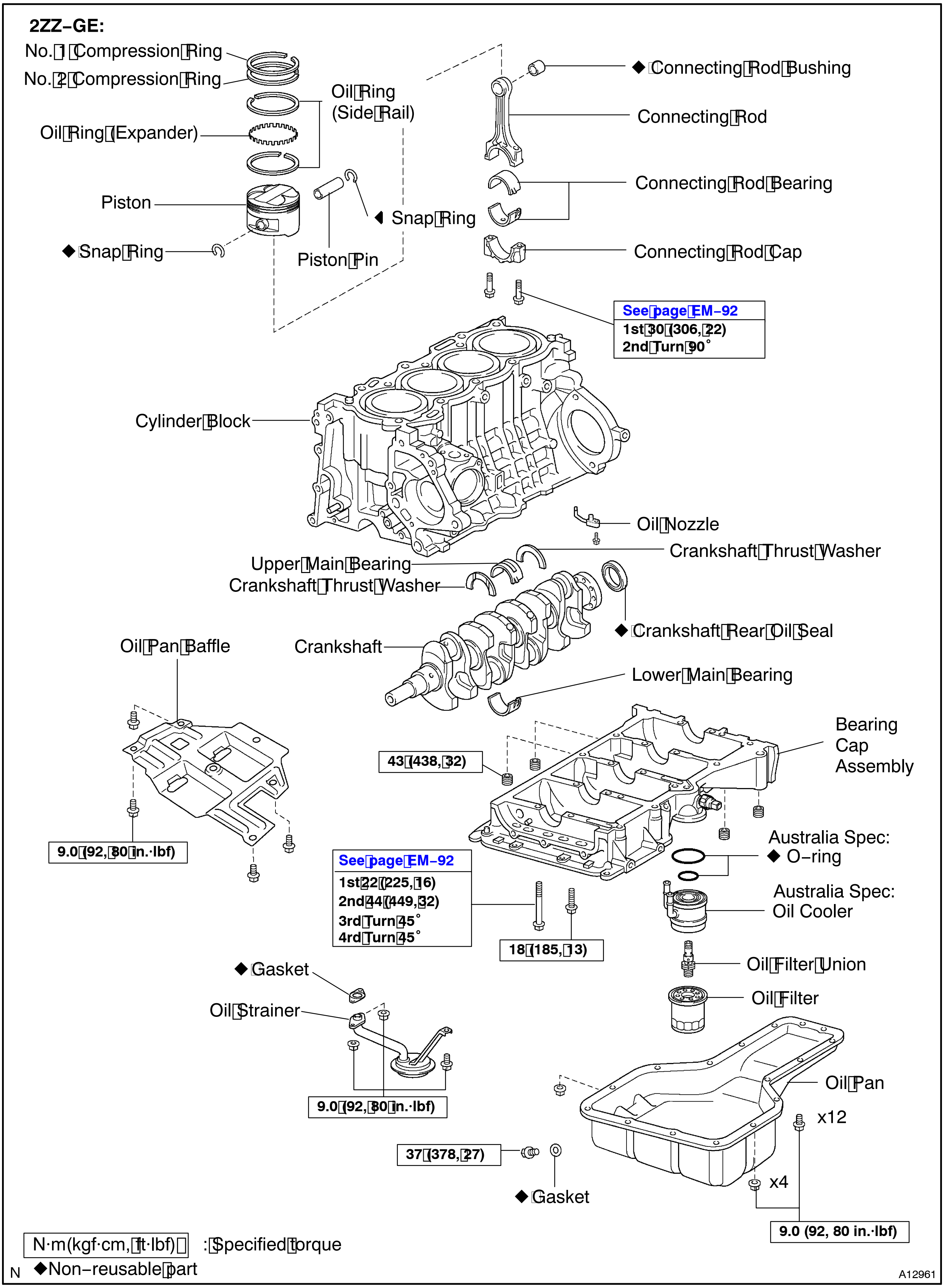
N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non–reusable part

A12960

1ZZ–FE:

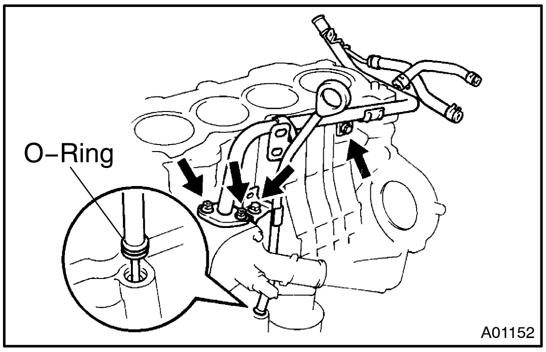

No.1 Compression Ring
No.2 Compression Ring
Oil Ring (Expander)
Oil Ring
(Side Rail)
Piston
◆ Snap Ring
Piston Pin
◆ Snap Ring
◆ Connecting Rod Bushing
Connecting Rod
Connecting Rod Bearing
Connecting Rod Cap
See page EM–92
1st 20 (200, 15)
2nd Turn 90°
Cylinder Block
Crankshaft Thrust Washer
Upper Main Bearing
Crankshaft Thrust Washer
◆ Crankshaft Rear Oil Seal
Crankshaft
Lower Main Bearing
Bearing Cap Sub Assembly
Oil Filter Union
30 (306, 21)
◆ Gasket
See page EM–92
1st 22 (225, 16)
2nd 44 (449, 32)
3rd Turn 45°
4rd Turn 45°
Oil Filter
18.5 (189, 13)
Oil Pan
Oil Strainer
9 (92, 80 in.·lbf)
9 (92, 80 in.·lbf)
x14
37 (378, 27)
◆ Gasket
x2
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
A01210


2ZZ–GE:
No. 1 Compression Ring
No. 2 Compression Ring
Oil Ring (Expander)
Oil Ring (Side Rail)
Piston
◆ Snap Ring
◆ Snap Ring
Piston Pin
◆ Connecting Rod Bushing
Connecting Rod
Connecting Rod Bearing
Connecting Rod Cap
See page EM–92
1st 30 (306, 22)
2nd Turn 90°
Cylinder Block
Oil Nozzle
Crankshaft Thrust Washer
Upper Main Bearing
Crankshaft Thrust Washer
◆ Crankshaft Rear Oil Seal
Oil Pan Baffle
Crankshaft
Lower Main Bearing
Bearing Cap Assembly
43 (438, 32)
9.0 (92, 80 in.·lbf)
See page EM–92
1st 22 (225, 16)
2nd 44 (449, 32)
3rd Turn 45°
4rd Turn 45°
18 (185, 13)
Australia Spec:
◆ O–ring
Australia Spec:
Oil Cooler
Oil Filter Union
Oil Filter
◆ Gasket
Oil Strainer
9.0 (92, 80 in.·lbf)
Oil Pan
x12
x4
37 (378, 27)
◆ Gasket
9.0 (92, 80 in.·lbf)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
N
A12961

EM163–02

DISASSEMBLY

1. M/T:
   REMOVE FLYWHEEL
2. A/T:
   REMOVE DRIVE PLATE
3. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
4. REMOVE TIMING CHAIN AND SPROCKETS
   (See page EM–19)
5. REMOVE ENGINE WIRE
6. REMOVE CYLINDER HEAD
   (See page EM–43)



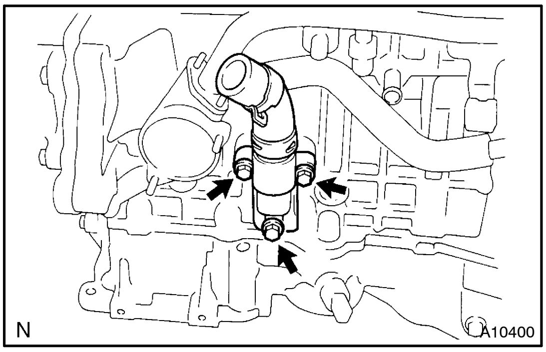
7. 1ZZ–FE:
   REMOVE OIL DIPSTICK AND GUIDE

(a) Remove the bolt and oil dipstick and guide.
(b) Remove the O–ring from the dipstick.

8. REMOVE WATER BYPASS PIPE

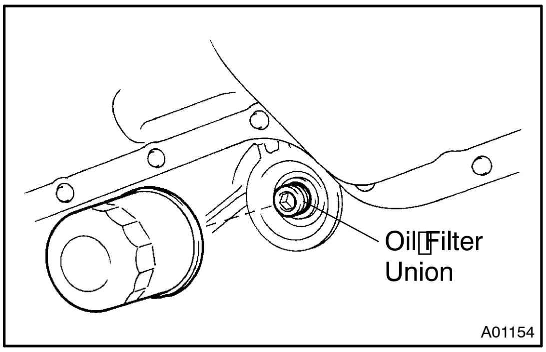
Remove the 2 nuts, bolts and water bypass pipe.

9. REMOVE THERMOSTAT
   (See page CO–9)
10. REMOVE KNOCK SENSOR
11. REMOVE ENGINE COOLANT DRAIN UNION
12. REMOVE OIL PUMP
   (See page LU–9)



13. 2ZZ–GE:
   REMOVE VENTILATION CASE

(a) Remove the 3 nuts, ventilation case and gasket.
(b) Remove the clip and No. 3 ventilation hose.



14. REMOVE OIL FILTER

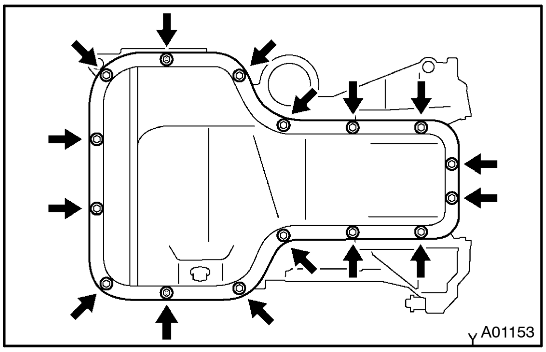
(See page LU–3)

15. Australia spec:
REMOVE OIL COOLER

(See page LU–15)

16. REMOVE OIL FILTER UNION

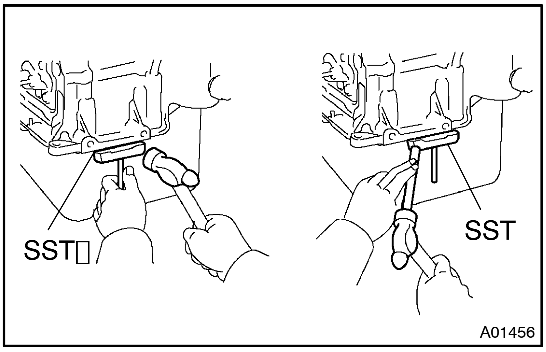
Using a 12 mm hexagon wrench, remove the oil filter union.



17. REMOVE OIL PAN

(a) 1ZZ–FE:
Remove the 14 bolts and 2 nuts.

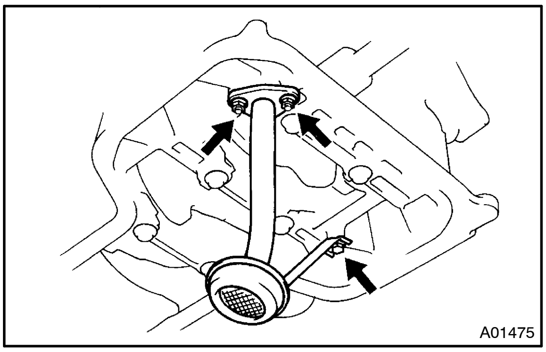
(b) 2ZZ–GE:
Remove the 12 bolts and 4 nuts.



(c) Insert the blade of SST between the bearing cap sub–assembly and oil pan, and cut off applied sealer and remove the oil pan.
SST 09032–00100

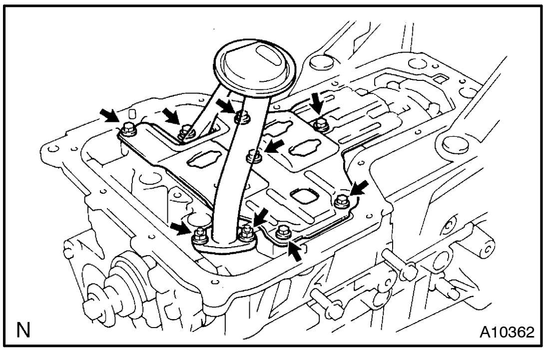
NOTICE:

- **Be careful not to the damage the oil pan contact surface of the bearing cap sub–assembly.**
- **Be careful not to damage the oil pan flange.**



18. 1ZZ–FE:
REMOVE OIL STRAINER

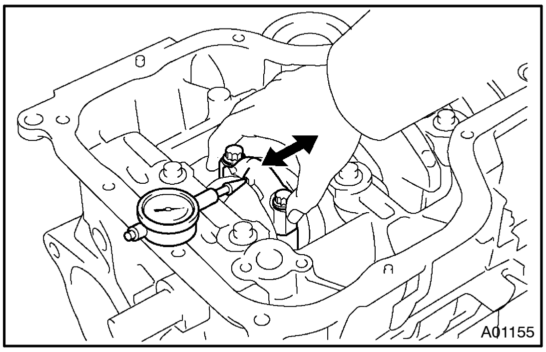
Remove the 2 nuts, bolt, oil strainer and gasket.



19. 2ZZ–GE:
REMOVE OIL STRAINER AND OIL PAN BAFFLE

(a) Remove the 2 nuts, bolt, oil strainer and gasket.

(b) Remove the 4 bolts, 2 nuts and oil pan baffle.



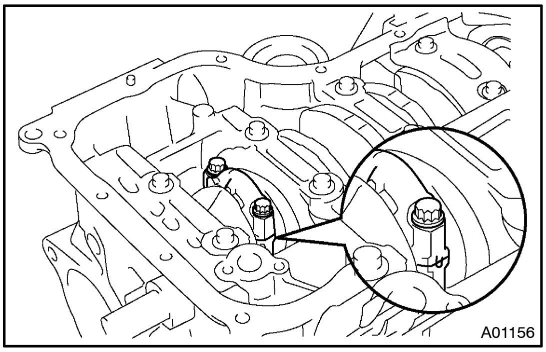
20. CHECK CONNECTING ROD THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance:
0.160 – 0.342 mm (0.0063 – 0.0135 in.)
Maximum thrust clearance:
0.342 mm (0.0135 in.)

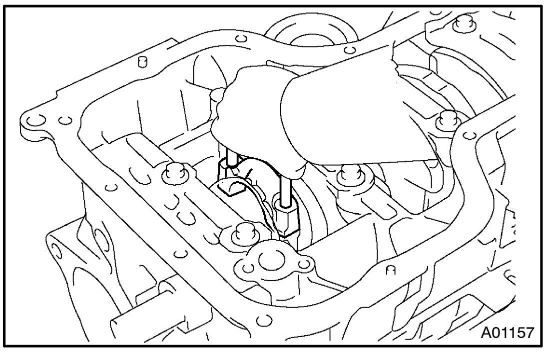
If the thrust clearance is greater than maximum, replace the connecting rod assembly(s). If necessary, replace the crankshaft.

Connecting rod thickness:
19.788 – 19.840 mm (0.7791 – 0.7811 in.)



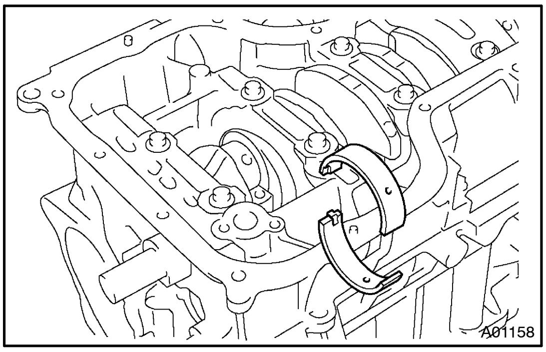
21. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

(a) Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
(b) Remove the 2 connecting rod cap bolts.



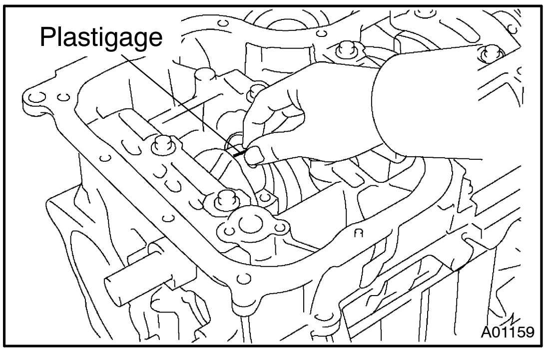
(c) Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

HINT:
Keep the lower bearing inserted with the connecting rod cap.

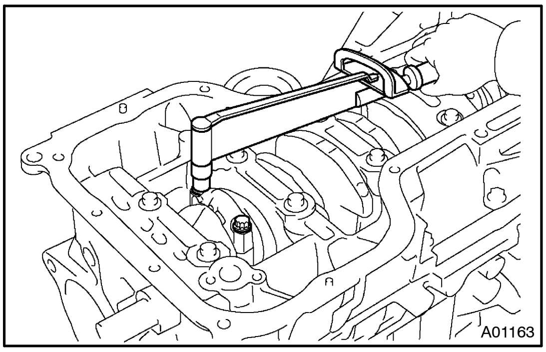


(d) Clean the crank pin and bearing.
(e) Check the crank pin and bearing for pitting and scratches.

If the crank pin or bearing is damaged, replace the bearings.
If necessary, replace the crankshaft.



(f) Lay a strip of Plastigage the crank pin.

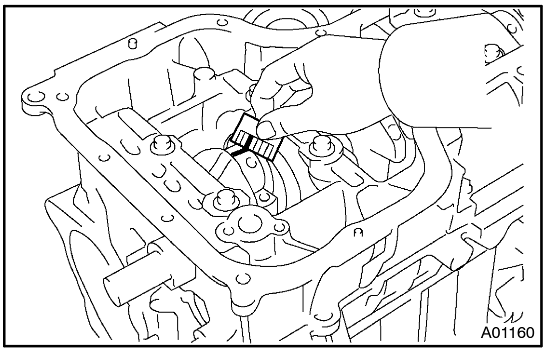


(g) Install the connecting rod cap with the 2 bolts.
(See page EM–92)

Torque:
1st:
1ZZ–FE: 20 N·m (204 kgf·cm, 15 ft·lbf)
2ZZ–GE: 30 N·m (306 kgf·cm, 22 ft·lbf)
2nd: Turn extra 90°

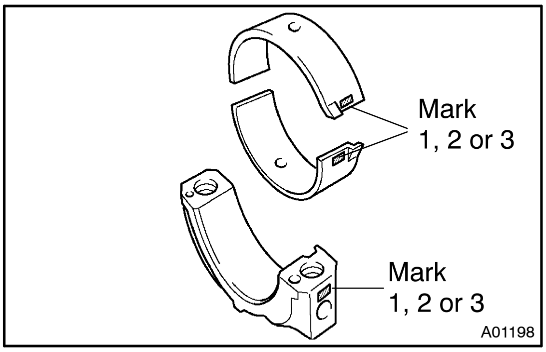
NOTICE:
Do not turn the crankshaft.

(h) Remove the 2 bolts, connecting rod cap and lower bearing. (See procedure (b) and (c) above)



(i) Measure the Plastigage at its widest point.
Standard oil clearance:
1ZZ–FE:
0.028 – 0.060 mm (0.0011 – 0.0024 in.)
2ZZ–GE:
0.028 – 0.052 mm (0.0011 – 0.0020 in.)
Maximum oil clearance;
0.08 mm (0.0031 in.)

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



HINT:
If replacing a bearing, replace it with one having the same number as marked on the connecting rod. There are 3 sizes of standard bearings, marked ”1”, ”2” and ”3” accordingly.

Reference

Standard bearing center wall thickness

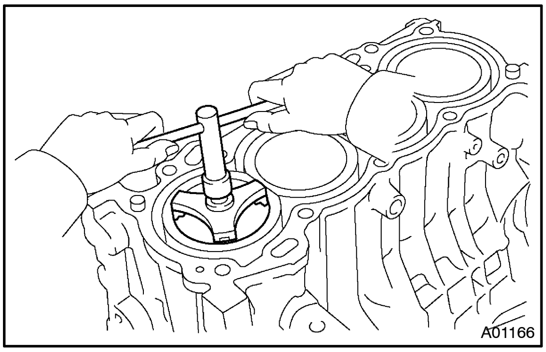
1ZZ–FE:

Mark	mm (in.)
”1”	1.486 – 1.490 (0.0585 – 0.0587)
”2”	1.490 – 1.494 (0.0587 – 0.0588)
”3”	1.494 – 1.498 (0.0588 – 0.0590)

2ZZ–GE:

Mark	mm (in.)
”1”	1.482 – 1.486 (0.0583 – 0.0585)
”2”	1.486 – 1.490 (0.0585 – 0.0587)
”3”	1.490 – 1.494 (0.0587 – 0.0588)

(j) Completely remove the Plastigage.

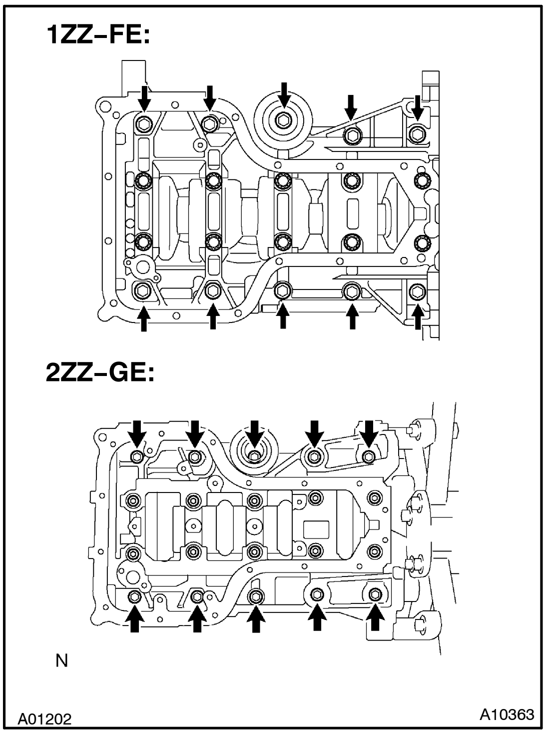


22. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

(a) Using a ridge reamer, remove all the carbon from the top of the cylinder.

(b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:
- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.

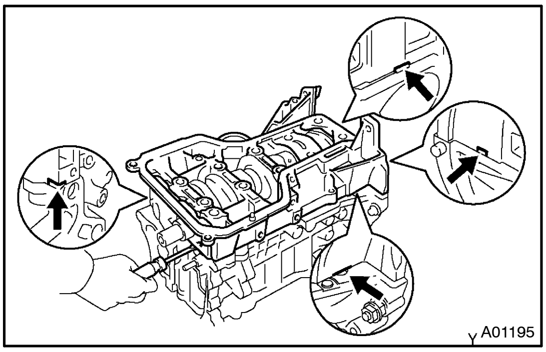


23. REMOVE BEARING CAP SUB–ASSEMBLY AND CRANKSHAFT REAR OIL SEAL, AND CHECK OIL CLEARANCE

(a) 2ZZ–GE:
Remove the 4 screw plugs from the bearing cap sub–assembly.

(b) Remove the 10 hexagon head bearing cap sub–assembly bolts.

(c) Uniformly loosen and remove the 10 bearing cap sub–assembly bolts, in several passes, in the sequence shown.



(d) Using a screwdriver, remove the bearing cap sub–assembly by prying the portions between the cylinder block and bearing cap sub–assembly. Remove the 5 lower main bearings.

NOTICE:

Be careful not to damage the contact surfaces of the cylinder block and bearing cap sub–assembly.

HINT:

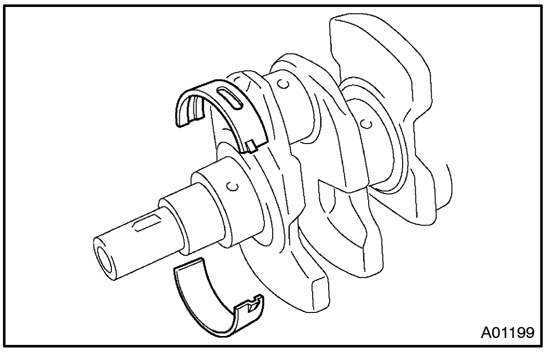
Keep the lower bearing and bearing cap sub–assembly together.

(e) Remove the crankshaft rear oil seal.

(f) Lift out the crankshaft.

HINT:

Keep the upper bearings together with the cylinder block.

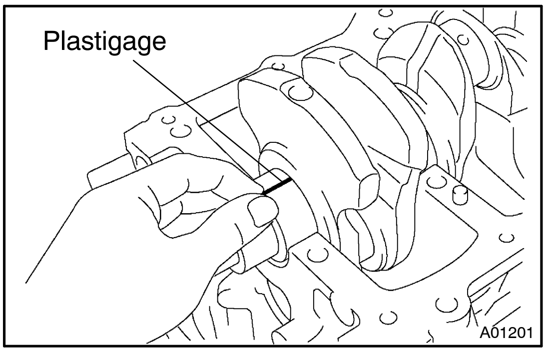


(g) Clean each main journal and bearing.

(h) Check each main journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings.

If necessary, replace the crankshaft.



(i) Place the crankshaft on the cylinder block.

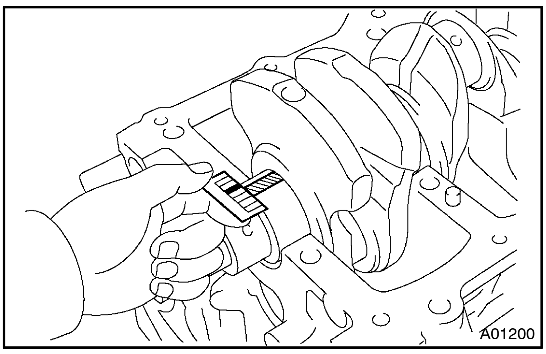
(j) Lay a strip of Plastigage across each journal.

(k) Install the bearing cap sub–assembly.
(See page EM–92)

NOTICE:

Do not turn the crankshaft.

(l) Remove the bearing cap sub–assembly.
(See procedures (a) to (e) above)



(m) Measure the Plastigage at its widest point.

Standard oil clearance:

1ZZ–FE:

0.015 – 0.032 mm (0.0006 – 0.0013 in.)

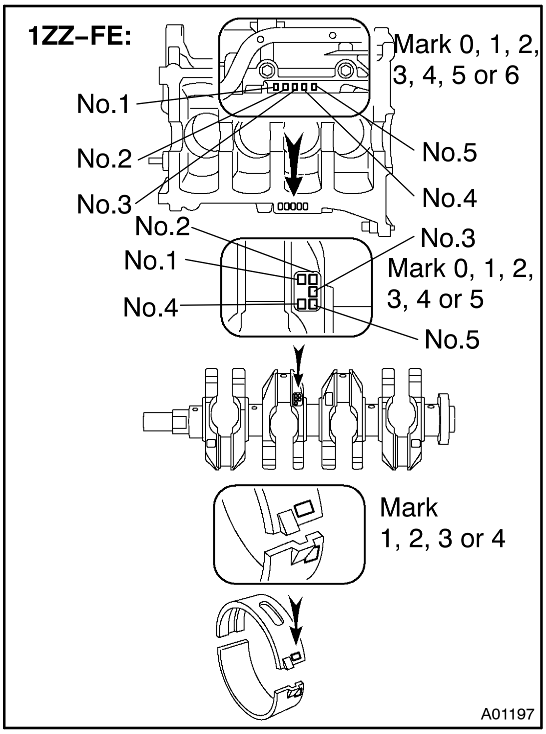
2ZZ–GE:

0.016 – 0.032 mm (0.0006 – 0.0013 in.)

Maximum oil clearance:

0.050 mm (0.0020 in.)

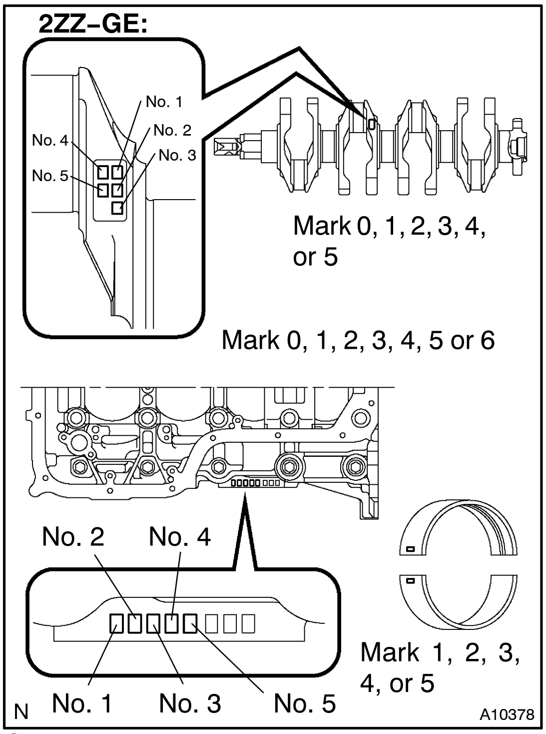
If the oil clearance is greater then maximum, replace the bearings. If necessary, replace the crankshaft.



(n) 1ZZ–FE:
If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then selecting the bearing with the same number as the total. There are 4 sizes of standard bearings, marked ”1”, ”2”, ”3” and ”4” accordingly.

	Total number		” ”: Number mark	
Cylinder block (A) + Crankshaft (B)	0 – 2	3 – 5	6 – 8	9 –11
Use bearing	”1”	”2”	”3”	”4”

EXAMPLE: Cylinder block ”4” (A)
+ Crankshaft ”3” (B)
= Total number 7 (Use bearing ”3”)



(o) 2ZZ–GE:
If using standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, refer to the following table to select bearing.

Standard bearings selection chart

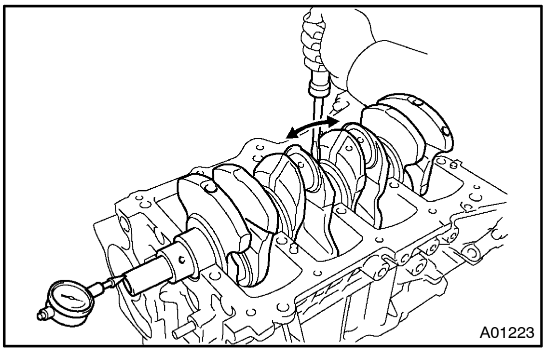
Cylinder block Number mark	Crank shaft number mark					
	0	1	2	3	4	5
0	1	1	1	2	2	2
1	1	1	2	2	2	3
2	1	2	2	2	3	3
3	2	2	2	3	3	3
4	2	3	3	3	4	4
5	3	3	3	4	4	4
6	3	3	4	4	4	5

EXAMPLE: Cylinder block ”4”, Crank shaft ”3”, Use bearing ”3”

Reference

Item	Mark	mm (in.)
Cylinder block main journal bore diameter (A)	”0” ”1” ”2” ”3” ”4” ”5” ”6”	52.000 – 52.003 (2.0472 – 2.0473) 52.003 – 52.005 (2.0473 – 2.0474) 52.005 – 52.007 (2.0474 – 2.0475) 52.007 – 52.010 (2.0475 – 2.0476) 52.010 – 52.012 (2.0476 – 2.0477) 52.012 – 52.014 (2.0477 – 2.0478) 52.014 – 52.016 (2.0478 – 2.0479)
Crankshaft main journal diameter (B)	”0” ”1” ”2” ”3” ”4” ”5”	47.998 – 48.000 (1.8897 – 1.8898) 47.996 – 47.998 (1.8896 – 1.8897) 47.994 – 47.996 (1.8895 – 1.8896) 47.992 – 47.994 (1.8894 – 1.8895) 47.990 – 47.992 (1.8893 – 1.8894) 47.988 – 47.990 (1.8892 – 1.8893)
1ZZ–FE: Standard bearing center wall thickness	”1” ”2” ”3” ”4”	1.993 – 1.996 (0.0785 – 0.0786) 1.996 – 1.999 (0.0786 – 0.0787) 1.999 – 2.002 (0.0787 – 0.0788) 2.002 – 2.005 (0.0788 – 0.0789)
2ZZ–GE Standard bearing center wall thickness	”1” ”2” ”3” ”4” ”5”	1.989 – 1.992 (0.0783 – 0.0784) 1.992 – 1.995 (0.0784 – 0.0785) 1.995 – 1.998 (0.0785 – 0.0787) 1.998 – 2.001 (0.0787 – 0.0788) 2.001 – 2.004 (0.0788 – 0.0789)

(p) Completely remove the Plastigage.



24. CHECK CRANKSHAFT THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:
0.04 – 0.24 mm (0.0016 – 0.0094 in.)
Maximum thrust clearance:
0.30 mm (0.0118 in.)

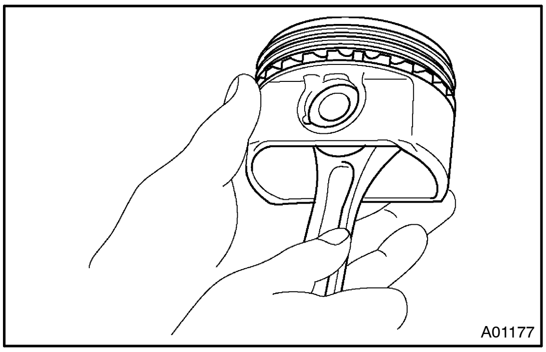
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:
2.430 – 2.480 mm (0.0957 – 0.0976 in.)

25. REMOVE CRANKSHAFT

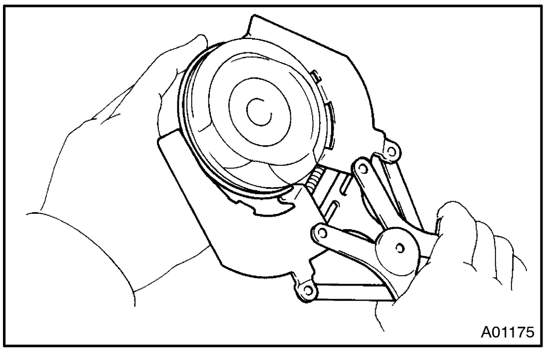
(a) Lift out the crankshaft.
(b) Remove the 5 upper main bearings and 2 thrust washers from the cylinder block.

HINT:
Arrange the main bearings and thrust washers in the correct order.


A01177

26. CHECK FIT BETWEEN PISTON AND PISTON PIN

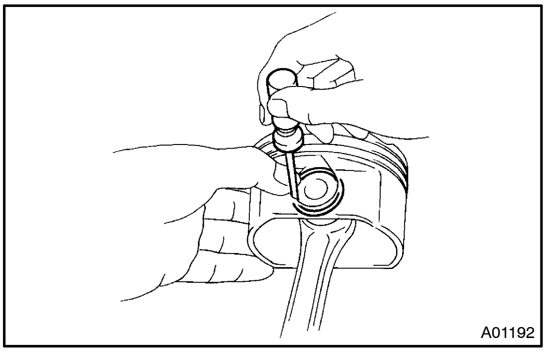
Try to move the piston back and forth on the piston pin.
If any movement is felt, replace the piston and pin as a set.


A01175

27. REMOVE PISTON RINGS

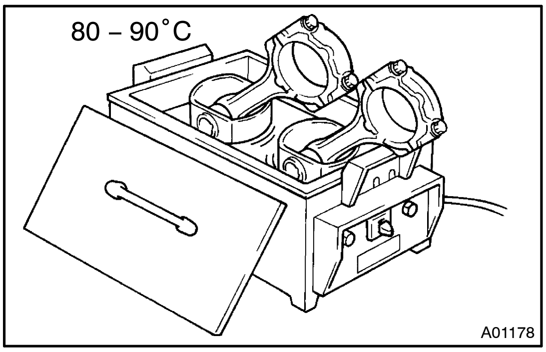
(a) Using a piston ring expander, remove the 2 compression rings.
(b) Remove the 2 side rails and oil ring by hand.

HINT:
Arrange the piston rings in the correct order only.


A01192

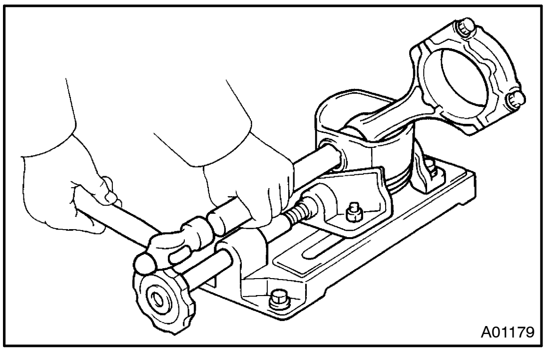
28. DISCONNECT CONNECTING ROD FROM PISTON

(a) Using a small screwdriver, pry out the 2 snap rings.



A01178

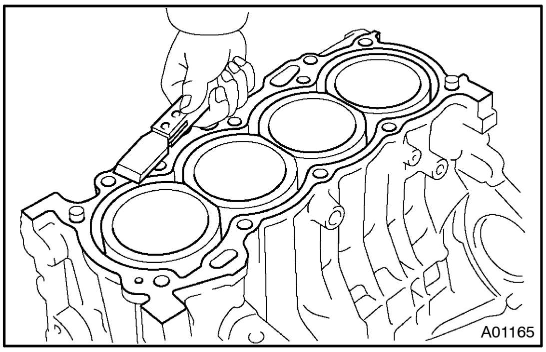
(b) 1ZZ–FE:
Gradually heat the piston to 80 – 90°C (176 – 194°F).


A01179

(c) 1ZZ–FE:
Using a plastic–faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

HINT:
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.

(d) 2ZZ–GE:
Remove the pin and connecting rod from the piston.



EM164–01

INSPECTION

1. REMOVE GASKET MATERIAL

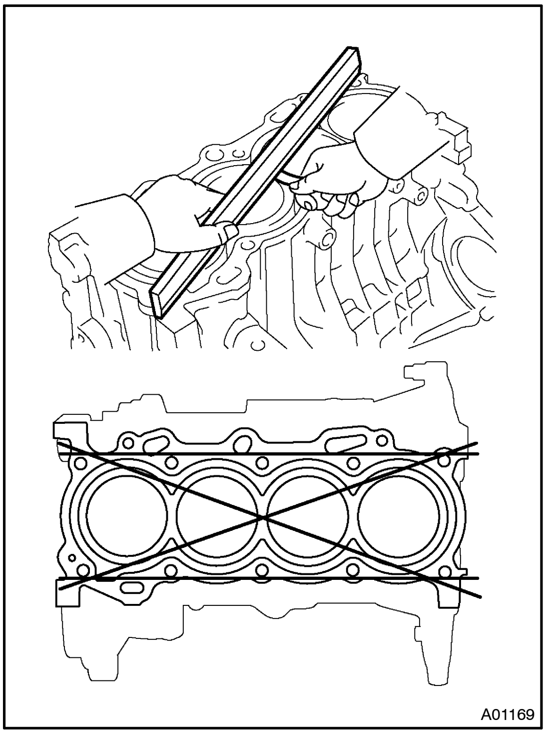
Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

2. CLEAN CYLINDER BLOCK

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

NOTICE:

If the cylinder is washed at high temperatures, the cylinder liner sticks out beyond the cylinder block, so always wash the cylinder block at a temperature of 45°C (133°F) or less.

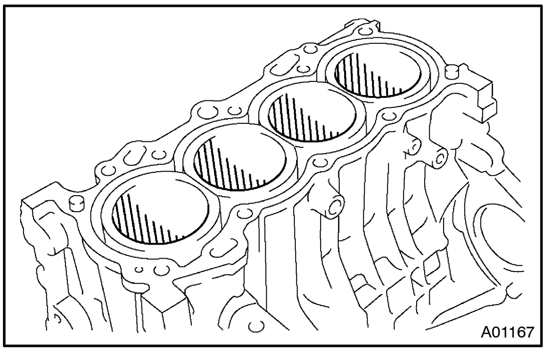


3. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage: 0.05 mm (0.0020 in.)

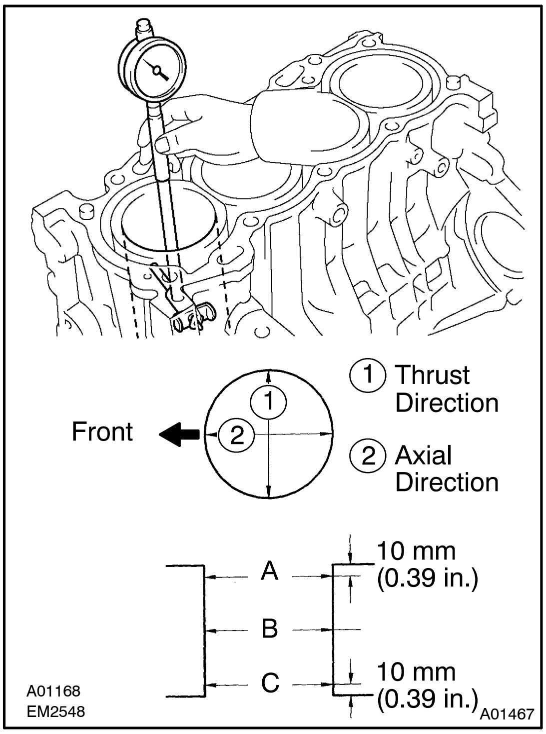
If warpage is greater than maximum, replace the cylinder block.



4. INSPECT CYLINDER BORE DIAMETER

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.

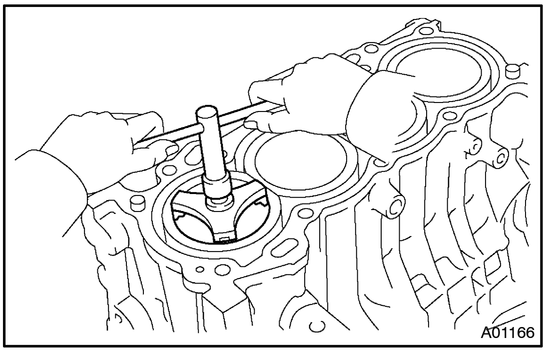


5. INSPECT CYLINDER BORE DIAMETER

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

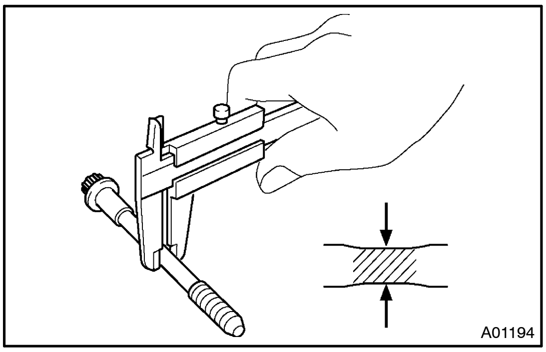
Standard diameter:
1ZZ–FE 79.000 – 79.013 mm (3.1102 – 3.1107 in.)
2ZZ–GE 82.000 – 82.013 mm (3.2283 – 3.2289 in.)
Maximum diameter:
1ZZ–FE 79.013 mm (3.1107 in.)
2ZZ–GE 82.013 mm (3.2289 in.)

If the diameter is greater than maximum, replace the cylinder block.



6. REMOVE CYLINDER RIDGE

If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.

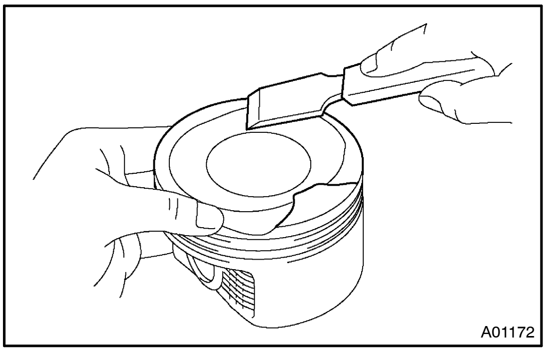


7. INSPECT 12 POINTED HEAD BEARING CAP SUB–ASSEMBLY BOLTS

Using vernier calipers, measure the tension portion diameter of the bolt.

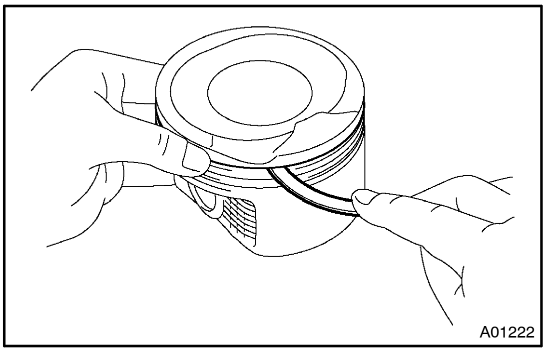
Standard diameter: 7.3 – 7.5 mm (0.287 – 0.295 in.)
Minimum diameter: 7.3 mm (0.287 in.)

If the diameter is less than minimum, replace the bolt.

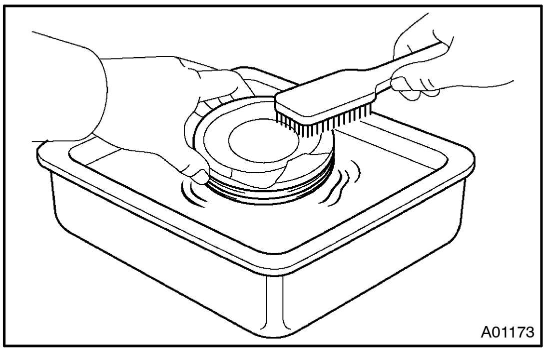


8. CLEAN PISTON

(a) Using a gasket scraper, remove the carbon from the piston top.

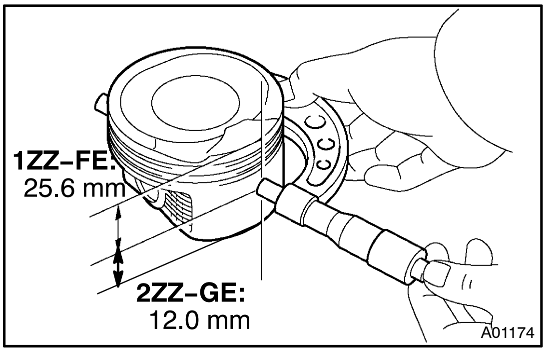

A01222

(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.


A01173

(c) Using solvent and a brush, thoroughly clean the piston.

NOTICE:
Do not use a wire brush.



A01174

9. INSPECT PISTON OIL CLEARANCE

(a) 1ZZ−FE:
Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 25.6 mm (1.008 in.) from the piston head.

(b) 2ZZ−GE:
Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 12.0 mm (0.048 in.) from the piston bottom.

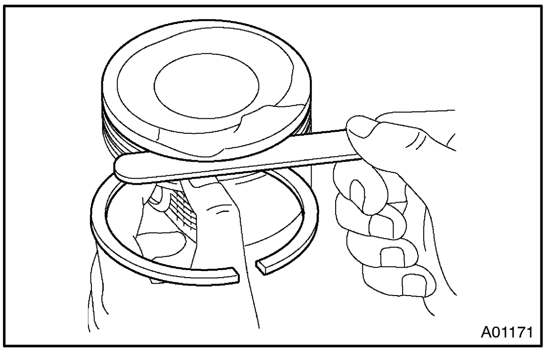
Piston diameter:
1ZZ−FE:
78.925 – 78.935 mm (3.1073 – 3.1077 in.)
2ZZ−GE:
81.975 – 81.993 mm (3.2274 – 3.2281 in.)

(c) Measure the cylinder bore diameter in the thrust directions (See procedure in step 5).

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

Standard oil clearance:
1ZZ−FE:
0.065 – 0.088 mm (0.0026 – 0.0035 in.)
2ZZ−GE:
0.007 – 0.038 mm (0.0003 – 0.0015 in.)
Maximum oil clearance:
0.10 mm (0.0039 in.)

If the oil clearance is greater than maximum, replace all the 4 pistons. If necessary, replace the cylinder block.

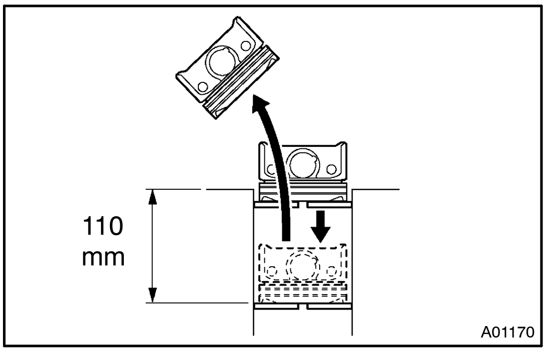


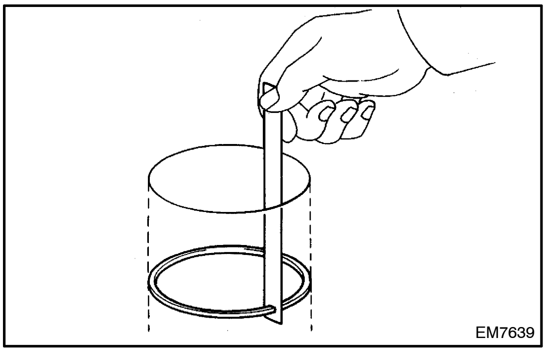
10. INSPECT PISTON RING END GAP

Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

Ring groove clearance:
0.030 – 0.070 mm (0.0012 – 0.0028 in.)

If the clearance is not as specified, replace the piston.



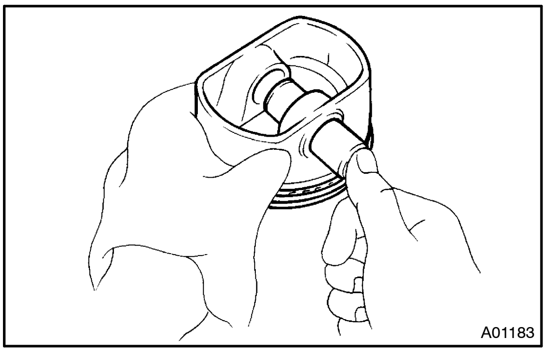


11. INSPECT PISTON RING END GAP

(a) Insert the piston ring into the cylinder bore.
(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.
(c) Using a feeler gauge, measure the end gap.

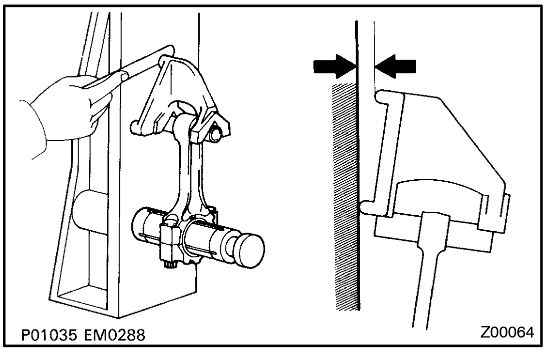
Standard end gap:
No.1 0.25 – 0.35 mm (0.0098 – 0.0138 in.)
No.2 0.35 – 0.50 mm (0.0138 – 0.0197 in.)
Oil (Side rail) 0.15 – 0.40 mm (0.0059 – 0.0157 in.)
Maximum end gap:
No.1 1.05 mm (0.0413 in.)
No.2 1.20 mm (0.0472 in.)
Oil (Side rail) 1.05 mm (0.0413 in.)

If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, replace the cylinder block.



12. INSPECT PISTON PIN FIT

At 80 – 90°C (176 – 194°F), you should be able to push the piston pin into the piston pin hole with your thumb.



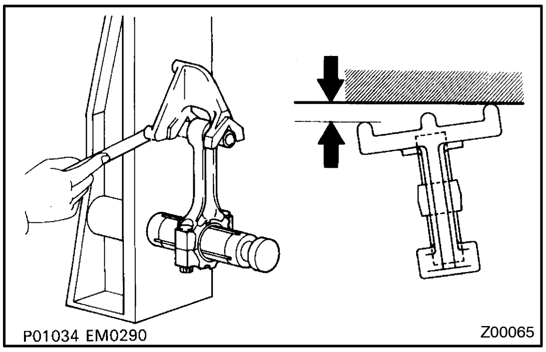
13. INSPECT CONNECTING ROD ALIGNMENT

Using a rod aligner and feeler gauge, check the connecting rod alignment.

- Check for out–of–alignment

Maximum out–of alignment:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

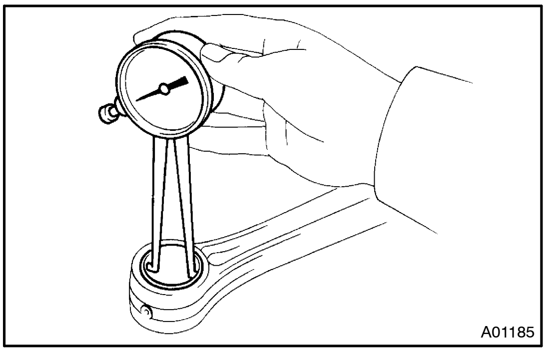
If out–of alignment is greater than maximum, replace the connecting rod assembly.



- Check for twist

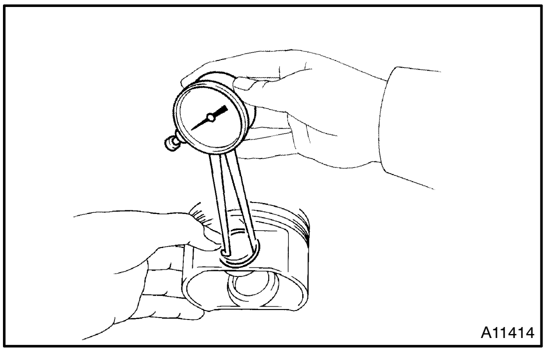
Maximum twist:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

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

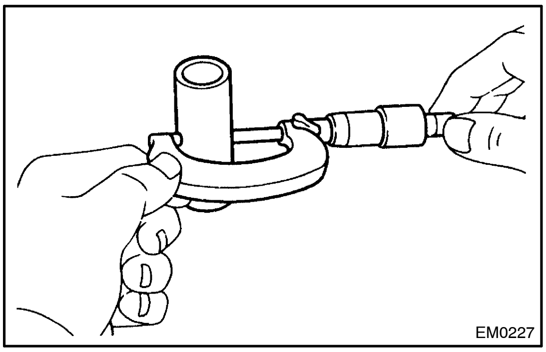


14. INSPECT PISTON PIN OIL CLEARANCE

(a) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.
Bushing inside diameter:
1ZZ–FE 20.012 – 20.021 mm (0.7879 – 0.7882 in.)
2ZZ–GE 20.011 – 20.023 mm (0.7878 – 0.7883 in.)



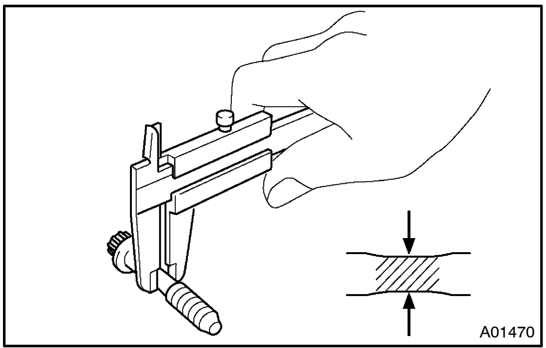
(b) 2ZZ–GE:
Using caliper gauge, measure the inside diameter of the piston bushing.
Bushing inside diameter:
20.013 – 20.025 mm (0.7879 – 0.7884 in.)



(c) Using a micrometer, measure the piston pin diameter.
Piston pin diameter:
1ZZ–FE 20.004 – 20.013 mm (0.7876 – 0.7879 in.)
2ZZ–GE 20.004 – 20.016 mm (0.7876 – 0.7880 in.)

(d) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.
Standard oil clearance:
1ZZ–FE 0.005 – 0.011 mm (0.0002 – 0.0004 in.)
2ZZ–GE
Piston x Piston pin
0.005 – 0.013 mm (0.0002 – 0.0005 in.)
Piston pin x Connecting rod
0.005 – 0.009 mm (0.0002 – 0.0004 in.)
Maximum oil clearance:
0.05 mm (0.0020 in.)

If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set.



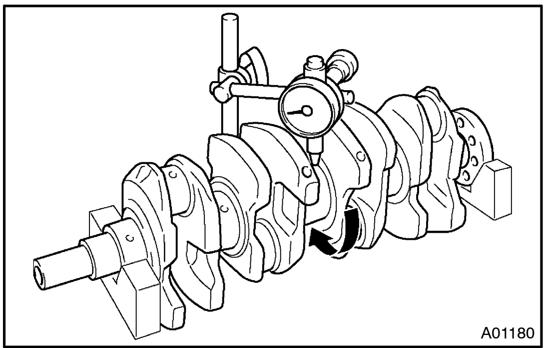
15. INSPECT CONNECTING ROD BOLTS

Using a vernier calipers, measure the tension portion diameter of the bolt.

Standard diameter: 6.6 – 6.7 mm (0.260 – 0.264 in.)

Minimum diameter: 6.4 mm (0.252 in.)

If the diameter is less than minimum, replace the bolt.



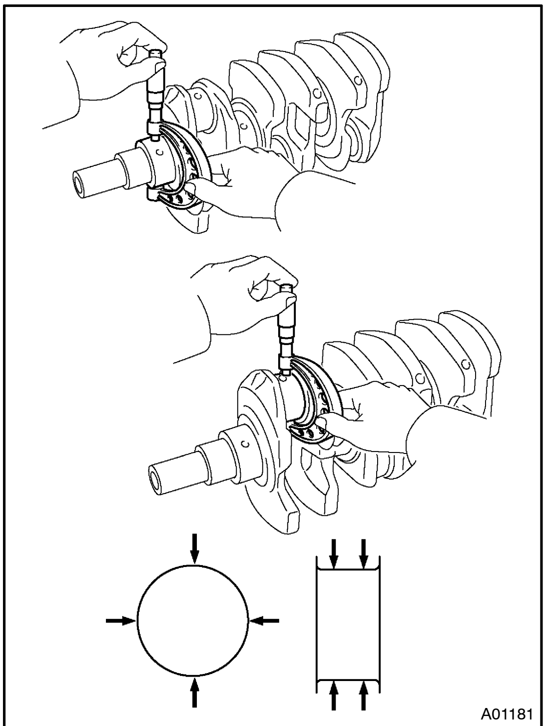
16. INSPECT CRANKSHAFT FOR CIRCLE RUNOUT

(a) Place the crankshaft on V–blocks.

(b) Using a dial indicator, measure the circle runout, as shown in the illustration.

Maximum circle runout: 0.03 mm (0.0012 in.)

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



17. INSPECT MAIN JOURNALS AND CRANK PINS

(a) Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter:
47.988 – 48.000 mm (1.8893 – 1.8898 in.)
Crank pin diameter:
1ZZ–FE:
43.992 – 44.000 mm (1.7320 – 1.7323 in.)
2ZZ–GE:
44.992 – 45.000 mm (1.7713 – 1.7717 in.)

If the diameter is not as specified, check the oil clearance (See page EM–75).

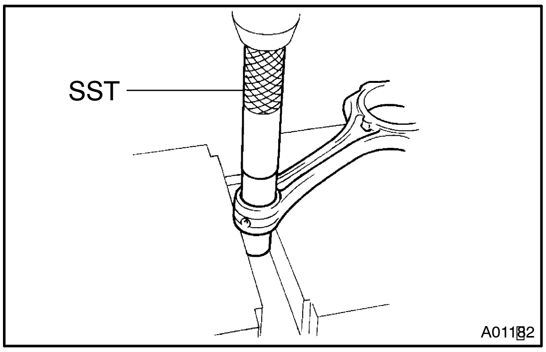
If necessary, replace the crankshaft.

(b) Check each main journal and crank pin for taper and out–of–round as shown.

Maximum taper and out–of–round:
0.02 mm (0.0008 in.)

If the taper and out–of round is greater than maximum, replace the crankshaft.

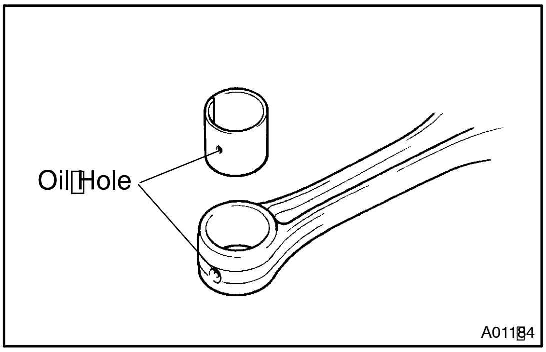
EM066–03



REPLACEMENT

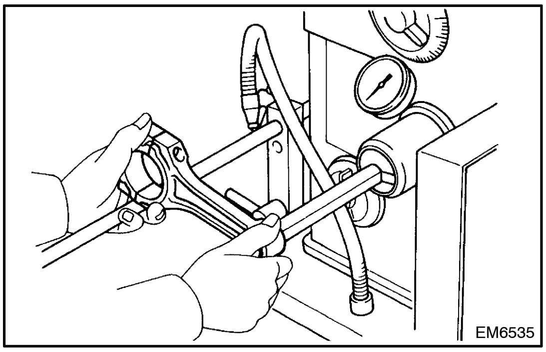
1. REPLACE CONNECTING ROD BUSHINGS

(a) Using SST and a press, press out the bushing.
SST 09222–30010

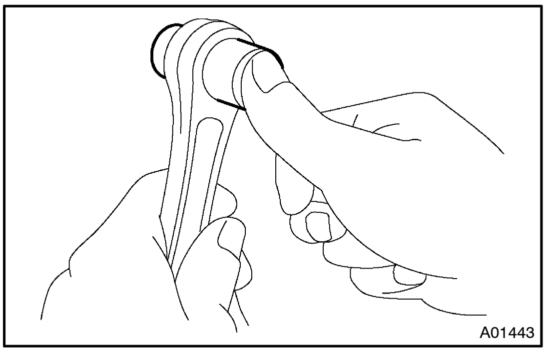


(b) Align the oil hoses of a new bushing and the connecting rod.

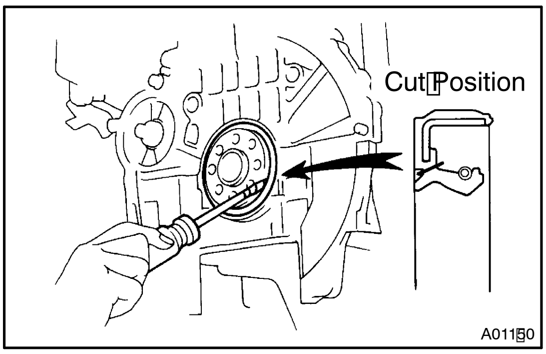
(c) Using SST and a press, press in the bushing.
SST 09222–30010



(d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (See page EM–84) between the bushing and piston pin.



(e) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.



2. REPLACE CRANKSHAFT REAR OIL SEAL

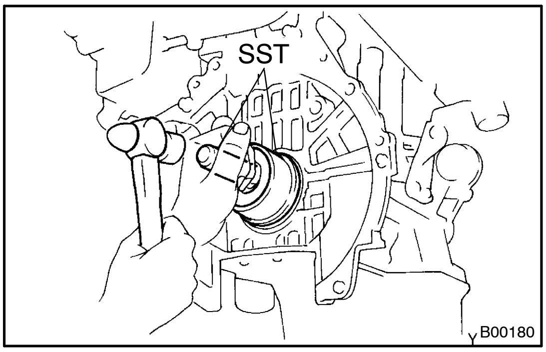
If rear oil seal is installed to cylinder block.

(a) Using a knife cut off the oil seal lip.

(b) Using a screwdriver, pry out the oil seal.

NOTICE:

Be careful not to damage the crankshaft. Tape the screwdriver tip.



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

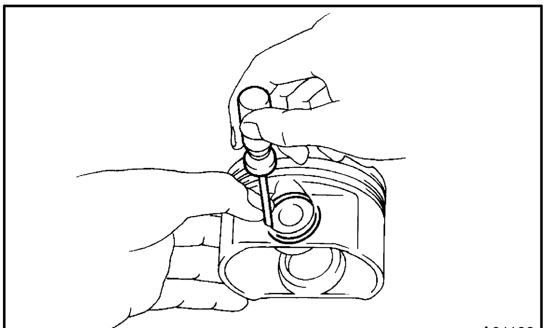
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–15030, 09950–70010 (09951–07100)

EM165–02

REASSEMBLY

HINT:

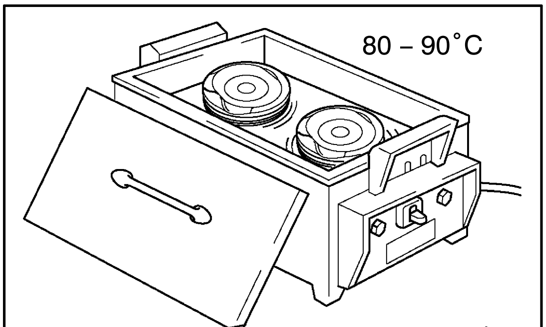
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O–rings and oil seals with new parts.


A01193

1. ASSEMBLE PISTON AND CONNECTING ROD

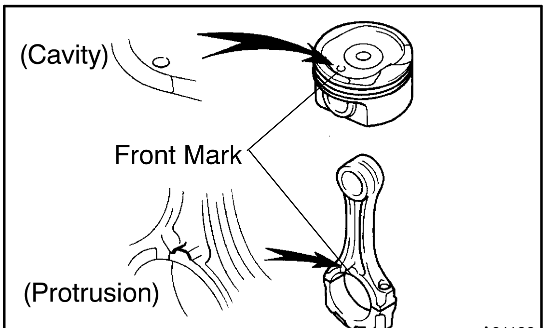
(a) Using a small screwdriver, install a new snap ring at one end of the piston pin hole.

HINT:
Be sure that end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.



A01187

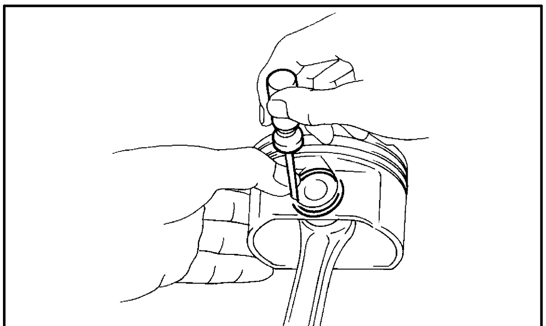
(b) 1ZZ–FE:
Gradually heat the piston to 80 – 90˚C (176 – 194˚F).



A01186

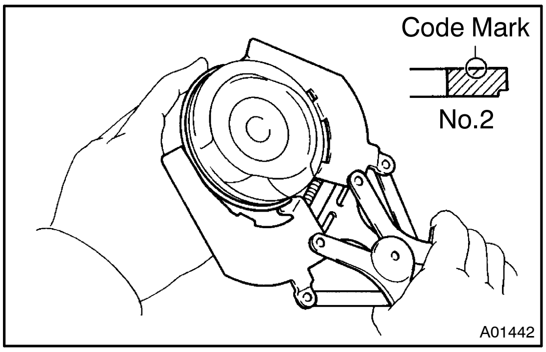
(c) Coat the piston pin with engine oil.

(d) Align the front marks on the piston and connecting rod, and push in the piston with your thumb.


A01192

(e) Using a small screwdriver, install a new snap ring on the other end of the piston pin hole.

HINT:
Be sure that end gap of the snap ring is not as aligned with the pin hole cutout portion of the piston.

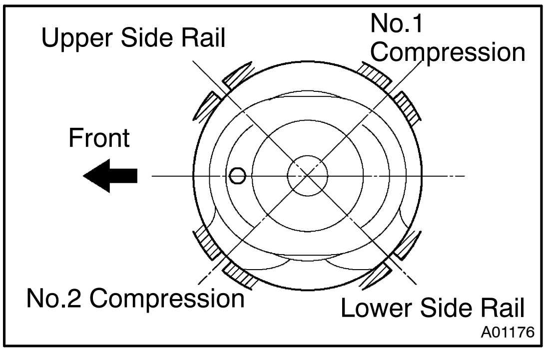


2. INSTALL PISTON RINGS

(a) Install the oil ring expander and 2 side rails by hand.

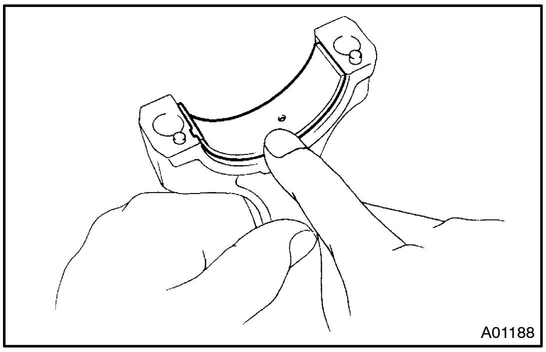
(b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

Code mark :
1ZZ–FE: T or 2R
2ZZ–GE: T



(c) Position the piston rings so that the ring ends are as shown.

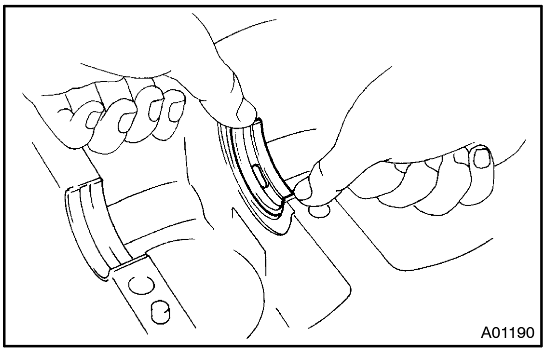
NOTICE:
Do not align the ring ends.



3. INSTALL CONNECTING ROD BEARINGS

(a) Align the bearing claw with the groove of the connecting rod or connecting cap.

(b) Install the bearings in the connecting rod and connecting rod cap.

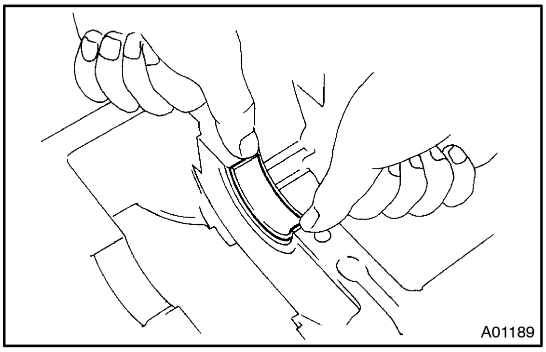


4. INSTALL MAIN BEARINGS

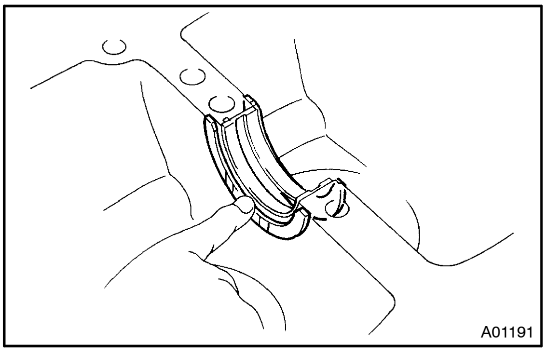
HINT:
Upper bearings have an oil groove and oil holes; Lower bearings do not.

(a) Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.

NOTICE:
Install the bearing with the oil hole in the cylinder block.



(b) Align the bearing claw with the claw grove of the main bearing cap, and push in the 5 lower bearings.

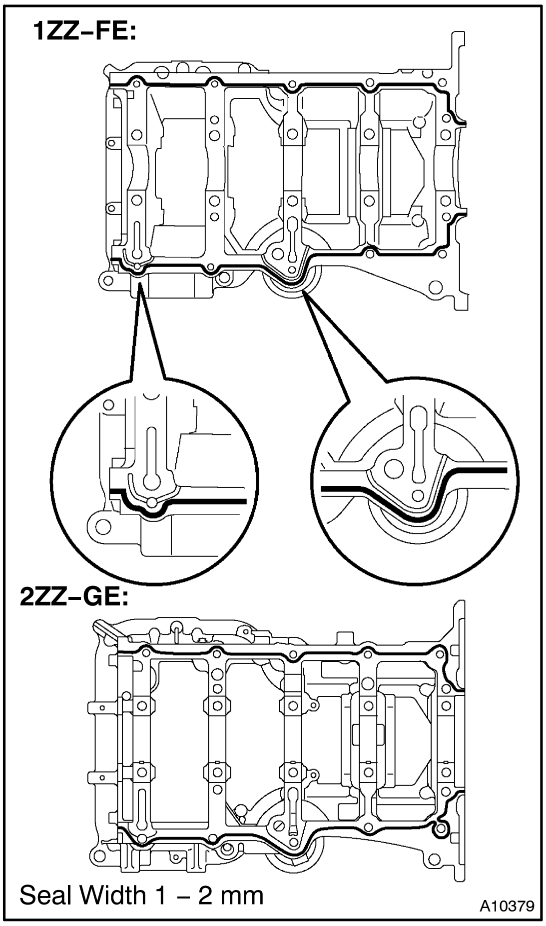


5. **INSTALL THRUST WASHERS**

Install the 2 thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.

6. **PLACE CRANKSHAFT ON CYLINDER BLOCK**

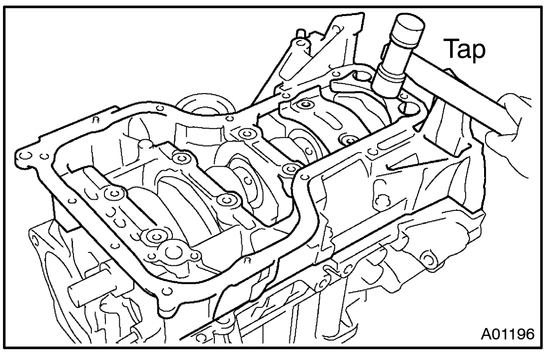
7. **PLACE BEARING CAP SUB–ASSEMBLY ON CYLINDER BLOCK**



(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the bearing cap sub–assembly and cylinder block.
- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.
- thoroughly clean all components to remove all the loose material.
- Using a non–reusable solvent, clean both sealing surfaces.

(b) Apply seal packing to the bearing cap sub–assembly as shown in the illustration.
Seal packing:
Part No. 08826–00080 or equivalent
- Install a nozzle that has been cut to a 1 – 2 mm (0.004 – 0.08 in.) opening.

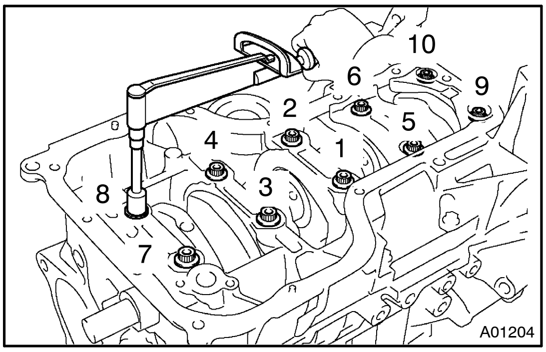
HINT:
Avoid applying an excessive amount to the surface.
- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



(c) Using a plastic–faced hammer, lightly tap the bearing cap sub–assembly to ensure a proper fit.

8. **INSTALL 12 POINTED HEAD BEARING CAP SUB–ASSEMBLY BOLTS**

HINT:
- The bearing cap sub–assembly bolts are tightened in 3 progressive steps (steps (b), (c) and (e)).
- If any of the bearing cap sub–assembly bolts in broken or deformed, replace it.



(a) Apply a light coat of engine oil on the threads and under the bearing cap sub–assembly bolts.

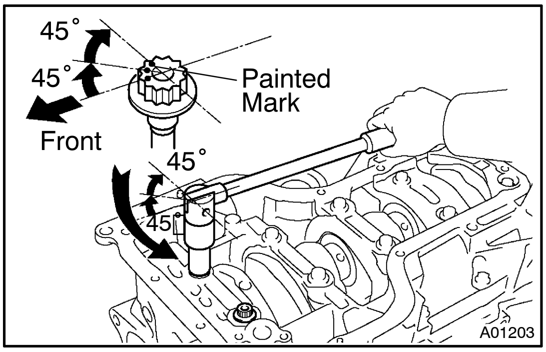
(b) Install and uniformly tighten the 10 bearing cap sub–assembly bolts, in several passes, in the sequence shown.

Torque: 22 N·m (225 kgf·cm, 16 ft·lbf)

(c) Retighten the bearing cap sub–assembly bolts, in several passes, in the sequence shown.

Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)

If any of the bearing cap sub–assembly bolts does not meet the torque specification, replace the bearing cap sub–assembly bolt.



(d) Mark the front of the bearing cap sub–assembly bolts with paint.

(e) Retighten the bearing cap sub–assembly bolts by 45° and 45° in the numerical order shown.

(f) Check that the painted mark is now at a 90° angle to the front.

9. INSTALL HEXAGON HEAD BEARING CAP SUB–ASSEMBLY BOLTS

(a) Install and uniformly tighten the 10 bearing cap sub–assembly bolts in several passes.

Torque:
1ZZ–FE: 18.5 N·m (189 kgf·cm, 14 ft·lbf)
2ZZ–GE: 18 N·m (185 kgf·cm, 13 ft·lbf)

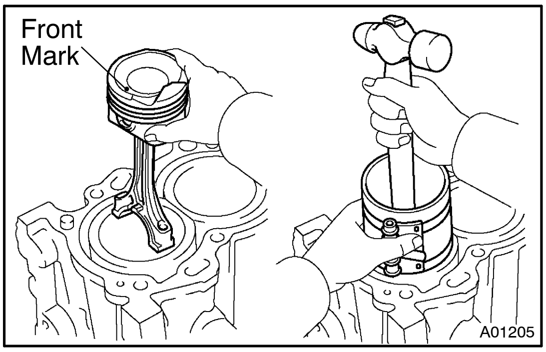
(b) Check that the crankshaft turns smoothly.

(c) 2ZZ–GE:
Apply adhesive to 2 or 3 threads, and install the 4 screw plugs.

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

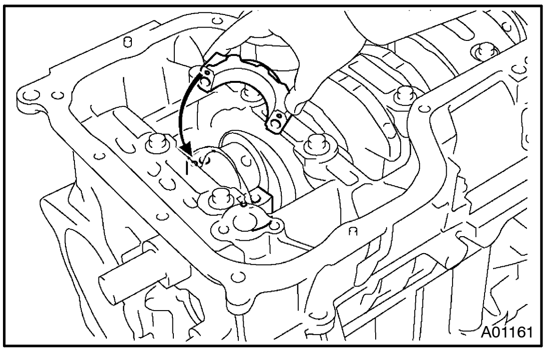
Torque: 43 N·m (438 kgf·cm, 32 ft·lbf)

10. CHECK CRANKSHAFT THRUST CLEARANCE
(See page EM–84)



11. INSTALL PISTON AND CONNECTING ROD ASSEMBLES

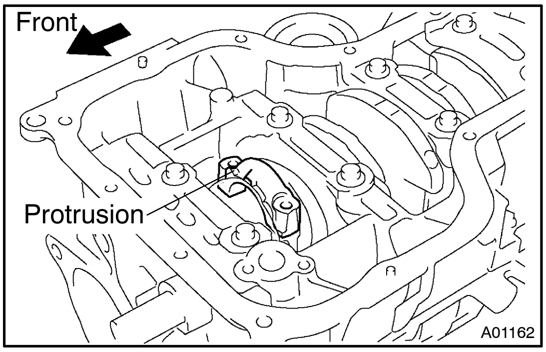
Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



12. PLACE CONNECTING ROD CAP ON CONNECTING ROD

(a) Match the numbered connecting rod cap with the connecting rod.

(b) Align the pin dowels of the connecting rod cap with the pins of the connecting rod, and install the connecting rod.

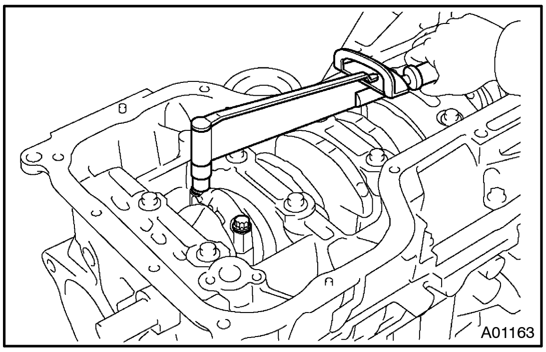


(c) Check that the protrusion of the connecting rod cap is facing in the correct direction.

13. INSTALL CONNECTING ROD CAP BOLTS

HINT:

- The connecting rod cap bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any of the connecting rod cap bolts is broken or deformed, replace it.

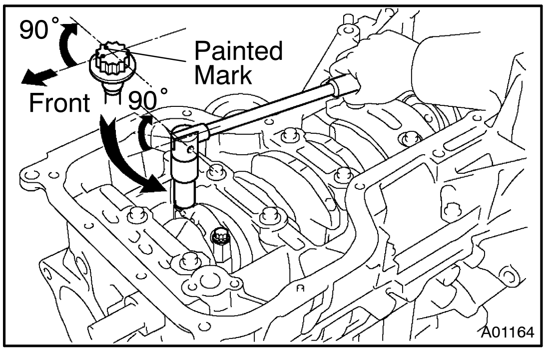


(a) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.

(b) Install and alternately tighten the 2 connecting rod cap bolts in several passes.

Torque:
1ZZ–FE: 20 N·m (204 kgf·cm, 15 ft·lbf)
2ZZ–GE: 30 N·m (306 kgf·cm, 22 ft·lbf)

If any of the connecting rod cap bolts does not meet the torque specification, replace the connecting rod cap bolts.



(c) Mark the front of the connecting cap bolts with paint.

(d) Retighten the cap bolts by 90° as shown.

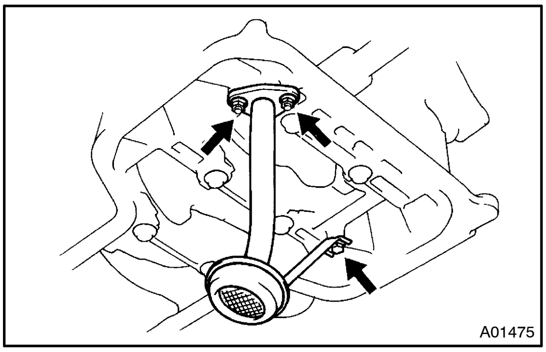
(e) Check that the painted mark is now at a 90° angle to the front.

(f) Check that the crankshaft turns smoothly.

14. CHECK CONNECTING ROD THRUST CLEARANCE
(See page EM–84)

15. INSTALL REAR CRANKSHAFT OIL SEAL
(See page EM–90)

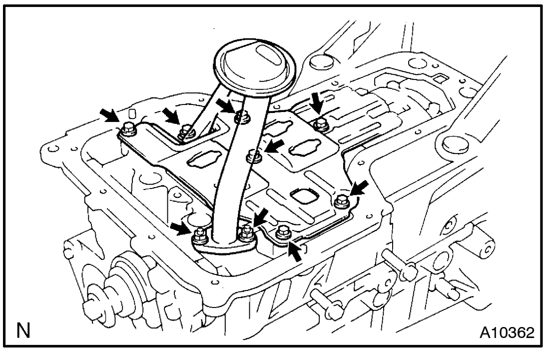
HINT:
Wipe seal packing away from the contact surface of the cylinder block assembly and oil seal.



16. **1ZZ–FE:
INSTALL OIL STRAINER**

Install a new gasket and the oil strainer with the 2 nuts and bolt.

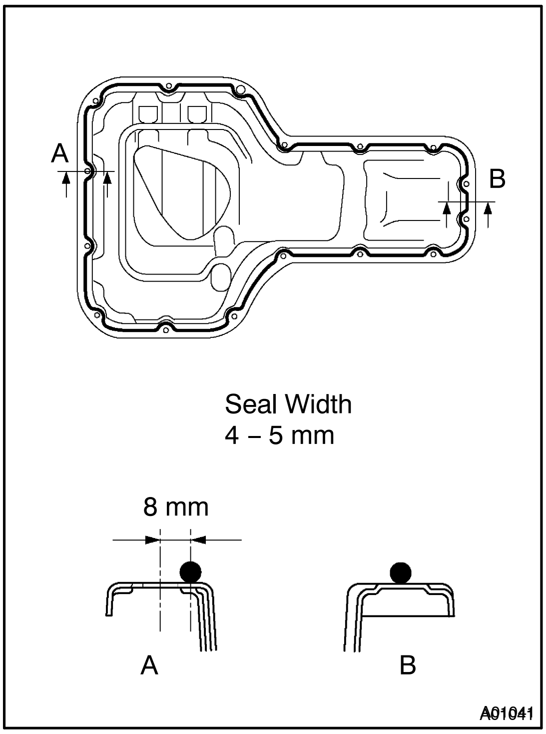
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



17. **2ZZ–GE:
INSTALL OIL PAN BAFFLE AND OIL STRAINER**

(a) Install the oil pan baffle with the 4 bolts and 2 nuts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

(b) Install a new gasket and oil strainer with the 2 nuts and bolt.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



18. **INSTALL OIL PAN**

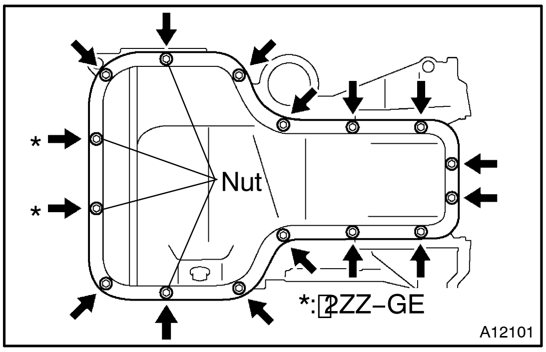
(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surface of the main bearing cap and oil pan.
- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

NOTICE:
Do not use a solvent which will affect the painted surfaces.

(b) Apply seal packing to the oil pan as shown in the illustration.
Seal packing:
Part No. 08826–00080 or equivalent
- Install a nozzle that has been cut to a 4 – 5 mm (0.16 – 0.20 in.) opening.

HINT:
Avoid applying an excessive amount to the surface.

- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



(c) 1ZZ–FE:
Install the oil pan with the 14 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.

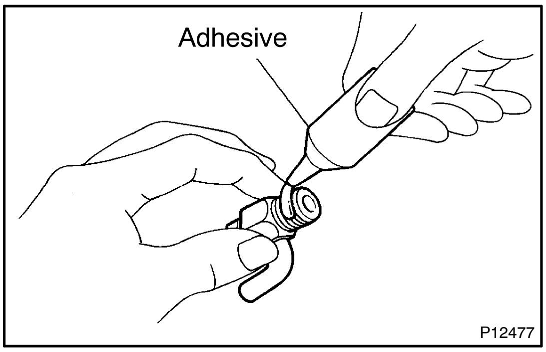
(d) 2ZZ–GE:
Install the oil pan with the 12 bolts and 4 nuts. Uniformly tighten the bolts and nuts in several passes.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

19. INSTALL OIL FILTER UNION
Torque: 30 N·m (306 kgf·cm, 21 ft·lbf)

20. Australia spec:
INSTALL OIL COOLER
(See page LU–17)

21. INSTALL OIL FILTER
(See page LU–3)

22. INSTALL OIL PUMP
(See page LU–13)



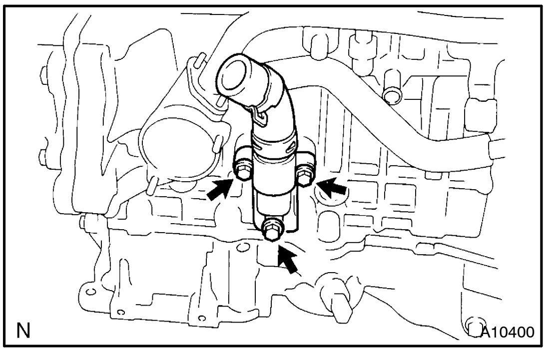
23. INSTALL ENGINE COOLANT DRAIN UNION

(a) Apply adhesive to 2 or 3 threads.
Adhesive:
Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent

(b) Install the drain union.
Torque:
1ZZ–FE 20 N·m (200 kgf·cm, 14 ft·lbf)
2ZZ–GE 25 N·m (255 kgf·cm, 18 ft·lbf)

HINT:
After applying the specified torque, rotate the drain union clockwise until its drain port is facing downward.

24. INSTALL KNOCK SENSOR
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

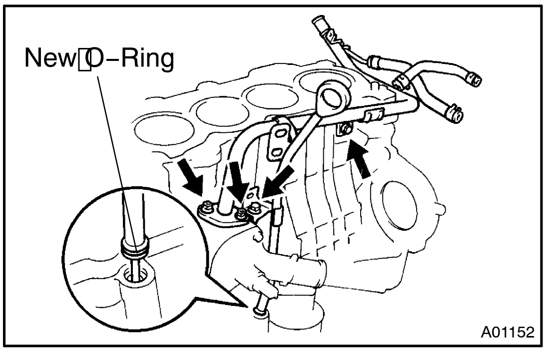


25. 2ZZ–GE:
INSTALL VENTILATION CASE

(a) Install a new gasket and ventilation case with the 3 bolts.
Torque: 8.5 N·m (87 kgf·cm, 75 in.·lbf)

(b) Install the No. 3 ventilation hose and connect the clip.

26. INSTALL THERMOSTAT
(See page CO–11)



27. INSTALL WATER BYPASS PIPE
Torque:
1ZZ–FE 9.0 N·m (92 kgf·cm, 80 in.·lbf)
2ZZ–GE
Bolt 8.5 N·m (87 kgf·cm, 75 in.·lbf)
Nut 10 N·m (100 kgf·cm, 7 ft·lbf)

28. 1ZZ–FE:
INSTALL OIL DIPSTICK AND GUIDE

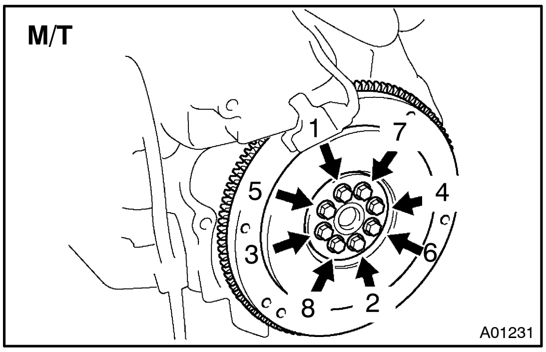
(a) Install a new O–ring on the dipstick guide.
(b) Apply soapy water on the O–ring.
(c) Connect the dipstick guide end to the main bearing cap.
(d) Install the dipstick guide with the bolt.
Torque: 11 N·m (113 kgf·cm, 8 ft·lbf)

29. INSTALL CYLINDER HEAD
(See page EM–66)

30. INSTALL ENGINE WIRE

31. INSTALL TIMING SPROCKETS AND TIMING CHAIN
(See page EM–26)

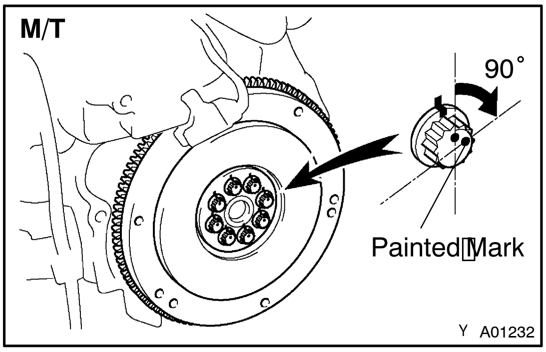
32. REMOVE ENGINE STAND



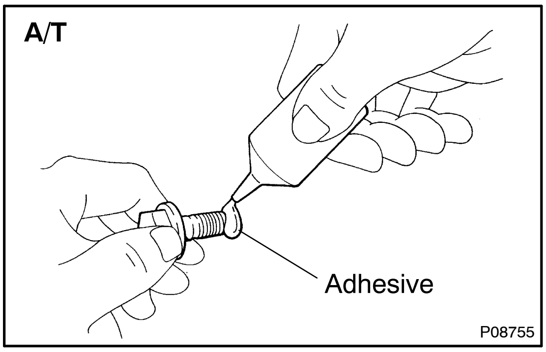
33. M/T:
INSTALL FLYWHEEL

HINT:
The flywheel bolts are tightened in 2 progressive steps, (a) and (c).

(a) Install and uniformly tighten the 8 mounting bolts, in several passes, in the sequence shown.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)



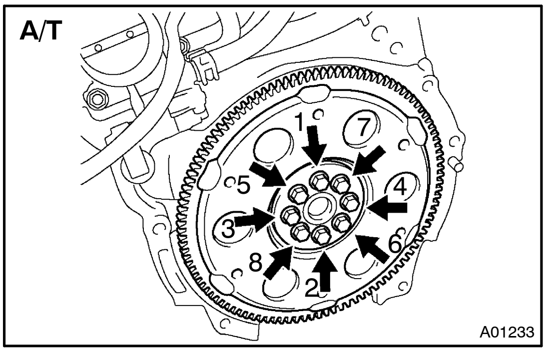
(b) Mark the flywheel bolt with paint.
(c) Retighten the flywheel bolts by an additional 90°.
(d) Check that the painted mark in now at a 90° angle to (b).



34. **A/T:**
INSTALL DRIVE PLATE

(a) Install the front spacer, drive plate and rear plate on the crankshaft.

(b) Apply adhesive to 2 or 3 threads of the mounting bolt end,
Adhesive:
Part No. 08833–00070, THREE BOND or equivalent



(c) Install and uniformly tighten the 8 mounting bolts, in several passes, in the sequence shown.
Torque: 88 N·m (897 kgf·cm, 65 ft·lbf)

EFI SYSTEM

FI0P9–01

PRECAUTION

1. BEFORE WORKING ON THE FUEL SYSTEM , DISCONNECT THE NEGATIVE (–) TERMINAL CABLE FROM THE BATTERY

HINT:
Any diagnostic trouble code retained by the computer will be erased when the negative (–) terminal cable is removed from the battery. Therefore, if necessary, read the diagnosis before removing the negative (–) terminal cable from the battery.

2. DO NOT SMOKE OR WORK NEAR AN OPEN FLAME WHEN WORKING ON THE FUEL SYSTEM

3. KEEP GASOLINE AWAY FROM RUBBER OR LEATHER PARTS

4. MAINTENANCE PRECAUTIONS

(a) In event of engine misfire, these precautions should be taken.
  (1) Check proper connection to battery terminals, etc.
  (2) After repair work, check that the ignition coil terminals and all other ignition system lines are reconnected securely.
  (3) When cleaning the engine compartment, be especially careful to protect the electrical system from water.

(b) Precautions when handling oxygen sensor.
  (1) Do not allow oxygen sensor to drop or hit against an object.
  (2) Do not allow the sensor to come into contact with water.

If vehicle is Equipped with Mobile Radio System (HAM, CB, etc.)
If the vehicle is equipped with a mobile communication system, refer to the precaution in the IN section.

5. AIR INDUCTION SYSTEM

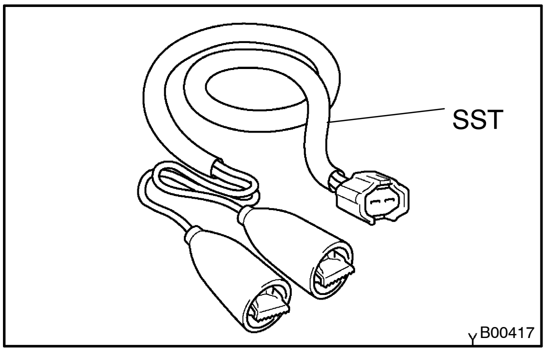
(a) Separation of the engine oil dipstick, oil filler cap, PCV hose, etc. may cause the engine to run out of turn.
(b) Disconnection, looseness or cracks in the parts of the air induction system between the throttle body and cylinder head will allow air suction and cause the engine to run out of turn.

6. ELECTRONIC CONTROL SYSTEM

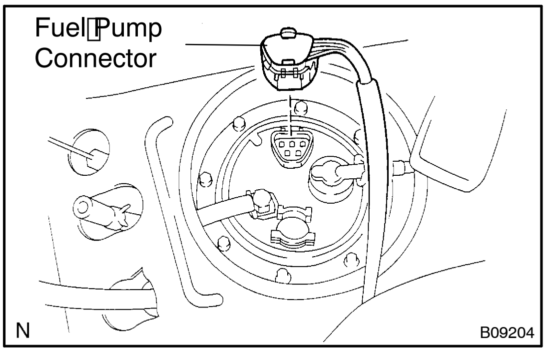
(a) Before removing EFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch to LOCK or disconnecting the negative (–) terminal cable from the battery.

HINT:
Always check the diagnostic trouble code before disconnecting the negative (–) terminal cable from the battery.

(b) When installing the battery, be especially careful not to incorrectly connect the positive (+) and negative (–) cables.
(c) Do not permit parts to receive a severe impact during removal or installation. Handle all EFI parts carefully, especially the engine ECU.
(d) Be careful during troubleshooting as there are numerous transistor circuits, and even slight terminal contact can cause further troubles.
(e) Do not open the engine ECU cover.
(f) When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on the EFI parts and wiring connectors.
(g) Parts should be replaced as an assembly.
(h) Care should be taken when pulling out and inserting wiring connectors.
  (1) Release the lock and pull out the connector, pulling on the connectors.
  (2) Fully insert the connector and check that it is locked.

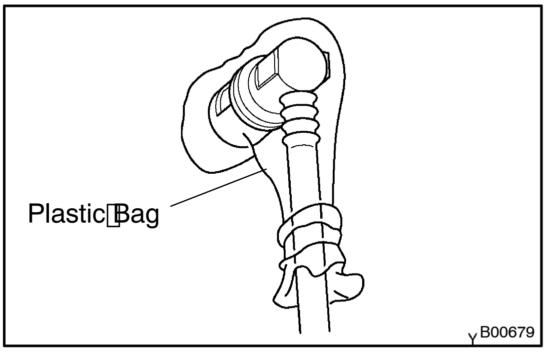


(i) Use SST for inspection or test of the injector or its wiring connector.
SST 09842–30080

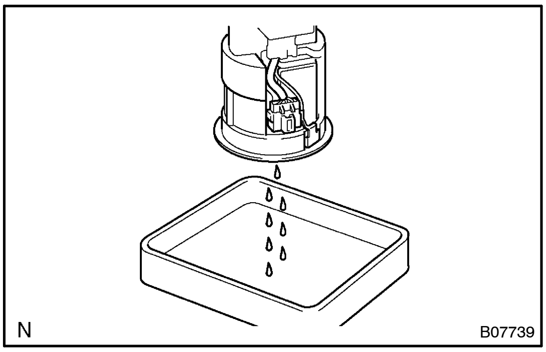


7. FUEL SYSTEM

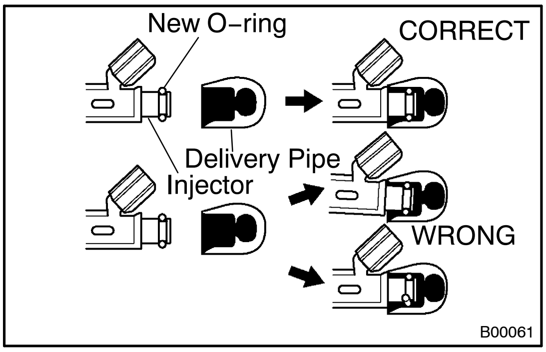
(a) When disconnecting the high fuel pressure line, a large amount of gasoline will spill out, so observe these procedures.
  (1) Disconnect the fuel pump connector.
  (2) Start the engine. After the engine has stopped on its own, turn the ignition switch to LOCK.
  (3) Disconnect the fuel tube (See page FI–11).
  (4) Drain the fuel remained inside the fuel tube.



  (5) Protect the disconnected fuel tube from damage and foreign material by covering it with a plastic bag.



(6) Put a container under the connection.

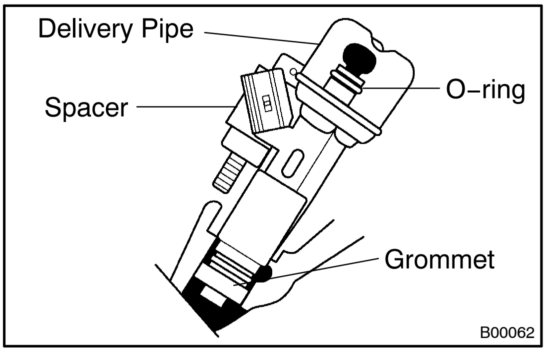


(b) Observe these precautions when removing and installing the injector.

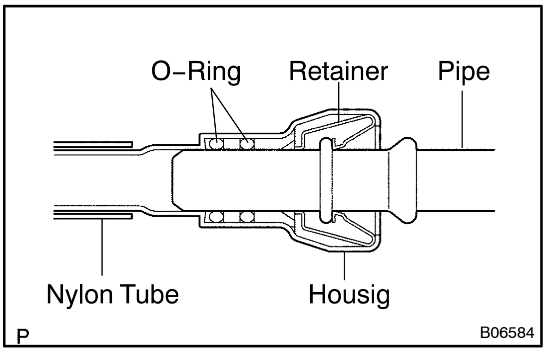
(1) Never reuse the O–ring.

(2) When placing a new O–ring on the injector, take care not to damage it in any way.

(3) Coat a new O–ring with spindle oil or gasoline before installing. Never use engine, gear or brake oil.

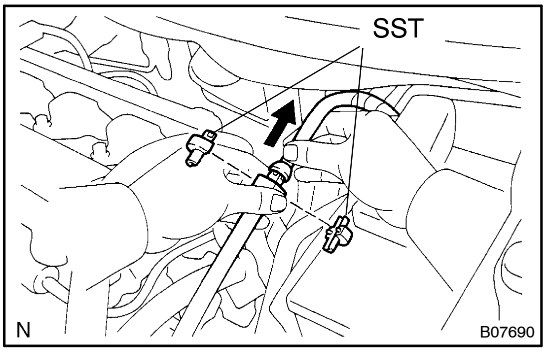


(c) Install the injector to the delivery pipe and cylinder head, as shown in the illustration. Before installing the injector, be sure to apply spindle oil or gasoline on the place where the delivery pipe or the cylinder head touches O–ring of the injector.



(d) Observe these precautions when disconnecting the fuel delivery pipe. The structure of the metallic connector is shown as left.

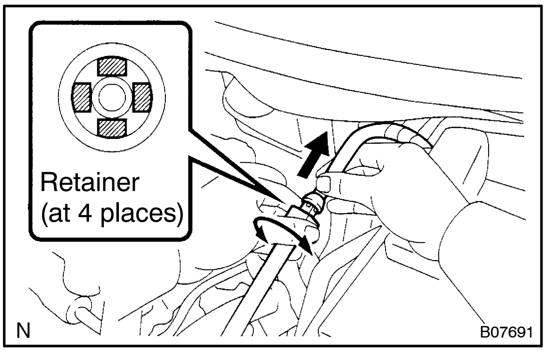
(1) Remove the fuel pipe clamp.



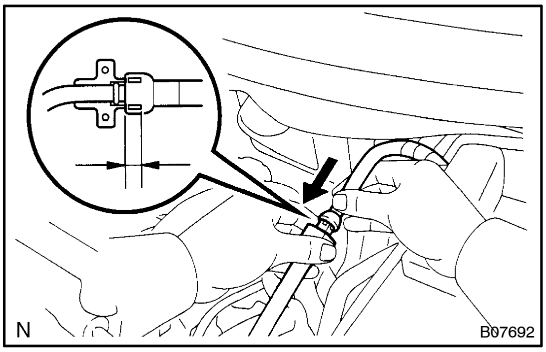
(2) Get the metallic connector of the fuel tube assembly, pull it out towards the rear and hold it as it is.

(3) Assemble SST to the connection as shown.

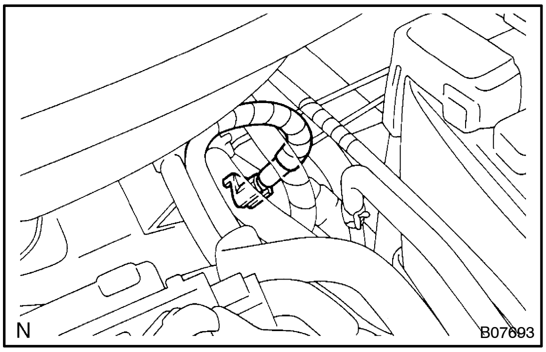
SST 09268–21010



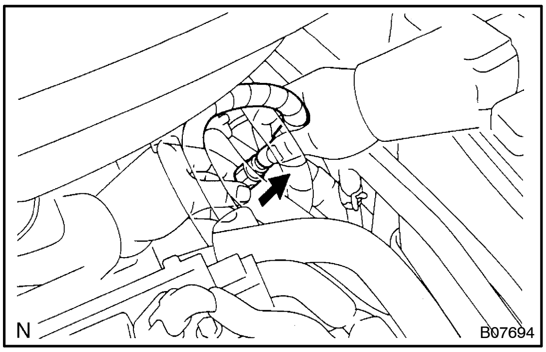
(4) Turn SST, align the retainers inside the connector with SST chamfered parts and incert SST into the connector.



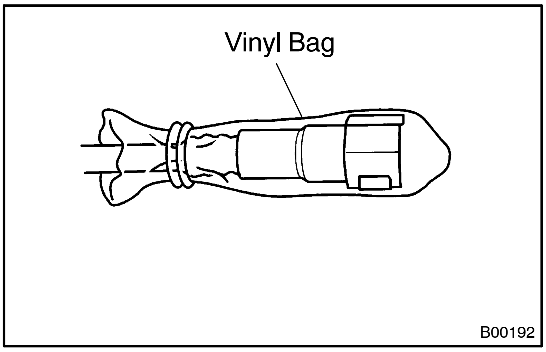
(5) Hold SST as it at step 4, push the connector towards SST to put the retainers on SST champfered parts.
(6) Slide SST and the connector together towards the fuel tube assembly.



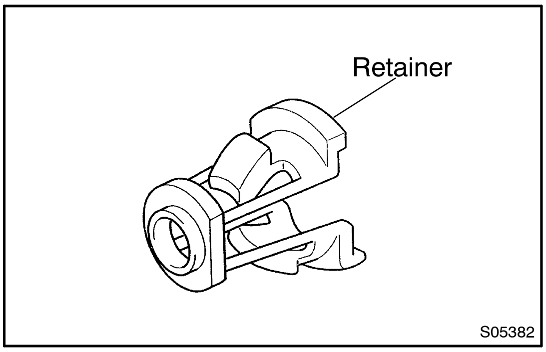
(e) Observe these precautions when disconnecting the fuel tube connector (quick type).
(1) Remove the fuel pipe clamp.
(2) Check if there is any dirt like mud on the pipe and around the connector before disconnecting them and clean the dirt away.



(3) Be sure to disconnect with hands.
(4) When the connector and the pipe are stuck, pinch the retainer between the hands, push and pull the connector to free to disconnect and pull it out. Do not use any tool at this time.
(5) Inspect if there is any dirt or the likes on the seal surface of the disconnected pipe and clean it away.



(6) Prevent the disconnected pipe and connector from damaging and mixing foreign objects by covering them with a vinyl bag.

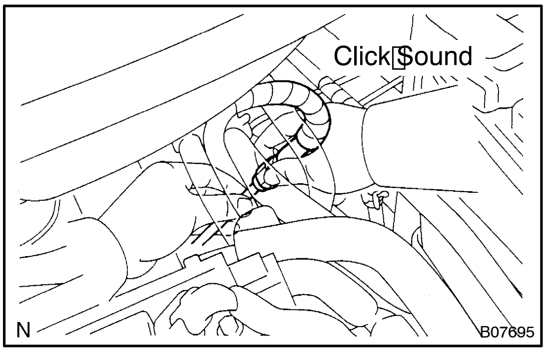


(f) Observe these precautions when connecting the fuel tube connector (quick type).

(1) Do not reuse the retainer removed from the pipe.

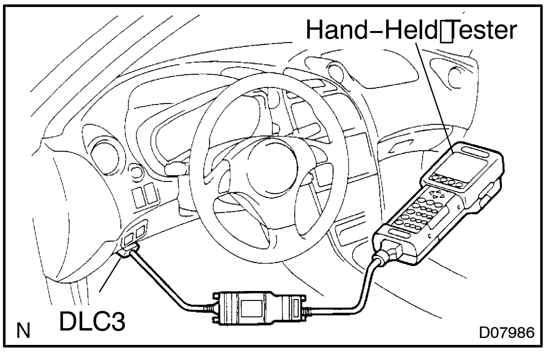
(2) Must use hands without using tools when to remove the retainer from the pipe.

(3) Check if there is any damage or foreign objects on the connected part of the pipe.



(4) Match the axis of the connector with axis of the pipe, and push in the connector until retainer makes a "click" sound. In case that the connections is tight, apply little amount of new engine oil on the tip of the pipe.

(5) After having finished the connection, check if the pipe and the connector are securely connected by pulling them.



(g) Check that there are no fuel leaks after doing maintenance anywhere on the fuel system.

(1) Connect the hand–held tester to the DLC3.

(2) Turn the ignition switch ON and hand–held tester main switch ON.

(3) Select the active test mode on the hand–held tester.

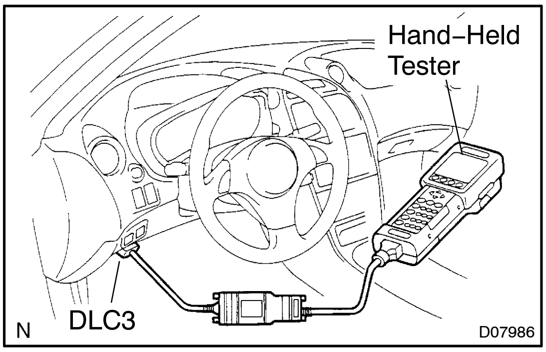
(4) Please refer to the hand–held tester operator's manual for further details.

(5) If you have no hand–held tester, connect the positive (+) and negative (–) leads from the battery to the fuel pump connector. (See page FI–6)

(6) Check that there are no leaks from any part of the fuel system.

(7) Turn the ignition switch to LOCK.

(8) Disconnect the hand–held tester from the DLC3.



FUEL PUMP

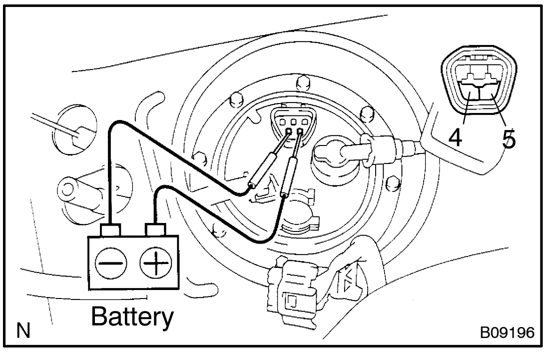
SF098–06

ON–VEHICLE INSPECTION

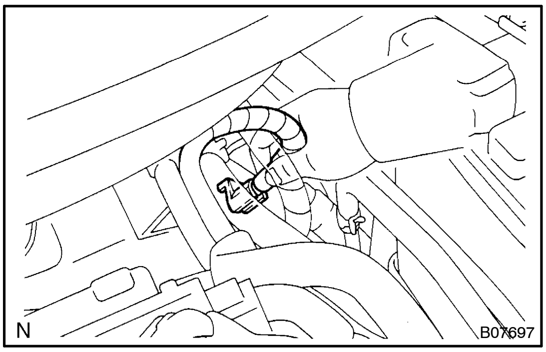
1. **CHECK FUEL PUMP OPERATION**
(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON and hand–held tester main switch ON.

NOTICE:
Do not start the engine.

(c) Select the active test mode on the hand–held tester.
(d) Please refer to the hand–held tester operator's manual for further details.



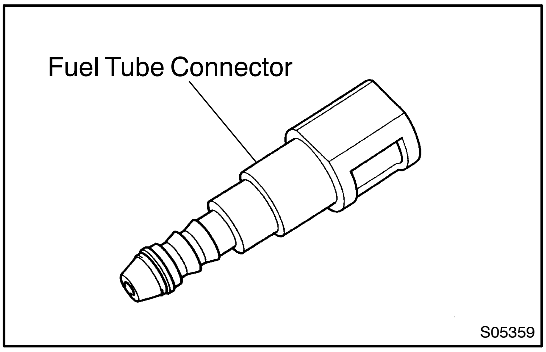
(e) If you have no hand–held tester, connect the positive (+) lead from the battery to terminal 4 of the connecter, and the negative (–) lead to terminal 5.



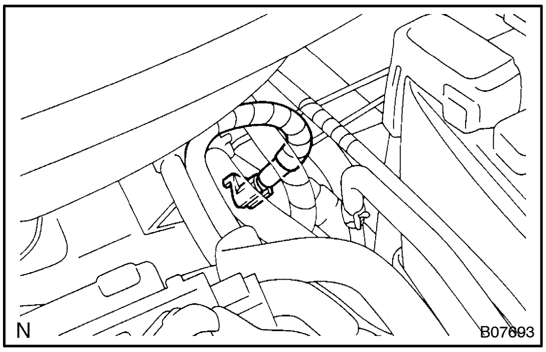
(f) Check that there is pressure in the fuel inlet pipe from the fuel line.

HINT:
If there is fuel pressure, you will hear the sound of fuel flowing. If there is no pressure, check Fusible link, Fuses, EFI Main relay, Fuel pump, engine ECU, and Wiring connector.

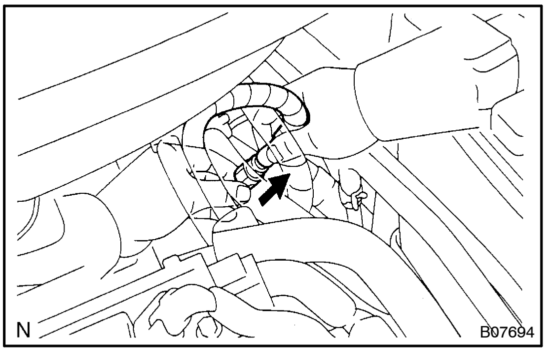
(g) Turn the ignition switch to LOCK.
(h) Disconnect the hand–held tester from the DLC3.



2. **CHECK FUEL PRESSURE**
(a) Check the battery positive voltage is above 12 V.
(b) Disconnect the negative (–) terminal cable from the battery.
(c) Purchase the new fuel tube and take out the fuel tube connector from its pipe.
Part No. 23906–23020



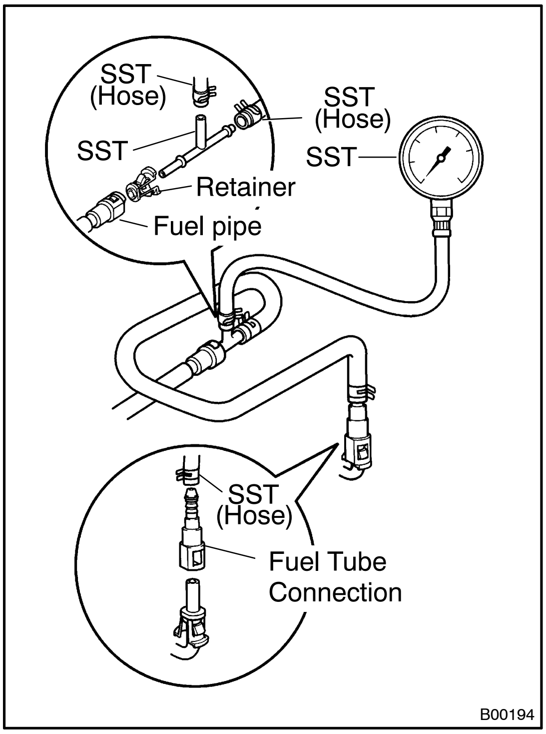
(d) Remove the fuel pipe clamp.



(e) Disconnect the fuel tube (fuel tube connector) from the fuel pipe.

CAUTION:

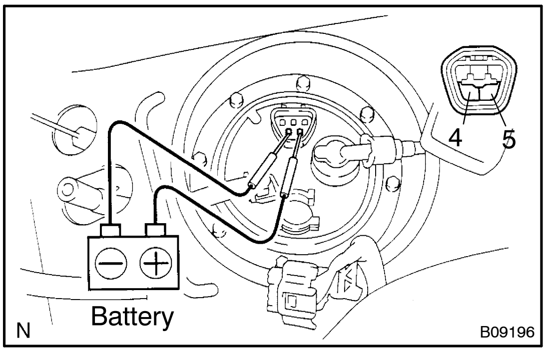
- **Perform disconnecting operations of the fuel tube connector (quick type) after observing the precautions.**
- **As there is retained pressure in the fuel pipe line, prevent if from splashing inside the engine compartment.**



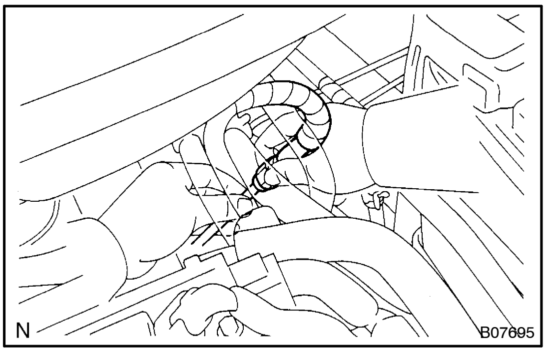
(f) Install SST (pressure gauge) as shown in the illustration by using SST and fuel tube connector.
SST 09268–41047 (95336–08070), 09268–45014 (09268–41200, 09268–41220, 09268–41250)

(g) Wipe off any splattered gasoline.

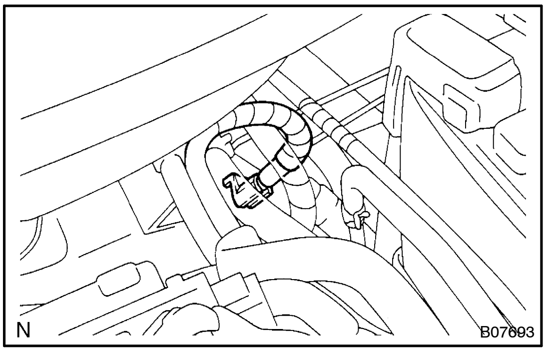
(h) Reconnect the negative (–) terminal cable to the battery.



(i) Connect the hand–held tester to the DLC3.
If you have no hand–held tester, connect the positive (+) lead from the battery to terminal 4 of the connecter, and the negative (–) lead to terminal 5.
(j) Measure the fuel pressure.
Fuel pressure:
304 – 343 kPa (3.1 – 3.5 kgf/cm^2, 44 – 50 psi)
If pressure is high, replace the fuel pressure regulator.
If pressure is low, check the Fuel hoses and connections, Fuel pump, Fuel filter, and Fuel pressure regulator.
(k) Disconnect the hand–held tester from the DLC3.
(l) Start the engine.
(m) Measure the fuel pressure at idle.
Fuel pressure:
304 – 343 kPa (3.1 – 3.5 kgf/cm^2, 44 – 50 psi)
(n) Stop the engine.
(o) Check that the fuel pressure remains as specified for 5 minutes after the engine has stopped.
Fuel pressure:
147 kPa (1.5 kgf/cm^2, 21 psi) or more
If pressure is not as specified, check the fuel pump, pressure regulator and/or injectors.
(p) After checking fuel pressure, disconnect the negative (–) terminal cable from the battery and carefully, remove the SST and fuel tube connector to prevent gasoline from splashing.
SST 09268–41047 (95336–08070), 09268–45014 (09268–41200, 09268–41220, 09268–41250)



(q) Reconnect the fuel tube (fuel tube connector).
CAUTION:
Perform connecting operations of the fuel tube connector (quick type) after observing the precautions.

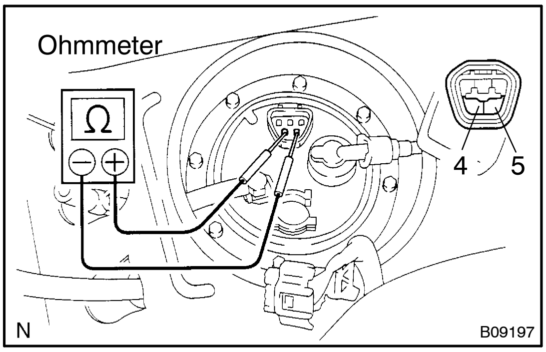


(r) Install the fuel pipe clamp.
(s) Reconnect the negative (–) terminal cable to the battery.
(t) Check for fuel leakage.

3. REMOVE REAR SEAT CUSHION

4. REMOVE FLOOR SERVICE HOLE COVER

5. DISCONNECT FUEL PUMP & SENDER GAUGE CONNECTOR

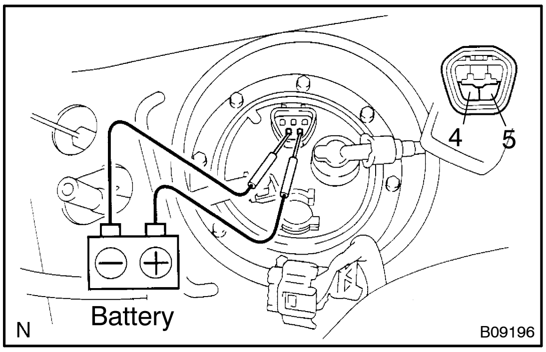


6. **INSPECT FUEL PUMP RESISTANCE**

Using an ohmmeter, measure the resistance between terminals 4 and 5.

Resistance:
0.2 – 3.0 Ω at 20°C (68 °F)

If the resistance is not as specified, replace the fuel pump.



7. **INSPECT FUEL PUMP OPERATION**

Connect the positive (+) lead from the battery to terminal 4 of the connector and the negative (–) terminal 5. Check that the pump operates.

NOTICE:

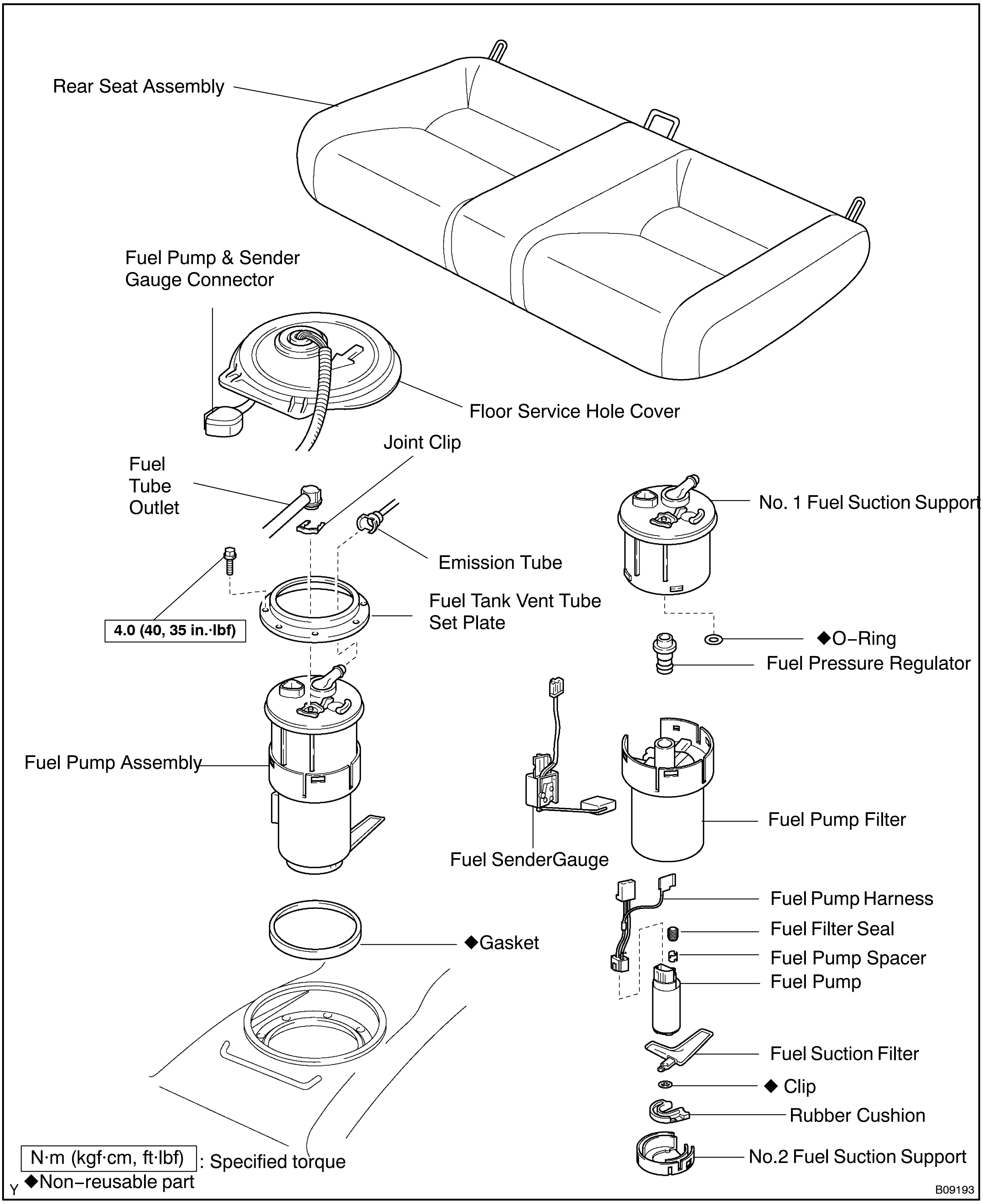
- **These tests must be done quickly (within 10 seconds) to prevent the coil from burning out.**
- **Keep fuel pump as far away from the battery as possible.**
- **Always do the switching at the battery side.**

If operation is not as specified, replace the fuel pump or lead wire.

8. **RECONNECT FUEL PUMP & SENDER GAUGE CONNECTOR**
9. **REINSTALL FLOOR SERVICE HOLE COVER**
10. **REINSTALL REAR SEAT CUSHION**

SF099–05

COMPONENTS



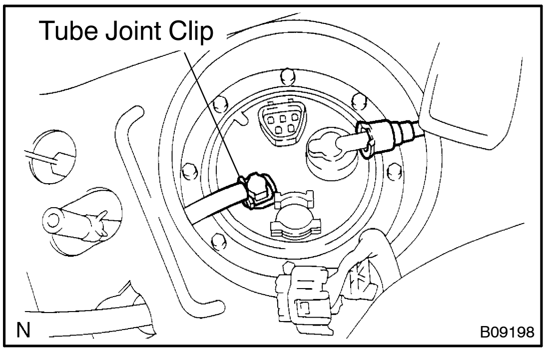
SF09A–05

REMOVAL

CAUTION:

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

1. **REMOVE REAR SEAT CUSHION**
2. **REMOVE FLOOR SERVICE HOLE COVER**
3. **DISCONNECT FUEL PUMP & SENDER GAUGE CONNECTOR**



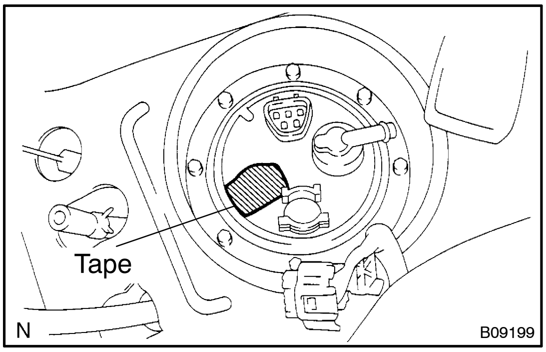
4. **DISCONNECT FUEL TUBE AND EMISSION TUBE**

(a) Wash away the mud, dust and the likes on the fuel suction plate with water.

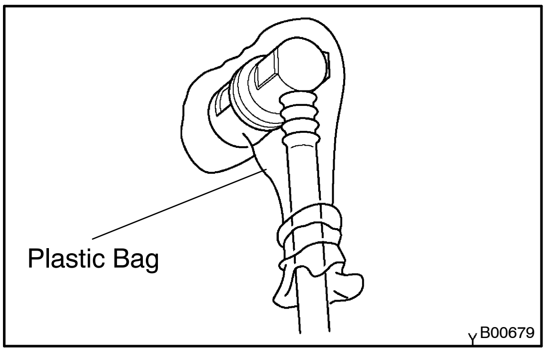
(b) Pull off the tube joint clip from the No. 1 fuel suction plate.

(c) Disconnect the fuel tube from the fuel pump assembly.

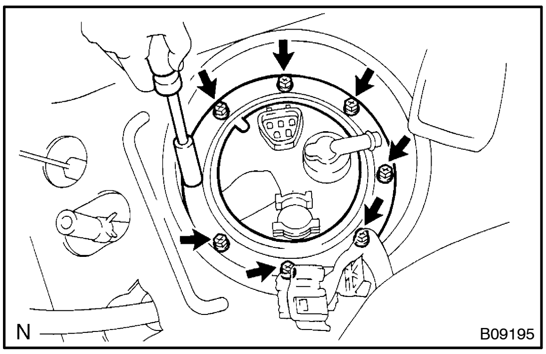
(d) Disconnect the emission tube from the fuel pump assembly.



(e) Attach the tape in order to protect the port portion from the dust.



(f) Protect the disconnected fuel tube from damage and foreign material by covering it with a plastic bag.



5. **REMOVE FUEL PUMP ASSEMBLY FROM FUEL TANK**

(a) Remove the 8 bolts and fuel tank vent tube set plate.

(b) Pull out the fuel pump assembly.

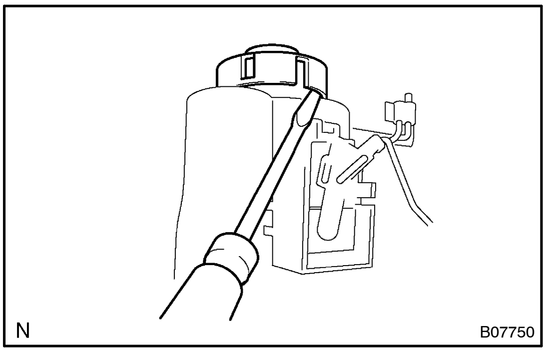
NOTICE:

- **Do not damage the fuel pump filter.**
- **Be careful that the arm of the sender gauge should not bent.**

(c) Remove the gasket from the pump assembly.

SF13P–03

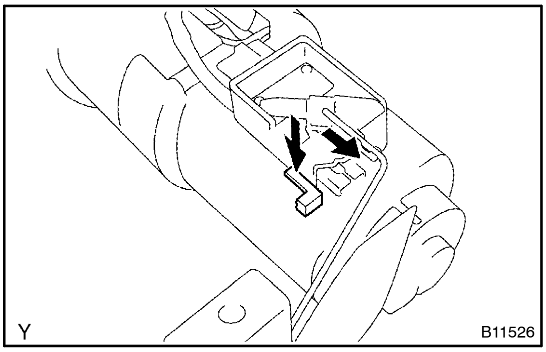
DISASSEMBLY



1. REMOVE NO. 2 FUEL SUCTION SUPPORT

(a) Using a small screwdriver, remove the No. 2 fuel suction support.

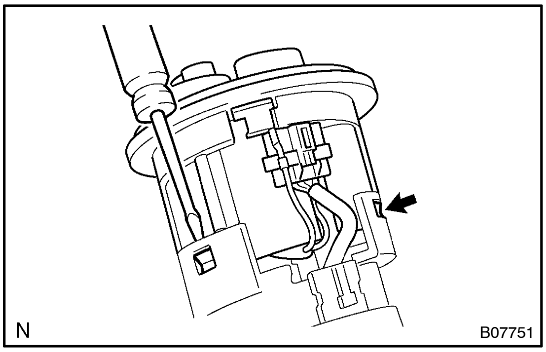
(b) Remove the rubber cushion.



2. REMOVE NO. 1 FUEL SUCTION SUPPORT

(a) Disconnect the fuel sender gauge connector and earth plate.

(b) While pressing the lock of the fuel pump filter, slide the fuel sender gauge and remove it.



(c) Using a small screwdriver, remove the No. 1 fuel suction support.

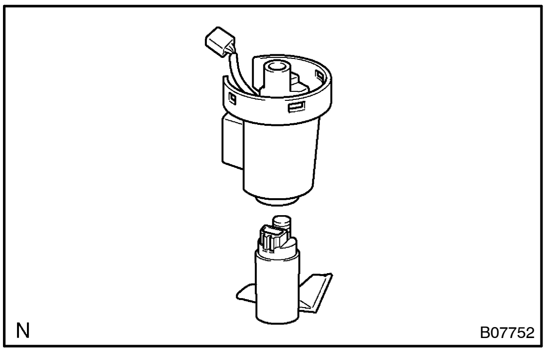
NOTICE:

Do not damage the fuel suction support and fuel suction plate.

(d) Disconnect the fuel pump harness from the No. 1 fuel suction support and fuel pump.

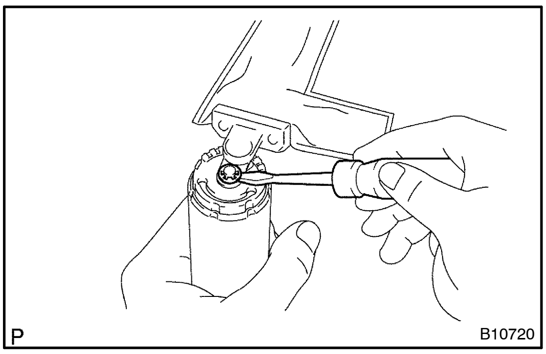
3. REMOVE FUEL PRESSURE REGULATOR

Pull out the fuel pressure regulator and O–ring from the fuel filter.



4. REMOVE FUEL PUMP

Remove the pump from the fuel filter.

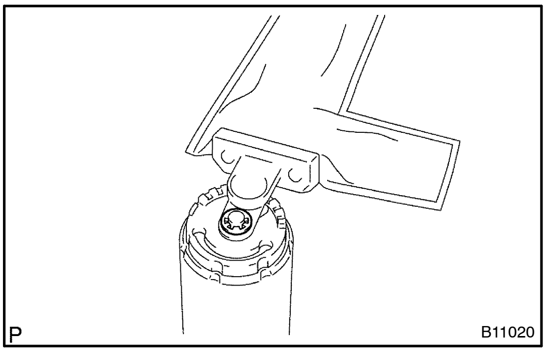


5. REMOVE FUEL SUCTION FILTER

(a) Using a small screwdriver, pry out the clip.

(b) Pull out the suction filter.

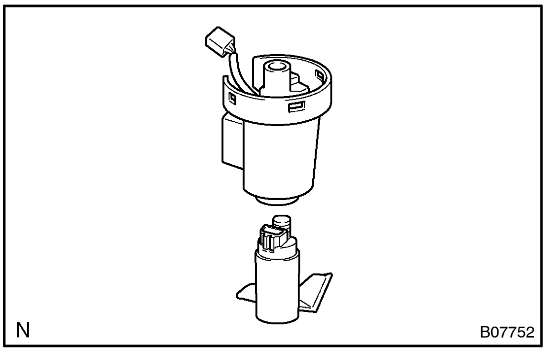
SF13Q–03



REASSEMBLY

1. INSTALL FUEL SUCTION FILTER

Install the suction filter with a new clip.



2. INSTALL FUEL PUMP

Connect the fuel pump to the fuel filter.

3. INSTALL FUEL PRESSURE REGULATOR

(a) Install the O–ring to the pressure regulator.

HINT:

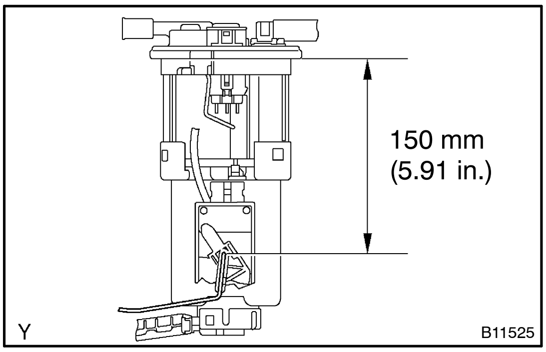
Apply a light coat of gasoline to a new O–ring, and install it to the pressure regulator.

(b) Connect the pressure regulator to the fuel filter.

4. INSTALL NO. 1 FUEL SUCTION SUPPORT

(a) Connect the fuel pump harness to the No. 1 fuel suction support and fuel pump.

(b) Install the No. 1 fuel suction support to the fuel filter.



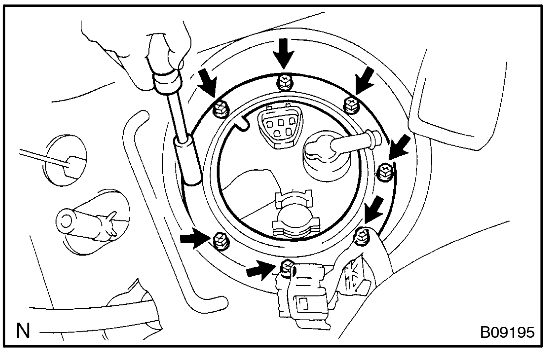
(c) Install the fuel sender gauge to the fuel pump filter so that the distance between the No.1 fuel suction support and the float fulcrum of the fuel sender gauge is 150 mm (5.91 in.).

(d) Connect the fuel sender gauge connector and earth plate.

5. INSTALL NO. 2 FUEL SUCTION SUPPORT

(a) Install the rubber cushion.

(b) Install the No. 2 fuel suction support to the No. 1 fuel suction support.



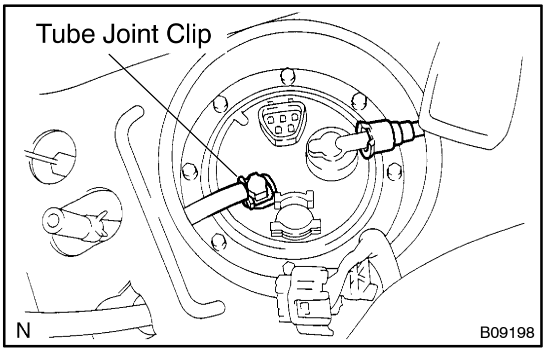
SF09D–05

INSTALLATION

1. **INSTALL FUEL PUMP ASSEMBLY**
(a) Install the new gasket to the fuel pump assembly.
(b) Install the fuel pump assembly to the fuel tank.

NOTICE:
- **Do not damage the fuel pump filter.**
- **Be careful that the arm of the sender gauge should not bent.**

(c) Install the 8 bolts and fuel tank vent tube set plate from the fuel tank.
Torque: 4.0 N·m (40 kgf·cm, 35 in.·lbf)



2. **CONNECT FUEL TUBE**
(a) Clean up around the fuel tube.
(b) Connect the fuel tube and emission tube to the fuel pump assembly.
(c) Connect the tube joint clip to the fuel suction plate.
3. **CONNECT FUEL PUMP AND SENDER GAUGE CONNECTOR**

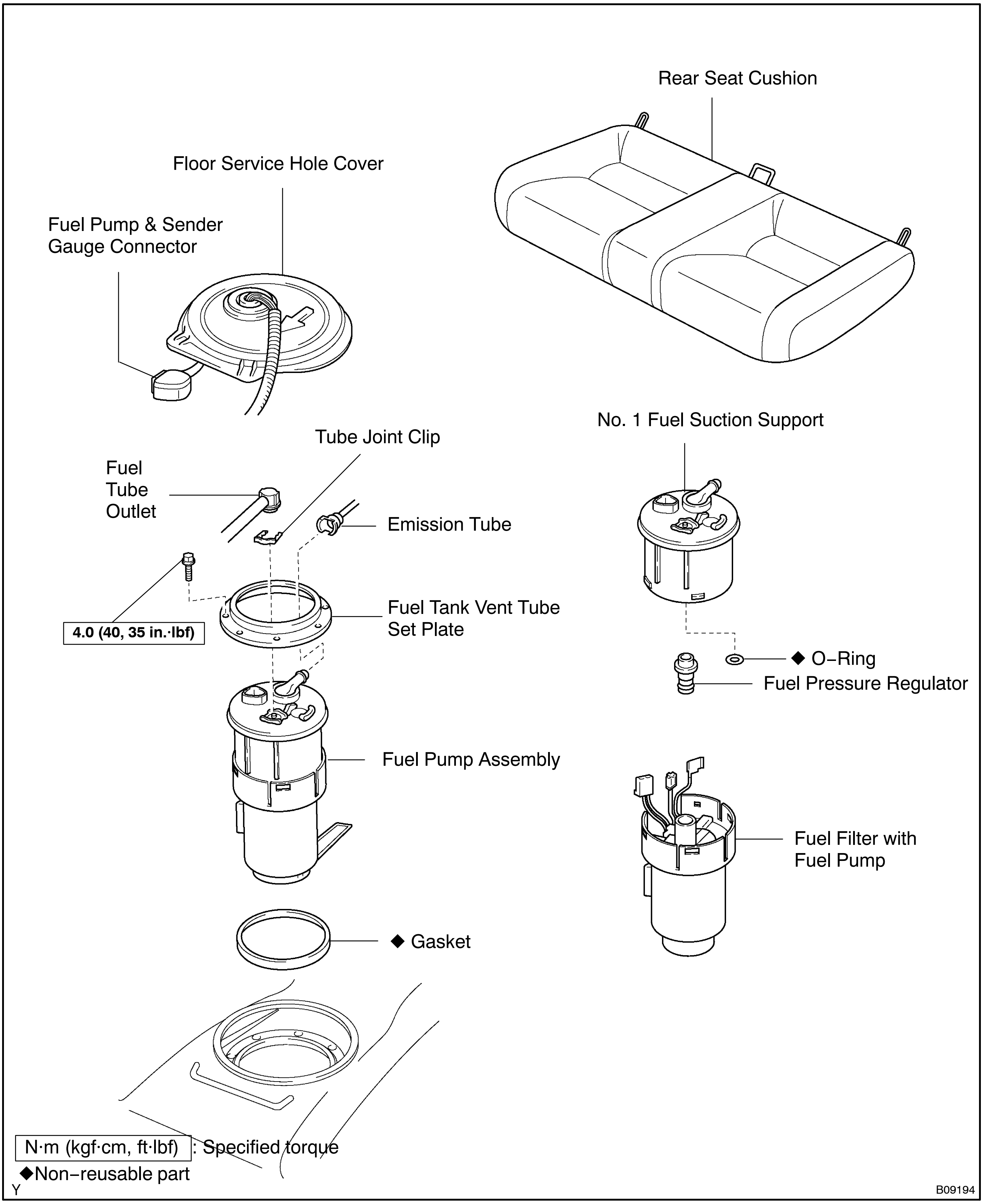
HINT:
Start the engine, check for fuel leakage.

4. **INSTALL FLOOR SERVICE HOLE COVER**
(a) Install the service hole cover.
(b) Install the floor carpet.
5. **INSTALL REAR SEAT CUSHION**

FUEL PRESSURE REGULATOR

COMPONENTS

SF09E–05



SF13R–01

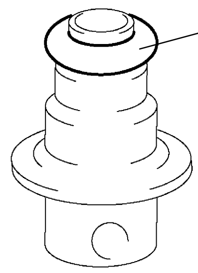
REMOVAL

1. **REMOVE FUEL PUMP ASSEMBLY FROM FUEL TANK** (See page FI–11)
2. **REMOVE NO. 1 FUEL SUCTION SUPPORT** (See page FI–12)
3. **REMOVE FUEL PRESSURE REGULATOR**

(a) Pull out the pressure regulator.

(b) Remove the O–ring from the pressure regulator.

SF0Z6–05



INSTALLATION

1. INSTALL FUEL PRESSURE REGULATOR

(a) Install the O–ring to the pressure regulator.

HINT:

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

(b) Connect the pressure regulator from the fuel filter.

2. INSTALL NO. 1 FUEL SUCTION SUPPORT
(See page FI–13)

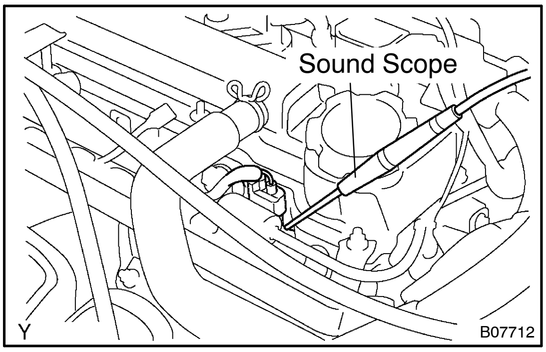
3. INSTALL FUEL PUMP ASSEMBLY TO FUEL TANK
(See page FI–14)

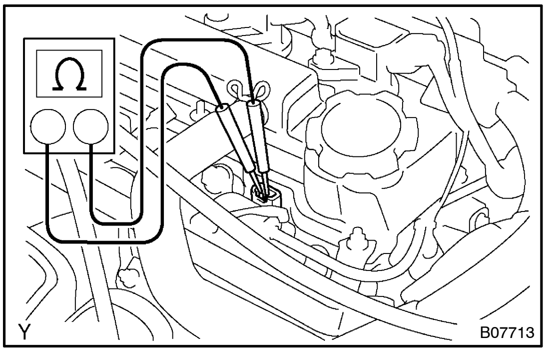
INJECTOR

ON–VEHICLE INSPECTION

SF16H–01

1. **REMOVE NO. 2 CYLINDER HEAD COVER**





2. **CHECK OPERATION SOUND FROM EACH INJECTOR**

(a) Connect the PCV hose to cylinder head cover.

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

(c) If you have no sound scope, you can check the injector transmission operation with your finger.

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

(d) Disconnect the PCV hose from cylinder head cover.

3. **INSPECT INJECTOR RESISTANCE**

(a) Disconnect the injector connector.

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

Resistance:
13.4 – 14.2 Ω at 20°C (68°F)

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

(c) Reconnect the injector connector.

4. **INSTALL WIRE HARNESS PROTECTOR COVER**

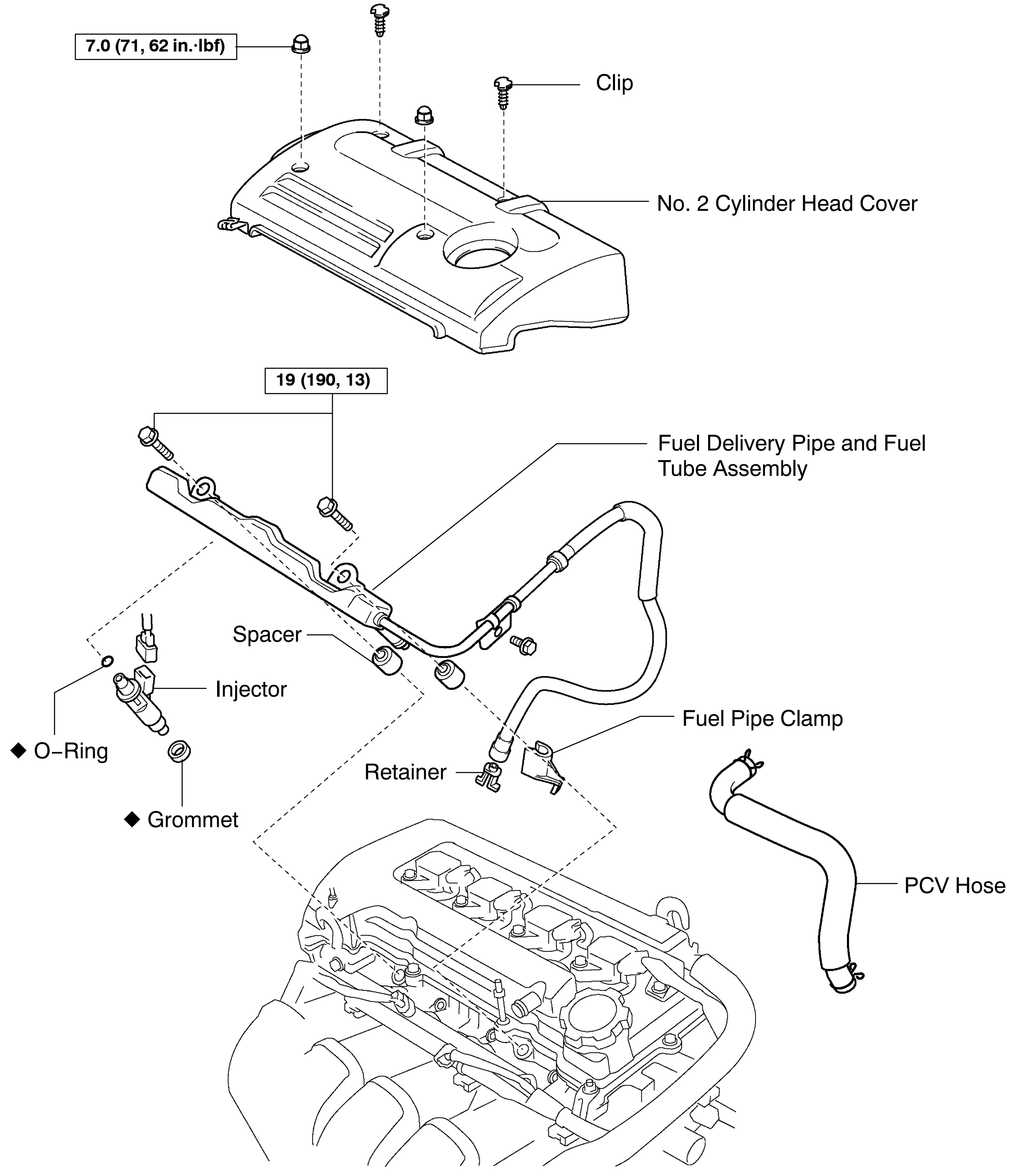
(a) Install the wire harness protector cover with bolt and 2 nuts.

(b) Connect the PCV hose to cylinder head cover.

SF16I–01

COMPONENTS

1ZZ–FE:

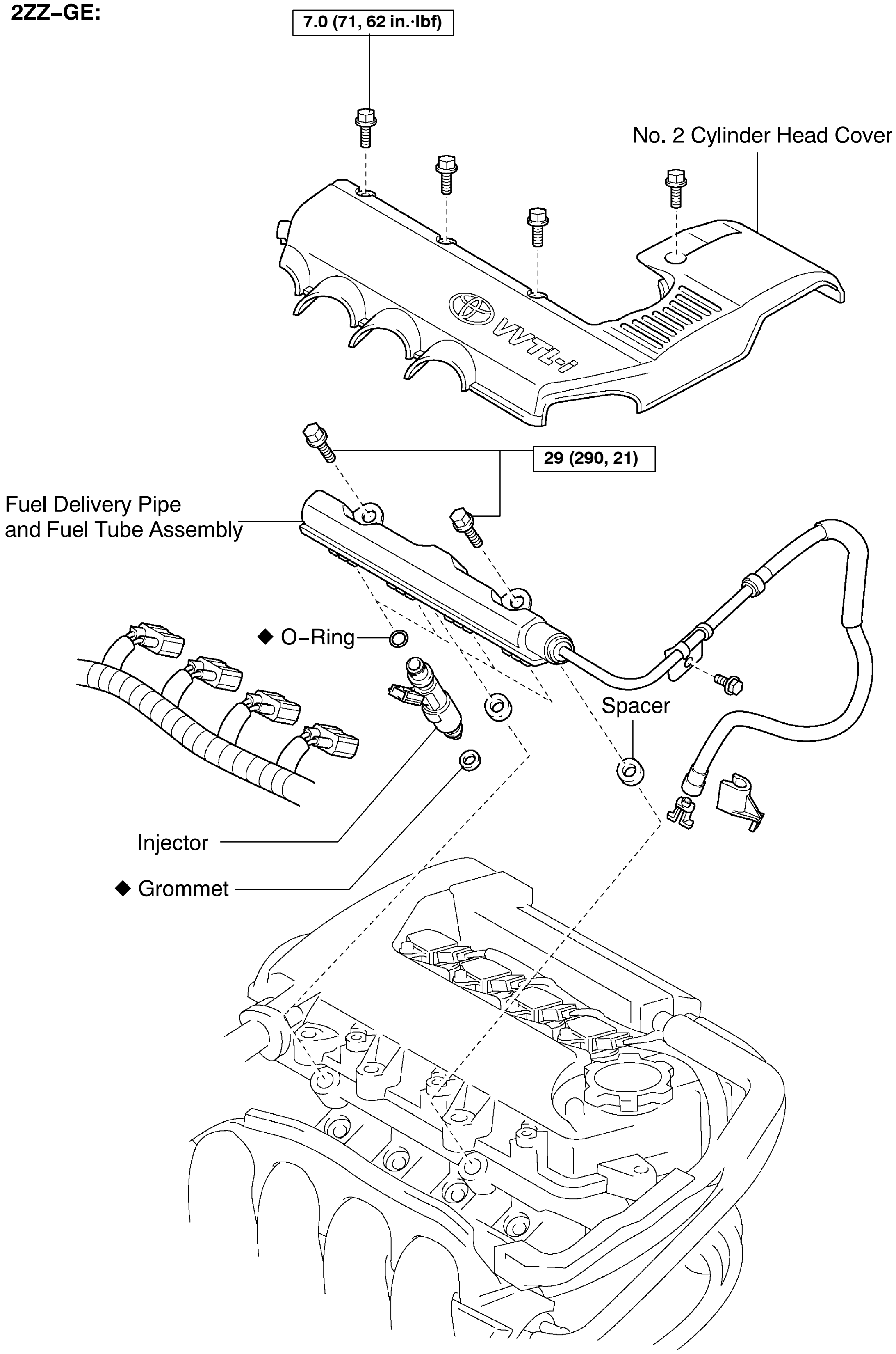


N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non–reusable part

Y B09173

2ZZ–GE:



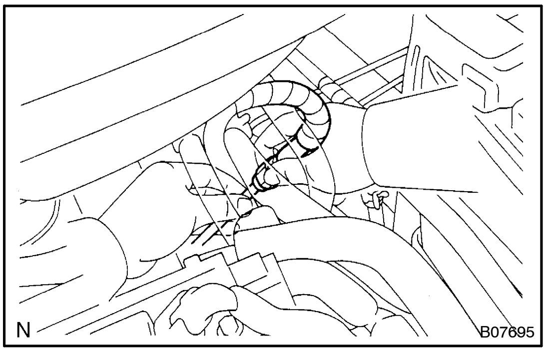
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part

B07714

SF16J–01

REMOVAL

1. **REMOVE NO. 2 CYLINDER HEAD COVER**
2. **1ZZ–FE:**
   REMOVE PCV HOSE

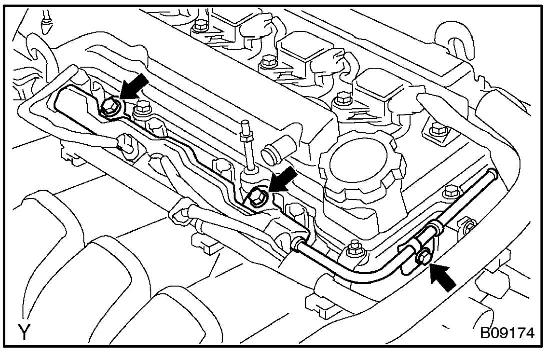


3. **DISCONNECT FUEL TUBE**

(a) Remove the fuel pipe clamp.
(b) Disconnect the fuel tube (fuel tube connector) from the fuel pipe.

CAUTION:

- **Perform disconnecting operations of the fuel tube connector (quick type) after observing the precautions.**
- **As there is retained pressure in the fuel pipe line, prevent it from splashing inside the engine compartment.**

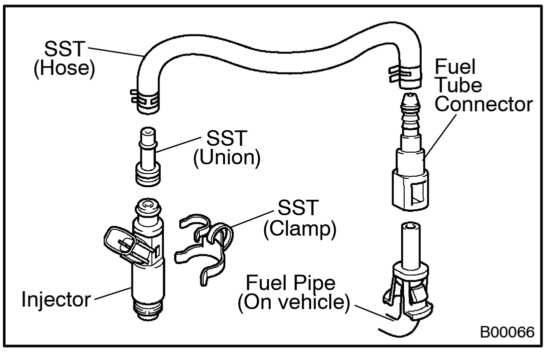


4. **REMOVE DELIVERY PIPE AND INJECTORS**

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

(a) Disconnect the 4 injector connectors from injector.
(b) Remove the 3 bolts and delivery pipe together with the 4 injectors and fuel pipe.
(c) Remove the 2 spacers from the cylinder head.
(d) Pull out the 4 injectors from the delivery pipe.
(e) Remove the O–ring and grommet from each injector.

SF09K–06

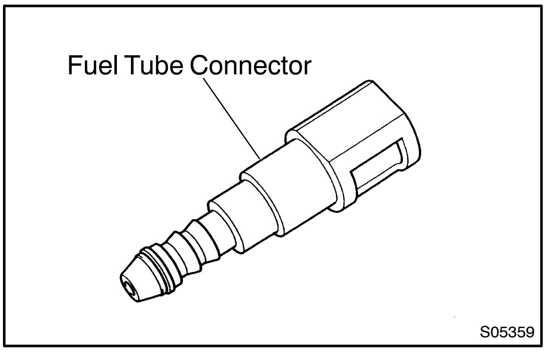


INSPECTION

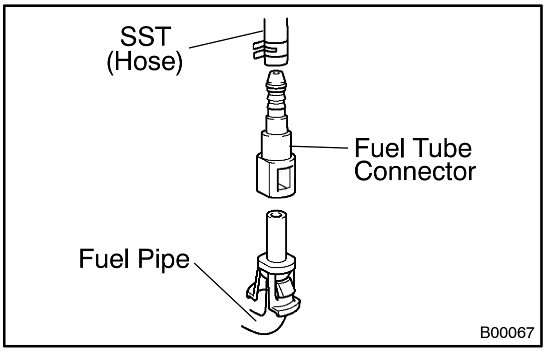
1. INSPECT INJECTOR INSPECTION

CAUTION:

Keep injector clear of sparks during the test.



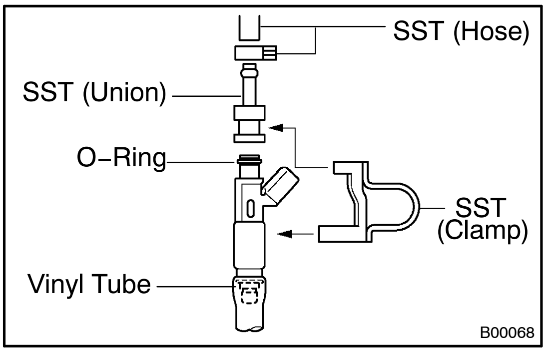
(a) Purchase the new fuel tube and take out the fuel tube connector from its pipe.
Part No. 23901–22010



(b) Connect SST (hose) and fuel tube connector to the fuel pipe.
SST 09268–41047

CAUTION:

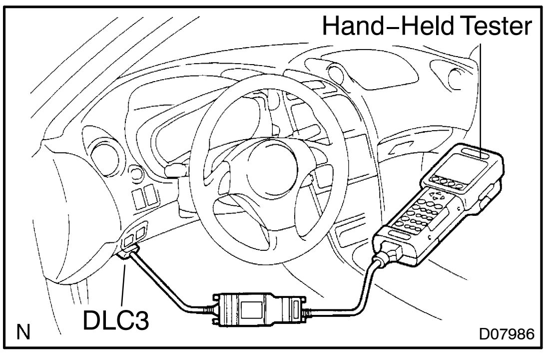
Perform connecting operations of the fuel tube connector (quick type) after observing the precautions.



(c) Install the grommet and O–ring to the injector.
(d) Connect SST (union and hose) to the injector, and hold the injector to prevent gasoline from splashing out.
SST 09268–41047
(e) Put the injector into a graduated cylinder.

HINT:

Install a suitable vinyl tube onto the injector to prevent gasoline from splashing out.



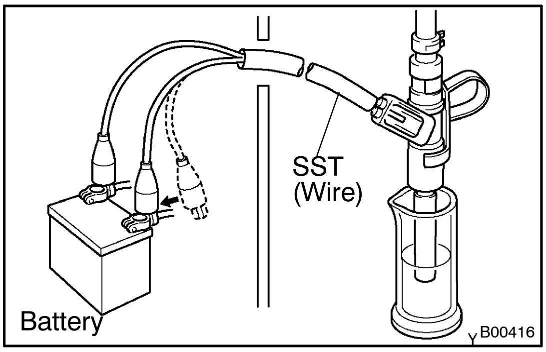
(f) Connect the hand–held tester to the DLC3.
(g) Turn the ignition switch ON and hand–held tester main switch ON.

NOTICE:

Do not start the engine.

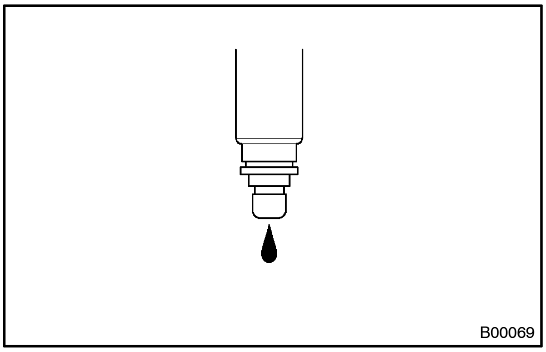
(h) Select the active test mode on the hand–held tester.
(i) Please refer to the hand–held tester operator's manual for further details.

(j) If you have no hand–held tester, connect the positive (+) and negative (–) leads from the battery to the fuel pump connector.
(See page FI–18)



(k) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.
SST 09842–30080
Volume:
47 – 58 cm^3 (2.7 – 3.3 cu in.) per 15 sec.
Difference between each injector:
10 cm^3 (0.6 cu in.) or less

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



2. INSPECT LEAKAGE

(a) In the condition above, disconnect the test probes of SST (wire) from the battery and check the fuel leakage from the injector.
SST 09842–30080
Fuel drop:
1 drop or less per 12 minutes

(b) Turn the ignition switch to LOCK.

(c) Disconnect the negative (–) terminal cable from the battery.

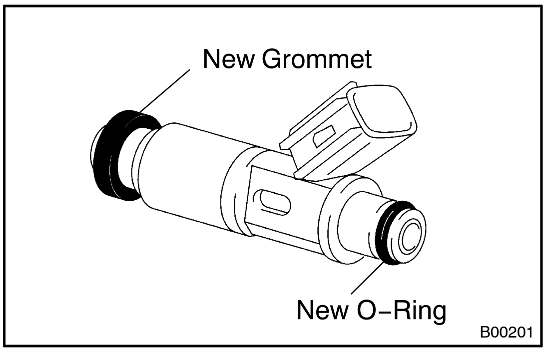
(d) Remove the SST and fuel tube connector.
SST 09268–41047

CAUTION:
- **Perform disconnecting operations of the fuel tube connector (quick type) after observing the precautions.**
- **As there is retained pressure in the fuel pipe line, prevent it from splashing inside the engine compartment.**

(e) Disconnect the hand–held tester from the DLC3.

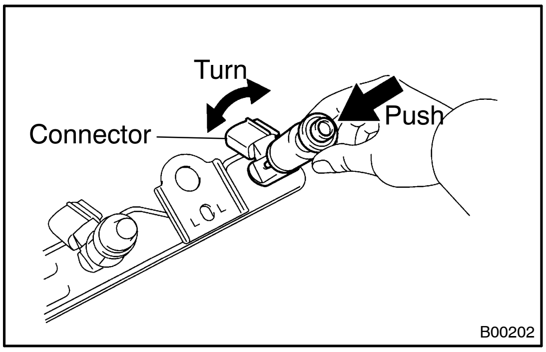
SF09L–05

INSTALLATION

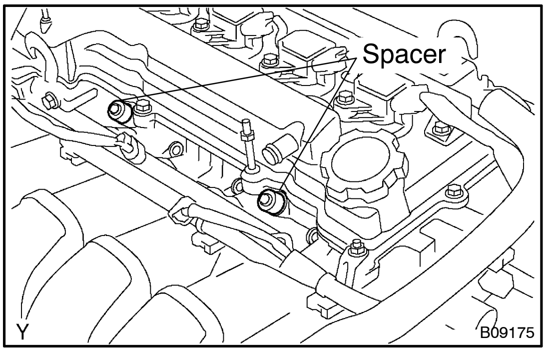


1. INSTALL INJECTORS AND DELIVERY PIPES

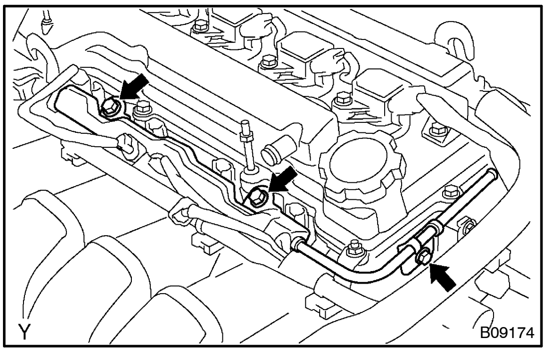
(a) Install the grommet to each injector.
(b) Apply a light coat of spindle oil or gasoline to new O–ring and install them to each injector.



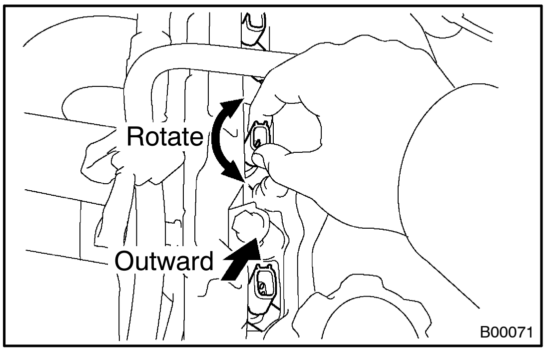
(c) Apply a light coat of spindle oil or gasoline on the place where a delivery pipe touches on O–ring.
(d) While turning the injector clockwise and counterclockwise, push it to the delivery pipes. Install the 4 injectors.
(e) Position the injector connector outward.



(f) Place the 2 spacers in position on the cylinder head.
(g) Apply a light coat of spindle oil or gasoline on the place where a cylinder head touches an O–ring of the injector.
(h) Place the delivery pipe and fuel pipe together with the 4 injectors in position on the cylinder head.



(i) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.
(j) Temporarily install the bolt holding the fuel pipe to the cylinder head.

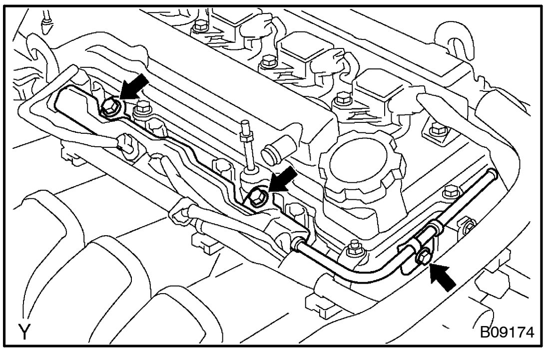


(k) Check that the injectors rotate smoothly.

HINT:

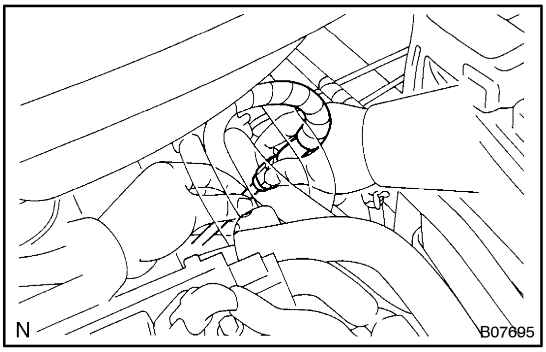
If injectors do not rotate smoothly, the probable cause is incorrect installation of O–ring. Replace the O–ring.

(l) Position the injector connector connector outward.



(m) Tighten the 2 bolts holding the delivery pipe to the cylinder head.
Torque:
1ZZ–FE: 19 N·m (190 kgf·cm, 14 ft·lbf)
2ZZ–GE: 29 N·m (290 kgf·cm, 21 ft·lbf)

(n) Tighten the bolt holding the fuel pipe to the cylinder head.
Torque: 9 N·m (92 kgf·cm, 7 ft·lbf)



2. CONNECT FUEL TUBE

(a) Connect the fuel tube (fuel tube connector) to the fuel pipe.

CAUTION:
Perform connecting operations of the connector (quick type) after observing the precautions.

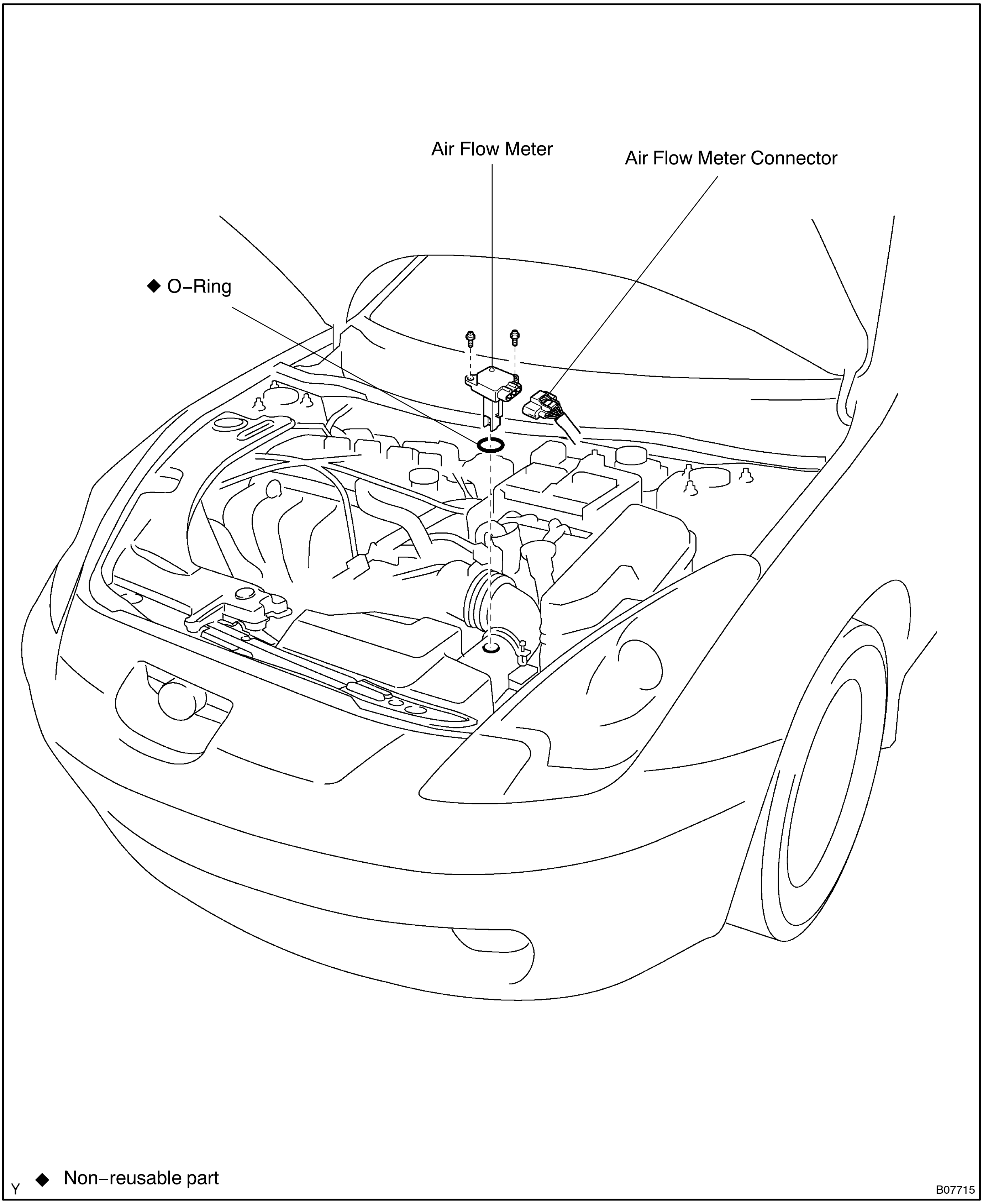
(b) Install the fuel pipe clamp.

3. INSTALL NO. 2 CYLINDER HEAD COVER

AIR FLOW METER

COMPONENTS

FI0DU−03

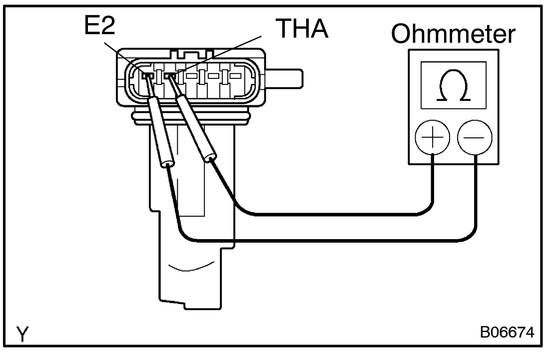


FI0M7–03

REMOVAL

REMOVE AIR FLOW METER

Remove the 2 screws, air flow meter and O–ring.



FI0M8–03

INSPECTION

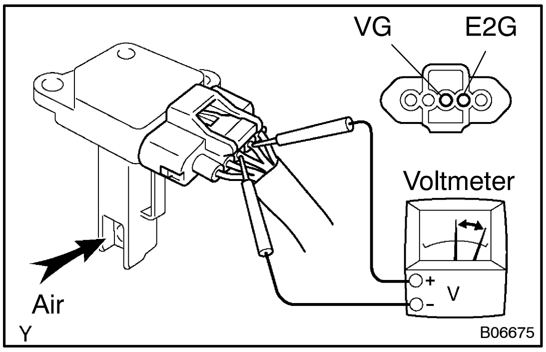
1. INSPECT AIR FLOW METER RESISTANCE

Using an ohmmeter, measure the resistance between terminals THA and E2.

Resistance:

Terminals	Resistance	Temperature
THA – E2	13.6 – 18.4 kΩ	–20°C (–4°F)
THA – E2	2.21 – 2.69 kΩ	20°C (68°F)
THA – E2	0.49 – 0.67 kΩ	60°C (140°F)

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



2. INSPECT AIR FLOW METER OPERATION

(a) Connect the air flow meter connector.

(b) Turn the ignition switch to ON.

(c) Using a voltmeter, connect the positive (+) tester probe to terminal VG, and negative (–) tester probe to terminal E2G.

(d) Blow air into the air flow meter, and check that the voltage fluctuates.

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

(e) Turn the ignition switch LOCK.

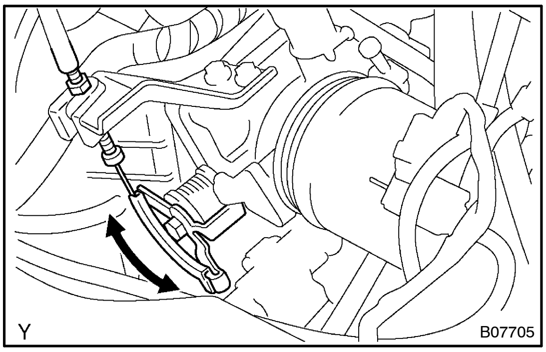
(f) Disconnect the air flow meter connector.

FI0M9–03

INSTALLATION

INSTALL AIR FLOW METER

Install the air flow meter and a new O–ring with 2 screws.



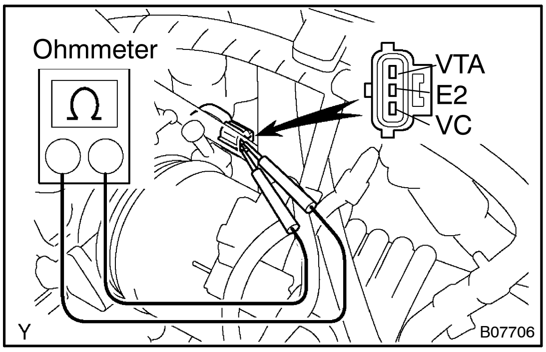
THROTTLE BODY

SF09P–04

ON–VEHICLE INSPECTION

1. INSPECT THROTTLE BODY

Check that the throttle linkage moves smoothly.



2. INSPECT THROTTLE POSITION SENSOR

(a) Remove the air cleaner assembly with air flow meter.

(b) Disconnect the throttle position sensor connector.

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

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ

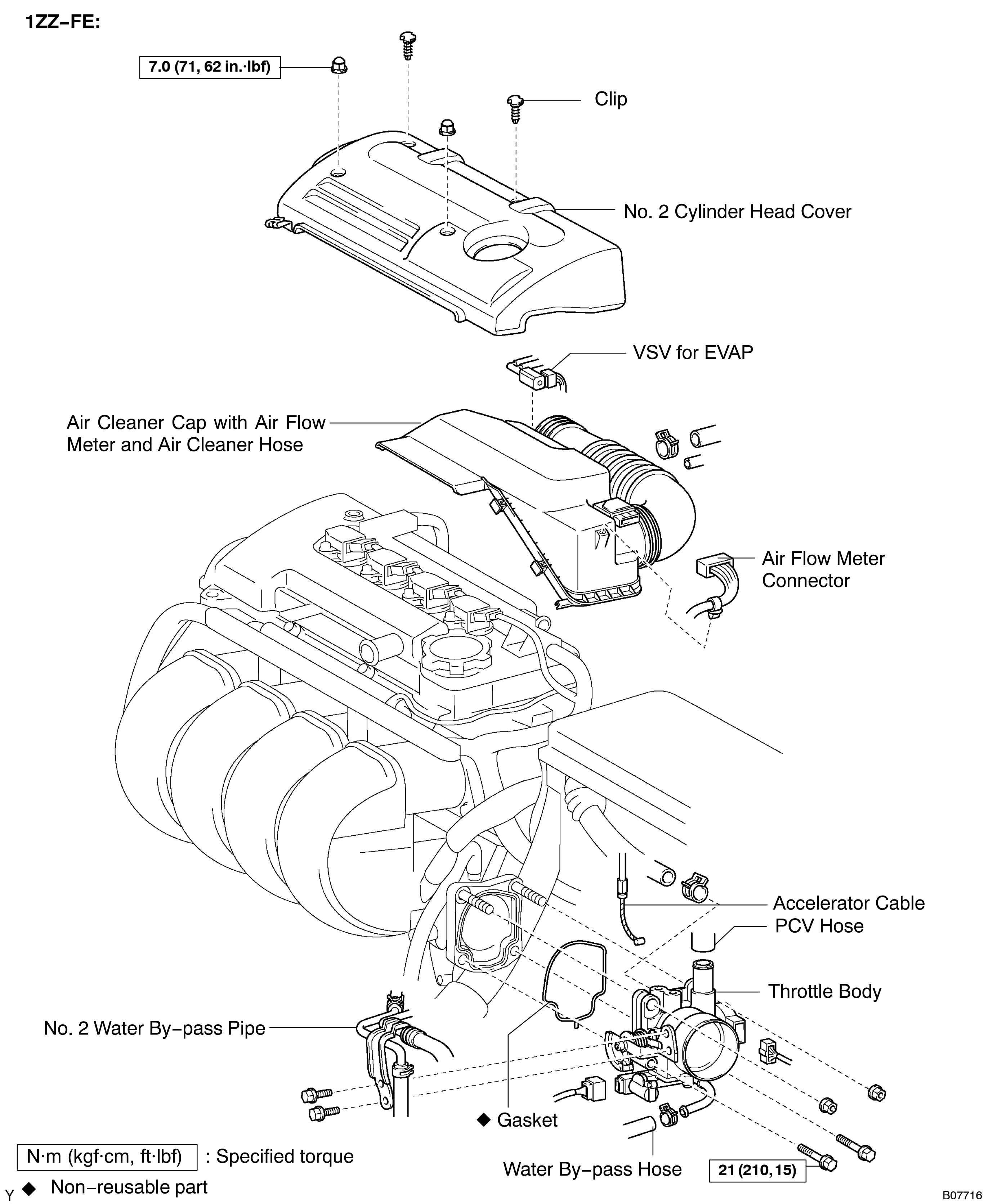
(d) Reconnect the throttle position sensor connector.

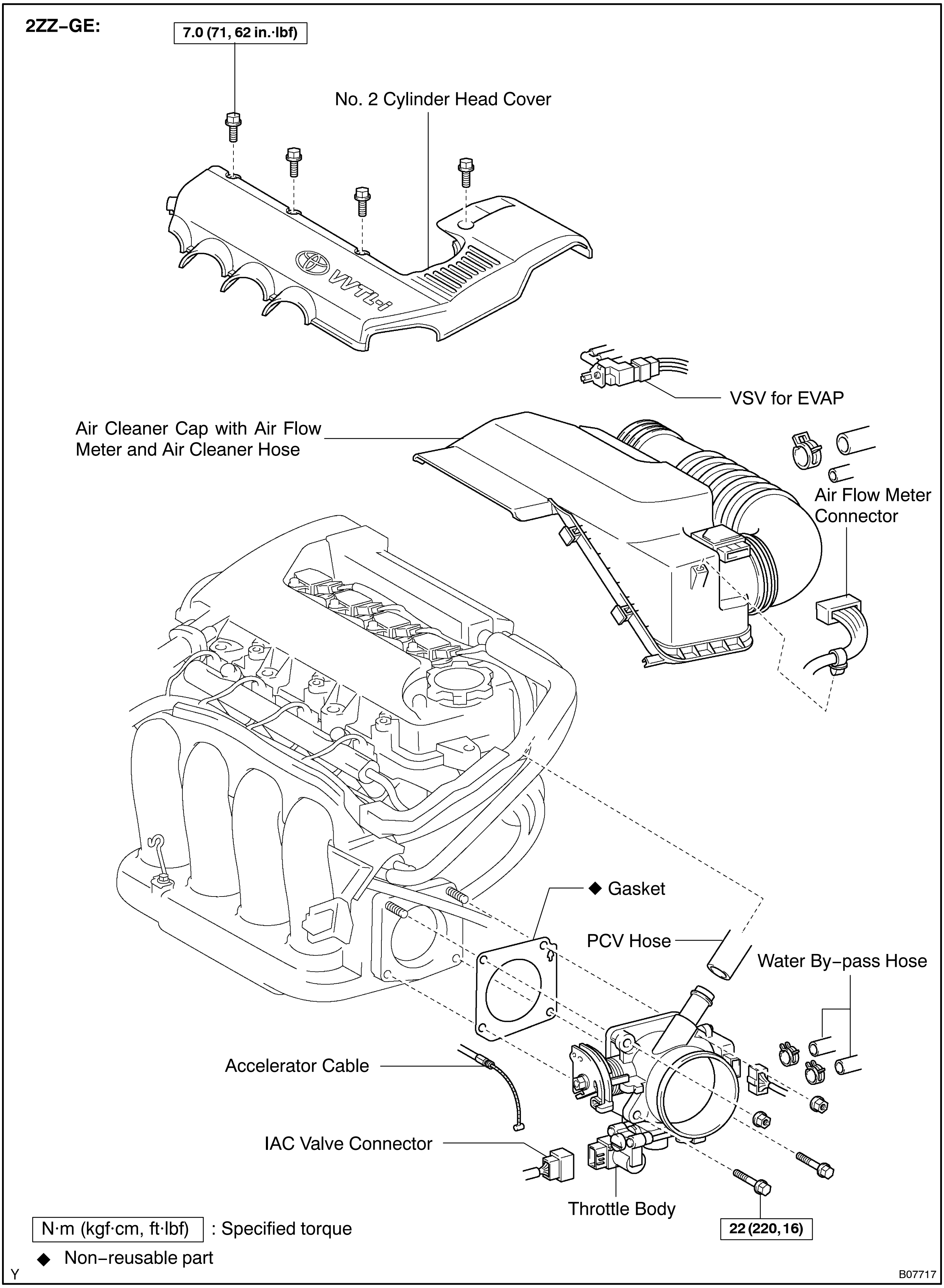
(e) Reinstall the air cleaner assembly with air flow meter.

SF15R–01

COMPONENTS

1ZZ–FE:




2ZZ–GE:
7.0 (71, 62 in.·lbf)
No. 2 Cylinder Head Cover
VSV for EVAP
Air Cleaner Cap with Air Flow Meter and Air Cleaner Hose
Air Flow Meter Connector
◆ Gasket
PCV Hose
Water By–pass Hose
Accelerator Cable
IAC Valve Connector
Throttle Body
22 (220, 16)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
Y
B07717

SF15S–01

REMOVAL

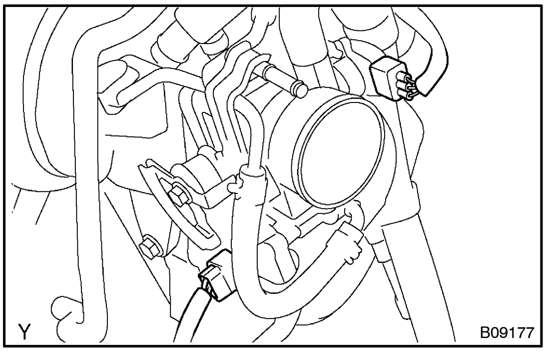
1. DRAIN ENGINE COOLANT

2. DISCONNECT ACCELERATOR CABLE

3. REMOVE NO. 2 CYLINDER HEAD COVER

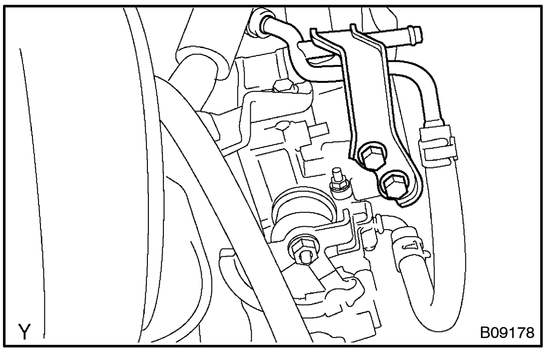
4. REMOVE AIR CLEANER HOSE AND CAP WITH MAF METER

(a) Disconnect the VSV for EVAP.
(b) Disconnect the 2 air hoses from air cleaner cap.
(c) Loosen the air cleaner hose clamp bolt.
(d) Disconnect the mass air flow meter connector.
(e) Disconnect the 3 air cleaner cap clips.
(f) Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap together with the air cleaner hose.

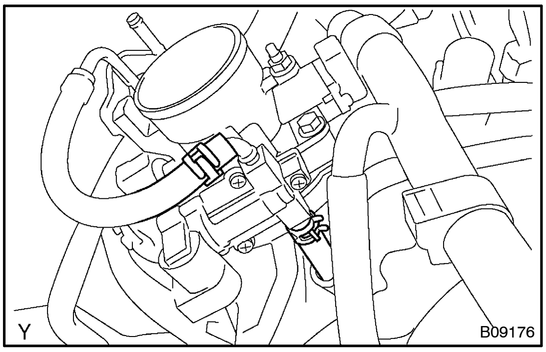


5. REMOVE THROTTLE BODY

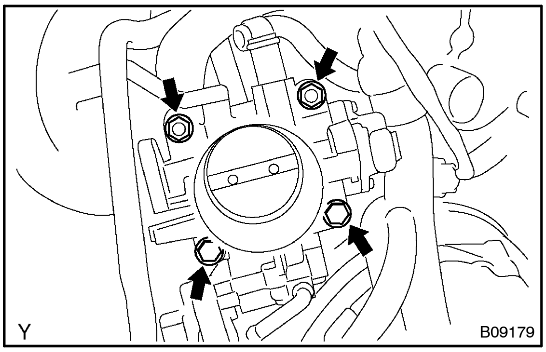
(a) Disconnect the throttle position sensor connector.
(b) Disconnect the IAC valve connector.
(c) Disconnect the PCV hose from throttle body.



(d) 1ZZ–FE:
Remove the 2 bolts and disconnect the No. 2 water by–pass pipe.



(e) Disconnect the 2 water bypass hoses.

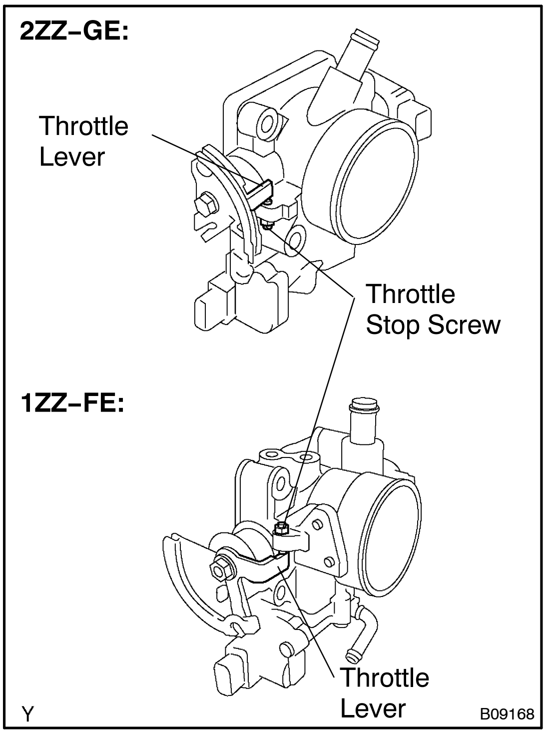


(f) Remove the 2 bolts, 2 nuts and throttle body from the intake manifold.

(g) Remove the throttle body gasket.

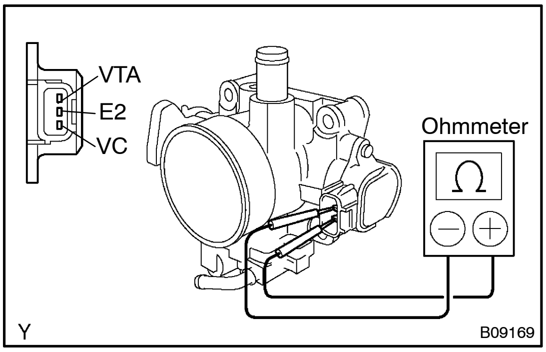
SF09S–04

INSPECTION



1. INSPECT THROTTLE VALVE

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



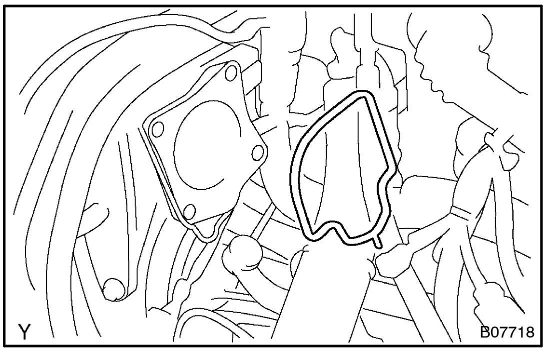
2. INSPECT THROTTLE POSITION SENSOR

Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ

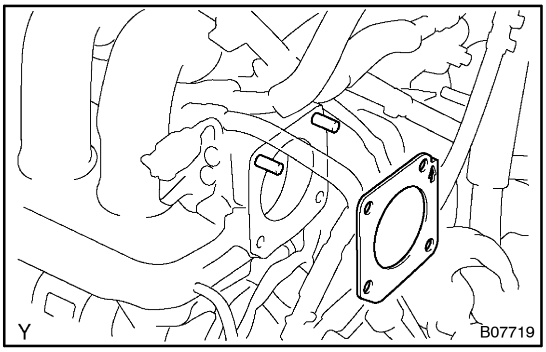
SF15T–01

INSTALLATION



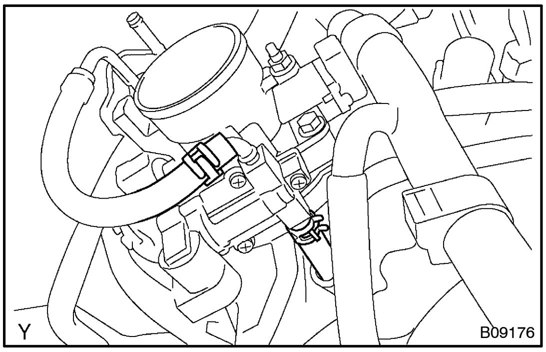
1. INSTALL THROTTLE BODY

(a) 1ZZ–FE:
Install a new gasket on the intake manifold, as shown in the illustration.

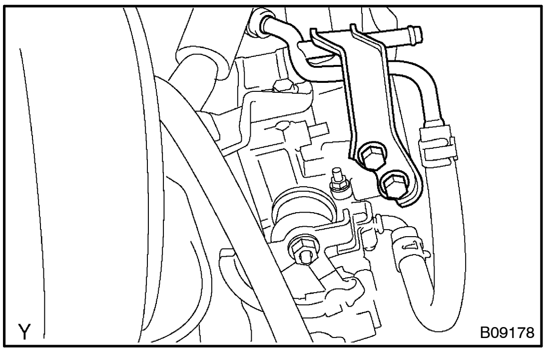


(b) 2ZZ–GE:
Install a new gasket on the intake manifold, as shown in the illustration.

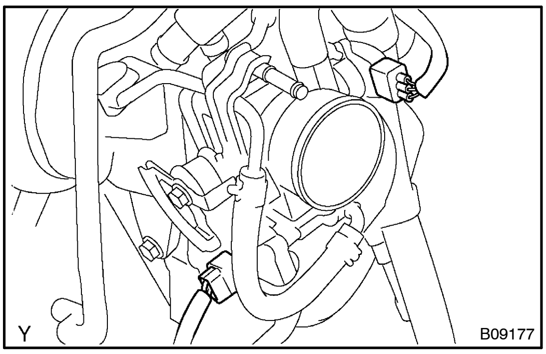
(c) Install the throttle body with the 2 bolts and 2 nuts.
Torque:
1ZZ–FE: 21 N·m (210 kgf·cm, 15 ft·lbf)
2ZZ–GE: 22 N·m (220 kgf·cm, 16 ft·lbf)



(d) Connect the 2 water bypass hoses to the throttle body.



(e) 1ZZ–FE:
Install the No. 2 water by–pass pipe with the 2 bolts.

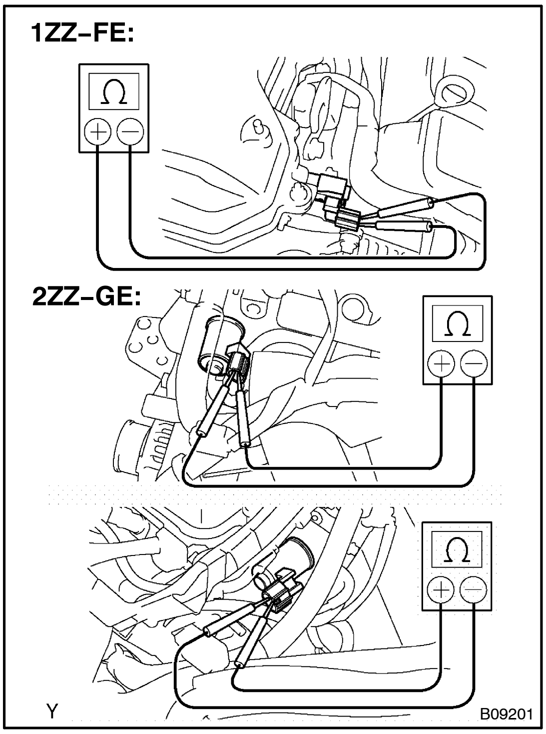


(f) Connect the IAC valve connector.
(g) Connect the throttle position sensor connector.
(h) Connect the PCV hose to throttle body.

2. INSTALL AIR CLEANER HOSE AND CAP WITH MAF METER

3. INSTALL NO. 2 CYLINDER HEAD COVER

4. FILL RADIATOR WITH ENGINE COOLANT



CAMSHAFT TIMING OIL CONTROL VALVE

SF0SL–07

ON–VEHICLE INSPECTION

INSPECT OIL CONTROL VALVE RESISTANCE

(a) Remove the No. 2 cylinder head cover.

(b) 2ZZ–GE:
Disconnect the 2 PCV hoses.

(c) Disconnect the oil control valve connector.

(d) Using an ohmmeter, measure the resistance between the terminals.
Resistance: 6.9 – 7.9 Ω at 20°C (68°F)

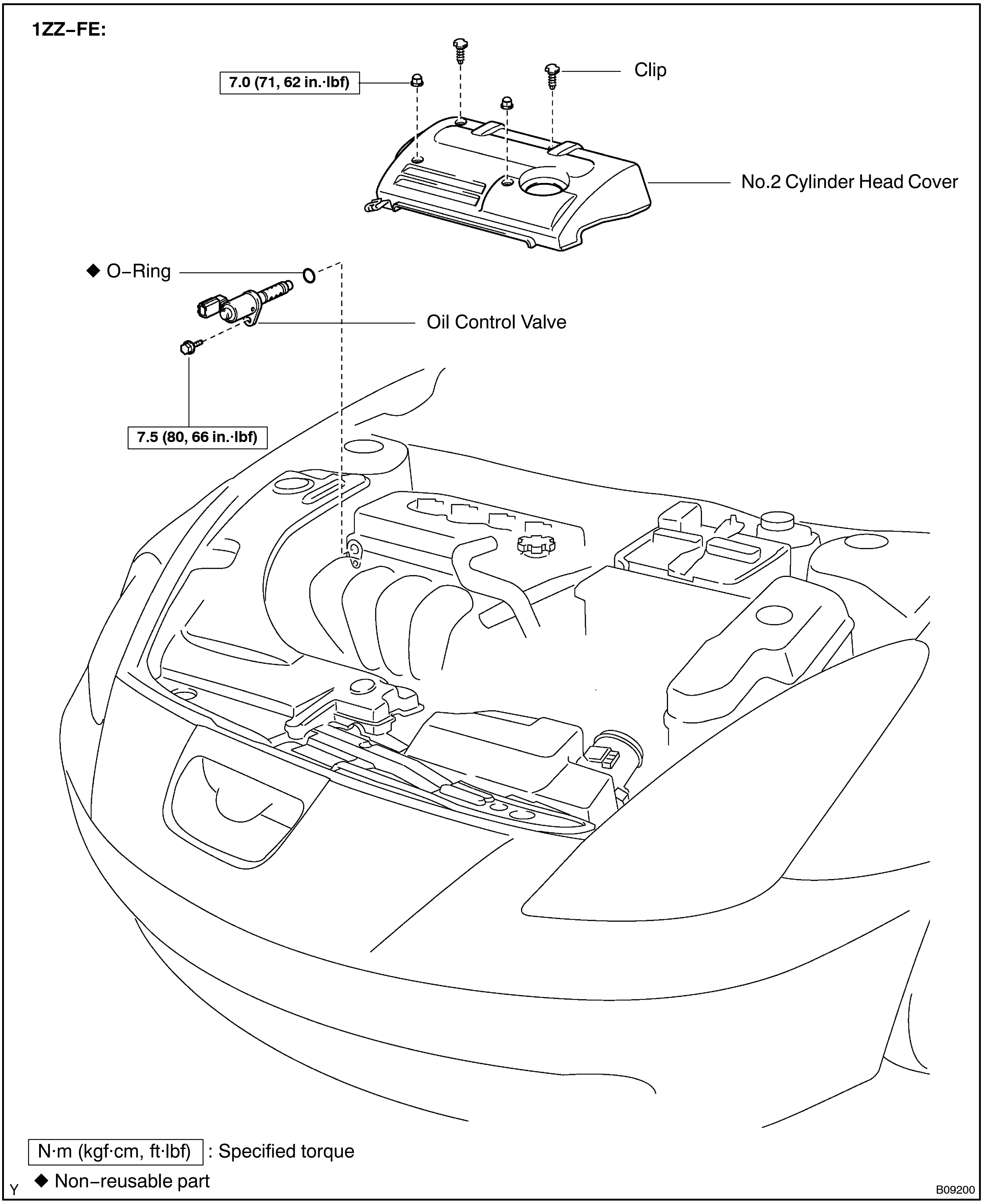
If the resistance is not as specified, replace the valve.

(e) Reconnect the oil control valve connector.

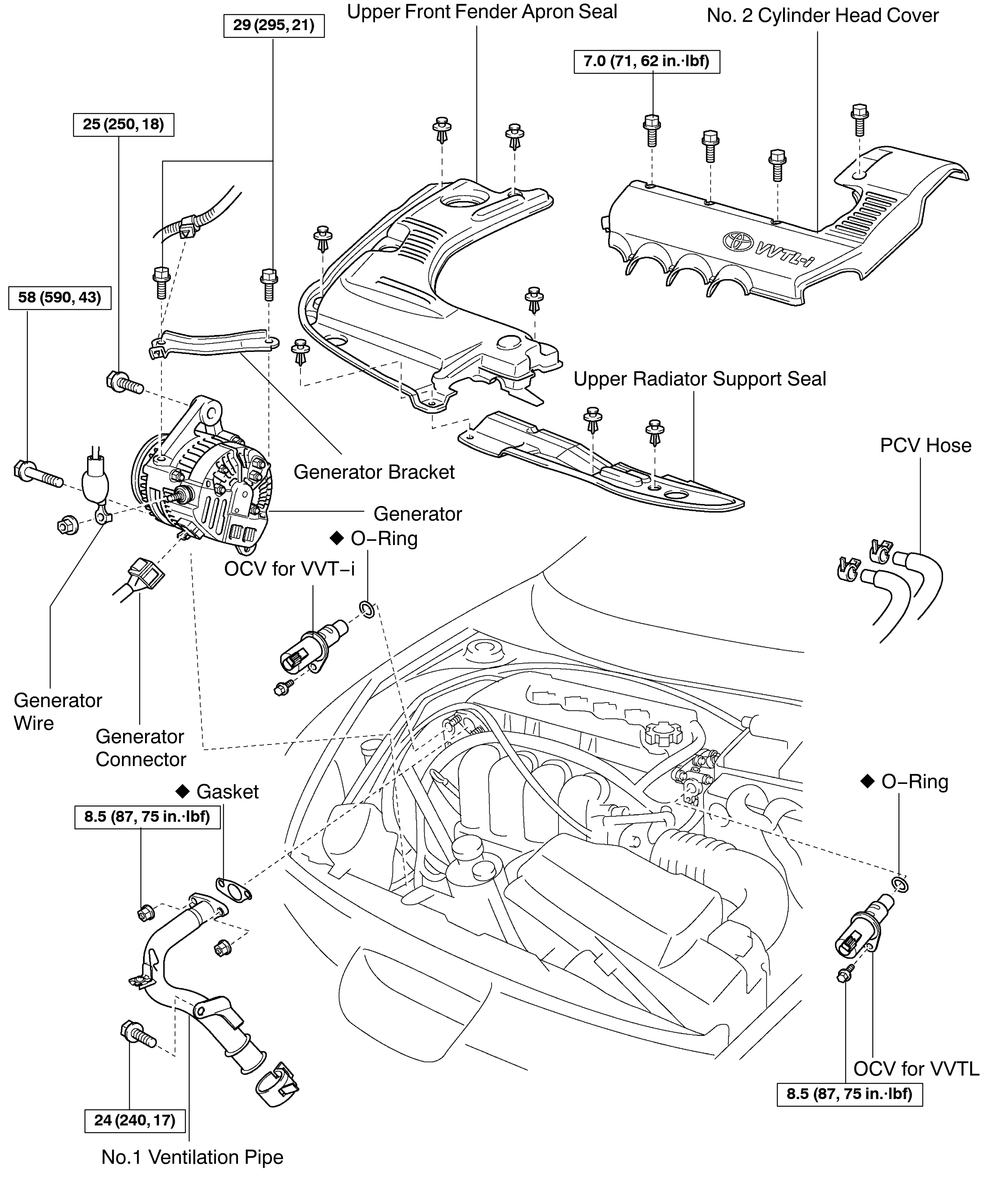
(f) Reinstall the V–bank cover.

SF16L–01

COMPONENTS



2ZZ–GE:



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

◆ Non–reusable part

SF0ZY–04

REMOVAL

1. **REMOVE NO. 2 CYLINDER HEAD COVER**
2. **2ZZ–GE:**
DISCONNECT 2 PCV HOSES, UPPER FRONT FENDER APRON SEAL AND UPPER RADIATOR SUPPORT SEAL
3. **2ZZ–GE:**
REMOVE ALTERNATOR

(a) Remove the 2 bolts and alternator bracket.
Torque: 29 N·m (295 kgf·cm, 21 ft·lbf)

(b) Remove the drive belt.

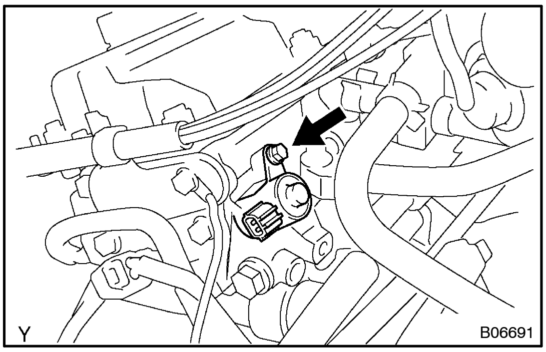
(c) Remove the 2 bolts and alternator.
Torque:
14 mm head 25 N·m (250 kgf·cm, 18 ft·lbf)
17 mm head 58 N·m (590 kgf·cm, 43 ft·lbf)

4. **2ZZ–GE:**
REMOVE NO. 1 VENTILATION PIPE

(a) Remove the 2 nuts, bolt and gasket.

HINT:
At the time of installation, please refer to the following items.
Use a new gasket.

(b) Reomve the hose clamp and disconnect No.1 ventilation pipe.



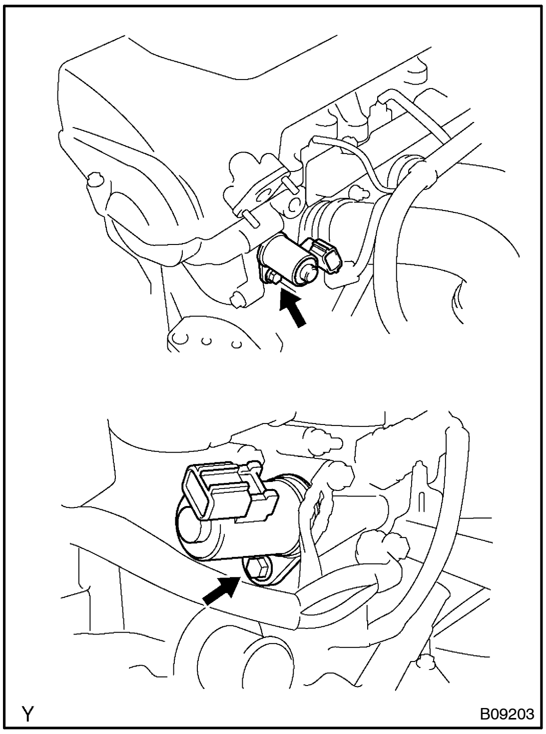
5. **1ZZ–FE:**
REMOVE CAMSHAFT TIMING OIL CONTROL VALVE

(a) Disconnect the oil control valve connector.

(b) Remove the bolt and oil control valve.
Torque: 7.5 N·m (80 kgf·cm, 66 in.·lbf)

(c) Remove the O–ring from the oil control valve.

HINT:
At the time of installation, please refer to the following items.
Use a new O–ring.

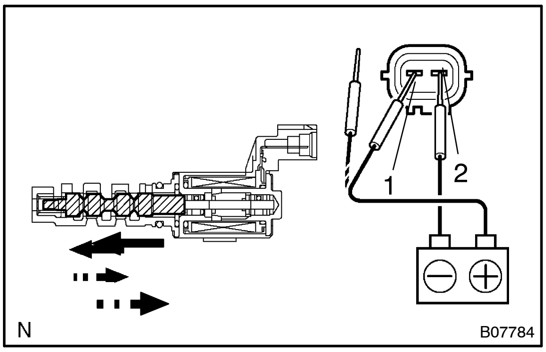


6. 2ZZ–GE:
REMOVE 2 CAMSHAFT TIMING OIL CONTROL VALVES

(a) Disconnect the oil control valve connector.
(b) Remove the 2 bolts and oil control valves.
Torque: 8.5 N·m (87 kgf·cm, 75 in.·lbf)
(c) Remove the O–ring from the each oil control valve.

HINT:
At the time of installation, please refer to the following items.
Use a new O–ring.

SF0SO–07



INSPECTION

INSPECT CAMSHAFT OIL CONTROL VALVE OPERATION

Connect the positive (+) lead from the battery to terminal 1 and negative (–) lead to terminal 2, and check the movement of the valve.

Battery positive voltage is applied	Valve moves in ← direction
Battery positive voltage is cut off	Valve moves in ··→ direction

If operation is not as specified, replace the valve.

SF0SP–07

INSTALLATION

Installation is in the reverse order of removal. **(See page FI–40)**

IDLE SPEED CONTROL (ISC) VALVE

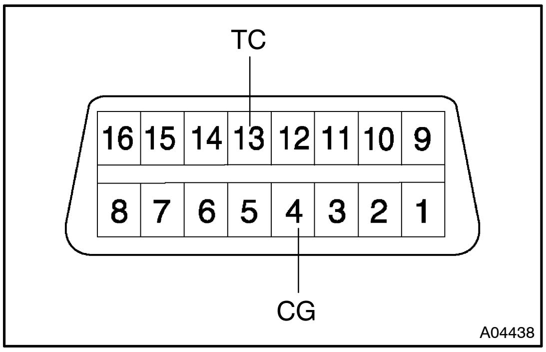
FI0MA–02

ON–VEHICLE INSPECTION

INSPECT ISC VALVE OPERATION

(a) Initial conditions:

- Engine at normal operating temperature
- Idle speed set correctly
- Transmission in neutral
- A/C switch OFF



(b) Using SST, connect terminals TC and CG of the DLC3.
SST 09843–18020

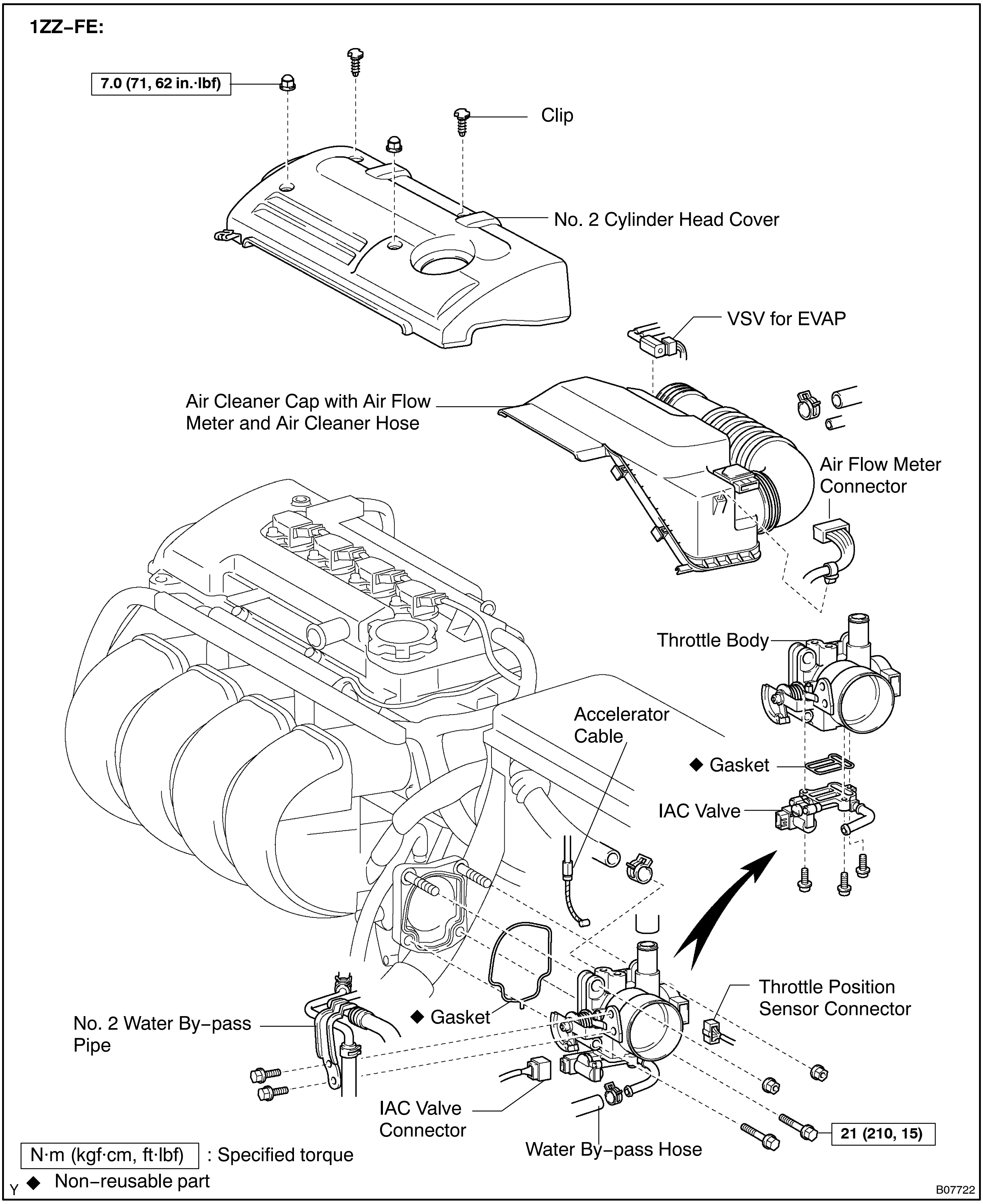
(c) After engine speed has been kept kept at 900 – 1,300 rpm for 5 seconds, check that it returns to idle speed.

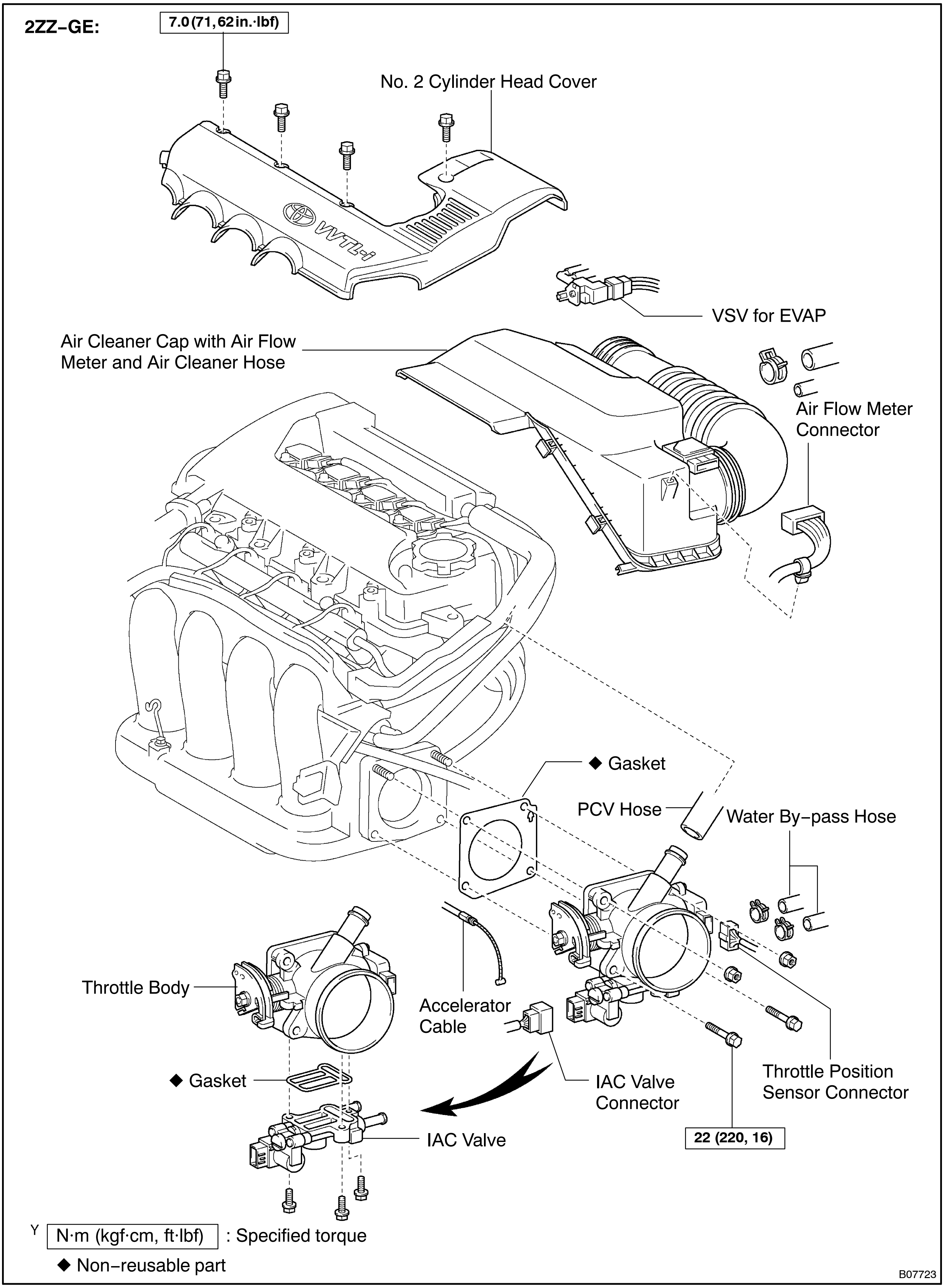
If the rpm operation is not as specified, check the ISC valve, wiring and engine ECU.

(d) Remove the SST from the DLC3.
SST 09843–18020

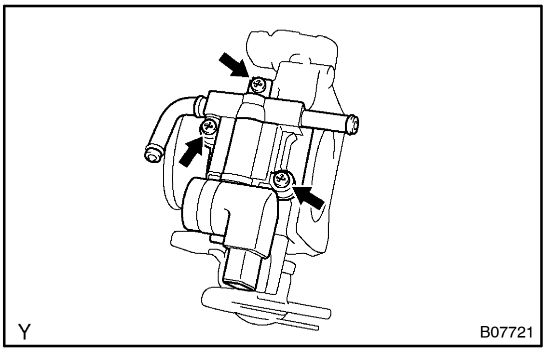
FI0PA–01

COMPONENTS




2ZZ–GE:
7.0 (71, 62 in.·lbf)
No. 2 Cylinder Head Cover
VVTL-i
VSV for EVAP
Air Cleaner Cap with Air Flow Meter and Air Cleaner Hose
Air Flow Meter Connector
◆ Gasket
PCV Hose
Water By–pass Hose
Throttle Body
Accelerator Cable
◆ Gasket
IAC Valve Connector
Throttle Position Sensor Connector
IAC Valve
22 (220, 16)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
B07723

FI0PB–01



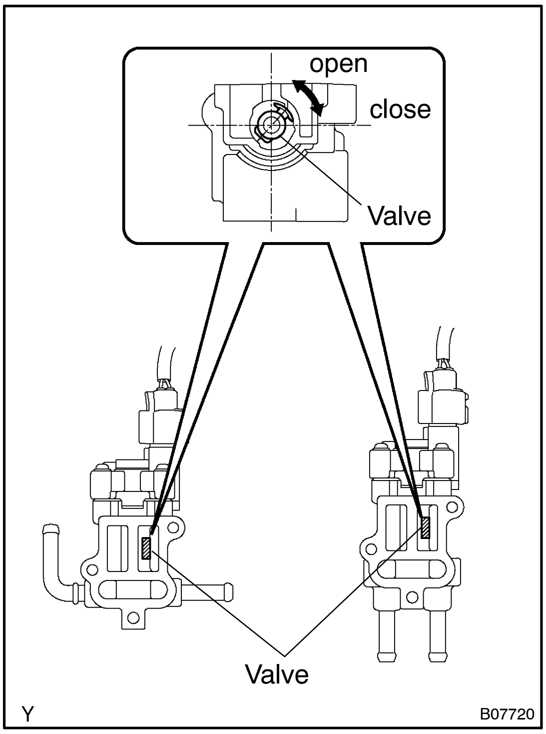
REMOVAL

1. REMOVE THROTTLE BODY
(See page FI–33)

2. REMOVE ISC VALVE

Remove the 4 screws, ISC valve and gasket.

FI0MD–02



INSPECTION

INSPECT ISC VALVE OPERATION

(a) Check that the ISC valve is half opened.
(b) Connect the ISC valve connector to the ISC valve.
(c) Disconnect the water temperature sensor connector from the water temperature sensor.
(d) Turn the ignition switch ON.
(e) Check that the ISC valve moves.

HINT:
Repeat connecting and disconnecting of ISC valve connector several times and check the operation of the valve.
If operation is not as specified, replace the ISC valve.

(f) Turn the ignition switch OFF.
(g) Connect the water temperature sensor connector to the water temperature sensor.
(h) Disconnect the ISC valve connector from the ISC valve.

FI0ME–02

INSTALLATION

Installation is in reverse order of removal (See page FI–47).

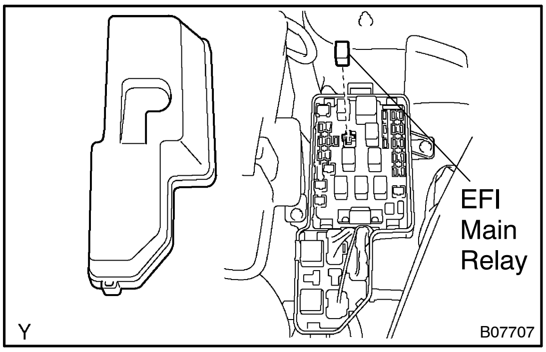
HINT:

Install the ISC valve with a new gasket.

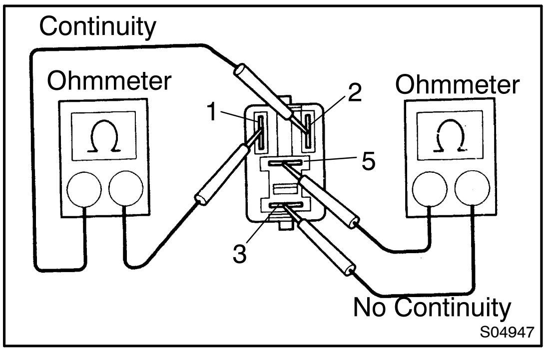
EFI MAIN RELAY

SF09Z–05

INSPECTION



1. **REMOVE EFI MAIN RELAY (Marking: EFI)**



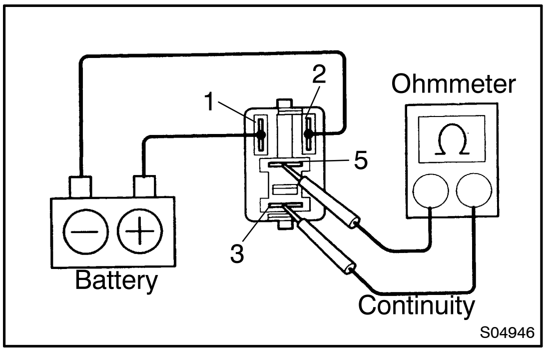
2. **INSPECT EFI MAIN RELAY CONTINUITY**

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

(b) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.



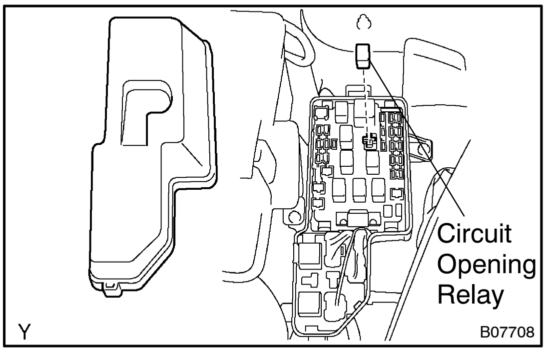
3. **INSPECT EFI MAIN RELAY OPERATION**

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

(b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If there is no continuity, replace the relay.

4. **REINSTALL EFI MAIN RELAY**

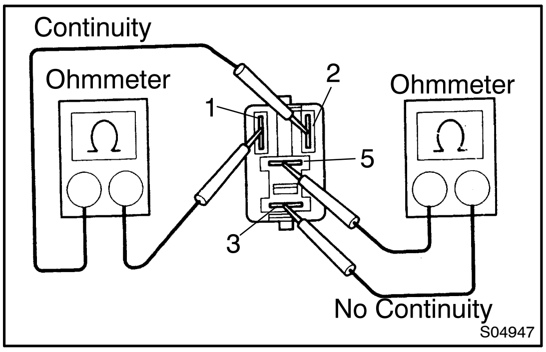


CIRCUIT OPENING RELAY

SF0A0–05

INSPECTION

1. REMOVE CIRCUIT OPENING RELAY



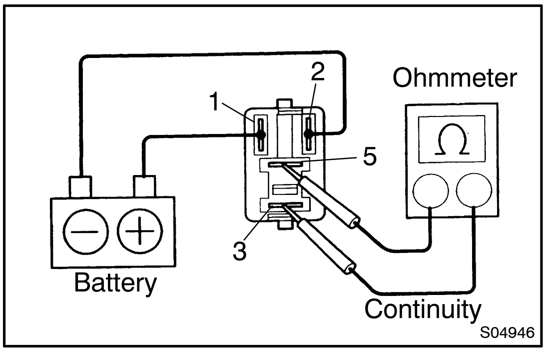
2. INSPECT CIRCUIT OPENING RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

(b) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.



3. INSPECT CIRCUIT OPENING RELAY OPERATION

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

(b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

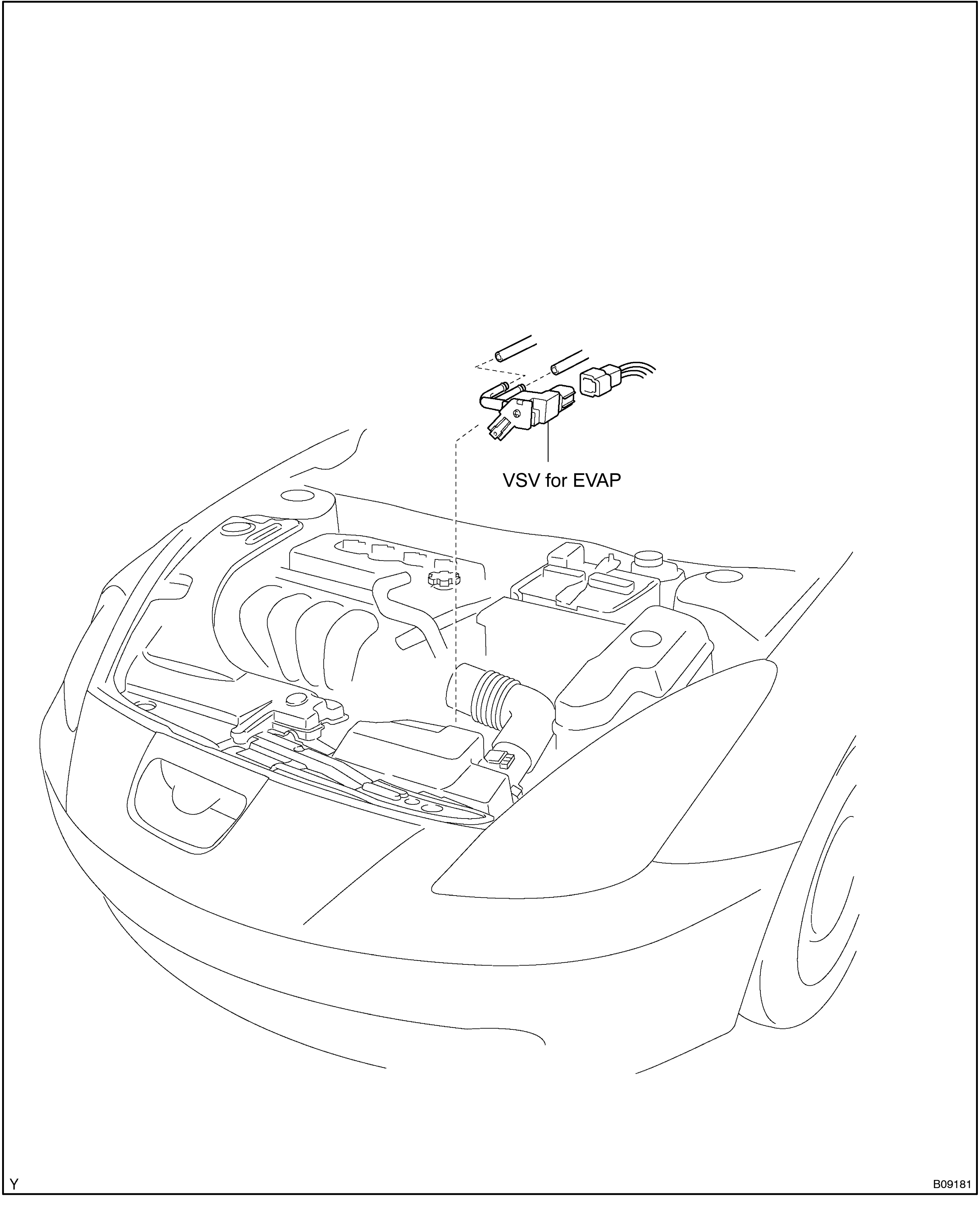
If there is no continuity, replace the relay.

4. REINSTALL CIRCUIT OPENING RELAY

VSV FOR EVAPORATIVE EMISSION (EVAP)

FI0PC–01

COMPONENTS



SF16K–01

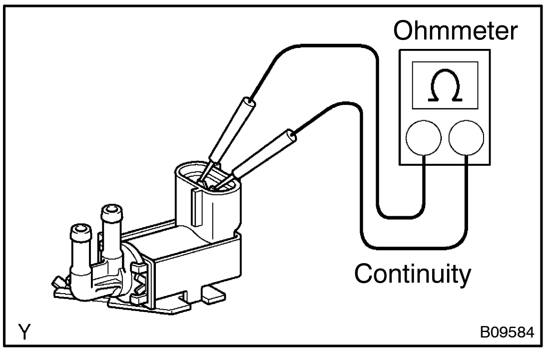
INSPECTION

1. REMOVE VSV

(a) Disconnect the 2 EVAP hoses from the VSV.

(b) Disconnect the VSV connector.

(c) Remove the bolt and VSV.



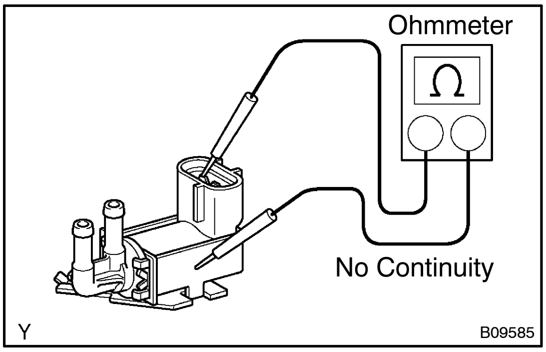
2. INSPECT VSV FOR OPEN CIRCUIT

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

Resistance:

27 – 33 Ω at 20°C (68°F)

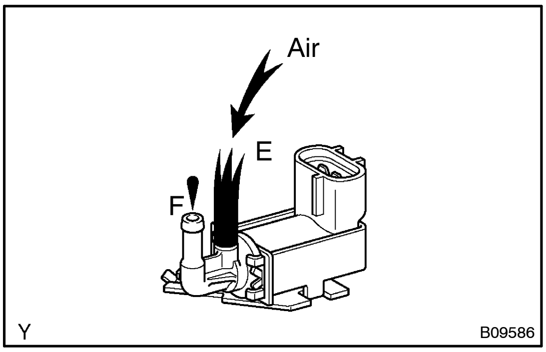
If there is no continuity, replace the VSV.



3. INSPECT VSV FOR GROUND

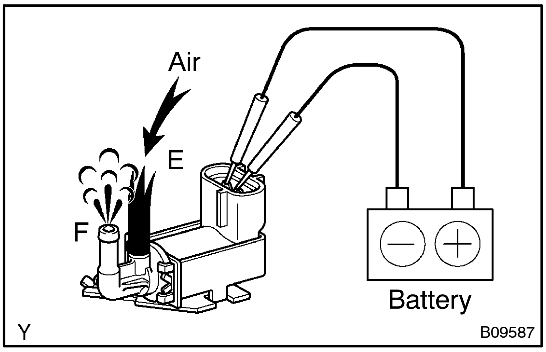
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.



4. INSPECT VSV OPERATION

(a) Check that air flows with difficulty from port E to port F.



(b) Apply battery voltage across the terminals.

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

If operation is not as specified, replace the VSV.

5. REINSTALL VSV

(a) Install the VSV with the bolt.

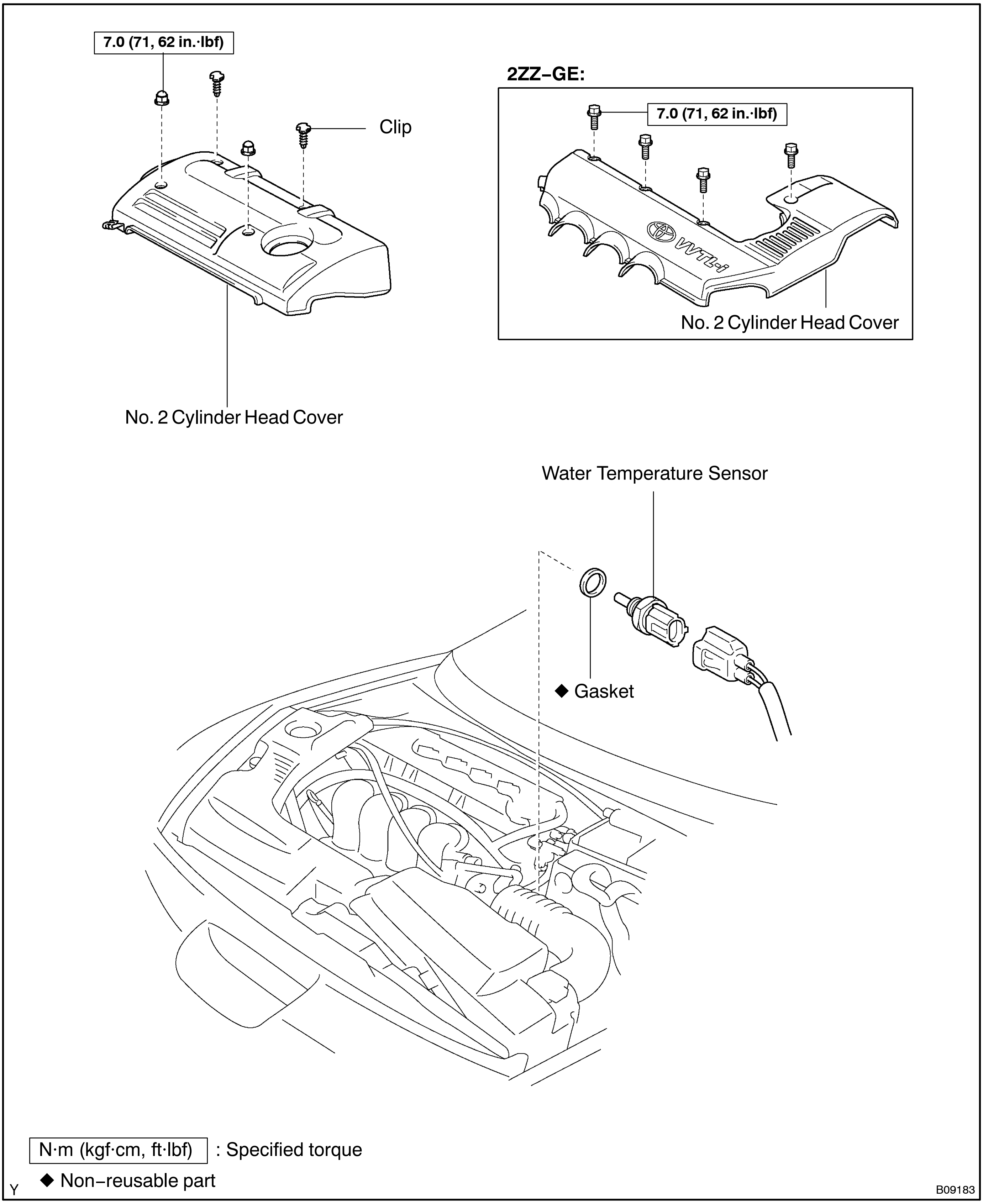
(b) Connect the VSV with the bolt.

(c) Connect the 2 EVAP hoses to the VSV.

WATER TEMPERATURE SENSOR

COMPONENTS

FI0PD–01

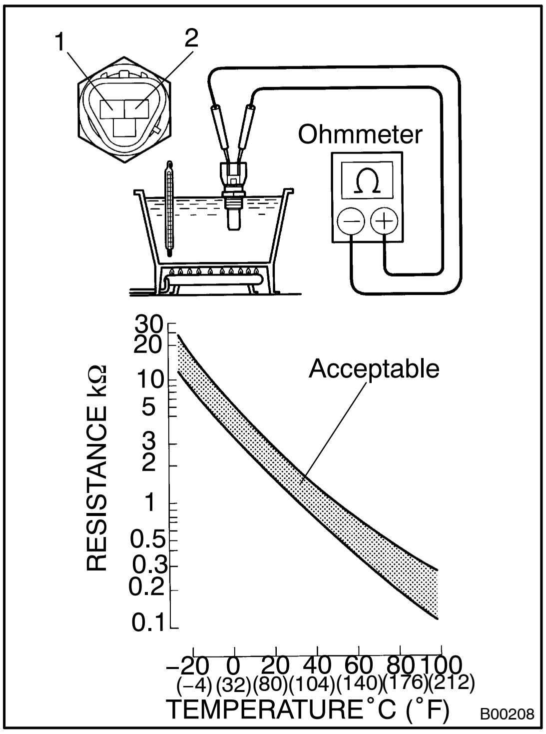


FI0PE–01

INSPECTION

1. **DRAIN ENGINE COOLANT**
2. **REMOVE NO.2 CYLINDER HEAD COVER**
3. **REMOVE WATER TEMPERATURE SENSOR**

(a) Disconnect the sensor connector.
(b) Remove the water temperature sensor.



4. **INSPECT WATER TEMPERATURE SENSOR RESISTANCE**

Using an ohmmeter, measure the resistance between terminals 1 (E2) and 2 (THW).

Resistance: Refer to the graph

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

5. **REINSTALL WATER TEMPERATURE SENSOR**

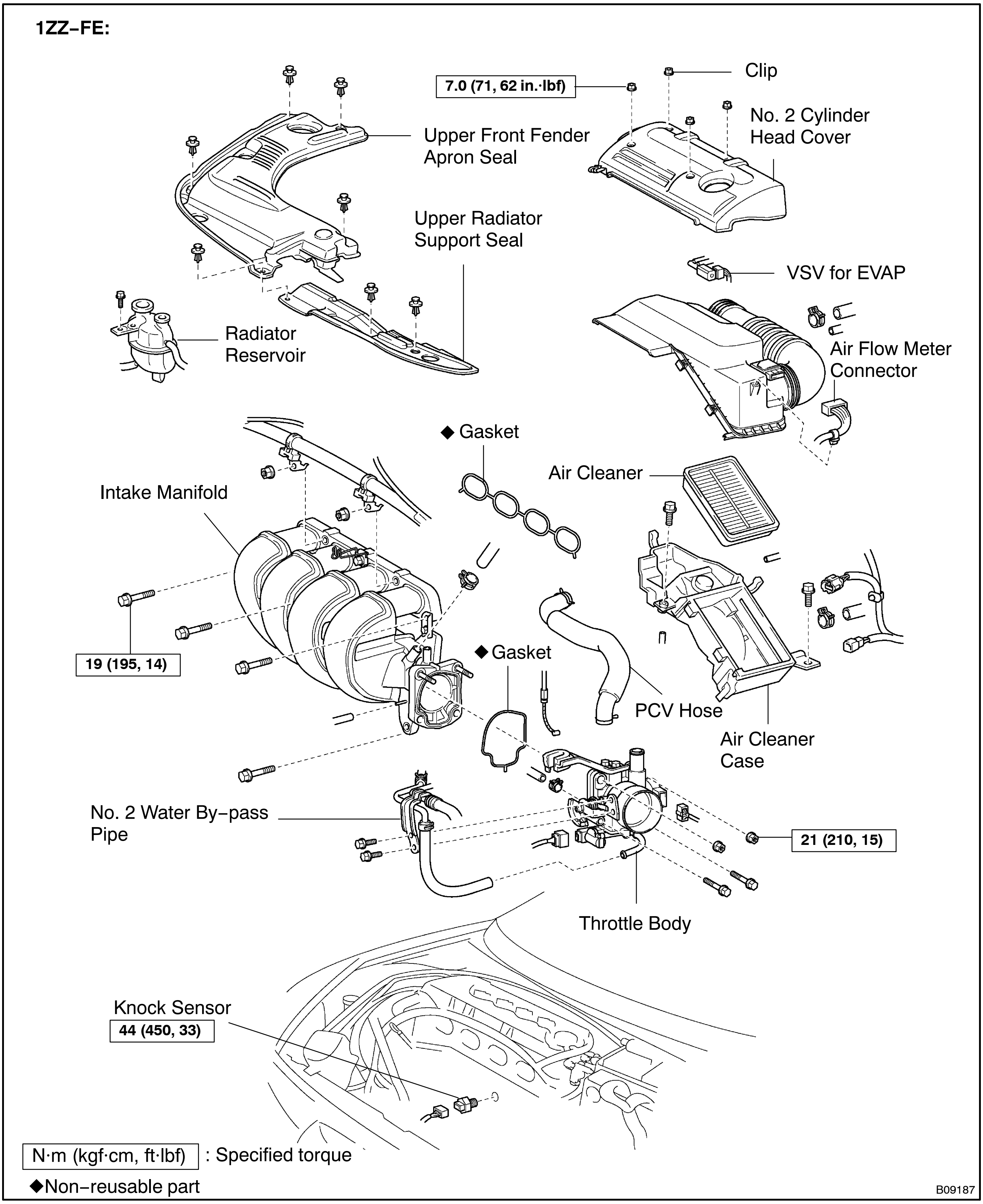
Install a new gasket to the water temperature sensor and connect the connector.

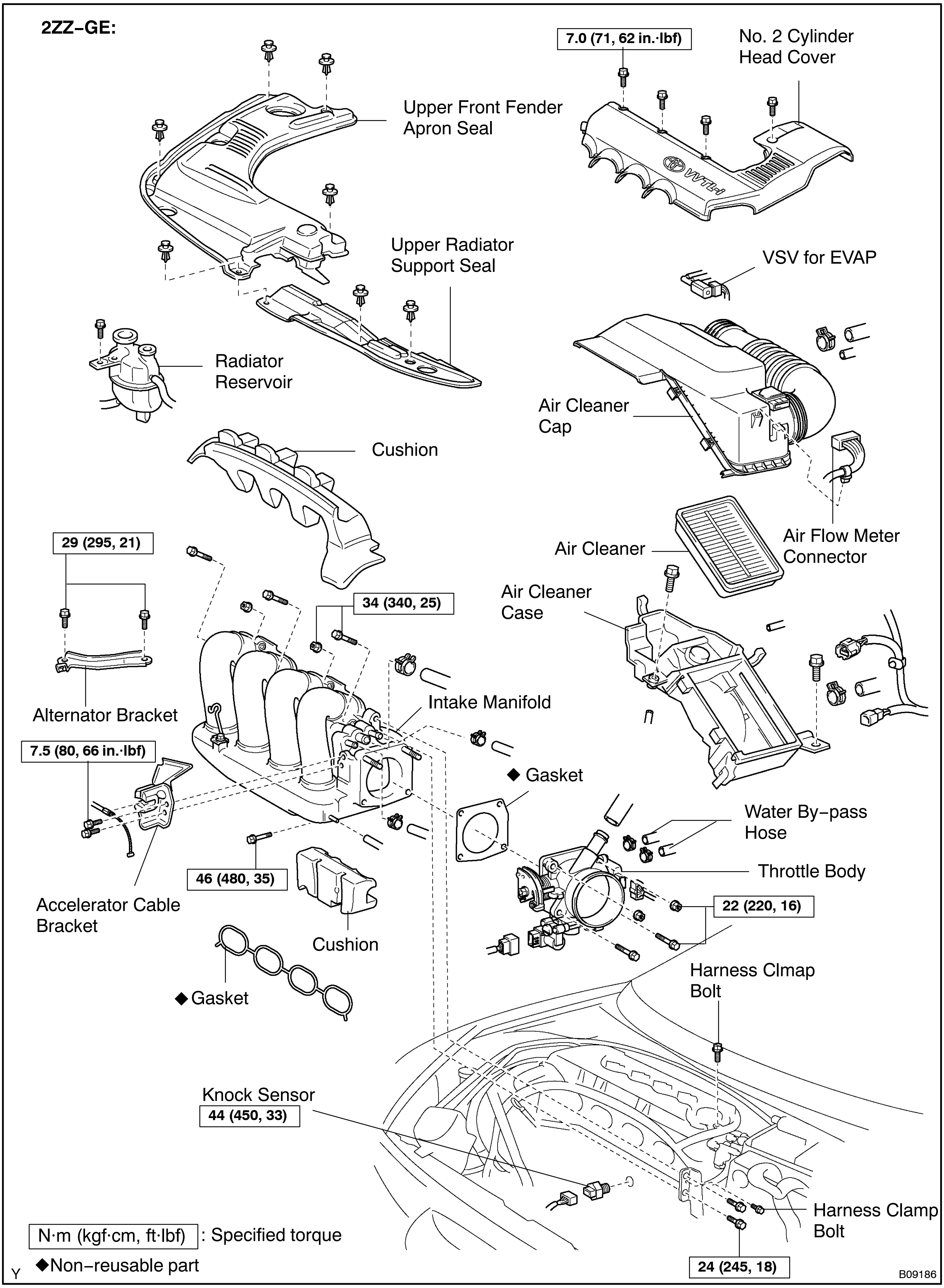
6. **REINSTALL NO.2 CYLINDER HEAD COVER**
7. **FILL RADIATOR WITH ENGINE COOLANT**

KNOCK SENSOR

COMPONENTS

FI0PF–01

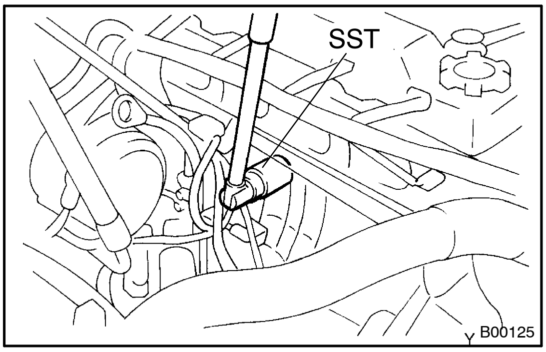



2ZZ–GE:
7.0 (71, 62 in.·lbf)
No. 2 Cylinder Head Cover
Upper Front Fender Apron Seal
Upper Radiator Support Seal
VSV for EVAP
Radiator Reservoir
Air Cleaner Cap
Cushion
29 (295, 21)
Air Cleaner
Air Flow Meter Connector
Air Cleaner Case
34 (340, 25)
Intake Manifold
Alternator Bracket
7.5 (80, 66 in.·lbf)
◆Gasket
Water By–pass Hose
46 (480, 35)
Throttle Body
Accelerator Cable Bracket
22 (220, 16)
Cushion
Harness Clmap Bolt
◆Gasket
Knock Sensor
44 (450, 33)
Harness Clamp Bolt
N·m (kgf·cm, ft·lbf) : Specified torque
◆Non–reusable part
24 (245, 18)
B09186

FI0MH–02

INSPECTION

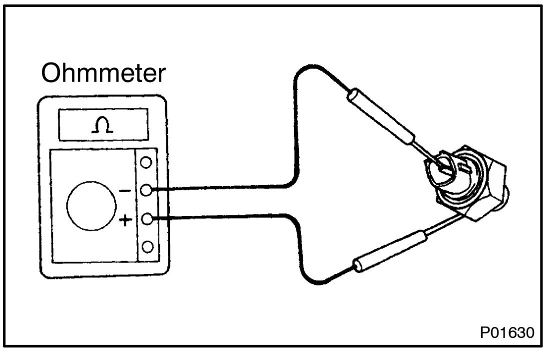
1. **REMOVE THROTTLE BODY**
   (See page FI–33)
2. **REMOVE RADIATOR RESERVOIR**
   (See page CO–17)
3. **REMOVE INTAKE MANIFOLD**
   (See page EM–43)



B00125

4. **REMOVE KNOCK SENSOR**

(a) Disconnect the knock sensor connector.
(b) Using SST, remove the knock sensor.
SST 09816–30010



P01630

5. **INSPECT KNOCK SENSOR**

Using an ohmmeter, check that there is continuity between the terminal and body.
If there is continuity, replace the sensor.

6. **REINSTALL KNOCK SENSOR**

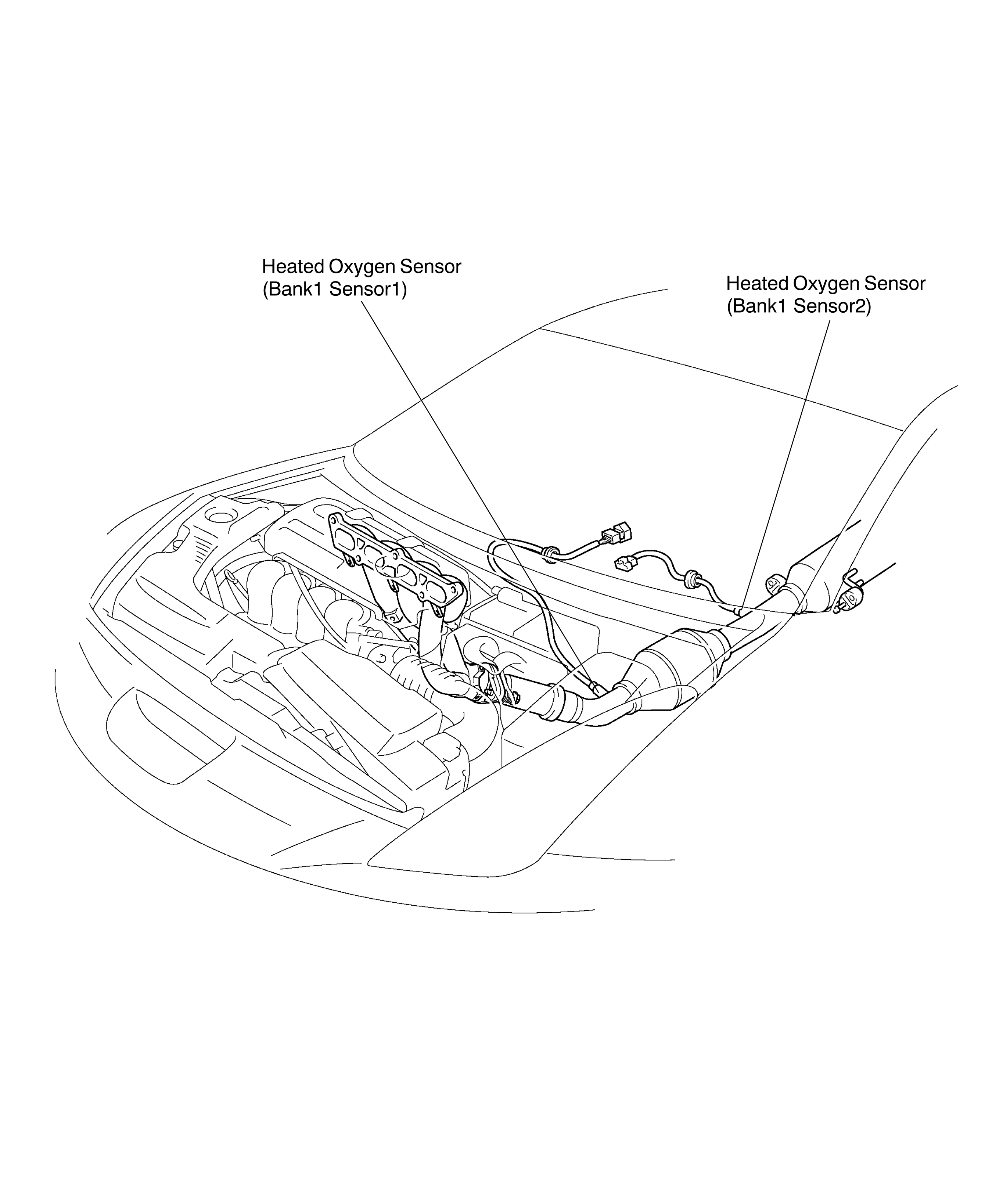
(a) Using SST, install the knock sensor.
SST 09816–30010
(b) Connect the knock sensor connector.

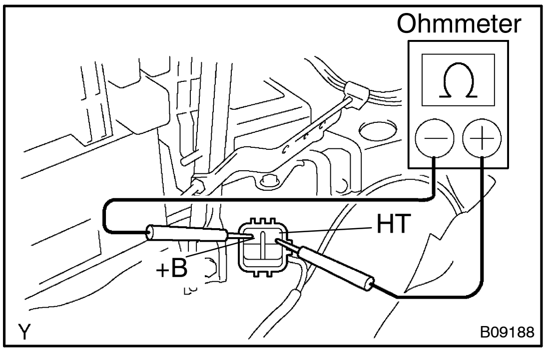
7. **REINSTALL INTAKE MANIFOLD**
   (See page EM–66)
8. **REINSTALL RADIATOR RESERVOIR**
   (See page CO–23)
9. **REINSTALL THROTTLE BODY**
   (See page FI–36)

OXYGEN SENSOR

COMPONENTS

FI0MI–02





FI0PG–01

INSPECTION

1. **INSPECT HEATER RESISTANCE OF HEATED OXYGEN SENSOR (Bank1 Sensor1)**

(a) Disconnect the oxygen sensor connector.

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

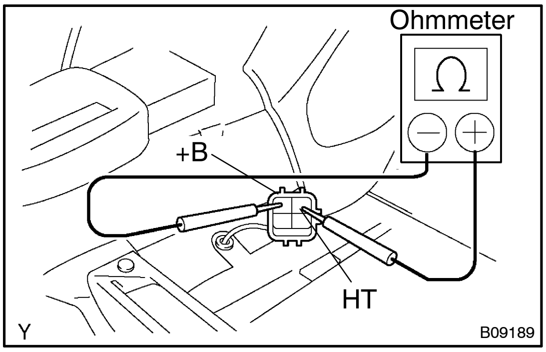
Resistance:

11 – 16 Ω at 20°C (68°F)

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

Torque: 44 N·m (450 kgf·cm, 31 ft·lbf)

(c) Reconnect the oxygen sensor connector.



2. **INSPECT HEATER RESISTANCE OF HEATED OXYGEN SENSOR (Bank1, Sensor2)**

(a) Remove the passenger's seat.

(b) Take out the floor carpet.

(c) Disconnect the oxygen sensor connector.

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

Resistance:

11 – 16 Ω at 20°C (68°F)

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

Torque: 44 N·m (450 kgf·cm, 31 ft·lbf)

(e) Reconnect the oxygen sensor connector.

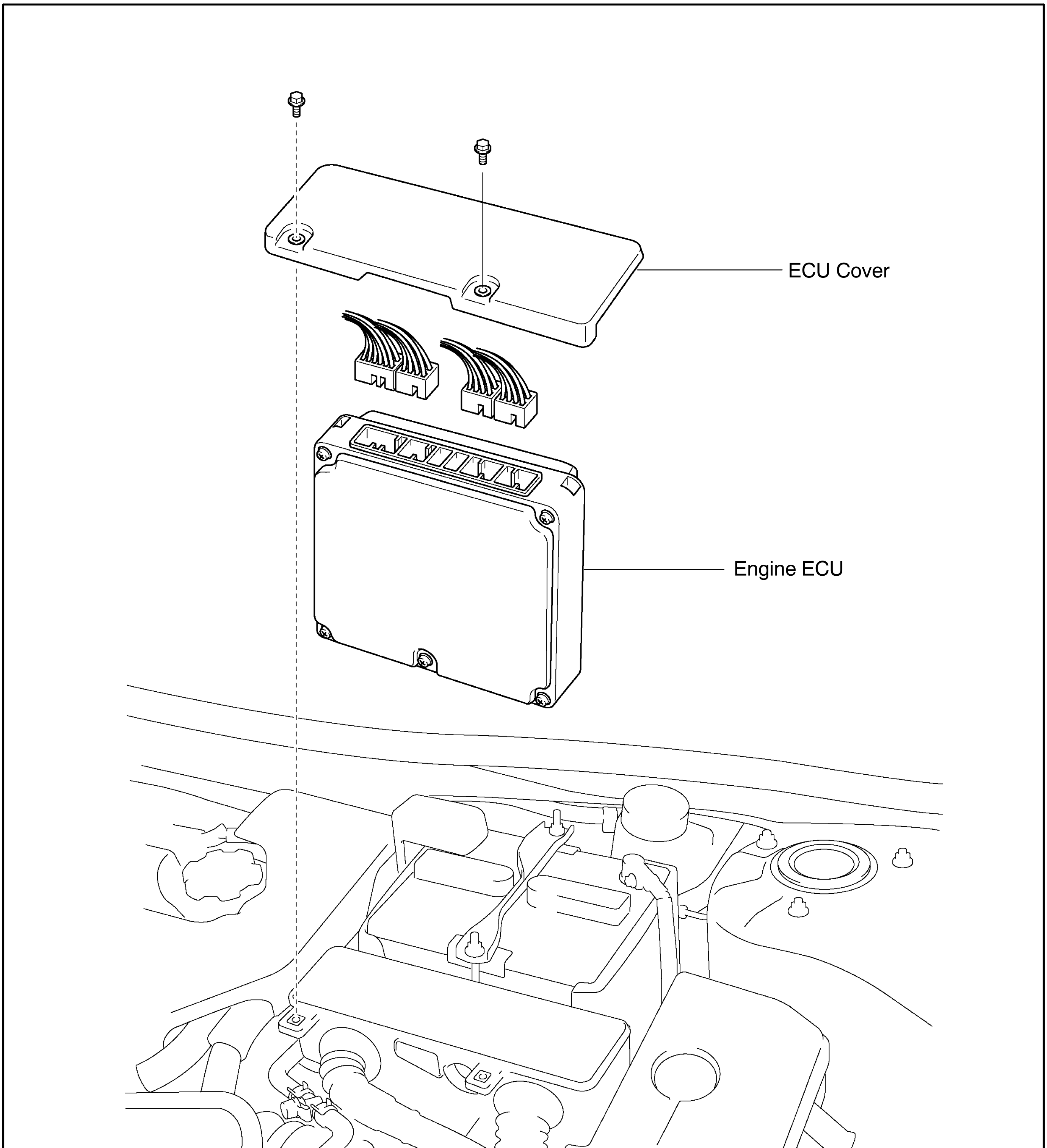
(f) Resistance the floor carpet.

(g) Reinstall the passenger's seat.

ENGINE ECU

COMPONENTS

FI029–03



FI02A–01

INSPECTION

1. REMOVE ENGINE ECU
2. INSPECT ENGINE ECU (See page DI–22)
3. REINSTALL ENGINE ECU

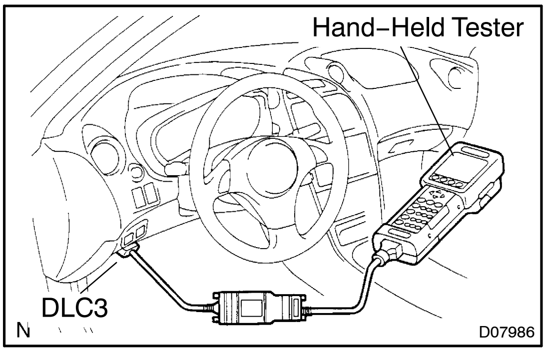
FUEL CUT RPM

SF0AD–06

INSPECTION

1. WARM UP ENGINE

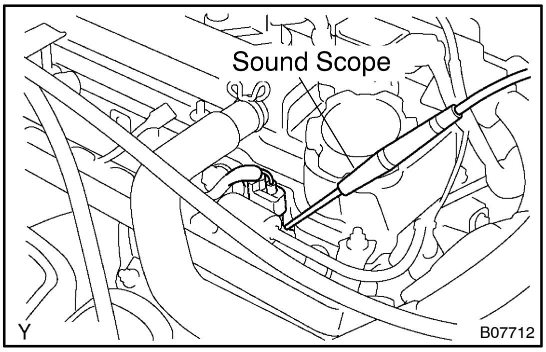
Allow the engine to warm up to normal operating temperature.



2. CONNECT HAND–HELD TESTER

(a) Connect the hand–held tester scan tool to the DLC3.

(b) Please refer to the hand–held tester operator's manual for further details.



3. INSPECT FUEL CUT OFF RPM

(a) Increase the engine speed to at least 3,500 rpm.

(b) Use a sound scope to check for injector operating noise.

(c) Check that when the throttle lever is released, injector operation noise stops momentarily and then resumes.

HINT:

Measure with the A/C OFF.

Fuel return rpm: 1,400 rpm

4. DISCONNECT HAND–HELD TESTER

IGNITION SYSTEM

IG0FA–02

ON–VEHICLE INSPECTION

NOTICE:

"Cold" and "Hot" in these sentences express the temperature of the coils themselves. "Cold" is from –10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

1. INSPECT IGNITION COIL (WITH IGNITER) AND SPARK TEST

Check that the spark occurs.

(1) Remove the ignition coils (with igniter).
(See page IG–6)

(2) Using a 16 mm (0.63 in.) plug wrench, remove the spark plugs.

(3) Install the spark plugs to each ignition coils (with igniter), and connect the ignition coil connectors.

(4) Disconnect the 4 injector connectors.

(5) Ground the spark plugs.

(6) Check if spark occurs while engine is being cranked.

NOTICE:

To prevent gasoline from being injected from injectors during this test, crank the engine for no more than 5 – 10 seconds at time.

If the spark does not occur, do the test as follows:

SPARK TEST

↓ NO

CHECK CONNECTION OF IGNITION COIL CONNECTOR → BAD → Connect securely.

↓ OK

CHANGE IT TO NORMAL IGNITION COIL (WITH IGNITER) AND PERFORM SPARK TEST AGAIN → OK → Replace the ignition coil (with igniter).

↓ NO

CHECK POWER SUPPLY TO IGNITION COIL (WITH 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 (with igniter).

↓ OK

CHECK RESISTANCE OF CAMSHAFT POSITION SENSOR (See step 3)

	Cold	Hot
Resistance:	**835 – 1,400 Ω**	**1,060 – 1,645 Ω**

→ BAD → Replace the camshaft position sensor.

↓ OK

CHECK RESISTANCE OF CRANKSHAFT POSITION SENSOR (See step 4)

	Cold	Hot
Resistance:	**1,630 – 2,740 Ω**	**2,065 – 3,225 Ω**

→ BAD → Replace the crankshaft position sensor.

↓ OK

CHECK IGT SIGNAL FROM ECU (See page DI–97) → BAD → Check wiring between ECU and ignition coil (with igniter), and then try another ECU.

↓ OK

TRY ANOTHER IGNITION COIL (WITH IGNITER)

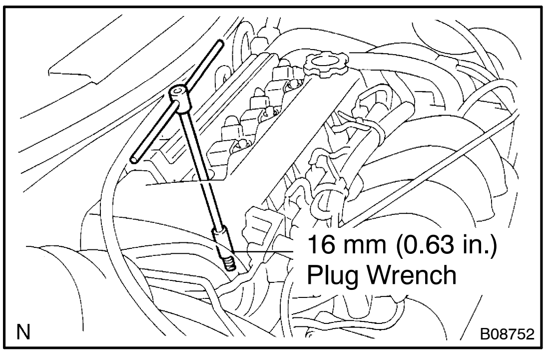
(7) Using a 16 mm (0.63 in.) plug wrench, install the spark plugs.

Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

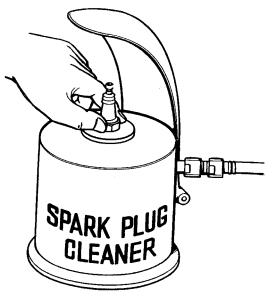
(8) Install the ignition coils (with igniter).
(See page IG–7)

2. INSPECT SPARK PLUGS

(a) Remove the ignition coils (with igniter).
(See page IG–6)



(b) Using a 16 mm (0.63 in.) plug wrench, remove the spark plugs.



IG0152

(c) Clean the spark plugs.

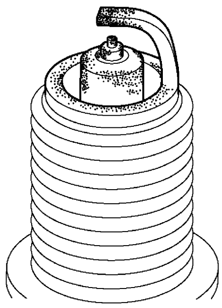
If the electrode has traces of wet carbon, allow it to dry and then clean with a spark plug cleaner.

Air pressure: Below 588 kPa (6 kgf/cm², 85 psi)

Duration: 20 seconds or less

HINT:

If there are traces of oil, remove it with gasoline before using the spark plug cleaner.



B01301

(d) Check the spark plug for thread damage and insulator damage.

If abnormal, replace the spark plug.

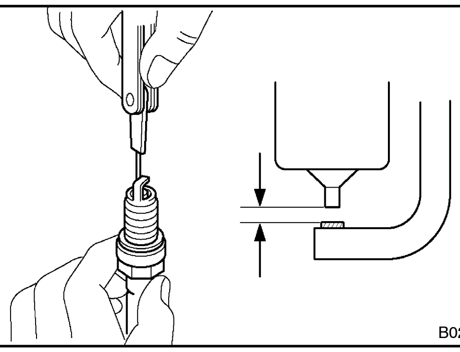
Recommended spark plug:

1ZZ–FE:

DENSO made	K16RU11
NGK made	BKR5EYA11

2ZZ–GE:

DENSO made	SK20R11
NGK made	IFR6A11



B02101

(e) Adjust electrode gap.

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

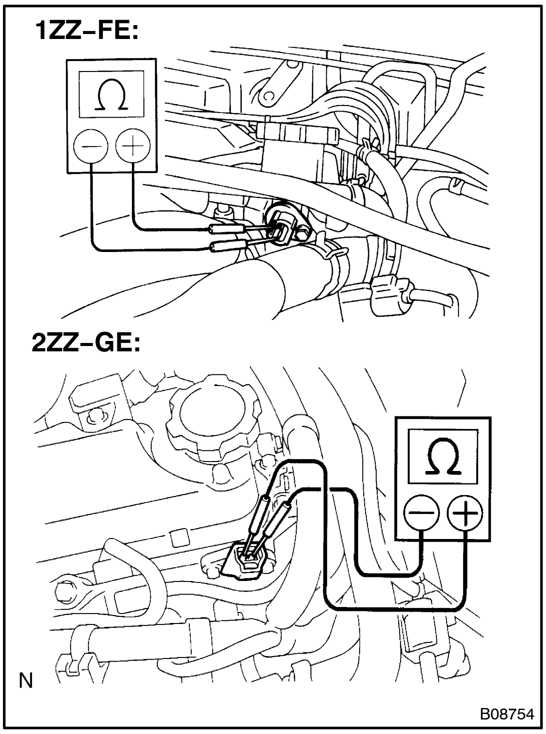
Electrode gap: 1.1 mm (0.043 in.)

(f) Using a 16 mm (0.63 in.) plug wrench, install the spark plugs.

Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)

(g) Install the ignition coils (with igniter).

(See page IG–7)



3. INSPECT CAMSHAFT POSITION SENSOR

(a) Disconnect the camshaft position sensor connector.

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

Resistance:

Cold	835 – 1,400 Ω
Hot	1,060 – 1,645 Ω

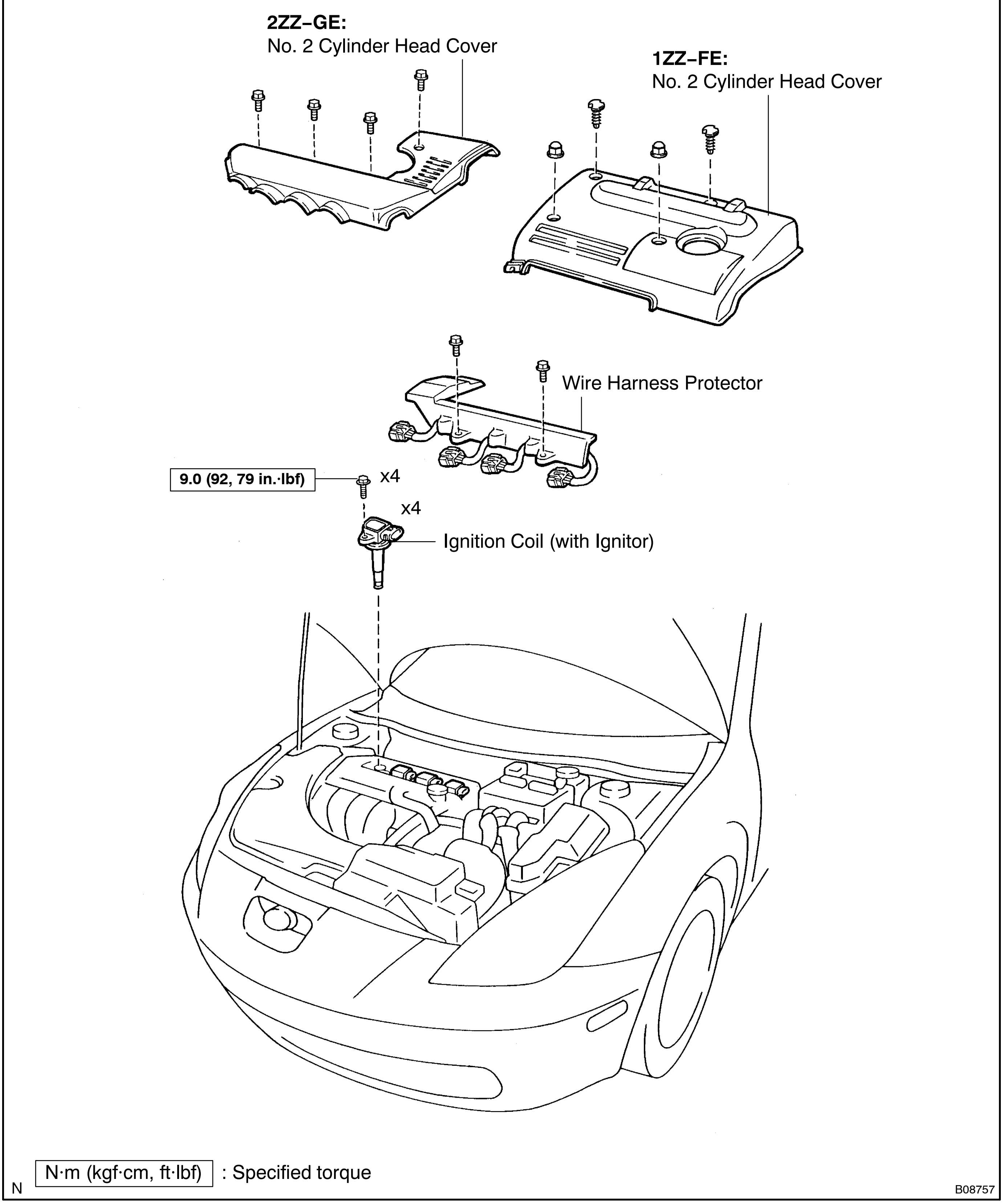
If the resistance is not as specified, replace the camshaft position sensor.

(c) Connect the camshaft position sensor connector.

IGNITION COIL

IG0BO–03

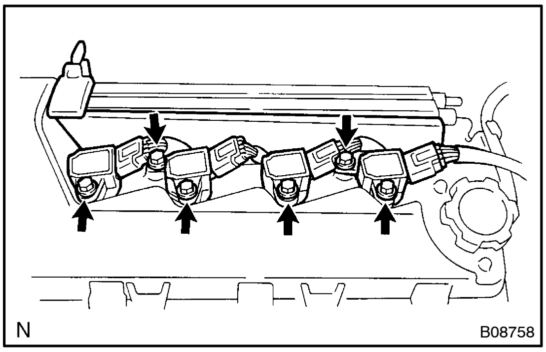
COMPONENTS



IG0BP–03

REMOVAL

1. REMOVE NO. 2 CYLINDER HEAD COVER



2. REMOVE IGNITION COILS (WITH IGNITER) FROM SPARK PLUGS

(a) Remove the 2 bolts and disconnect the wire harness protector.

(b) Disconnect the 4 ignition coil connectors.

(c) Remove the 4 bolts and pull out the 4 ignition coils (with igniter).

Torque: 9.0 N·m (92 kgf·cm, 79 in.·lbf)

IG0BQ–02

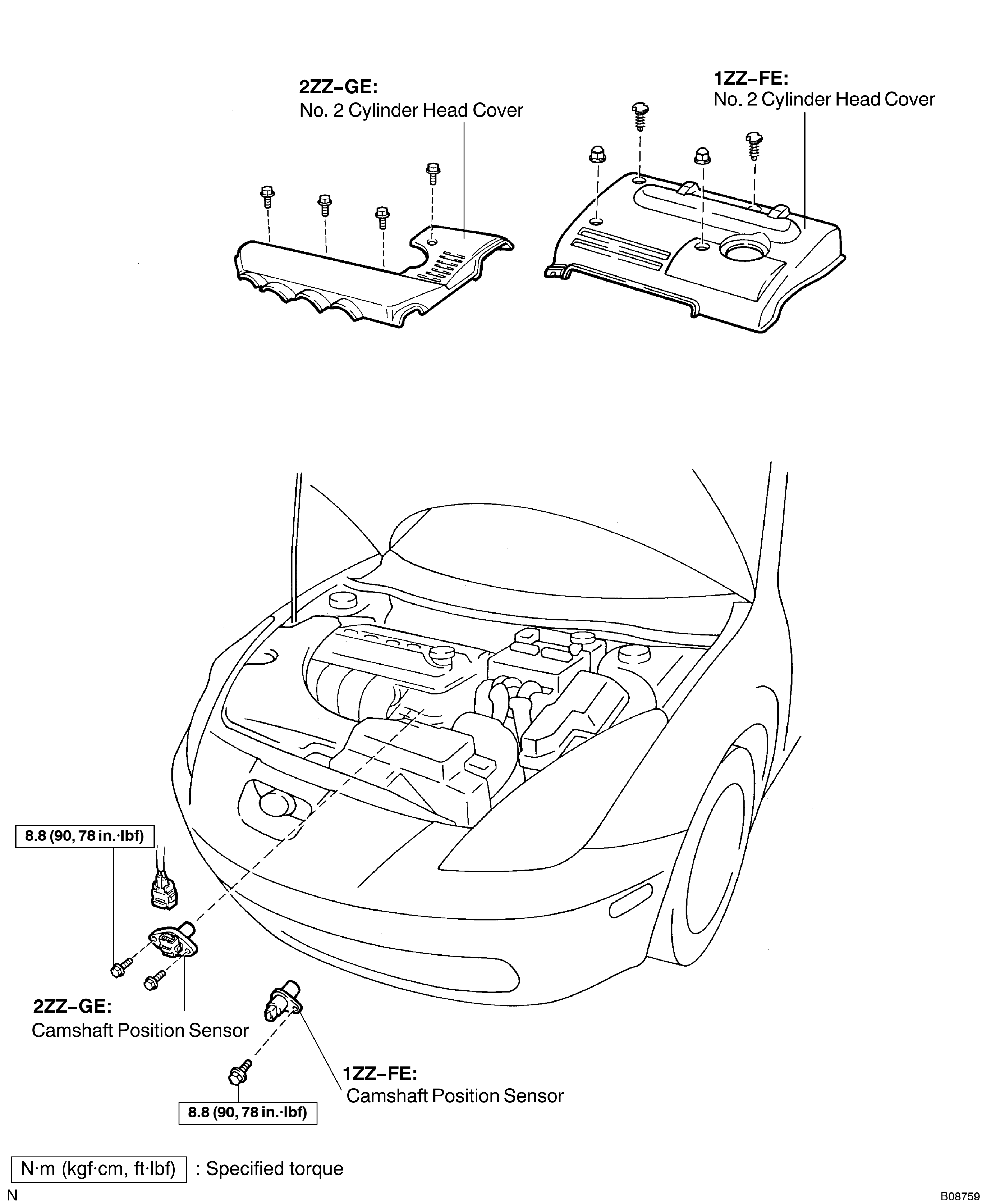
INSTALLATION

Installation is in the reverse order of removal (See page IG–6).

CAMSHAFT POSITION SENSOR

COMPONENTS

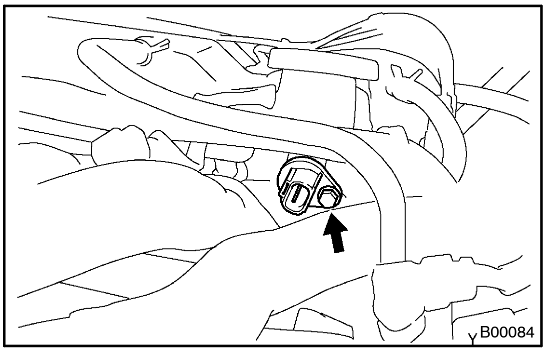
IG0BR–03



IG0F6–01

REMOVAL

1. REMOVE NO. 2 CYLINDER HEAD COVER

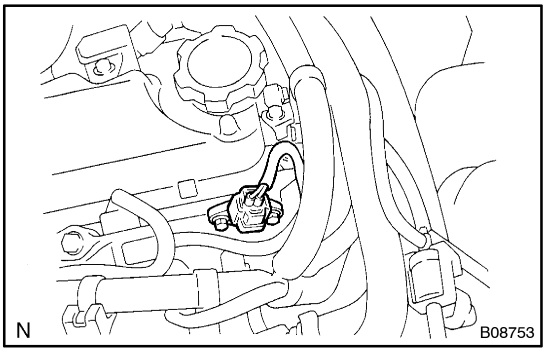


2. 1ZZ–FE:
REMOVE CAMSHAFT POSITION SENSOR

(a) Disconnect the connector.

(b) Remove the bolt and camshaft position sensor.

Torque: 8.8 N·m (90 kgf·cm, 78 in.·lbf)



3. 2ZZ–GE:
REMOVE CAMSHAFT POSITION SENSOR

(a) Disconnect the connector.

(b) Remove the 2 bolts and camshaft position sensor.

Torque: 8.8 N·m (90 kgf·cm, 78 in.·lbf)

IG0EQ–01

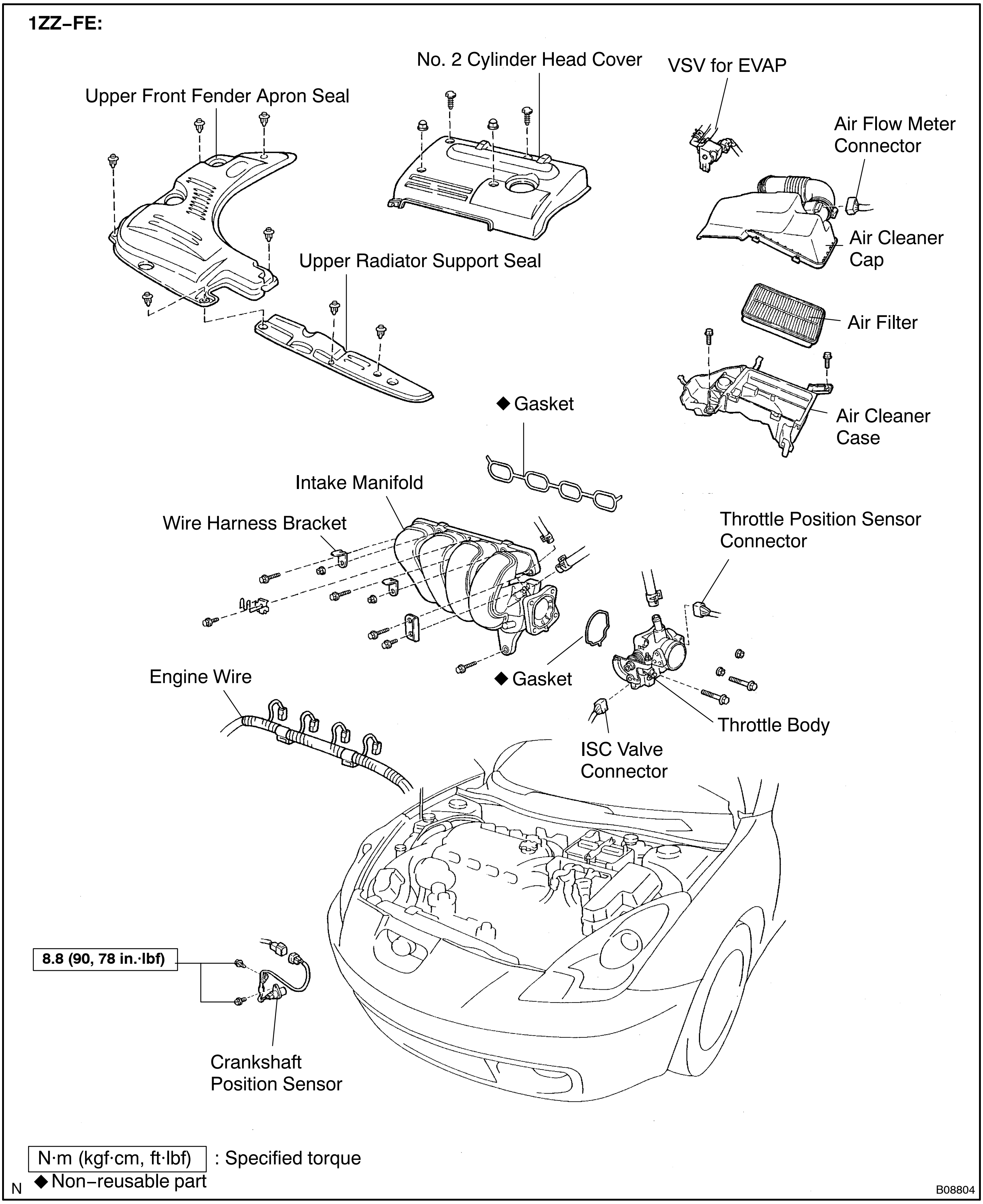
INSTALLATION

Installation is in the reverse order of removal (See page IG–9).

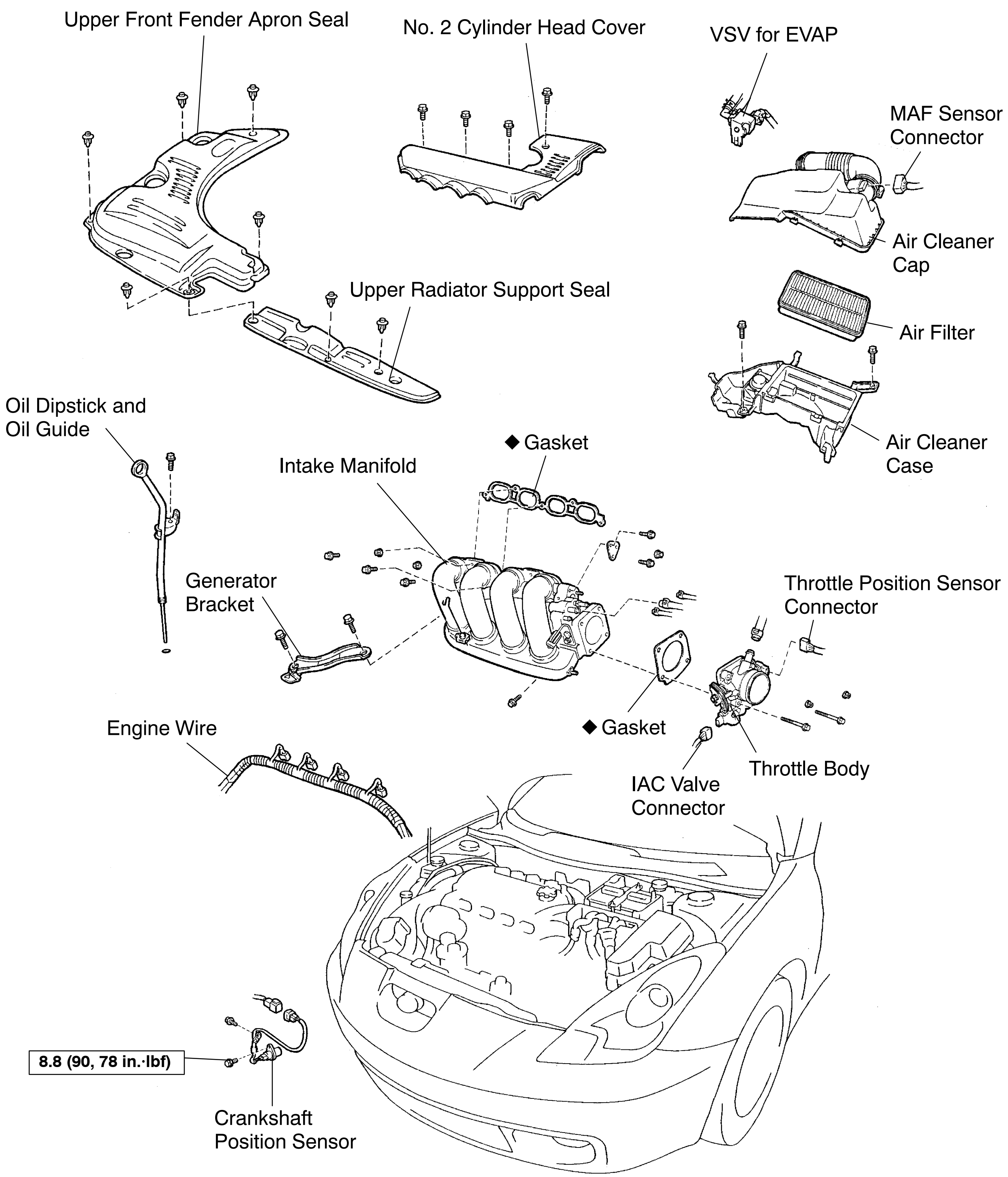
CRANKSHAFT POSITION SENSOR

COMPONENTS

IG0F9–02



2ZZ–GE:



N

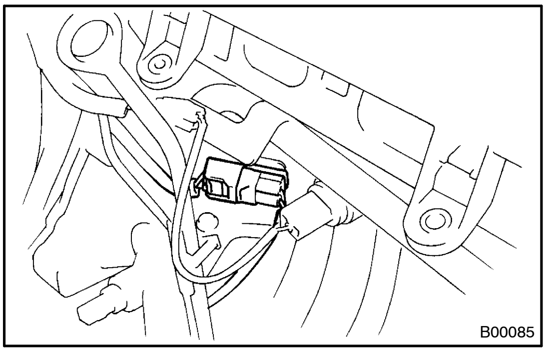
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part

B09366

IG0F7–01

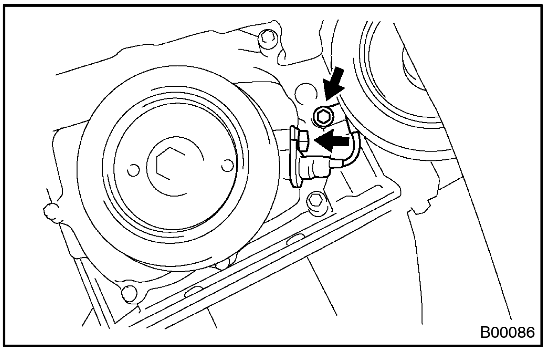
REMOVAL

1. **REMOVE INTAKE MANIFOLD (****See page EM–43****)**
2. **REMOVE ENGINE UNDER COVER RH**


B00085

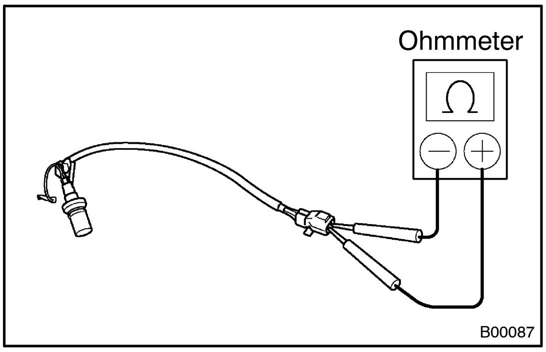
3. **REMOVE CRANKSHAFT POSITION SENSOR**

(a) Disconnect the crankshaft position sensor connector.


B00086

(b) Remove the 2 bolt and crankshaft position sensor.

Torque: 8.8 N·m (90 kgf·cm, 78 in.·lbf)



IG0F8–01

INSPECTION

NOTICE:
"Cold" and "Hot" in these sentences express the temperature of the sensor itself. "Cold" is from –10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

INSPECT CRANKSHAFT POSITION SENSOR RESISTANCE
Using an ohmmeter, measure the resistance between terminals.

Resistance:
Cold: 1,630 – 2,740 Ω
Hot: 2,065 – 3,225 Ω

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

IG0BW–03

INSTALLATION

Installation is in the reverse order of removal **(See page IG–13).**

HOW TO USE THIS MANUAL

GENERAL INFORMATION

IN001–18

1. INDEX

An INDEX is provided on the first page of each section to guide you to the item to be repaired. To assist you in finding your way through the manual, the Section Title and major heading are given at the top of every page.

2. GENERAL DESCRIPTION

At the beginning of each section, a General Description is given that pertains to all repair operations contained in that section.
Read these precautions before starting any repair task.

3. TROUBLESHOOTING

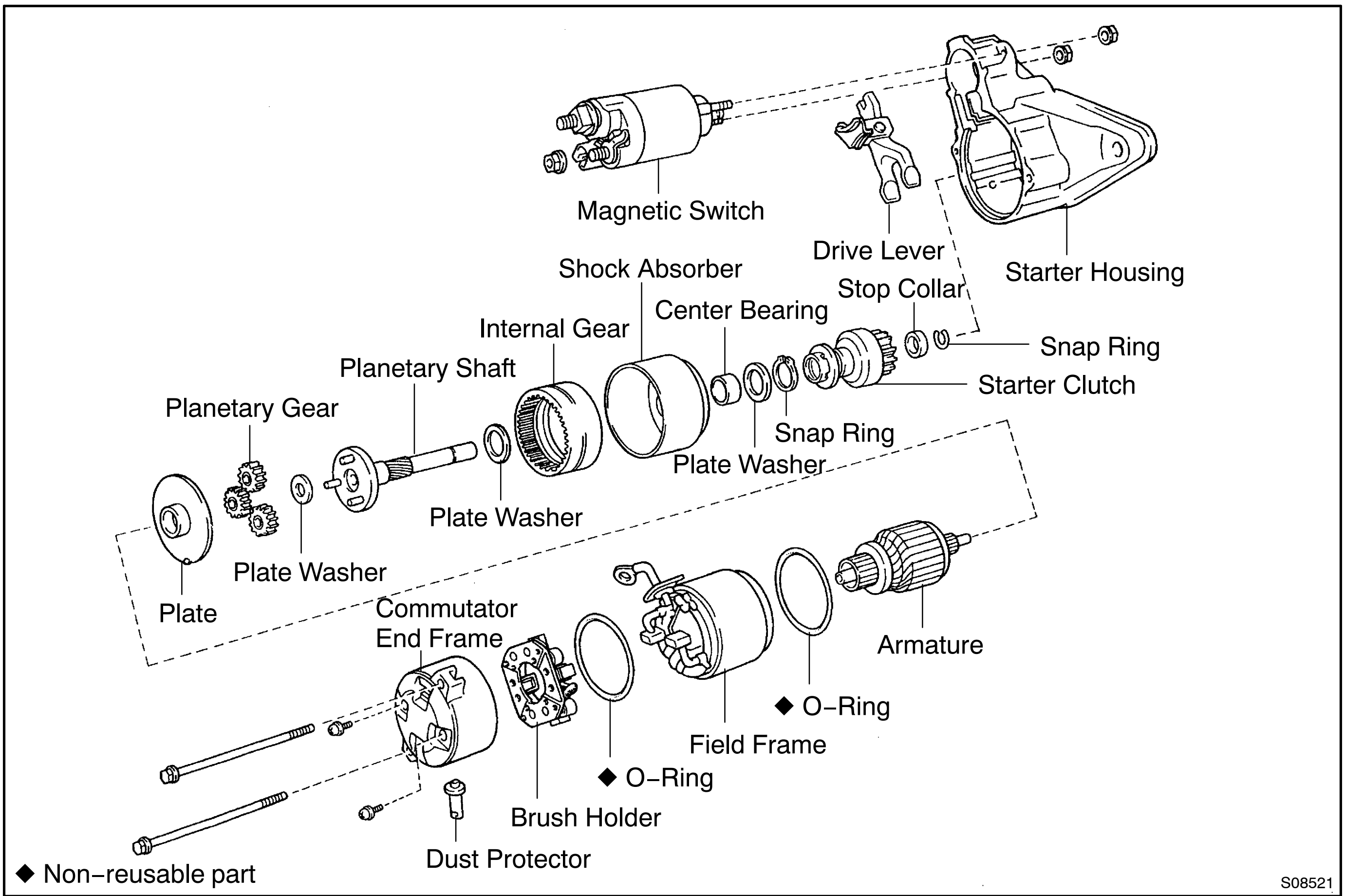
TROUBLESHOOTING tables are included for each system to help you diagnose the problem and find the cause. The fundamentals of how to proceed with troubleshooting are described on page IN–9.
Be sure to read this before performing troubleshooting.

4. PREPARATION

Preparation lists the SST (Special Service Tools), recommended tools, equipment, lubricant and SSM (Special Service Materials) which should be prepared before beginning the operation and explains the purpose of each one.

5. REPAIR PROCEDURES

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



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

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

Example:

Task heading : what to do

Illustration:
what to do and where

21. CHECK PISTON STROKE OF OVERDRIVE BRAKE

(a) Place SST and a dial indicator onto the overdrive brake Piston as shown in the illustration.

SST 09350–30020 (09350–06120)

Set part No. *Component part No.*

Detailed text : how to do task

(b) Measure the stroke applying and releasing the compressed air (392 — 785 kPa, 4 — 8 kgf/cm^2 or 57 — 114 psi) as shown in the illustration.

Piston stroke: 1.40 — 1.70 mm (0.0551 — 0.0669 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.

6. REFERENCES

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

7. 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 Service Specifications section for quick reference.

8. 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 perform the repair efficiently.

9. SI UNIT

The UNITS given in this manual are primarily expressed according to the SI UNIT (International System of Unit), and alternately expressed in the metric system and in the English System.

Example:

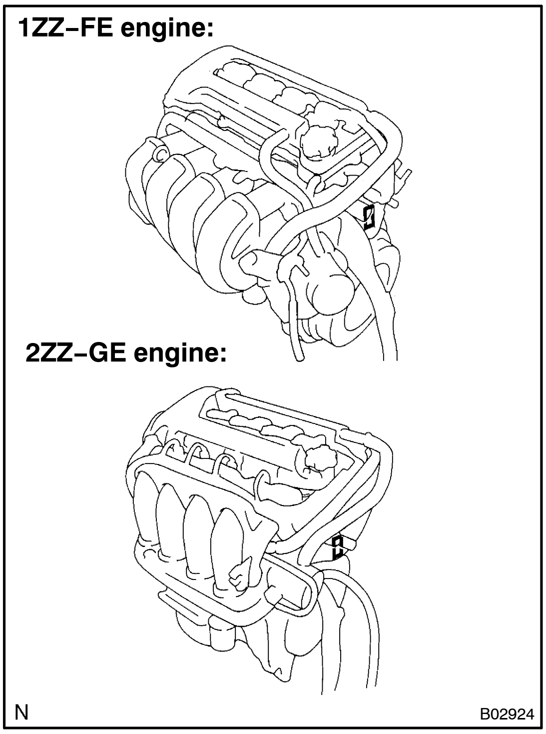
Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)

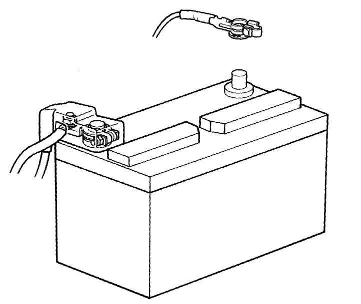
IDENTIFICATION INFORMATION

IN00Q–19

ENGINE SERIAL NUMBER

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




FI1066

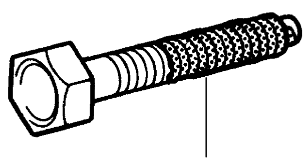
REPAIR INSTRUCTIONS

IN0BX–07

GENERAL INFORMATION

BASIC REPAIR HINT

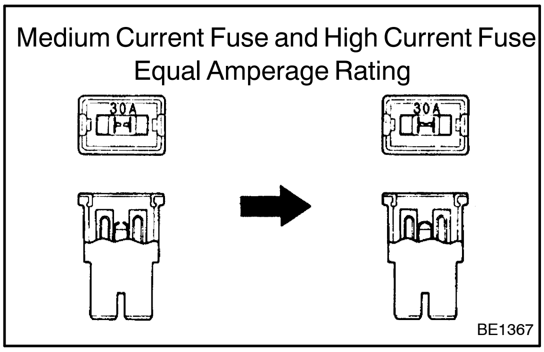
(a) Use fender, seat and floor covers to keep the vehicle clean and prevent damage.
(b) During disassembly, keep parts in the appropriate order to facilitate reassembly.
(c) Observe the following:
  (1) Before performing electrical work, disconnect the negative (–) terminal cable from the battery.
  (2) If it is necessary to disconnect the battery for inspection or repair, always disconnect the negative (–) terminal cable which is grounded to the vehicle body.
  (3) To prevent damage to the battery terminal, loosen the cable nut and raise the cable straight up without twisting or prying it.
  (4) Clean the battery terminals and cable ends with a clean shop rag. Do not scrape them with a file or other abrasive objects.
  (5) Install the cable ends to the battery terminals with the nut loose, and tighten the nut after installation. Do not use a hammer to tap the cable ends onto the terminals.
  (6) Be sure the cover for the positive (+) terminal is properly in place.
(d) Check hose and wiring connectors to make sure that they are secure and correct.
(e) Non–reusable parts
  (1) Always replace cotter pins, gaskets, O–rings and oil seals etc. with new ones.
  (2) Non–reusable parts are indicated in the component illustrations by the "◆" symbol.
(f) Precoated parts
Precoated parts are bolts and nuts, etc. that are coated with a seal lock adhesive at the factory.
  (1) If a precoated part is retightened, loosened or caused to move in any way, it must be recoated with the specified adhesive.
  (2) When reusing precoated parts, clean off the old adhesive and dry with compressed air. Then apply the specified seal lock adhesive to the bolt, nut or threads.
  (3) Precoated parts are indicated in the component illustrations by the "★" symbol.



Z11554

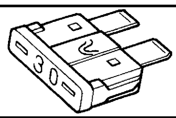
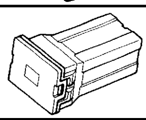
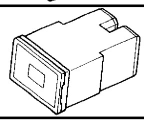
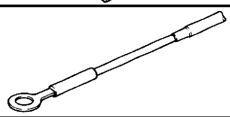
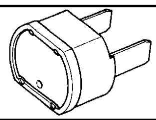
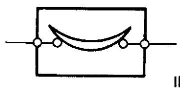
(g) When necessary, use a sealer on gaskets to prevent leaks.
(h) Carefully observe all specifications for bolt tightening torques. Always use a torque wrench.

(i) 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 in section PP (Preparation) in this manual.



BE1367

(j) 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

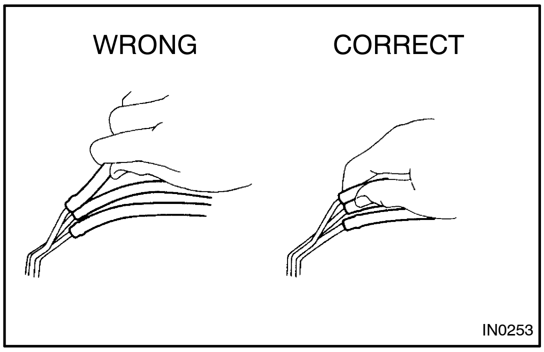
V00076

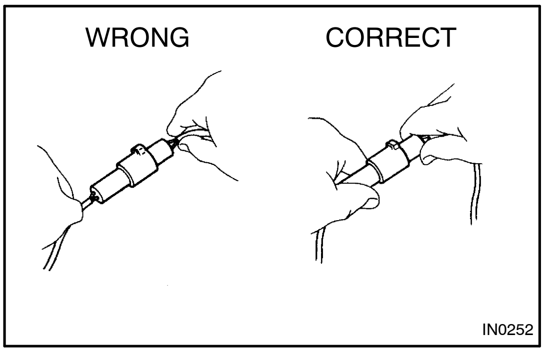
(k) Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.
- Cancel the parking brake on the level place and shift the transmission in Neutral (or N position).
- When jacking up the front wheels of the vehicle at first place stoppers behind the rear wheels.
- When jacking up the rear wheels of the vehicle at first place stoppers behind the rear wheels.

- When either the front or rear wheels only should be jacked up, set rigid racks and place stoppers in front and behind the other wheels on the ground.
- After the vehicle is jacked up, be sure to support it on rigid racks. 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.

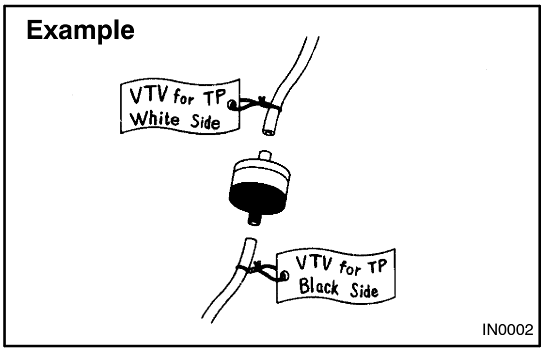
(l) Observe the following precautions to avoid damage to the following parts:

(1) 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.)





(2) To disconnect vacuum hoses, pull on the end, not the middle of the hose.
(3) To pull apart electrical connectors, pull on the connector itself, not the wires.
(4) 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.
(5) When steam cleaning an engine, protect the electronic components, air filter and emissions–related components from water.
(6) Never use an impact wrench to remove or install temperature switches or temperature sensors.
(7) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.
(8) 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.



IN0002

(m) Tag hoses before disconnecting them:
  (1) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.
  (2) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.

(n) Unless otherwise stated, all resistance is measured at an ambient temperature of 20°C (68°F). Because the resistance may be outside specifications if measured at high temperatures immediately after the vehicle has been running, measurements should be made when the engine has cooled down.

FOR ALL OF VEHICLES

IN00R–01

PRECAUTION

1. 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.

(a) Use only unleaded gasoline
(b) Avoid prolonged idling
Avoid running the engine at idle speed for more than 20 minutes.
(c) Avoid spark jump test
(1) Perform spark jump test only when absolutely necessary. Perform this test as rapidly as possible.
(2) While testing, never race the engine.
(d) Avoid prolonged engine compression measurement
Engine compression tests must be done as rapidly as possible.
(e) 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.
(f) Avoid coasting with ignition turned off and prolonged braking
(g) Do not dispose of used catalyst along with parts contaminated with gasoline or oil

2. IF VEHICLE IS EQUIPPED WITH MOBILE COMMUNICATION SYSTEM

For vehicles with mobile communication systems such as two–way radios and cellular telephones, observe the following precautions.

(1) Install the antenna as far as possible away from the ECU and sensors of the vehicle's electronic system.
(2) Install the antenna feeder at least 20 cm (7.87 in.) away from the ECU and sensors of the vehicle's electronics systems. For details about ECU and sensors locations, refer to the section on the applicable component.
(3) Do not wind the antenna feeder together with the other wiring. As much as possible, also avoid running the antenna feeder parallel with other wire harnesses.
(4) Confirm that the antenna and feeder are correctly adjusted.
(5) Do not install powerful mobile communications system.

3. FOR USING HAND–HELD TESTER

CAUTION:
Observe the following for safety reasons:

- **Before using the hand–held tester, the hand–held tester's operator manual should be read throughly.**
- **Be sure to route all cables securely when driving with the hand–held tester connected to the vehicle. (i.e. Keep cables away from feet, pedals, steering wheel and shift lever.)**
- **Two persons are required when test driving with the hand–held tester, one person to drive the vehicle and one person to operate the hand–held tester.**

HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

IN005–1B

GENERAL INFORMATION

A large number of ECU controlled systems are used in the CELICA. In general, the ECU controlled system is considered to be a very intricate system requiring a high level of technical knowledge and expert skill to troubleshoot. However, the fact is that if you proceed to inspect the circuits one by one, troubleshooting of these systems is not complex. If you have adequate understanding of the system and a basic knowledge of electricity, accurate diagnosis and necessary repair can be performed to locate and fix the problem. This manual is designed through emphasis of the above standpoint to help service technicians perform accurate and effective troubleshooting, and is compiled for the following major ECU controlled systems:

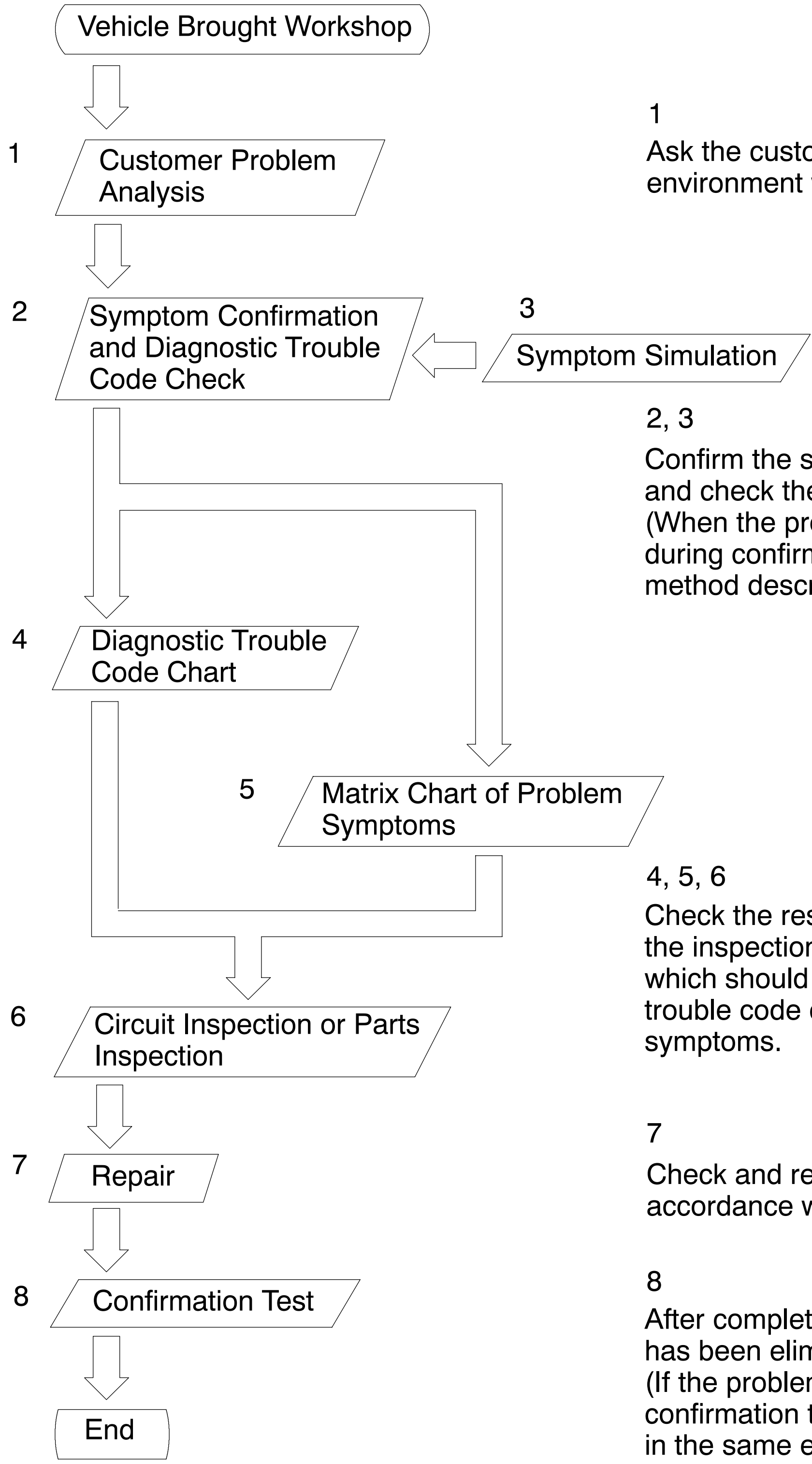
System	Page
1. Engine	DI–1

The troubleshooting procedure and how to make use of it are described on the following pages.

IN006–19

HOW TO PROCEED WITH TROUBLESHOOTING

Carry out troubleshooting in accordance with the procedure on the following page. Here, only the basic procedure is shown. Details are provided in each section, showing the most effective methods for each circuit. Confirm the troubleshooting procedures first for the relevant circuit before beginning troubleshooting of that circuit.



1

Ask the customer about the conditions and the environment when the problem occurred.

2, 3

Confirm the symptoms and the problem conditions, and check the diagnostic trouble codes.
(When the problem symptoms do not appear during confirmation, use the symptom simulation method described later on.)

4, 5, 6

Check the results obtain in Step 2, then confirm the inspection procedure for the system or the part which should be checked using the diagnostic trouble code chart or the matrix chart of problem symptoms.

7

Check and repair the affected system or part in accordance with the instructions in Step 6.

8

After completing repairs, confirm that the problem has been eliminated.
(If the problem is not reproduced, perform the confirmation test under the same conditions and in the same environment as when it occurred for the first time.)

1. CUSTOMER PROBLEM ANALYSIS

In troubleshooting, the problem symptoms must be confirmed accurately and all preconceptions must be cleared away in order to give an accurate judgment. To ascertain just what the problem symptoms are, it is extremely important to ask the customer about the problem and the conditions at the time it occurred.

Important Point in the Problem Analysis:

The following 5 items are important points in the problem analysis. Past problems which are thought to be unrelated and the repair history, etc. may also help in some cases, so as much information as possible should be gathered and its relationship with the problem symptoms should be correctly ascertained for reference in troubleshooting. A customer problem analysis table is provided in the troubleshooting section for each system for your use.

Important Points in the Customer Problem Analysis

- What –––––Vehicle model, system name
- When –––––Date, time, occurrence frequency
- Where –––––Road conditions
- Under what conditions? –––––Running conditions, driving conditions, weather conditions
- How did it happen? –––––Problem symptoms

(Sample) Engine control system check sheet.

CUSTOMER PROBLEM ANALYSIS CHECK

ENGINE CONTROL SYSTEM Check Sheet

Inspector's Name

Customer's Name		**Model and Model Year**	
Driver's Name		**Frame No.**	
Data Vehicle Brought in		**Engine Model**	
License No.		**Odometer Reading**	km miles

Problem Symptoms	☐ **Engine does not Start**	☐ **Engine does not crank** ☐ **No initial combustion** ☐ **No complete combustion**
	☐ **Difficult to Start**	☐ **Engine cranks slowly** ☐ **Other**
	☐ **Poor Idling**	☐ **Incorrect first idle** ☐ **Idling rpm is abnormal** ☐ **High (rpm)** ☐ **Low (rpm)** ☐ **Rough idling** ☐ **Other**
	☐ **Poor Drive ability**	☐ **Hesitation** ☐ **Back fire** ☐ **Muffler explosion (after–fire)** ☐ **Surging** ☐ **Knocking** ☐ **Other**
	☐ **Engine Stall**	☐ **Soon after starting** ☐ **After accelerator pedal depressed** ☐ **After accelerator pedal released** ☐ **During A/C operation** ☐ **Shifting from N to D** ☐ **Other**
	☐ **Others**	

...onstant ☐ Sometimes (times per day/month)

2. SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE CHECK

The diagnostic system in the CELICA fulfills various functions. The first function is the Diagnostic Trouble Code Check in which a malfunction in the signal circuits to the ECU is stored in code in the ECU memory at the time of occurrence, to be output by the technician during troubleshooting. Another function is the Input Signal Check which checks if the signals from various switches are sent to the ECU correctly.
By using these check functions, the problem areas can be narrowed down quickly and troubleshooting can be performed effectively. Diagnostic functions are incorporated in the following systems in the CELICA.

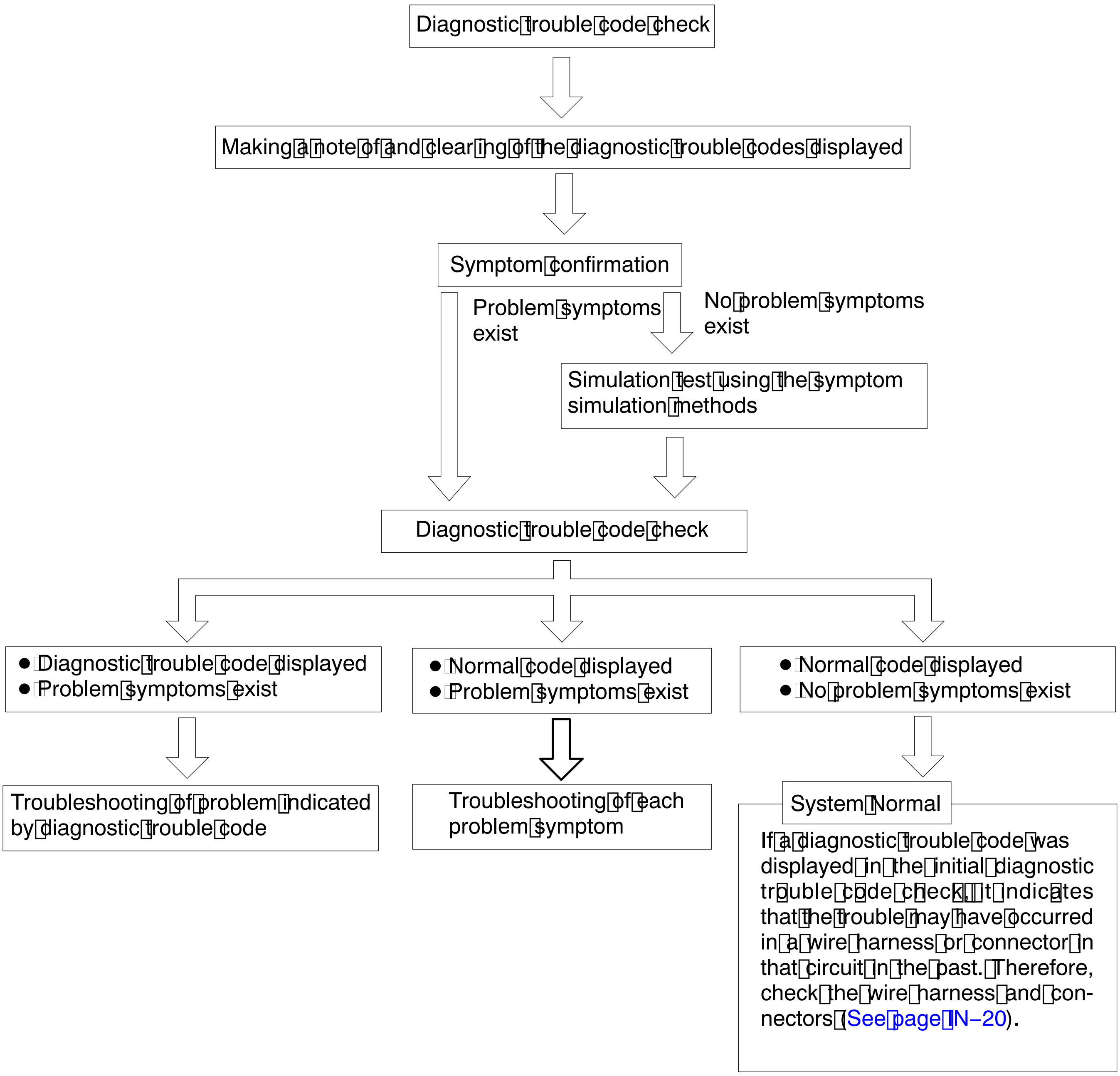
System	Diagnostic Trouble Code Check	Input Signal Check (Sensor Check)	Other Diagnosis Function
Engine	○ (with Check Mode)	○	Diagnostic Test Mode

In diagnostic trouble code check, it is very important to determine whether the problem indicated by the diagnostic trouble code is still occurring or occurred in the past but returned to normal at present. In addition, it must be checked in the problem symptom check whether the malfunction indicated by the diagnostic trouble code is directly related to the problem symptom or not. For this reason, the diagnostic trouble codes should be checked before and after the symptom confirmation to determine the current conditions, as shown in the table below. If this is not done, it may, depending on the case, result in unnecessary troubleshooting for normally operating systems, thus making it more difficult to locate the problem, or in repairs not pertinent to the problem. Therefore, always follow the procedure in correct order and perform the diagnostic trouble code check.

DIAGNOSTIC TROUBLE CODE CHECK PROCEDURE

Diagnostic Trouble Code Check (Make a note of and then clear)	**Confirmation of Symptoms**	**Diagnostic Trouble Code Check**	**Problem Condition**
Diagnostic Trouble Code Display	Problem symptoms exist	Same diagnostic trouble code is displayed	Problem is still occurring in the diagnostic circuit
		Normal code is displayed	The problem is still occurring in a place other than in the diagnostic circuit. (The diagnostic trouble code displayed first is either for a past problem or it is a secondary problem.)
	No problem symptoms exist		The problem occurred in the diagnostic circuit in the past.
Normal Code Display	Problem symptoms exist	Normal code is displayed	The problem is still occurring in a place other than in the diagnostic circuit.
	No problem symptoms exist	Normal code is displayed	The problem occurred in a place other than in the diagnostic circuit in the past.

Taking into account the above points, a flow chart showing how to proceed with troubleshooting using the diagnostic trouble code check is shown below. This flow chart shows how to utilize the diagnostic trouble code check effectively, then by carefully checking the results, indicates how to proceed either to diagnostic trouble code troubleshooting or to troubleshooting of problem symptoms.

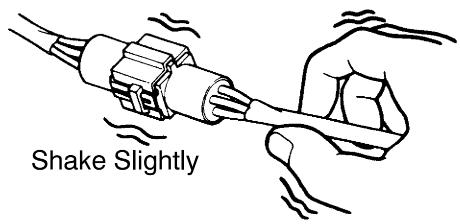
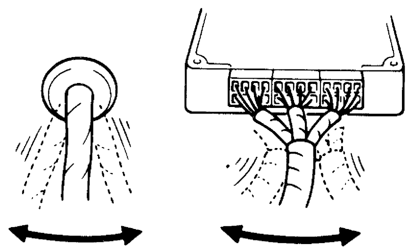
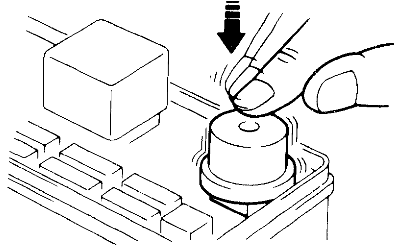


3. SYMPTOM SIMULATION

The most difficult case in troubleshooting is when there are no problem symptoms occurring. In such cases, a thorough customer problem analysis must be carried out, then simulate the same or similar conditions and environment in which the problem occurred in the customer's vehicle. No matter how much experience a technician has, or how skilled he may be, if he proceeds to troubleshoot without confirming the problem symptoms he will tend to overlook something important in the repair operation and make a wrong guess somewhere, which will only lead to a standstill. For example, for a problem which only occurs when the engine is cold, or for a problem which occurs due to vibration caused by the road during driving, etc., the problem can never be determined so long as the symptoms are confirmed with the engine hot condition or the vehicle at a standstill. Since vibration, heat or water penetration (moisture) are likely causes for problems which are difficult to reproduce, the symptom simulation tests introduced here are effective measures in that the external causes are applied to the vehicle in a stopped condition.

Important Points in the Symptom Simulation Test:

In the symptom simulation test, the problem symptoms should of course be confirmed, but the problem area or parts must also be found out. To do this, narrow down the possible problem circuits according to the symptoms before starting this test and connect a tester beforehand. After that, carry out the symptom simulation test, judging whether the circuit being tested is defective or normal and also confirming the problem symptoms at the same time. Refer to the matrix chart of problem symptoms for each system to narrow down the possible causes of the symptom.

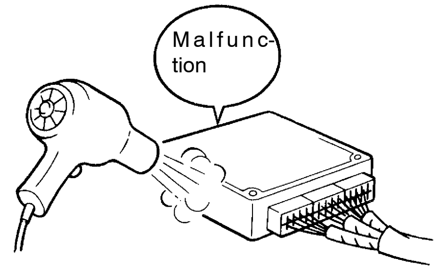
1	VIBRATION METHOD: When vibration seems to be the major cause.
CONNECTORS Slightly shake the connector vertically and horizontally. **WIRE HARNESS** Slightly shake the wire harness vertically and horizontally. The connector joint, fulcrum of the vibration, and body through portion are the major areas to be checked thoroughly.	 Shake Slightly  Swing Slightly FI2331 FI2332
PARTS AND SENSOR Apply slight vibration with a finger to the part of the sensor considered to be the problem cause and check if the malfunction occurs. HINT: Applying strong vibration to relays may result in open relays.	Vibrate Slightly  FI2330

V07268

2	HEAT METHOD: When the problem seems to occur when the suspect area is heated.

Heat the component that is the likely cause of the malfunction with a hair dryer or similar object. Check to see if the malfunction occurs.

NOTICE:
(1) Do not heat to more than 60°C (140°F). (Temperature limit that no damage is done to the component.)
(2) Do not apply heat directly to parts in the ECU.



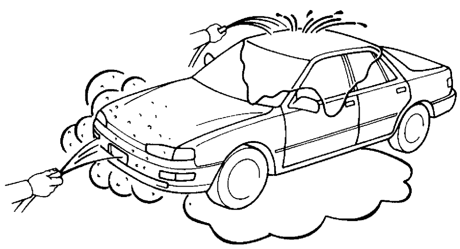
FI2334

3	WATER SPRINKLING METHOD: When the malfunction seems to occur on a rainy day or in a high–humidity condition.

Sprinkle water onto the vehicle and check to see if the malfunction occurs.

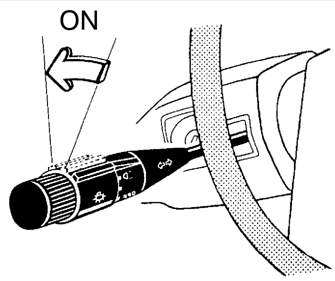
NOTICE:
(1) Never sprinkle water directly into the engine compartment, but indirectly change the temperature and humidity by applying water spray onto the radiator front surface.
(2) Never apply water directly onto the electronic components.

(Service hint)
If a vehicle is subject to water leakage, the leaked water may contaminate the ECU. When testing a vehicle with a water leakage problem, special caution must be used.


FI6649

4	OTHER: When a malfunction seems to occur when electrical load is excessive.

Turn on all electrical loads including the heater blower, head lights, rear window defogger, etc. and check to see if the malfunction occurs.



FI2336

V07469

4. DIAGNOSTIC TROUBLE CODE CHART

The inspection procedure is shown in the table below. This table permits efficient and accurate troubleshooting using the diagnostic trouble codes displayed in the diagnostic trouble code check. Proceed with troubleshooting in accordance with the inspection procedure given in the diagnostic chart corresponding to the diagnostic trouble codes displayed. The engine diagnostic trouble code chart is shown below as an example.

- DTC No.
  Indicates the diagnostic trouble code.
- Page or Instructions
  Indicates the page where the inspection procedure for each circuit is to be found, or gives instructions for checking and repairs.

- Trouble Area
  Indicates the suspect area of the problem.

- Detection Item
  Indicates the system of the problem or contents of the problem.

DTC CHART (SAE Controlled)

HINT: Parameters listed in the chart may not be exactly the same as your reading due to the type of instrument or other factors.

If a malfunction code is displayed during the DTC check in check mode, check the circuit for that code listed in the table below. For details of each code, turn to the page referred to under the "See page" for the respective "DTC No." in the DTC chart.

DTC No. (See page)	Detection Item	Trouble Area	CHK ENG *1	*Memory
P0105/31 (DI–12)	Vacuum Sensor Circuit Malfunction	● Open or short in vacuum sensor circuit ● Vacuum sensor ● Engine ECU	○	○
P0110/24 (DI–28)	Intake Air Temp. Circuit Malfunction	● Open or short in intake air temp. sensor circuit ● Intake air temp. sensor ● Engine ECU	–	○
P0115/22 (DI–31)	Water Temp. Circuit Malfunction	● Open or short in water temp. sensor circuit ● Water temp. sensor ● Engine ECU	○	○
P0120/41 (DI–32)	Throttle Position Sensor Circuit Malfunction	● Open or short in throttle position sensor circuit ● Throttle position sensor ● Engine ECU	–	○
		● Open or short in Oxygen sensor circuit ● Oxygen sensor		

5. PROBLEM SYMPTOMS TABLE

The suspect circuits or parts for each problem symptom are shown in the table below. Use this table to troubleshooting the problem when a ”Normal” code is displayed in the diagnostic trouble code check but the problem is still occurring. Numbers in the table indicate the inspection order in which the circuits or parts should be checked.

HINT:

When the problem is not detected by the diagnostic system even though the problem symptom is present, it is considered that the problem is occurring outside the detection range of the diagnostic system, or that the problem is occurring in a system other than the diagnostic system.

- Page
  Indicates the page where the flow chart for each circuit is located.
- Circuit Inspection, Inspection Order
  Indicates the circuit which needs to be checked for each problem symptom. Check in the order indicated by the numbers.
- Problem Symptom
- Circuit or Part Name
  Indicates the circuit or part which needs to be checked.

PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area	See page
Engine does not crank (Does not start)	1. Starter and starter relay	ST–12, 13
No initial combustion (Does not start)	1. Engine ECU power source circuit 2. Fuel pump control circuit 3. Engine ECU	DI–124 DI–127 IN–30
No complete combustion (Does not start)	1. Fuel pump control circuit	DI–127
Engine cranks normally (Difficult to start)	1. Starter signal circuit 2. Fuel pump control circuit 3. Compression	DI–121 DI–127 EM–3
Cold engine (Difficult to start)	1. Starter signal circuit 2. Fuel pump control circuit	DI–121 DI–127
Hot engine	1. Starter signal circuit 2. Fuel pump control circuit	DI–121 DI–127
High engine idle speed (Poor idling)	1. A/C signal circuit (Compressor circuit) 2. Engine ECU power source circuit	AC–54 DI–124
...dling)	1. A/C signal circuit 2. Fuel pump control circuit	
	1. Compression 2. Fuel pump control circuit	

6. CIRCUIT INSPECTION

How to read and use each page is shown below.

- Diagnostic Trouble Code No. and Detection Item

- Circuit Description
  The major role and operation, etc. of the circuit and its component parts are explained.

DTC	P0325/52	Knock Sensor Circuit Malfunction

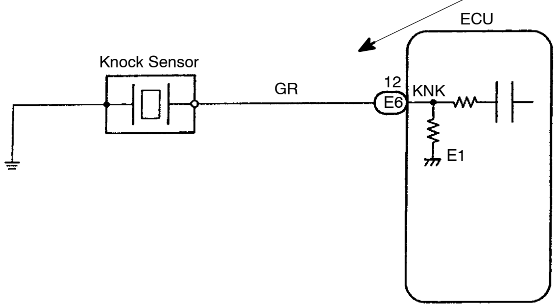
CIRCUIT DESCRIPTION

Knock sensor are fitted to the cylinder block to detect engine knocking. This sensor contains a piezoelectric element which generates a voltage when it becomes deformed, which occurs when the cylinder block vibrates due to knocking.

DTC No.	Detection Item	Trouble Area
P0325/52	No knock sensor 1 signal to engine ECU with engine speed between 1,700 rpm and 5,200 rpm	• Open or short in knock sensor circuit • Knock sensor (Looseness) • Engine ECU

- Indicates the diagnostic trouble code, diagnostic trouble code set parameter and suspect area of the problem.

WIRING DIAGRAM



- Wiring Diagram
  This shows a wiring diagram of the circuit.
  Use this diagram together with ELECTRICAL WIRING DIAGRAM to thoroughly understand the circuit.
  Wire colors are indicated by an alphabetical code.
  B = Black, L = Blue, R = Red, BR = Brown,
  LG = Light Green, V = Violet, G = Green,
  O = Orange, W = White, GR = Gray, P = Pink,
  Y = Yellow
  The first letter indicates the basic wire color and the second letter indicates the color of the stripe.

V08423

- Indicates the position of the ignition switch during the check.

LOCK Ignition Switch LOCK (OFF)

ON Ignition Switch ON

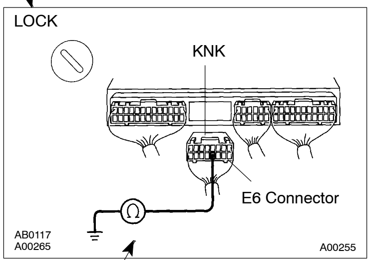
START Ignition Switch START

ACC Ignition Switch ACC

- Inspection Procedure
Use the inspection procedure to determine if the circuit is normal or abnormal, and , if it is abnormal, use it to determine whether the problem is located in the sensors, actuators, wire harness or ECU.

INSPECTION PROCEDURE

1	**Check continuity between terminal KNK of ECU connector and body ground.**



PREPARATION:

(a) Remove the glove compartment (See page FI–37).
(b) Disconnect the E6 connector of ECU.

CHECK:

Measure resistance between terminal KNK of ECU connector and body ground.

OK:

Resistance: 1 MΩ or higher

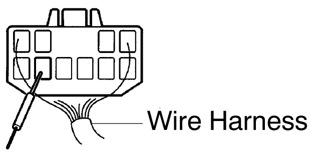
OK → **Go to step 3.**

NG

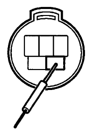
2	**Check knock sensor (See page FI–34).**

OK → **Replace knock sensor.**

- Indicates the place to check the voltage or resistance.
- Indicates the connector position to checked, from the front or back side.

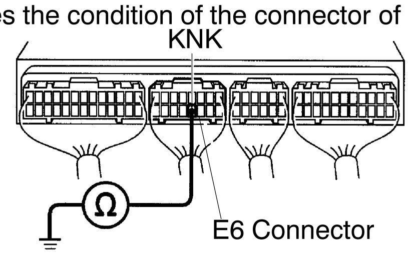


Check from the connector back side. (with harness)

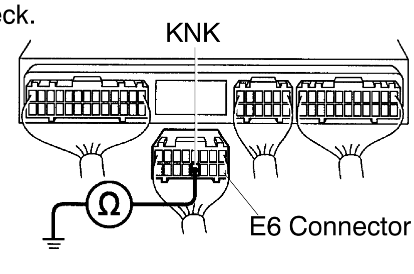


Check from the connector front side. (without harness) In this case, care must be taken not to bend the terminals.

- Indicates the condition of the connector of ECU during the check.



Connector being checked is connected.

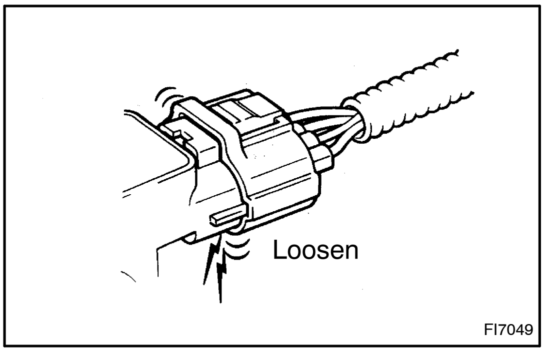


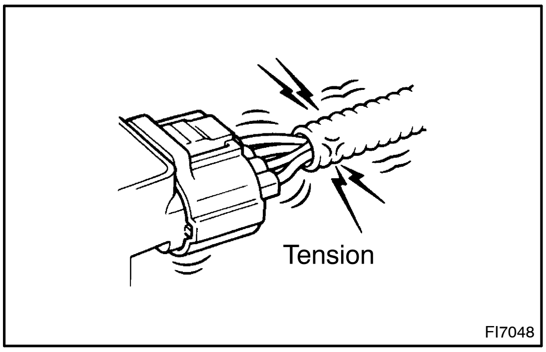
Connector being checked is disconnected.

V08425

IN0BW–07

HOW TO USE THE DIAGNOSTIC CHART AND INSPECTION PROCEDURE





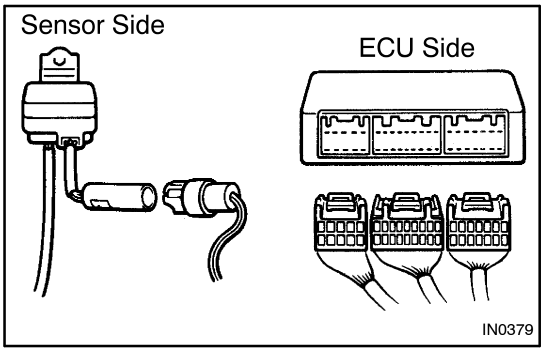
1. CONNECTOR CONNECTION AND TERMINAL INSPECTION

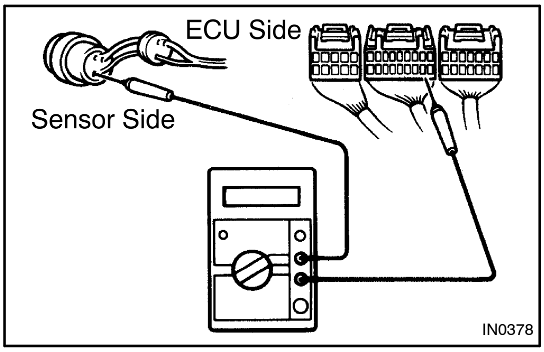
- For troubleshooting, diagnostic trouble code charts or problem symptom charts are provided for each circuit with detailed inspection procedures on the following pages.
- When all the component parts, wire harnesses and connectors of each circuit except the ECU are found to be normal in troubleshooting, then it is determined that the problem is in the ECU. Accordingly, if diagnosis is performed without the problem symptoms occurring, the instruction will be to check and replace the ECU, even if the problem is not in the ECU. So always confirm that the problem symptoms are occurring, or proceed with inspection while using the symptom simulation method.
- The instructions ”Check wire harness and connector” and ”Check and replace ECU” which appear in the inspection procedure, are common and applicable to all diagnostic trouble codes. Follow the procedure outlined below whenever these instructions appear.

OPEN CIRCUIT:
This could be due to a disconnected wire harness, faulty contact in the connector, a connector terminal pulled out, etc.
HINT:

- It is rarely the case that a wire is broken in the middle of it. Most cases occur at the connector. In particular, carefully check the connectors of sensors and actuators.
- Faulty contact could be due to rusting of the connector terminals, to foreign materials entering terminals or a drop in the contact pressure between the male and female terminals of the connector. Simply disconnecting and reconnecting the connectors once changes the condition of the connection and may result in a return to normal operation. Therefore, in troubleshooting, if no abnormality is found in the wire harness and connector check, but the problem disappears after the check, then the cause is considered to be in the wire harness or connectors.

SHORT CIRCUIT:
This could be due to a short circuit between the wire harness and the body ground or to a short inside the switch etc.
HINT:
When there is a short between the wire harness and body ground, check thoroughly whether the wire harness is caught in the body or is clamped properly.





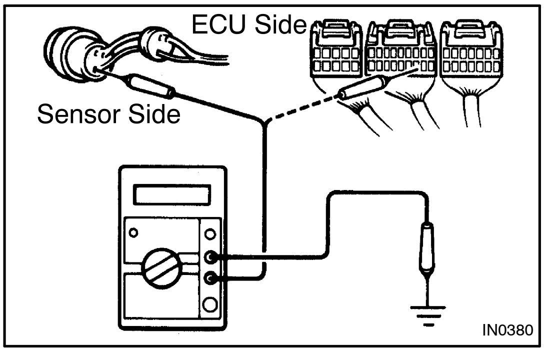
2. CONTINUITY CHECK (OPEN CIRCUIT CHECK)

(a) Disconnect the connectors at both ECU and sensor sides.

(b) Measure the resistance between the applicable terminals of the connectors.
Resistance: 1 Ω or less

HINT:

- Measure the resistance while lightly shaking the wire harness vertically and horizontally.
- When tester probes are inserted into a connector, insert the probes from the back. For waterproof connectors in which the probes cannot be inserted from the back, be careful not to bend the terminals when inserting the tester probes.

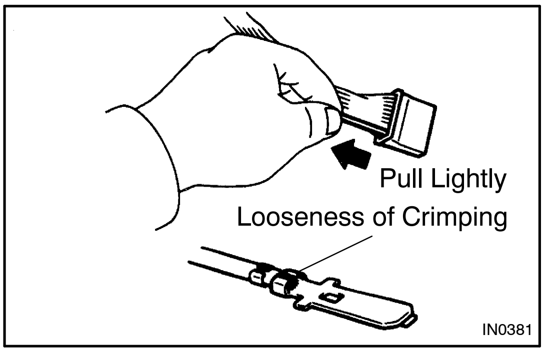


3. RESISTANCE CHECK (SHORT CIRCUIT CHECK)

(a) Disconnect the connectors at both ends.

(b) Measure the resistance between the applicable terminals of the connectors and body ground. Be sure to carry out this check on the connectors on both ends.
Resistance: 1 MΩ or higher

HINT:
Measure the resistance while lightly shaking the wire harness vertically and horizontally.



4. VISUAL CHECK AND CONTACT PRESSURE CHECK

(a) Disconnect the connectors at both ends.

(b) Check for rust or foreign material, etc. in the terminals of the connectors.

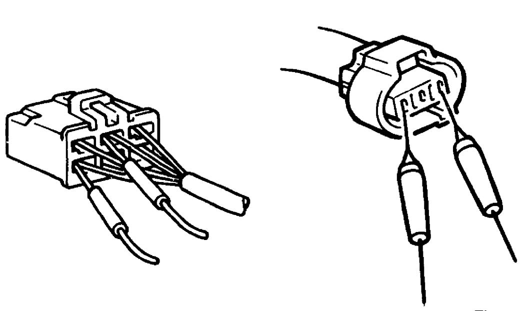
(c) Check crimped portions for looseness or damage and check if the terminals are secured in lock portion.

HINT:
The terminals should not come out when pulled lightly.

(d) Prepare a test male terminal and insert it in the female terminal, then pull it out.

NOTICE:
When testing a gold–plated female terminal, always use a gold–plated male terminal.

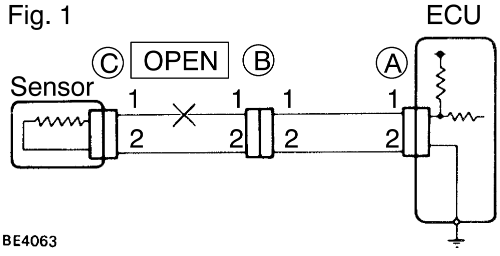
HINT:
When the test terminal is pulled out more easily than others, there may be poor contact in that section.


FI7187

5. CONNECTOR HANDLING

When inserting tester probes into a connector, insert them from the rear of the connector. When necessary, use mini test leads. For water resistant connectors which cannot be accessed from behind, take good care not to deform the connector terminals.

Fig. 1

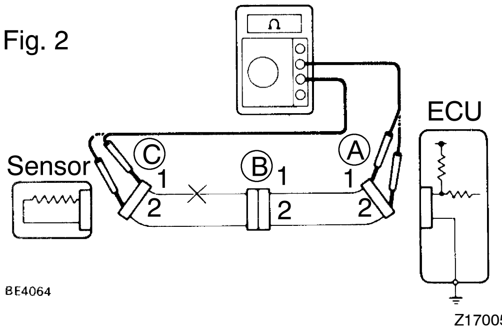


Z17004

6. CHECK OPEN CIRCUIT

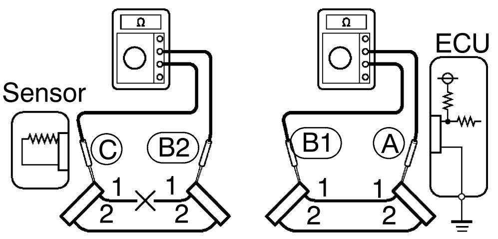
For the open circuit in the wire harness in Fig. 1, perform ”(a) Continuity Check” or ”(b) Voltage Check” to locate the section.

Fig. 2



Z17005

Fig. 3



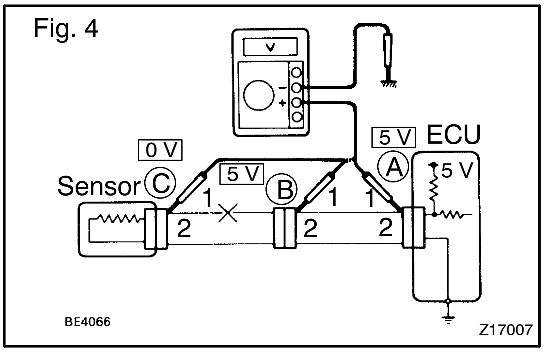
B04722

(a) Check the continuity.

(1) Disconnect connectors ”A” and ”C” and measure the resistance between them.
In the case of Fig. 2,
Between terminal 1 of connector ”A” and terminal 1 of connector ”C” → No continuity (open)
Between terminal 2 of connector ”A” and terminal 2 of connector ”C” → Continuity
Therefore, it is found out that there is an open circuit between terminal 1 of connector ”A” and terminal 1 of connector ”C”.

(2) Disconnect connector ”B” and measure the resistance between the connectors.
In the case of Fig. 3,
Between terminal 1 of connector ”A” and terminal 1 of connector ”B1” → Continuity
Between terminal 1 of connector ”B2” and terminal 1 of connector ”C” → No continuity (open)
Therefore, it is found out that there is an open circuit between terminal 1 of connector ”B2” and terminal 1 of connector ”C”.

Fig. 4



(b) Check the voltage.

In a circuit in which voltage is applied (to the ECU connector terminal), an open circuit can be checked for by conducting a voltage check.

As shown in Fig. 4, with each connector still connected, measure the voltage between body ground and terminal 1 of connector "A" at the ECU 5 V output terminal, terminal 1 of connector "B", and terminal 1 of connector "C", in that order.

If the results are:

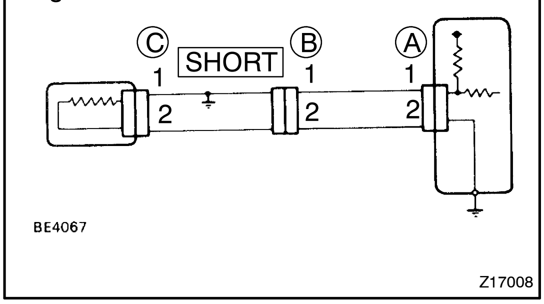
5 V: Between Terminal 1 of connector "A" and Body Ground

5 V: Between Terminal 1 of connector "B" and Body Ground

0 V: Between Terminal 1 of connector "C" and Body Ground

Then it is found out that there is an open circuit in the wire harness between terminal 1 of "B" and terminal 1 of "C".

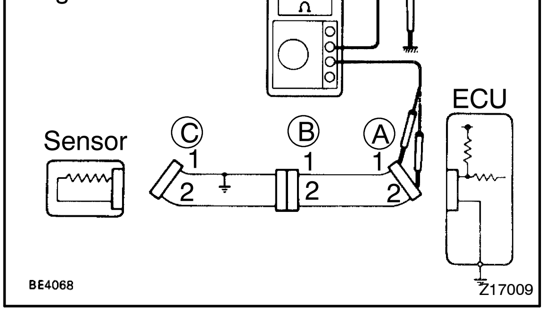
Fig. 5



7. CHECK SHORT CIRCUIT

If the wire harness is ground shorted as in Fig. 5, locate the section by conducting a "continuity check with ground".

Fig. 6



Check the continuity with ground.

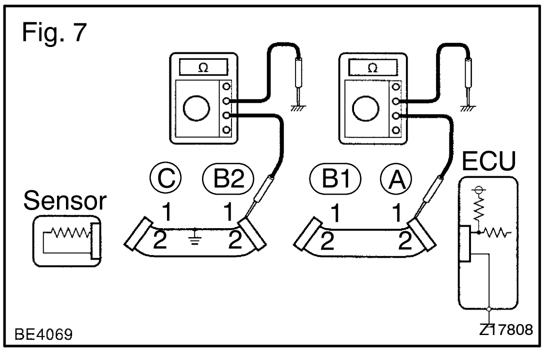
(1) Disconnect connectors "A" and "C" and measure the resistance between terminal 1 and 2 of connector "A" and body ground.

In the case of Fig. 6

Between terminal 1 of connector "A" and body ground → Continuity (short)

Between terminal 2 of connector "A" and body ground → No continuity

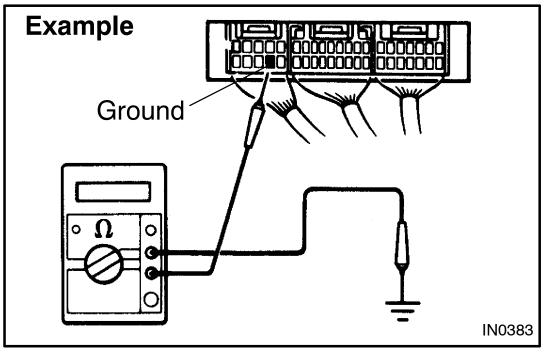
Therefore, it is found out that there is a short circuit between terminal 1 of connector "A" and terminal 1 of connector "C".



(2) Disconnect connector ”B” and measure the resistance between terminal 1 of connector ”A” and body ground, and terminal 1 of connector ”B2” and body ground.
In the case of Fig. 7
Between terminal 1 of connector ”A” and body ground → No continuity
Between terminal 1 of connector ”B2” and body ground → Continuity (short)
therefore, it is found out that there is a short circuit between terminal 1 of connector ”B2” and terminal 1 of connector ”C”.

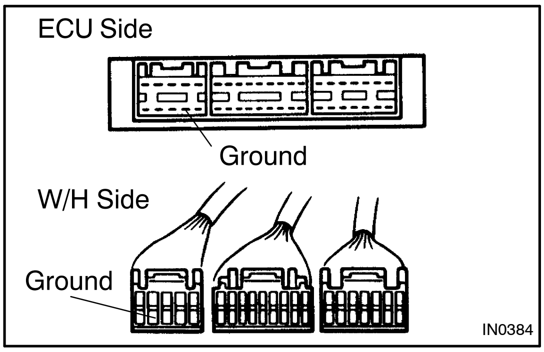
8. CHECK AND REPLACE ECU

First check the ECU ground circuit. If it is faulty, repair it. If it is normal, the ECU could be faulty, so replace the ECU with a known good one and check if the symptoms appear.



(1) Measure the resistance between the ECU ground terminal and the body ground.

Resistance: 1 Ω or less



(2) Disconnect the ECU connector, check the ground terminals on the ECU side and the wire harness side for bend and check the contact pressure.

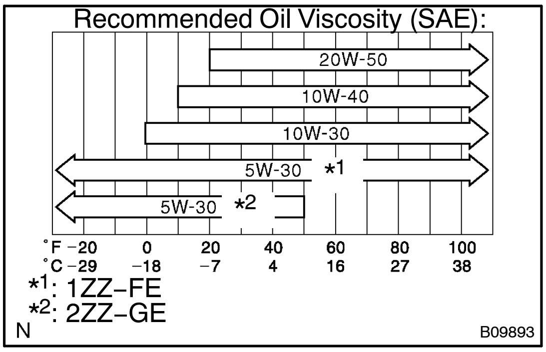
TERMS

ABBREVIATIONS USED IN THIS MANUAL

IN00S–13

Abbreviations	Meaning
A/C	Air Conditioning
AC	Alternating Current
ACC	Accessory
ACIS	Acoustic Control Induction System
ACSD	Automatic Cold Start Device
ALT	Alternator
AMP	Amplifier
APPROX.	Approximately
A/T	Automatic Transmission (Transaxle)
BACS	Boost Altitude Compensation System
BAT	Battery
BTDC	Before Top Dead Center
BVSV	Bimetallic Vacuum Switching Valve
CB	Circuit Breaker
CCO	Catalytic Converter for Oxidation
DC	Direct Current
DLC	Data Link Connector
DTC	Diagnostic Trouble Code
ECD	Electronic Control Diesel
ECT	Electronic Control Transmission
ECU	Electronic Control Unit
EDU	Electronic Driving Unit
EFI	Electronic Fuel Injection
E/G	Engine
EGR	Exhaust Gas Recirculation
EVAP	Evaporative Emission Control
E–VRV	Electronic Vacuum Regulating Valve
EX	Exhaust
FIPG	Formed In Place Gasket
FL	Fusible Link
Fr	Front
GND	Ground
HAC	High Altitude Compensator
IG	Ignition
IIA	Integrated Ignition Assembly
IN	Intake
ISC	Idle Speed Control
J/B	Junction Block
J/C	Junction Connector
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LH	Left–Hand

LHD	Left–Hand Drive
LO	Low
MAP	Manifold Absolute Pressure
MAX.	Maximum
MIL	Malfunction Indicator Lamp
MIN.	Minimum
MP	Multipurpose
M/T	Manual Transmission
N	Neutral
O2S	Oxygen Sensor
O/D	Overdrive
O/S	Oversize
PKB	Parking Brake
PS	Power Steering
RAM	Random Access Memory
R/B	Relay Block
RH	Right–Hand
RHD	Right–Hand Drive
ROM	Read Only Memory
Rr	Rear
SICS	Starting Injection Control System
SPEC	Specification
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch
TACH	Tachometer
TDC	Top Dead Center
TEMP.	Temperature
TM	Transmission
TMC	TOYOTA Motor Corporation
TWC	Three–Way Catalyst
U/D	Underdrive
VCV	Vacuum Control Valve
VIN	Vehicle Identification Number
VSV	Vacuum Switching Valve
w/	With
W/H	Wire Harness
w/o	Without
WU–TWC	Warm Up Three–Way Catalytic Converter
2WD	Two Wheel Drive Vehicle (4x2)
4WD	For Wheel Drive Vehicle (4x4)



OIL AND FILTER

LU0II–02

INSPECTION

1. CHECK ENGINE OIL QUALITY

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

If the quality is visibly poor, replace the oil.

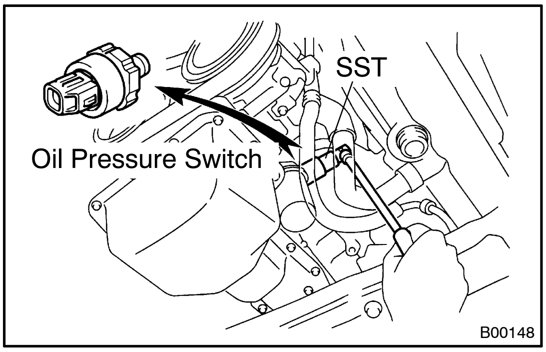
Oil grade:
API grade or SJ, Energy–Conserving or ILSAC multigrade engine oil is recommended. SAE 5W–30 is the best choice for your vehicle, for good fuel economy, and good starting in cold weather.

2. CHECK ENGINE OIL LEVEL

After warming up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "F" marks on the dipstick.

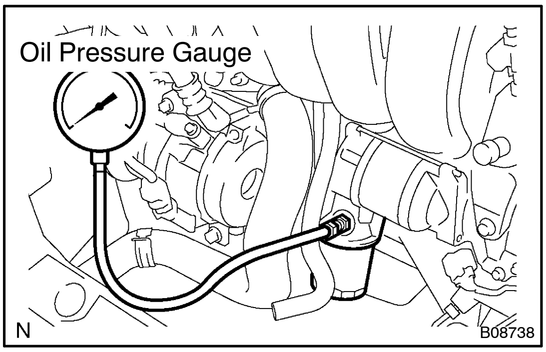
If low. check for leakage and add oil up to the "F" mark.

NOTICE:
Do not fill with engine oil above the "F" mark.



3. REMOVE OIL PRESSURE SWITCH, AND INSTALL OIL PRESSURE GAUGE

(a) Using SST, remove the oil pressure switch.
SST 09816–30010



(b) Install the oil pressure gauge.

4. WARM UP ENGINE

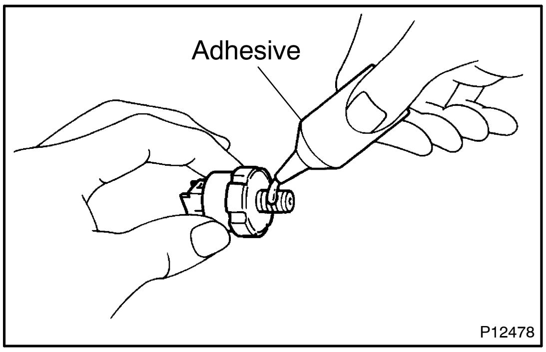
Allow the engine to warm up to normal operating temperature.

5. CHECK OIL PRESSURE

Oil pressure:
At idle speed
1ZZ–FE 29 kPa (0.3 kgf/cm^2, 4.3 psi) or more
2ZZ–GE 39.2 kPa (0.4 kgf/cm^2, 5.7 psi) or more
At 3,000 rpm
294 – 539 kPa (3.0 – 5.5 kgf/cm^2, 43 – 78 psi

6. REMOVE OIL PRESSURE GAUGE AND REINSTALL OIL PRESSURE SWITCH

(a) Remove the oil pressure gauge.



(b) Apply adhesive to 2 or 3 threads of the oil pressure switch.
Adhesive:
Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent

(c) Using SST, install the oil pressure switch.
SST 09816–30010
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)

7. START ENGINE AND CHECK FOR LEAKS

LU02L–02

REPLACEMENT

CAUTION:

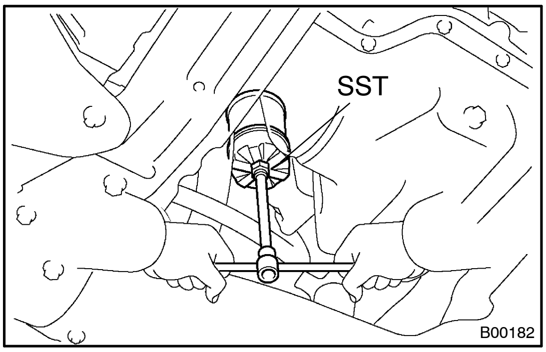
- **Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.**
- **Exercise caution in order to minimize the length and frequency of contact of your skin to used oil. Wear protective clothing and gloves. Wash your skin thoroughly with soap and water, or use water–less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.**
- **In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.**

1. REMOVE CENTER ENGIEN UNDER COVER

2. DRAIN ENGINE OIL

(a) Remove the oil filter cap.

(b) Remove the oil drain plug, and drain the oil into a container.



B00182

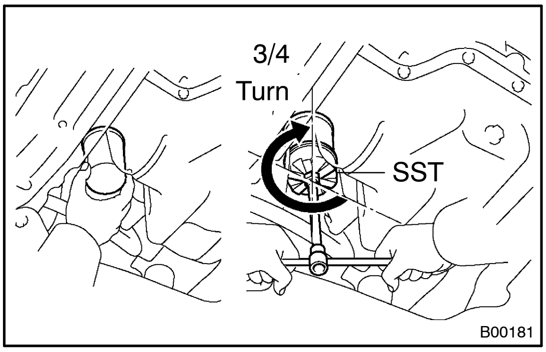
3. REPLACE OIL FILTER

(a) Using SST, remove the oil filter.
SST 09228–06501

(b) Check and clean the oil filter installation surface.

(c) Check the part number of the new oil filter is as same as old one.

(d) Apply clean engine oil to the gasket of a new oil filter.



B00181

(e) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.

(f) Using SST, tighten it an additional 3/4 turn.
SST 09228–06501

4. REFILL WITH ENGINE OIL

(a) Clean and install the oil drain plug with a new gasket.
Torque: 37 N·m (378 kgf·cm, 27 ft·lbf)

(b) Fill with fresh engine oil.
Capacity
1ZZ–FE
Drain and refill:
w/ Oil filter change: 3.7 liters (3.9 US qts, 3.3 Imp. qts)
w/o Oil filter change: 3.5 liters (3.7 US qts, 3.1 Imp. qts)
Dry fill: 4.1 liters (4.3 US qts, 3.6 Imp. qts)
2ZZ–GE
w/ Oil filter change: 4.4 liters (4.8 US qts, 4.0 Imp. qts)
w/o Oil filter change: 4.2 liters (4.6 US qts, 3.8 Imp. qts)
Dry fill: 5.2 liters (5.5 US qts, 4.6 Imp. ats)

(c) Install the oil filter cap.

5. START ENGINE AND CHECK FOR OIL LEAKS

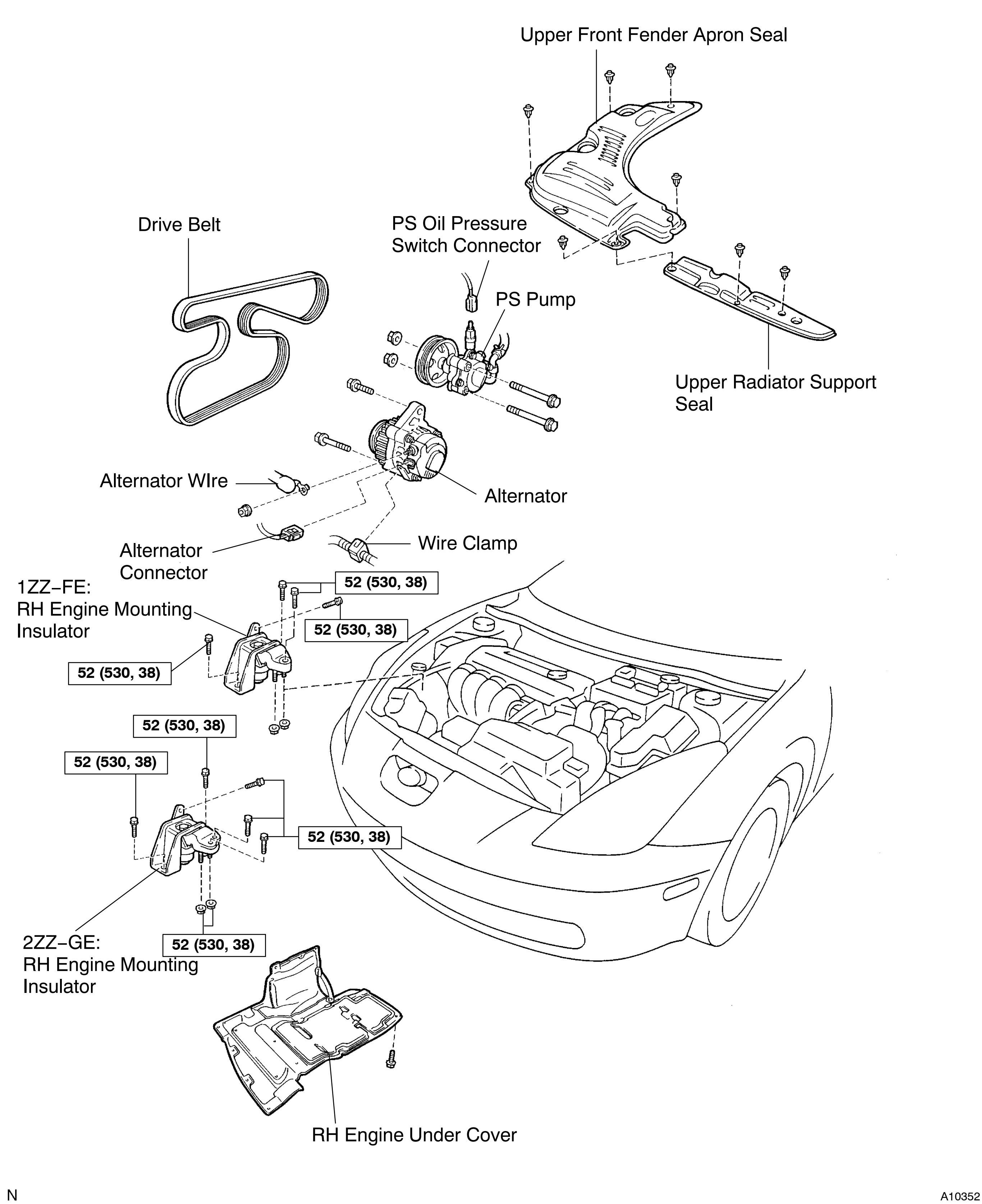
6. INSTALL CENTER ENGINE UNDER COVER

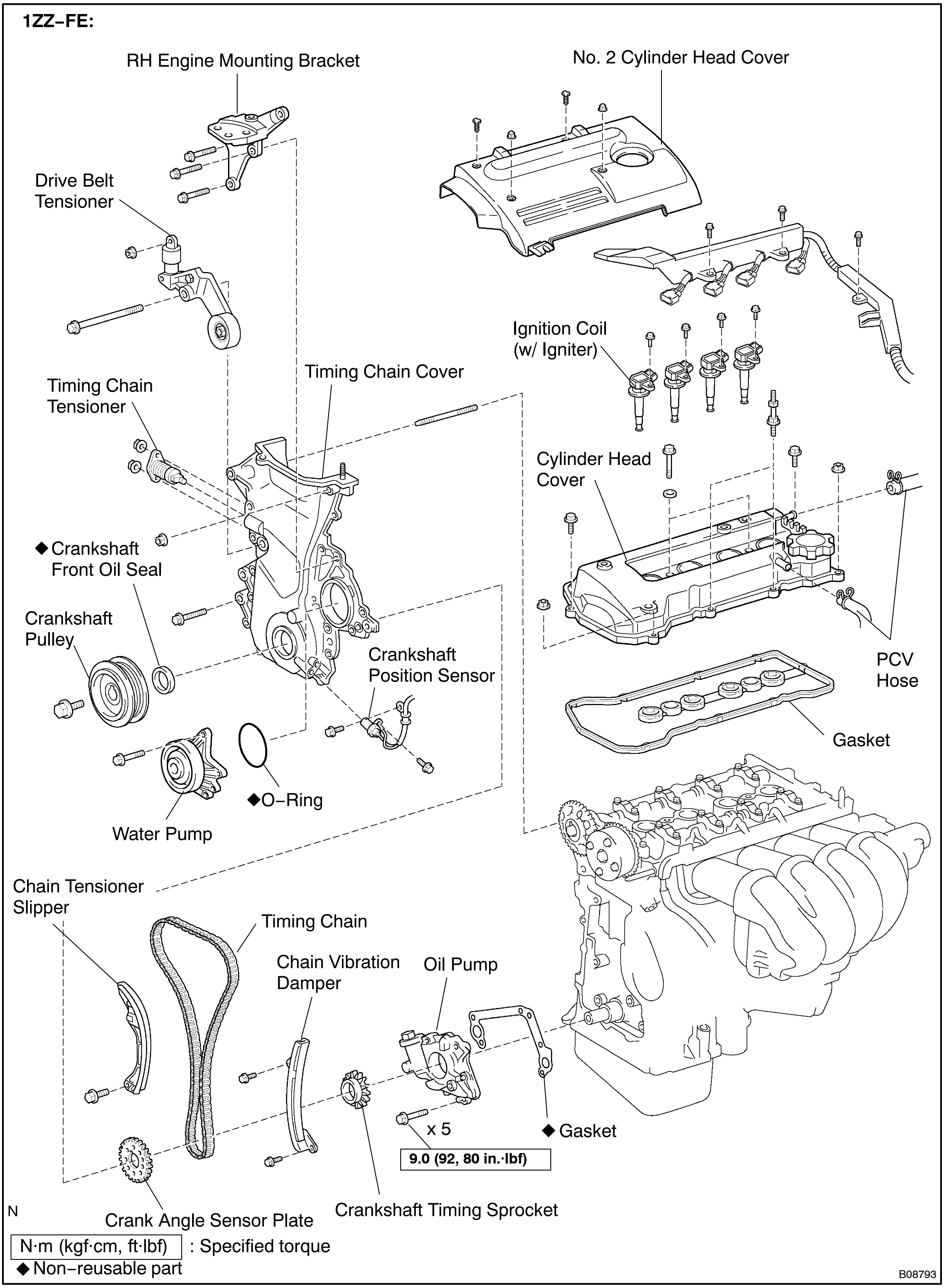
7. RECHECK ENGINE OIL LEVEL

OIL PUMP

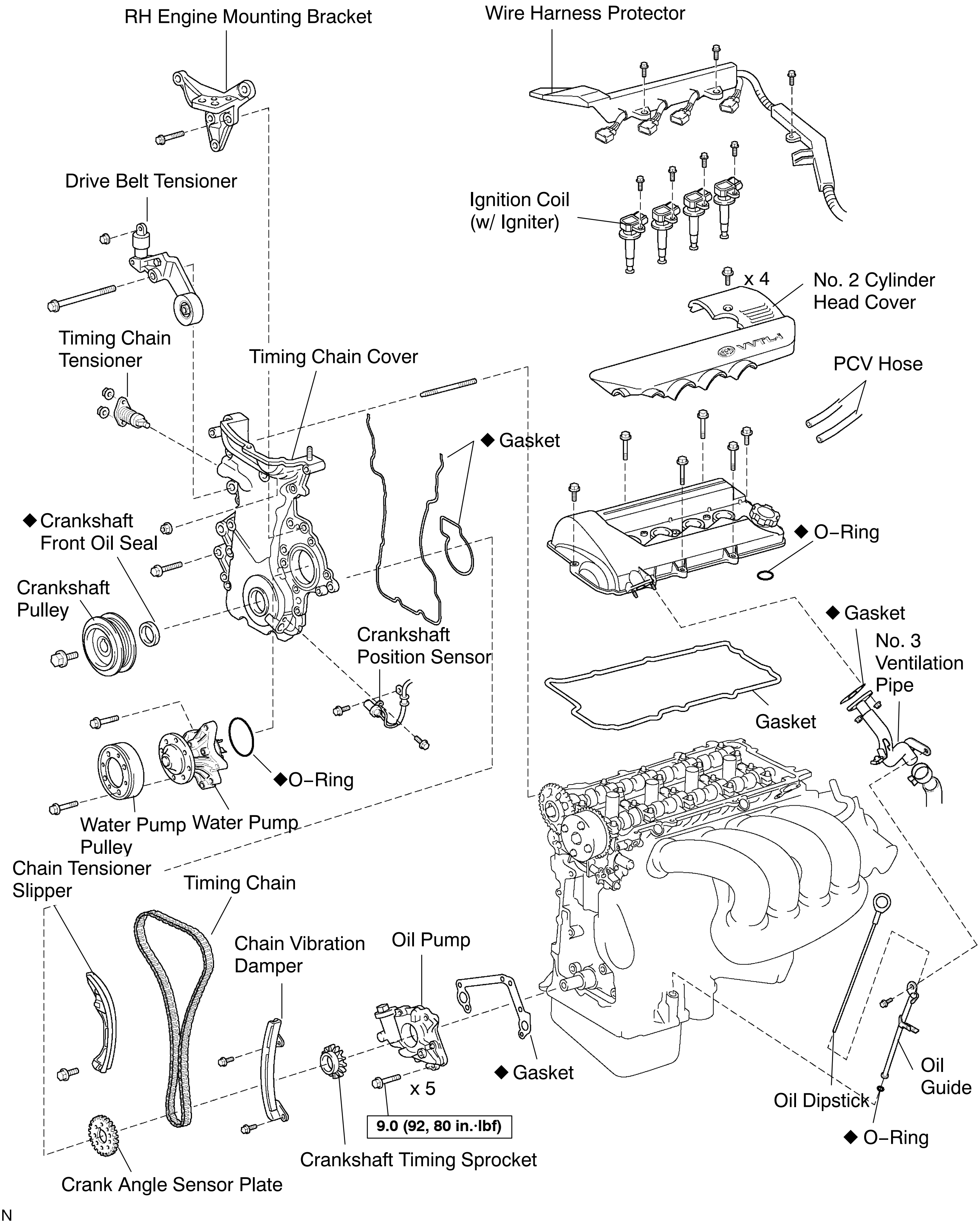
COMPONENTS

LU0IG–02



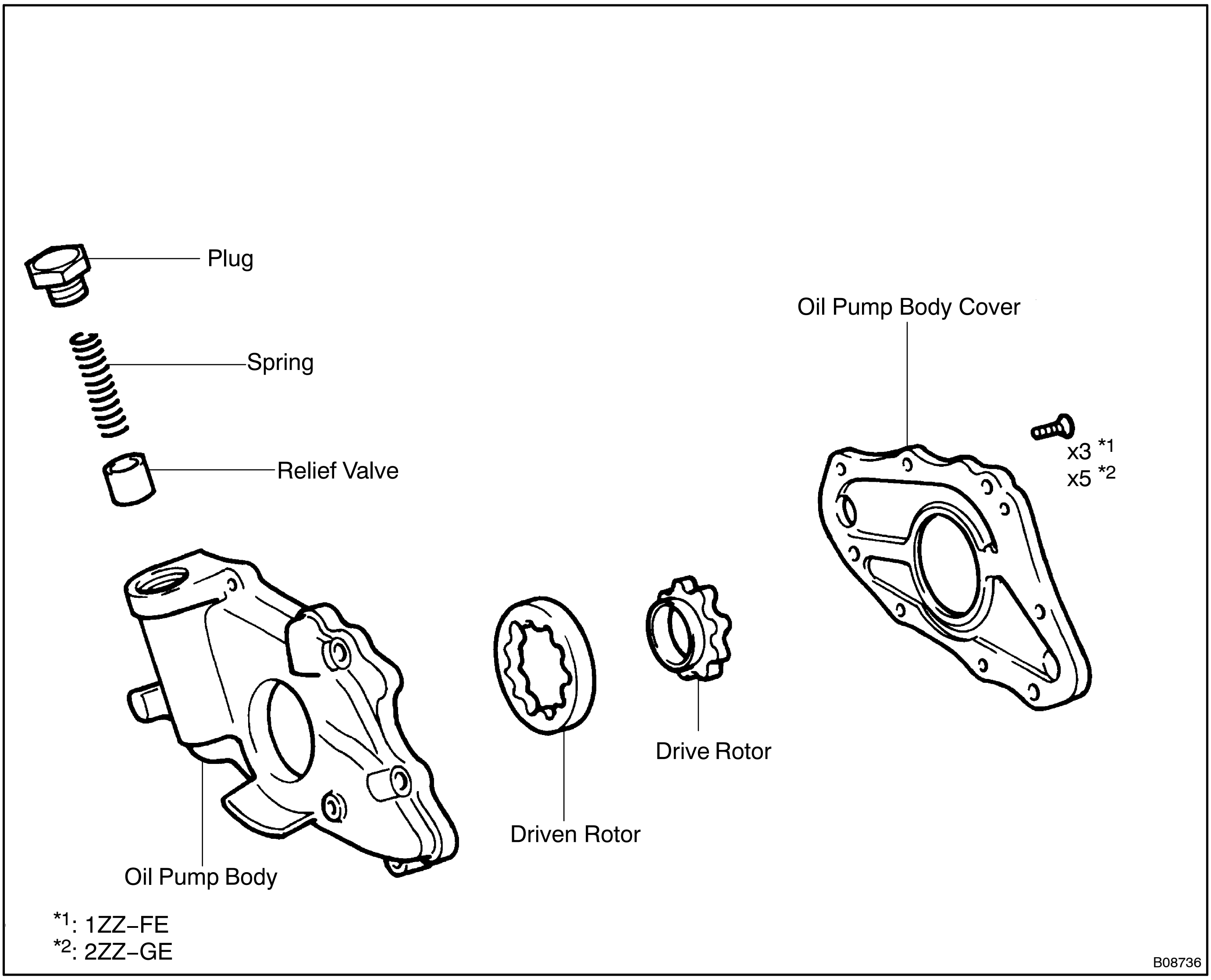

1ZZ–FE:
RH Engine Mounting Bracket
No. 2 Cylinder Head Cover
Drive Belt Tensioner
Ignition Coil (w/ Igniter)
Timing Chain Cover
Timing Chain Tensioner
Cylinder Head Cover
◆Crankshaft Front Oil Seal
Crankshaft Pulley
Crankshaft Position Sensor
PCV Hose
Gasket
◆O–Ring
Water Pump
Chain Tensioner Slipper
Timing Chain
Chain Vibration Damper
Oil Pump
x 5
◆Gasket
9.0 (92, 80 in.·lbf)
N
Crank Angle Sensor Plate
Crankshaft Timing Sprocket
N·m (kgf·cm, ft·lbf) : Specified torque
◆Non–reusable part
B08793

2ZZ–GE:

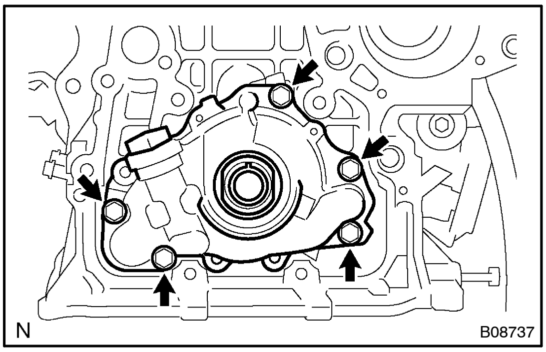


N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part

B08794


Plug
Spring
Relief Valve
Oil Pump Body Cover
x3 *1
x5 *2
Drive Rotor
Driven Rotor
Oil Pump Body
*1: 1ZZ–FE
*2: 2ZZ–GE
B08736

LU02N–02



REMOVAL

1. DRAIN ENGINE OIL
2. REMOVE TIMING CHAIN AND CRANKSHAFT TIMING SPROCKET (See pages EM–19)
3. REMOVE OIL PUMP

Remove the 5 bolts, oil pump and gasket.

LU02O–02

DISASSEMBLY

1. REMOVE RELIEF VALVE

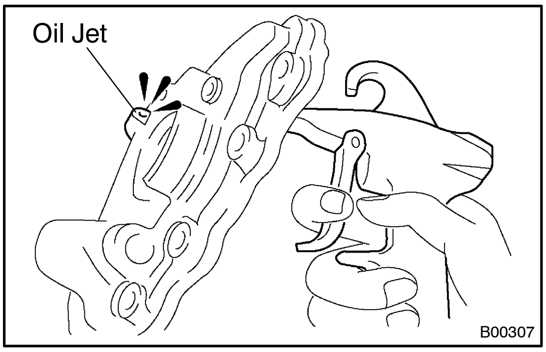
Remove the plug, spring and relief valve.

2. REMOVE DRIVE AND DRIVEN ROTORS

(a) 1ZZ–FE:
Remove the 3 screws, pump body cover, drive and driven rotors.

(b) 2ZZ–GE:
Remove the 5 screws, pump body cover, drive and driven rotors.

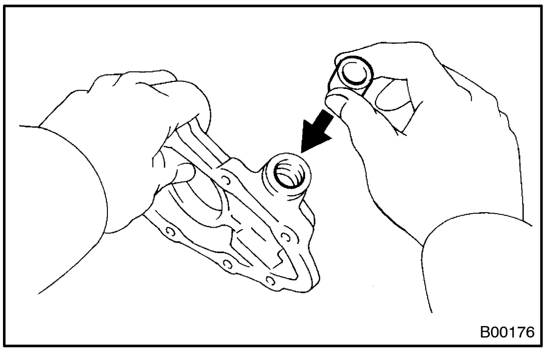
LU02P–02



INSPECTION

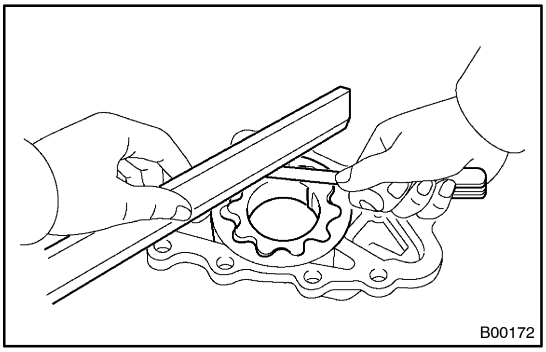
1. INSPECT OIL JET

Check the oil jet for damage or clogging.
If necessary, replace the oil pump assembly.



2. INSPECT RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.
If it does not, replace the relief valve. If necessary, replace the oil pump assembly.

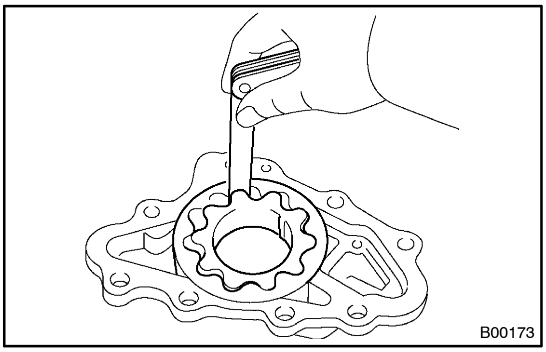


3. INSPECT ROTOR SIDE CLEARANCE

Using a feeler gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.

Standard side clearance:
0.030 – 0.080 mm (0.0012 – 0.0031 in.)
Maximum side clearance:
0.16 mm (0.0062 in.)

If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.

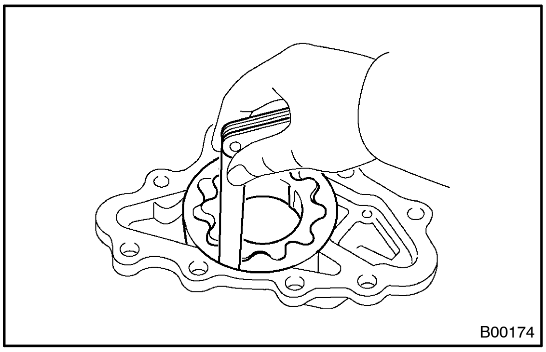


4. INSPECT ROTOR TIP CLEARANCE

Using a feeler gauge, measure the clearance between the drive and driven rotor tips.

Standard tip clearance:
0.060 – 0.180 mm (0.0024 – 0.0071 in.)
Maximum tip clearance:
0.35 mm (0.0138 in.)

If the tip clearance is greater than maximum, replace the rotors as a set.

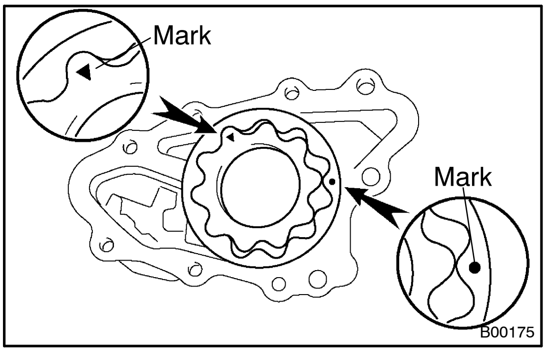


5. INSPECT ROTOR BODY CLEARANCE

Using a feeler gauge, measure the clearance between the driven rotor and body.

Standard body clearance:
0.125 – 0.180 mm (0.00492 – 0.00709 in.)
Maximum body clearance:
0.325 mm (0.01280 in.)

If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.



LU02Q–02

REASSEMBLY

1. INSTALL DRIVE AND DRIVEN ROTORS

(a) Place the drive and driven rotors into pump body with the marks facing the pump body cover side.

(b) 1ZZ–FE:
Install the pump body cover with the 3 screws.
Torque: 10.5 N·m (107 kgf·cm, 8 ft·lbf)

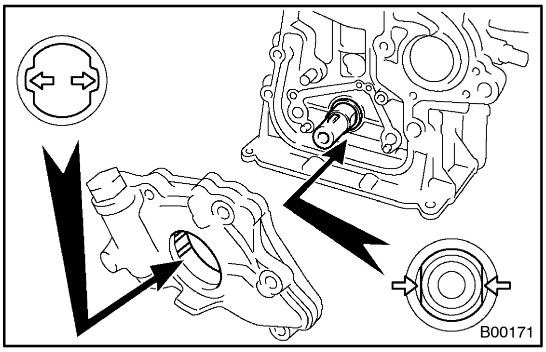
(c) 2ZZ–GE:
Install the pump body cover with the 5 screws.
Torque: 10.5 N·m (107 kgf·cm, 8 ft·lbf)

2. INSTALL RELIEF VALVE

Insert the relief valve and spring into the pump body hole, and install the plug.

Torque:
1ZZ–FE: 37 N·m (375 kgf·cm, 27 ft·lbf)
2ZZ–GE: 49 N·m (500 kgf·cm, 36 ft·lbf)

LU02R–02



INSTALLATION

1. **INSTALL OIL PUMP**

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

(b) Engage the spline teeth of the oil pump drive rotor with the large teeth of the crankshaft, and slide the oil pump.

(c) Install the oil pump with the 5 bolts.

Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

2. **INSTALL CRANKSHAFT TIMING SPROCKET AND TIMING CHAIN (See pages EM–26)**

3. **FILL ENGINE WITH OIL**

4. **START ENGINE AND CHECK FOR LEAKS**

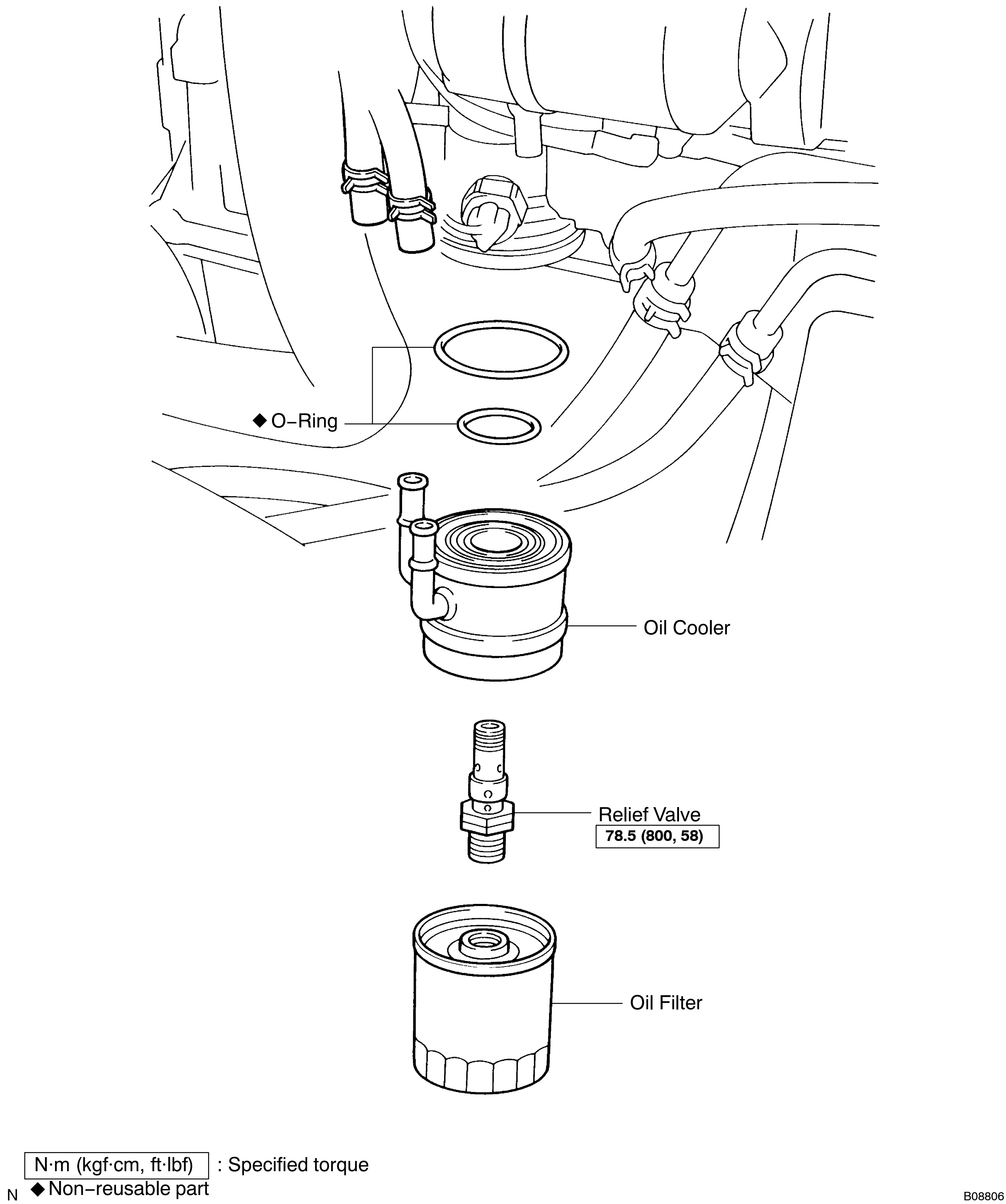
5. **RECHECK ENGINE OIL LEVEL**

OIL COOLER (2ZZ–GE)

LU0IJ–01

COMPONENTS

Australia spec:

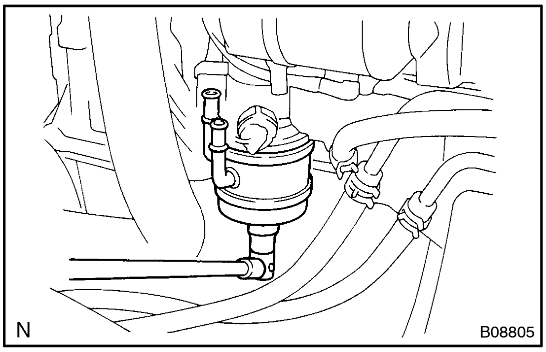


LU0IK–01

REMOVAL

1. DRAIN ENGINE COOLANT

2. REMOVE OIL FILTER (See page LU–3)

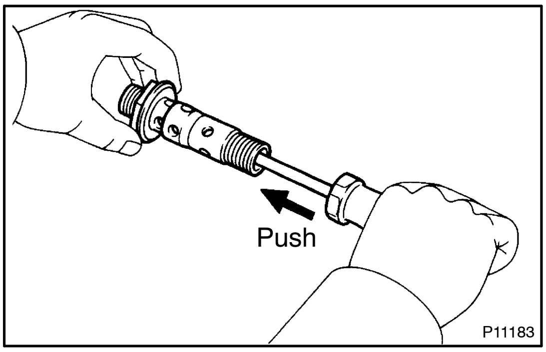


3. DISCONNECT WATER BYPASS HOSES FROM OIL COOLER

4. REMOVE OIL COOLER

(a) Remove the relief valve and oil cooler.

(b) Remove the 2 O–rings from the oil cooler.



LU0IL–01

INSPECTION

1. INSPECT RELIEF VALVE

Push the valve with a wooden stick to check if it is stuck.
If stuck, replace the relief valve.

2. INSPECT OIL COOLER

Check the oil cooler for damage or clogging.
If necessary, replace the oil cooler.

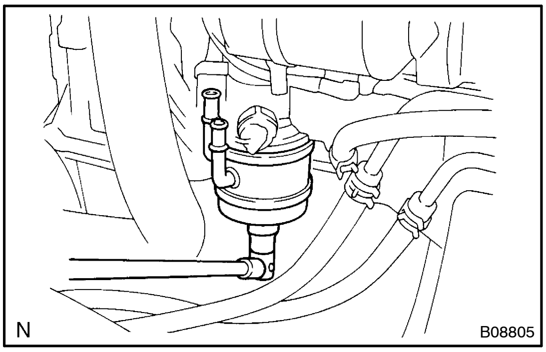
LU0IM–01

INSTALLATION

1. INSTALL OIL COOLER

(a) Install 2 new O–rings to the oil cooler.

(b) Apply a light coat of engine oil on the threads and under the head of the relief valve.



(c) Install the oil cooler and relief valve.

Torque: 78.5 N·m (800 kgf·cm, 58 ft·lbf)

2. CONNECT WATER BYPASS HOSES TO OIL COOLER

3. INSTALL OIL FILTER

4. FILL WITH ENGINE COOLANT **(See page LU–3)**

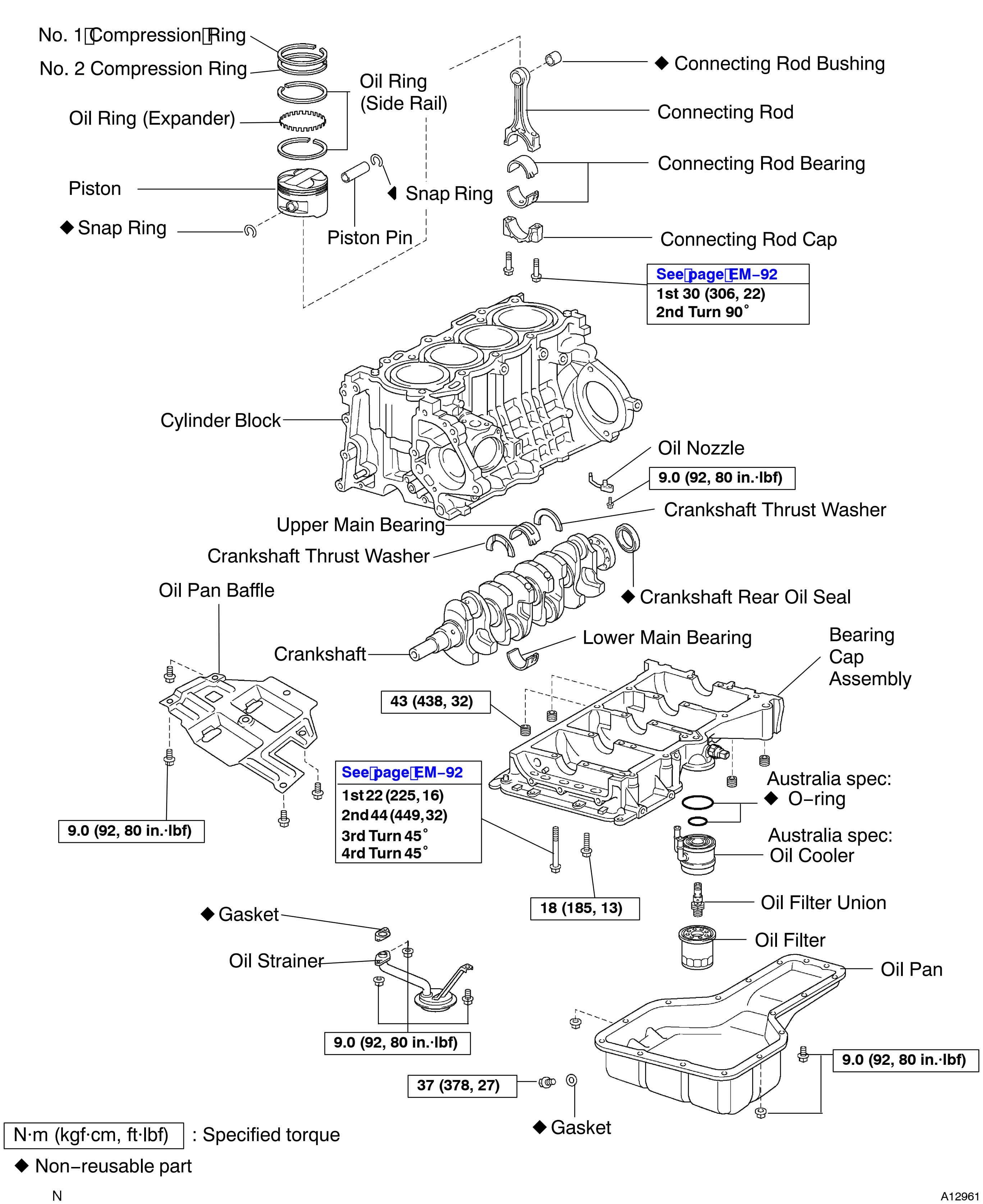
5. START ENGINE AND CHECK FOR LEAKS

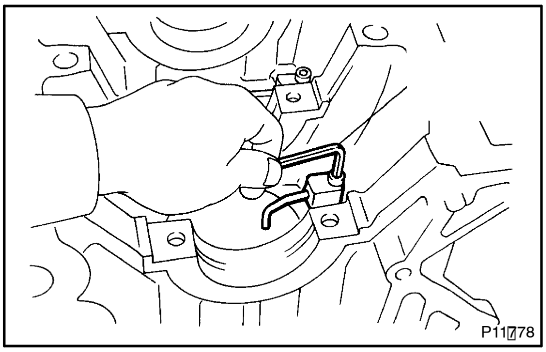
6. CHECK ENGINE OIL LEVEL

OIL NOZZLE (2ZZ–GE)

COMPONENTS

LU0IH–02




P11778

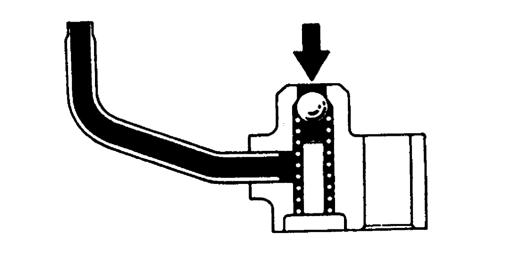
LU0ID-01

REMOVAL

1. REMOVE CRANKSHAFT (See page EM-75)

2. REMOVE OIL NOZZLE (WITH RELIEF VALVE)

Using a 5 mm hexagon wrench, remove the bolt and oil nozzle.


B03055

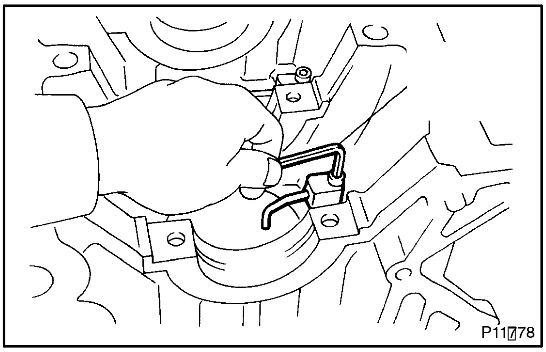
LU0IE–01

INSPECTION

INSPECT RELIEF VALVE (OIL NOZZLE)

Push the valve with a wooden stick to check if it is stuck.
If stuck, replace the relief valve.

LU0IF–01



INSTALLATION

1. INSTALL OIL NOZZLE (WITH RELIEF VALVE)

Using a 5 mm hexagon wrench, install the oil nozzle with the bolt.

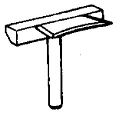
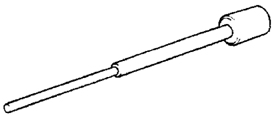
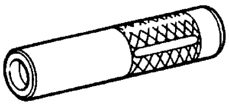
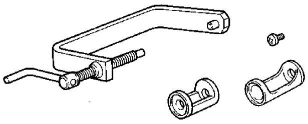
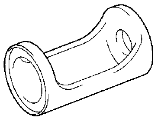
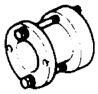
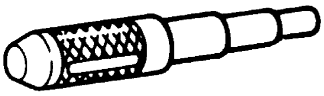
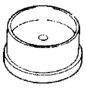
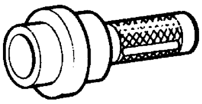
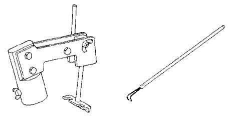
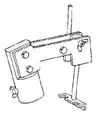
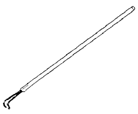
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

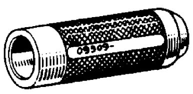
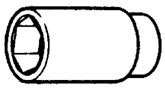
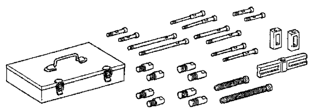
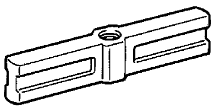
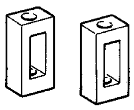
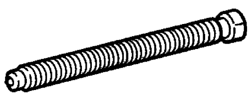
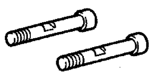
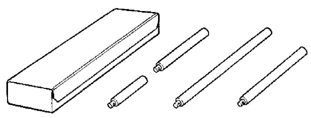
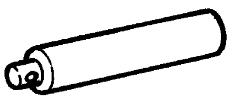
2. INSTALL CRANKSHAFT (See page EM–92)

ENGINE MECHANICAL

SST (Special Service Tools)

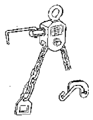
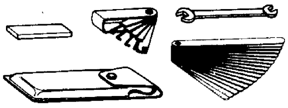
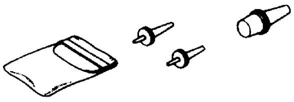
PP2EI–01

	09032–00100	Oil Pan Seal Cutter	
	09201–01055	Valve Guide Bushing Remover & Re placer 5.5	
	09201–41020	Valve Stem Oil Seal Replacer	
	09202–70020	Valve Spring Compressor	
	(09202–00020)	Attachment	
	09213–70010	Crankshaft Pulley Holding Tool	
	09222–30010	Connecting Rod Bushing Remover & Replacer	
	09223–15030	Oil Seal & Bearing Replacer	
	09223–22010	Crankshaft Front Oil Seal Replacer	
	09248–77010	Valve Clearance Adjusting Compressuor Set	
	(09248–07010)	Valve Clearance Adjusting Compressor	
	(09248–07020)	Adjusting Shim Remover	

	09309–37010	Transmission Bearing Replacer	
	09330–00021	Companion Flange Holding Tool	
	09816–30010	Oil Pressure Switch Socket	
	09950–50012	Puller C Set	
	(09951–05010)	Hanger 150	
	(09952–05010)	Slide Arm	
	(09953–05020)	Center Bolt 150	
	(09954–05020)	Claw No.2	
	09950–70010	Handle Set	
	(09951–07100)	Handle 100	

PP2EJ–01

RECOMMENDED TOOLS

	09090–04020	Engine Sling Device	For suspending engine
	09200–00010	Engine Adjust Kit .	
	09258–00030	Hose Plug Set .	Plug for vacuum hose, fuel hose etc.

EQUIPMENT

PP0JS–06

Abrasive compound	Valve
Caliper gauge	
CO/HC meter	
Compression gauge	
Connecting rod aligner	
Cylinder gauge	
Dial indicator	
Dye penetrant	
Engine tune–up tester	
Groove cleaning tool	Piston ring groove
Heater	
Magnetic finger	
Micrometer	
OBDII scan tool	
Pin hole grinder	Piston pin hole of piston
Piston ring compressor	
Piston ring expander	
Plastigage	
Precision straight edge	
Press	
Ridge reamer	Cylinder
Soft brush	
Solvent	
Spring tester	Valve spring
Steel square	Valve spring
Thermometer	
Torque wrench	
Torx wrench socket set	Stud bolt
Valve seat cutter	
V–block	
Vernier calipers	
Wire brush	Valve

PP187–02

SSM (Special Service Materials)

	08826–00080	Seal Packing Black or equivalent (FIPG)	
	08826–00100	Seal Packing 1282B, THREE BOND 1282B or equivalent (FIPG)	
	08833–00070	Adhesive 1324, THREE BOND 1324 or equivalent	

EMISSION CONTROL

EQUIPMENT

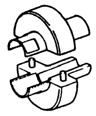
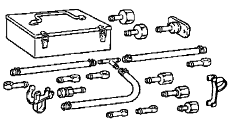
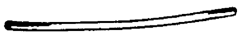
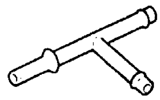
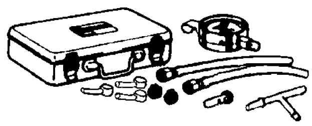
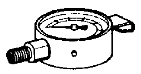
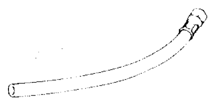
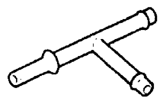
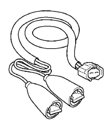
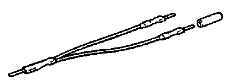
PP0JV–06

Torque wrench	

ELECTRONIC FUEL INJECTION

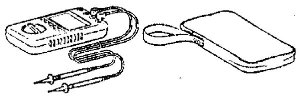
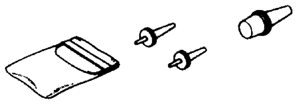
PP2ED–02

SST (Special Service Tools)

	09268–21010	Fuel Hose Puller	
	09268–41047	Injection Measuring Tool Set	
	(95336–08070)	Hose	
	(09268–41250)	T Joint	
	09268–45014	EFI Fuel Pressure Gauge	
	(09268–41200)	Gauge	
	(09268–41220)	Hose	
	(09268–41250)	T Joint	
	09816–30010	Oil Pressure Switch Socket	
	09842–30080	EFI Inspection Wire ”H”	
	09843–18020	Diagnosis Check Wire	

PP0JX–02

RECOMMENDED TOOLS

	09082–00040	TOYOTA Electrical Tester.	
	09258–00030	Hose Plug Set .	Plug for vacuum hose, fuel hose etc.

PP0JY–02

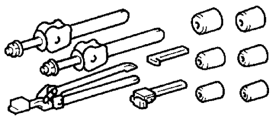
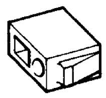
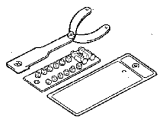
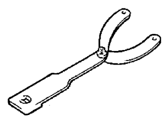
EQUIPMENT

Carburetor cleaner	Throttle body
Graduated cylinder	Injector
OBDII scan tool	
Soft brush	Throttle body
Sound scope	Injector
Torque wrench	
Vacuum gauge	

COOLING

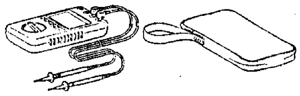
SST (Special Service Tools)

PP2DS–01

	09230–01010 Radiator Service Tool Set	
	09231–14010 Punch	
	09960–10010 Variable Pin Wrench Set	
	(09962–01000) Variable Pin Wrench Arm Assy	
	(09963–00600) Pin 6	

PP189–01

RECOMMENDED TOOLS

	09082–00040	TOYOTA Electrical Tester.	

PP18A–01

EQUIPMENT

Heater	ECT switch, Thermostat
Radiator cap tester	
Thermometer	ECT switch, Thermostat
Torque wrench	
Vernier calipers	

PP18B–02

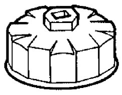
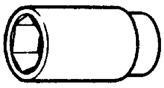
COOLANT

Item		Capacity	Classification
Engine coolant	1ZZ–FE:		Ethylene–glycol base
	M/T	5.7 liters (6.0 US qts, 5.0 Imp. qts)	
	A/T	5.6 liters (5.9 US qts, 4.9 Imp. qts)	
	2ZZ–GE:		
	M/T	5.9 liters (6.2 US qts, 5.2 Imp. qts)	
	A/T	5.8 liters (6.1 US qts, 5.1 Imp. qts)	

LUBRICATION

PP2DU–01

SST (Special Service Tools)

	09228–06501	Oil Filter Wrench	
	09816–30010	Oil Pressure Switch Socket	

PP0K5–05

EQUIPMENT

Oil pressure gauge	
Torque wrench	
Feeler gauge	
Straight edge	

PP0K6–06

LUBRICANT

Item		Capacity	Classification
Engine oil			API grade SJ, Energy–Conserving or ILSAC multigrade engine oil. SAE 5W–30 is the best choice for your vehicle, for good fuel economy,and good starting in cold weather.
Drain and refill	1ZZ–FE:		
	w/ Oil cooler	3.7 liters (3.9 US qts, 3.3 Imp.qts)	
	w/o Oil cooler	3.5 liters (3.7 US qts, 3.1 Imp.qts)	
	2ZZ–GE:		
	w/ Oil cooler	4.4 liters (4.8 US qts, 4.0 Imp.qts)	
	w/o Oil cooler	4.2 liters (4.6 US qts, 3.8 Imp.qts)	
Dry fill	1ZZ–FE:	4.1 liters (4.3 US qts, 3.6 Imp.qts)	
	2ZZ–GE:	5.2 liters (5.5 US qts, 4.6 Imp.qts)	

PP2DT–01

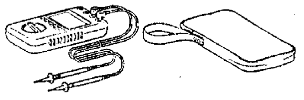
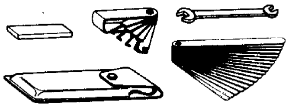
SSM (Special Service Materials)

08833–00080	Adhesive 1344 THREE BOND 1344 LOCTITE 242 or equivalent	Oil pressure switch

IGNITION

PP0K8–02

RECOMMENDED TOOLS

	09082–00040	TOYOTA Electrical Tester.	
	09200–00010	Engine Adjust Kit .	

PP0K9–05

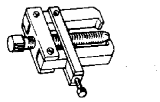
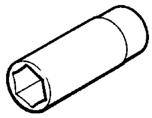
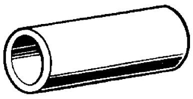
EQUIPMENT

Spark plug cleaner	

STARTING

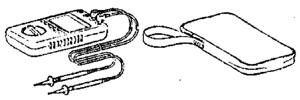
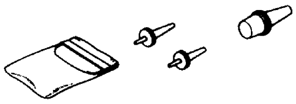
SST (Special Service Tools)

PP0KA–03

	09286–46011	Injection Pump Spline Shaft Puller	
	09810–38140	Starter Magnet Switch Nut Wrench 14	
	09820–00030	Alternator Rear Bearing Replacer	

PP0JX–02

RECOMMENDED TOOLS

	09082–00040	TOYOTA Electrical Tester.	
	09258–00030	Hose Plug Set .	Plug for vacuum hose, fuel hose etc.

EQUIPMENT

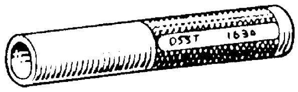
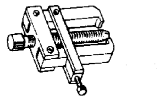
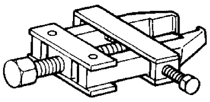
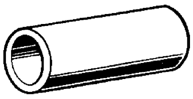
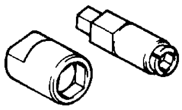
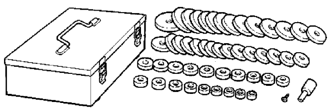
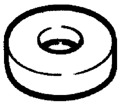
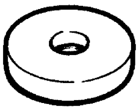
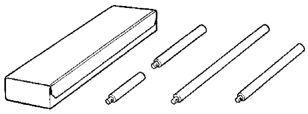
PP0KC–02

Dial indicator	Commutator
Magnetic finger	Steel ball
Press	Magnetic switch terminal kit part
Pull scale	Brush spring
Sandpaper	Commutator
Torque wrench	
V–block	Commutator
Vernier calipers	Commutator, Brush

CHARGING

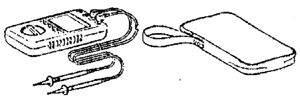
SST (Special Service Tools)

PP2DH–01

	09285–76010	Injection Pump Camshaft Bearing Cone Replacer	
	09286–46011	Injection Pump Spline Shaft Puller	
	09820–00021	Alternator Rear Bearing Puller	
	09820–00030	Alternator Rear Bearing Replacer	
	09820–63010	Alternator Pulley Set Nut Wrench Set	
	09950–60010	Replacer Set	
	(09951–00350)	Replacer 35	
	(09951–00530)	Replacer 53	
	09950–70010	Handle Set	
	(09951–07100)	Handle 100	

RECOMMENDED TOOLS

PP0KE–02

	09082–00040	TOYOTA Electrical Tester.	

PP0JY–02

EQUIPMENT

Carburetor cleaner	Throttle body
Graduated cylinder	Injector
OBDII scan tool	
Soft brush	Throttle body
Sound scope	Injector
Torque wrench	
Vacuum gauge	

STANDARD BOLT

HOW TO DETERMINE BOLT STRENGTH

SS0ZS–01

Bolt Type				Class
Hexagon Head Bolt		Stud Bolt	Weld Bolt	
Normal Recess Bolt	Deep Recess Bolt			
4 / No Mark	No Mark	No Mark		4T
5				5T
6 / w/ Washer	w/ Washer			6T
7				7T
8				8T
9				9T
10				10T
11				11T

B06431

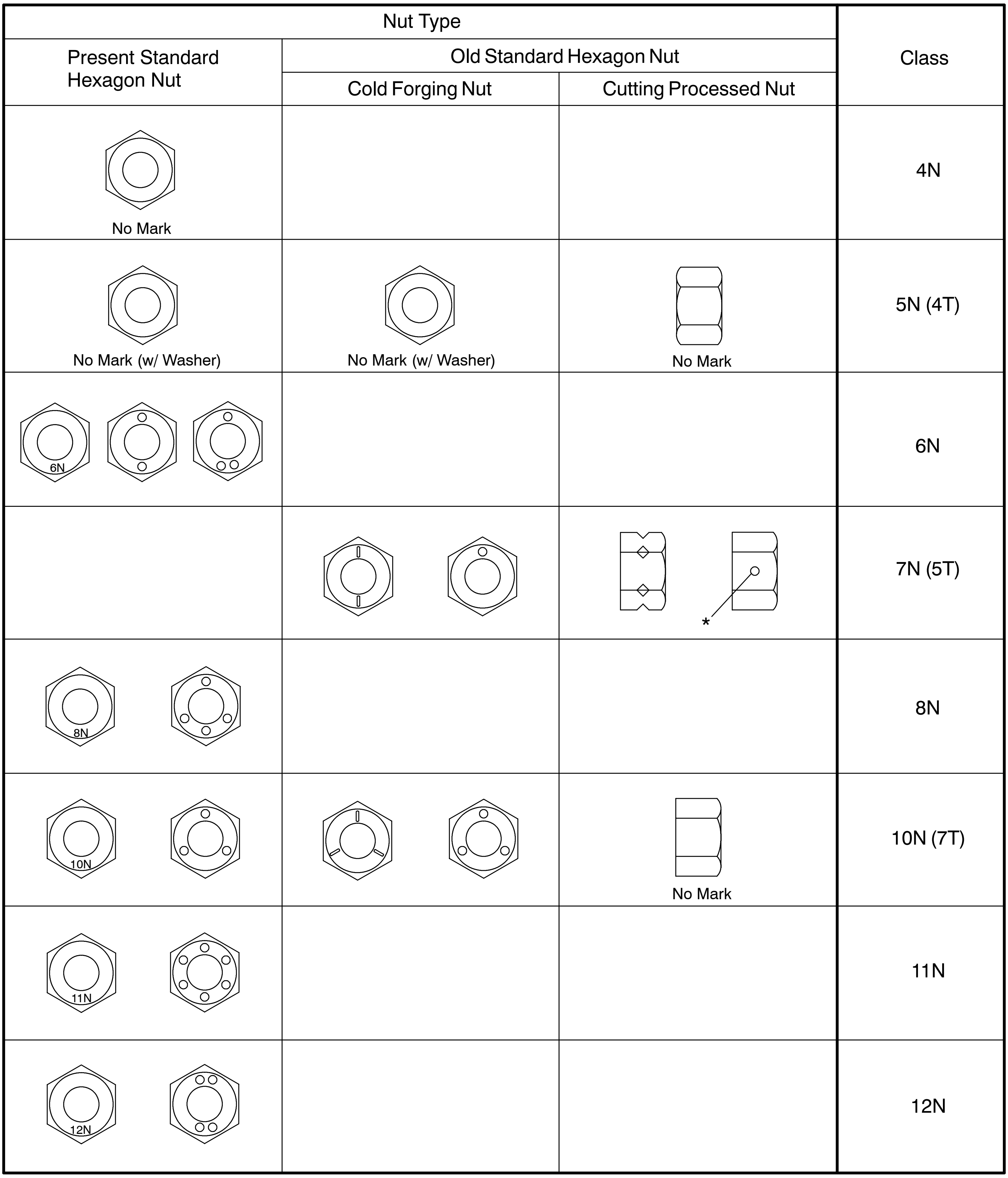
SS0ZT–01

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

SS0ZU–01

HOW TO DETERMINE NUT STRENGTH



Nut Type			Class
Present Standard Hexagon Nut	Old Standard Hexagon Nut		
	Cold Forging Nut	Cutting Processed Nut	
No Mark			4N
No Mark (w/ Washer)	No Mark (w/ Washer)	No Mark	5N (4T)
6N			6N
		*	7N (5T)
8N			8N
10N		No Mark	10N (7T)
11N			11N
12N			12N

*: Nut with 1 or more marks on one side surface of the nut.

B06432

HINT:
Use the nut with the same number of the nut strength classification or the greater than the bolt strength classification number when tightening parts with a bolt and nut.
Example: Bolt = 4T
Nut = 4N or more

ENGINE MECHANICAL

SS0MI–03

SERVICE DATA

Compression pressure	1ZZ–FE:	at 250 rpm STD	1,500 kPa (15.3 kgf/cm^2, 218 psi)
		Minimum	1,000 kPa (10.2 kgf/cm^2, 145 psi)
		Difference of pressure between each cylinder	100 kPa (1.0 kgf/cm^2, 15 psi) or less
	2ZZ–GE:	at 250 rpm STD	1,400 kPa (14.3 kgf/cm^2, 203 psi)
		Minimum	1,000 kPa (10.2 kgf/cm^2, 145 psi)
		Difference of pressure between each cylinder	110 kPa (1.1 kgf/cm^2, 16 psi) or less
Valve clearance	1ZZ–FE:	at cold Intake	0.15 – 0.25 mm (0.006 – 0.010 in.)
		Exhaust	0.25 – 0.35 mm (0.010 – 0.014 in.)
	Valve clearance adjusting shim		
		No. 06	5.060 mm (0.1992 in.)
		No. 08	5.080 mm (0.2000 in.)
		No. 10	5.100 mm (0.2008 in.)
		No. 12	5.120 mm (0.2016 in.)
		No. 14	5.140 mm (0.2024 in.)
		No. 16	5.160 mm (0.2031 in.)
		No. 18	5.180 mm (0.2039 in.)
		No. 20	5.200 mm (0.2047 in.)
		No. 22	5.220 mm (0.2055 in.)
		No. 24	5.240 mm (0.2063 in.)
		No. 26	5.260 mm (0.2071 in.)
		No. 28	5.280 mm (0.2079 in.)
		No. 30	5.300 mm (0.2087 in.)
		No. 32	5.320 mm (0.2094 in.)
		No. 34	5.340 mm (0.2102 in.)
		No. 36	5.360 mm (0.2110 in.)
		No. 38	5.380 mm (0.2118 in.)
		No. 40	5.400 mm (0.2126 in.)
		No. 42	5.420 mm (0.2134 in.)
		No. 44	5.440 mm (0.2142 in.)
		No. 46	5.460 mm (0.2150 in.)
		No. 48	5.480 mm (0.2157 in.)
		No. 50	5.500 mm (0.2165 in.)
		No. 52	5.520 mm (0.2173 in.)
		No. 54	5.540 mm (0.2181 in.)
		No. 56	5.560 mm (0.2189 in.)
		No. 58	5.580 mm (0.2197 in.)
		No. 60	5.600 mm (0.2205 in.)
		No. 62	5.620 mm (0.2213 in.)
		No. 64	5.640 mm (0.2220 in.)
		No. 66	5.660 mm (0.2228 in.)
		No. 68	5.680 mm (0.2236 in.)
		No. 70	5.700 mm (0.2244 in.)
		No. 72	5.720 mm (0.2252 in.)
		No. 74	5.740 mm (0.2260 in.)

Valve clearance	2ZZ–GE:	at cold Intake	0.15 – 0.25 mm (0.006 – 0.010 in.)
		Exhaust	0.35 – 0.45 mm (0.014 – 0.018 in.)
	Valve clearance adjusting shim		
		No. 00	2.000 mm (0.0787 in.)
		No. 02	2.020 mm (0.0795 in.)
		No. 04	2.040 mm (0.0803 in.)
		No. 06	2.060 mm (0.0811 in.)
		No. 08	2.080 mm (0.0819 in.)
		No. 10	2.100 mm (0.0827 in.)
		No. 12	2.120 mm (0.0835 in.)
		No. 14	2.140 mm (0.0843 in.)
		No. 16	2.160 mm (0.0850 in.)
		No. 18	2.180 mm (0.0858 in.)
		No. 20	2.200 mm (0.0866 in.)
		No. 22	2.220 mm (0.0874 in.)
		No. 24	2.240 mm (0.0882 in.)
		No. 26	2.260 mm (0.0890 in.)
		No. 28	2.280 mm (0.0898 in.)
		No. 30	2.300 mm (0.0906 in.)
		No. 32	2.320 mm (0.0913 in.)
		No. 34	2.340 mm (0.0921 in.)
		No. 36	2.360 mm (0.0929 in.)
		No. 38	2.380 mm (0.0937 in.)
		No. 40	2.400 mm (0.0945 in.)
		No. 42	2.420 mm (0.0953 in.)
		No. 44	2.440 mm (0.0961 in.)
		No. 46	2.460 mm (0.0969 in.)
		No. 48	2.480 mm (0.0976 in.)
		No. 50	2.500 mm (0.0984 in.)
		No. 52	2.520 mm (0.0992 in.)
		No. 54	2.540 mm (0.1000 in.)
		No. 56	2.560 mm (0.1008 in.)
		No. 58	2.580 mm (0.1016 in.)
		No. 60	2.600 mm (0.1024 in.)
		No. 62	2.620 mm (0.1031 in.)
		No. 64	2.640 mm (0.1039 in.)
		No. 66	2.660 mm (0.1047 in.)
		No. 68	2.680 mm (0.1055 in.)
		No. 70	2.700 mm (0.1063 in.)
		No. 72	2.720 mm (0.1071 in.)
		No. 74	2.740 mm (0.1079 in.)
		No. 76	2.760 mm (0.1087 in.)
		No. 78	2.780 mm (0.1094 in.)
		No. 80	2.800 mm (0.1102 in.)
Ignition timing	1ZZ–FE:		10 – 18° BTDC @ idle
	2ZZ–GE:		8 – 12° BTDC @ idle
Idle speed	1ZZ–FE:	M/T	700 ± 50 rpm
		A/T	750 ± 50 rpm
	2ZZ–GE:	M/T	800 ± 50 rpm
		A/T	750 ± 50 rpm
Chain and timing sprocket	Chain length at 16 links	Maximum	122.6 mm (4.827 in.)
	Camshaft timing sprocket wear (w/ chain)	Minimum	97.3 mm (3.831 in.)
	Crankshaft timing sprocket wear (w/ chain)	Minimum	51.6 mm (2.031 in.)
Chain tensioner slipper and vibration damper	Wear	Maximum	1.0 mm (0.039 in.)

Cylinder head	Warpage	Maximum	0.05 mm (0.0020 in.)
	Valve seat		
	Refacing angle		30°, 45°, 75°
	Contacting angle		45°
	Contacting width		1.0 – 1.4 mm (0.039 – 0.055 in.)
	Residuary width	Minimum Intake	3.3 mm (0.130 in.)
		Exhaust	3.2 mm (0.126 in.)
	Valve guide busing bore diameter	1ZZ–FE	
		STD	10.285 – 10.306 mm (0.4049 – 0.4057 in.)
		O/S 0.05	10.335 – 10.356 mm (0.4068 – 0.4077 in.)
		2ZZ–GE	
		STD	10.488 – 10.506 mm (0.41291 – 0.41362 in.)
		O/S 0.05	10.538 – 10.556 mm (0.41488 – 0.41559 in.)
	Cylinder head bolt diameter		
		at tension portion STD	9.0 – 9.2 mm (0.354 – 0.362 in.)
		Minimum	9.0 mm (0.354 in.)
Valve guide bushing	1ZZ–FE:		
	Inside diameter		5.510 – 5.530 mm (0.2169 – 0.2177 in.)
	Protrusion height		8.7 – 9.1 mm (0.342 – 0.358 in.)
	2ZZ–GE:		
	Inside diameter		5.500 – 5.518 mm (0.2165 – 0.2172 in.)
	Protrusion height		15.3 – 15.7 mm (0.602 – 0.618 in.)
Valve	1ZZ–FE:		
	Valve overall length	STD Intake	88.65 mm (3.4902 in.)
		Exhaust	88.69 mm (3.4917 in.)
		Minimum Intake	88.35 mm (3.4783 in.)
		Exhaust	88.39 mm (3.4799 in.)
	Valve face angle		44.5°
	Stem diameter	Intake	5.470 – 5.485 mm (0.2154 – 0.2159 in.)
		Exhaust	5.465 – 5.480 mm (0.2152 – 0.2157 in.)
	Stem oil clearance	STD Intake	0.025 – 0.060 mm (0.0010 – 0.0024 in.)
		Exhaust	0.030 – 0.065 mm (0.0012 – 0.0026 in.)
		Maximum Intake	0.08 mm (0.0031 in.)
		Exhaust	0.10 mm (0.0039 in.)
	Margin thickness	STD	1.0 mm (0.039 in.)
		Minimum	0.7 mm (0.028 in.)
	2ZZ–GE:		
	Valve overall length	STD Intake	111.3 mm (4.382 in.)
		Exhaust	111.7 mm (4.398 in.)
		Minimum Intake	110.9 mm (4.366 in.)
		Exhaust	111.3 mm (4.382 in.)
	Valve face angle		44.5°
	Stem diameter	Intake	5.460 – 5.475 mm (0.21496 – 0.21555 in.)
		Exhaust	5.445 – 5.470 mm (0.21437 – 0.21535 in.)
	Stem oil clearance	STD Intake	0.025 – 0.058 mm (0.00098 – 0.00228 in.)
		Exhaust	0.030 – 0.063 mm (0.00118 – 0.00248 in.)
		Maximum	0.10 mm (0.0039 in.)
	Margin thickness	STD	1.0 mm (0.039 in.)
		Minimum	0.7 mm (0.028 in.)

Valve spring	1ZZ–FE:		
	Deviation	Maximum	1.6 mm (0.063 in.)
	Angle (Reference)	Maximum	2°
	Free length		45.90 mm (1.807 in.)
	Installed tension at 33.6 mm (1.323 in.)		139.6 – 154.4 N (14.2 – 15.8 kgf, 31.3 – 34.8 lbf)
	Maximum working tension at 24.6 mm (0.969 in.)		244.9 – 276.1 N (25.5 – 28.1 kgf, 56.2 – 61.9 lbf)
	2ZZ–GE:		
	Deviation	Maximum	1.6 mm (0.063 in.)
	Angle (Reference)	Maximum	2°
	Free length	Intake	46.4 mm (1.830 in.)
		Exhaust	46.5 mm (1.831 in.)
	Installed tension at 38.5 mm (1.516 in.)	Intake	220.2 – 243.8 N (22.5 – 24.7 kgf, 49.6 – 55.5 lbf)
		Exhaust	208.2 – 229.8 N (21.2 – 23.4 kgf, 47.6 – 52.6 lbf)
	Maximum working tension	Intake at 27.3 mm (1.075 in.)	533 – 589 N (54.4 – 60.1 kgf, 119.9 – 132.5 lbf)
		Exhaust at 28.5 mm (1.122 in.)	495.5 – 548.5 N (50.5 – 55.9 kgf, 111.3 – 123.3 lbf)
Valve lifter	1ZZ–FE:		
	Lifter diameter		30.966 – 30.976 mm (1.2191 – 1.2195 in.)
	Lifter bore diameter		31.000 – 31.025 mm (1.2205 – 1.2215 in.)
	Oil clearance	STD	0.024 – 0.059 mm (0.0009 – 0.0023 in.)
		Maximum	0.079 mm (0.0031 in.)
Camshaft	1ZZ–FE:		
	Thrust clearance	STD	0.040 – 0.095 mm (0.0016 – 0.0037 in.)
		Maximum	0.11 mm (0.0043 in.)
	Journal oil clearance	STD	0.035 – 0.072 mm (0.0014 – 0.0028 in.)
		Maximum	0.10 mm (0.0039 in.)
	Journal diameter	No. 1	34.449 – 34.465 mm (1.3563 – 1.3569 in.)
		Others	22.949 – 22.965 mm (0.9035 – 0.9041 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Cam lobe height	STD Intake	44.333 – 44.433 mm (1.7454 – 1.7493 in.)
		Exhaust	43.761 – 43.861 mm (1.7229 – 1.7268 in.)
		Minimum Intake	44.18 mm (1.7394 in.)
		Exhaust	43.61 mm (1.7169 in.)
	2ZZ–GE:		
	Thrust clearance	STD	0.04 – 0.14 mm (0.0016 – 0.0055 in.)
		Maximum	0.15 mm (0.0059 in.)
	Journal oil clearance	STD	
		No. 1	0.035 – 0.076 mm (0.00138 – 0.00299 in.)
		Others	0.035 – 0.072 mm (0.00138 – 0.00283 in.)
		Maximum	0.1 mm (0.039 in.)
	Journal diameter	No. 1	34.449 – 34.465 mm (1.35626 – 1.35689 in.)
		Others	27.949 – 27.965 mm (1.10035 – 1.10098 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Cam lobe height	STD Intake	
		No. 1	40.607 – 40.707 mm (1.59586 – 1.59979 in.)
		No. 2	38.769 – 38.869 mm (1.52362 – 1.52755 in.)
		Exhaust	
		No. 1	40.019 – 40.119 mm (1.57275 – 1.57668 in.)
		No. 2	38.863 – 38.963 mm (1.52732 – 1.53125 in.)
		Minimum Intake	
		No. 1	40.45 mm (1.5925 in.)
		No. 2	38.61 mm (1.5201 in.)
		Exhaust	
		No. 1	39.86 mm (1.5693 in.)
		No. 2	38.71 mm (1.5240 in.)
Intake manifold	Warpage	Maximum	0.10 mm (0.0039 in.)
Exhaust manifold	Warpage	Maximum	0.70 mm (0.0276 in.)

Cylinder block	1ZZ–FE:	
	Cylinder head surface warpage Maximum	0.05 mm (0.0020 in.)
	Cylinder bore diameter STD	79.000 – 79.013 mm (3.1102 – 3.1107 in.)
	Maximum	79.013 mm (3.1107 in.)
	12 pointed head bearing cap sub–assembly bolt diameter	
	at tension portion STD	7.3 – 7.5 mm (0.287 – 0.295 in.)
	Minimum	7.3 mm (0.287 in.)
	2ZZ–GE:	
	Cylinder head surface warpage Maximum	0.05 mm (0.0020 in.)
	Cylinder bore diameter STD	82.000 – 82.013 mm (3.2283 – 3.2289 in.)
	Maximum	82.013 mm (3.2289 in.)
	12 pointed head bearing cap sub–assembly bolt diameter	
	at tension portion STD	7.3 – 7.5 mm (0.287 – 0.295 in.)
	Minimum	7.3 mm (0.287 in.)
Piston and piston ring	1ZZ–FE:	
	Piston diameter	
	at 25.6 mm (1.008 in.) from the piston head	78.925 – 78.935 mm (3.1073 – 3.1077 in.)
	Piston oil clearance	
	STD	0.065 – 0.088 mm (0.0026 – 0.0035 in.)
	Maximum	0.10 mm (0.0039 in.)
	Piston ring groove clearance	0.030 – 0.070 mm (0.0012 – 0.0028 in.)
	Piston ring end gap STD No. 1	0.25 – 0.35 mm (0.0098 – 0.0138 in.)
	No. 2	0.35 – 0.50 mm (0.0138 – 0.0197 in.)
	Oil	0.15 – 0.40 mm (0.0059 – 0.0157 in.)
	Maximum No. 1	1.05 mm (0.0413 in.)
	No. 2	1.20 mm (0.0472 in.)
	Oil	1.05 mm (0.0413 in.)
	2ZZ–GE:	
	Piston diameter	
	at 12.0 mm (0.048 in.) from the piston head	81.975 – 81.993 mm (3.2274 – 3.2281 in.)
	Piston oil clearance	
	STD	0.007 – 0.038 mm (0.0003 – 0.0015 in.)
	Maximum	0.10 mm (0.0039 in.)
	Piston ring groove clearance	0.030 – 0.070 mm (0.0012 – 0.0028 in.)
	Piston ring end gap STD No. 1	0.25 – 0.35 mm (0.0098 – 0.0138 in.)
	No. 2	0.35 – 0.50 mm (0.0138 –0.0197 in.)
	Oil	0.15 – 0.40 mm (0.0059 – 0.0157 in.)
	Maximum No. 1	1.05 mm (0.0413 in.)
	No. 2	1.20 mm (0.0472 in.)
	Oil	1.05 mm (0.0413 in.)

Connecting rod	1ZZ-FE:		
	Thrust clearance	STD	0.160 – 0.342 mm (0.0063 – 0.0135 in.)
		Maximum	0.342 mm (0.0135 in.)
	Connecting rod thickness		19.788 – 19.840 mm (0.7791 – 0.7811 in.)
	Connecting rod bearing center wall thickness		
	Reference	Mark 1	1.486 – 1.490 mm (0.0585 – 0.0587 in.)
		Mark 2	1.490 – 1.494 mm (0.0587 – 0.0588 in.)
		Mark 3	1.494 – 1.498 mm (0.0588 – 0.0590 in.)
	Connecting rod oil clearance	STD	0.028 – 0.060 mm (0.0011 – 0.0024 in.)
		Maximum	0.08 mm (0.0031 in.)
	Rod out-of-alignment	Maximum per/100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Rod twist	Maximum per/100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Bushing inside diameter		20.012 – 20.021 mm (0.7879 – 0.7882 in.)
	Piston pin diameter		20.004 – 20.013 mm (0.7876 – 0.7879 in.)
	Bushing oil clearance	STD	0.005 – 0.011 mm (0.0002 – 0.0004 in.)
		Maximum	0.05 mm (0.0020 in.)
	Connecting rod bolt diameter		
		at tension portion STD	6.6 – 6.7 mm (0.260 – 0.264 in.)
		Minimum	6.4 mm (0.252 in.)
	2ZZ-GE:		
	Thrust clearance	STD	0.160 – 0.342 mm (0.0063 – 0.0135 in.)
		Maximum	0.342 mm (0.0135 in.)
	Connecting rod thickness		19.788 – 19.840 mm (0.7791 – 0.7811 in.)
	Connecting rod bearing center wall thickness		
	Reference	Mark 1	1.482 – 1.486 mm (0.0583 – 0.0585 in.)
		Mark 2	1.486 – 1.490 mm (0.0585 – 0.0587 in.)
		Mark 3	1.490 – 1.494 mm (0.0587 – 0.0588 in.)
	Connecting rod oil clearance	STD	0.028 – 0.052 mm (0.0011 – 0.0020 in.)
		Maximum	0.08 mm (0.0031 in.)
	Rod out-of-alignment	Maximum per/100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Rod twist	Maximum per/100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Bushing inside diameter	Connecting rod	20.011 – 20.023 mm (0.7878 – 0.7883 in.)
		Piston	20.013 – 20.025 mm (0.7879 – 0.7884 in.)
	Piston pin diameter		20.004 – 20.016 mm (0.7876 – 0.7880 in.)
	Bushing oil clearance	STD Piston x Piston pin	0.005 – 0.013 mm (0.0002 – 0.0005 in.)
		Piston pin x Connecting rod	0.005 – 0.009 mm (0.0002 – 0.0004 in.)
		Maximum	0.05 mm (0.0020 in.)
	Connecting rod bolt diameter		
		at tension portion STD	6.6 – 6.7 mm (0.260 – 0.264 in.)
		Minimum	6.4 mm (0.252 in.)

Crankshaft	1ZZ–FE:		
	Thrust clearance	STD	0.04 – 0.24 mm (0.0016 – 0.0094 in.)
		Maximum	0.30 mm (0.0118 in.)
	Thrust washer thickness		2.430 – 2.480 mm (0.0957 – 0.0976 in.)
	Main journal oil clearance	STD	0.015 – 0.032 mm (0.0006 – 0.0013 in.)
		Maximum	0.050 mm (0.0020 in.)
	Main journal diameter	Mark 0	47.998 – 48.000 mm (1.8897 – 1.8898 in.)
		Mark 1	47.996 – 47.998 mm (1.8896 – 1.8897 in.)
		Mark 2	47.994 – 47.996 mm (1.8895 – 1.8896 in.)
		Mark 3	47.992 – 47.994 mm (1.8894 – 1.8895 in.)
		Mark 4	47.990 – 47.992 mm (1.8893 – 1.8894 in.)
		Mark 5	47.988 – 47.990 mm (1.8892 – 1.8893 in.)
	Main bearing center wall thickness		
	Reference	Mark 1	1.993 – 1.996 mm (0.0785 – 0.0786 in.)
		Mark 2	1.996 – 1.999 mm (0.0786 – 0.0787 in.)
		Mark 3	1.999 – 2.002 mm (0.0787 – 0.0788 in.)
		Mark 4	2.002 – 2.005 mm (0.0788 – 0.0789 in.)
	Crank pin diameter		43.992 – 44.000 mm (1.7320 – 1.7323 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Main journal taper and out–of round	Maximum	0.02 mm (0.0008 in.)
	Crank pin taper and out–of round	Maximum	0.02 mm (0.0008 in.)
	2ZZ–GE:		
	Thrust clearance	STD	0.04 – 0.24 mm (0.0016 – 0.0094 in.)
		Maximum	0.30 mm (0.0118 in.)
	Thrust washer thickness		2.430 – 2.480 mm (0.0957 – 0.0976 in.)
	Main journal oil clearance	STD	0.016 – 0.032 mm (0.0006 – 0.0013 in.)
		Maximum	0.050 mm (0.0020 in.)
	Main journal diameter	Mark 0	47.998 – 48.000 mm (1.8897 – 1.8898 in.)
		Mark 1	47.996 – 47.998 mm (1.8896 – 1.8897 in.)
		Mark 2	47.994 – 47.996 mm (1.8895 – 1.8896 in.)
		Mark 3	47.992 – 47.994 mm (1.8894 – 1.8895 in.)
		Mark 4	47.990 – 47.992 mm (1.8893 – 1.8894 in.)
		Mark 5	47.988 – 47.990 mm (1.8892 – 1.8893 in.)
	Main bearing center wall thickness		
	Reference	Mark 1	1.989 – 1.992 mm (0.0783 – 0.0784 in.)
		Mark 2	1.992 – 1.995 mm (0.0784 – 0.0785 in.)
		Mark 3	1.995 – 1.998 mm (0.0785 – 0.0787 in.)
		Mark 4	1.998 – 2.001 mm (0.0787 – 0.0788 in.)
		Mark 5	2.001 – 2.004 mm (0.0788 – 0.0789 in.)
	Crank pin diameter		44.992 – 45.000 mm (1.7713 – 1.7717 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Main journal taper and out–of round	Maximum	0.02 mm (0.0008 in.)
	Crank pin taper and out–of round	Maximum	0.02 mm (0.0008 in.)

SS0MJ–03

TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Camshaft timing sprocket x Camshaft	1ZZ–FE	45	460	33
	2ZZ–GE	54	551	40
Valve timing controller assembly x Camshaft	1ZZ–FE	45	460	33
	2ZZ–GE	54	551	40
Chain vibration damper x Cylinder block	1ZZ–FE	11	113	8
	2ZZ–GE	20.5	209	15
Chain tensioner slipper x Cylinder block	1ZZ–FE	18.5	189	14
	2ZZ–GE	20.5	209	15
Timing chain cover				
1ZZ–FE: (See page EM–26)	10 mm head bolt A	13	133	10
	10 mm head bolt C	9	92	80 in.·lbf
	10 mm head bolt others	11	113	8
	12 mm head bolt D	18.5	189	14
	Stud (E8)	9.3	95	82 in.·lbf
2ZZ–GE: (See page EM–26)	Bolt A	21	214	15
	Bolt B	11	113	8
	Bolt C	9.0	92	80 in.·lbf
	Bolt D	9.0	92	80 in.·lbf
	Stud (E8)	9.3	95	82 in.·lbf
RH engine mounting bracket x Timing chain cover	1ZZ–FE	47	479	35
	2ZZ–GE	49	500	36
Driver belt tensioner x Timing chain cover	Bolt			
	1ZZ–FE	69	704	51
	2ZZ–GE	100	1,020	74
	Nut	29	296	21
Crankshaft position sensor x Timing chain cover		9.0	92	80 in.·lbf
Crankshaft pulley x Crankshaft	1ZZ–FE	138	1,409	102
	2ZZ–GE	120	1,200	87
Chain tensioner x Timing chain cover		9.0	92	80 in.·lbf
Cylinder head cover x Cylinder head	1ZZ–FE w/ Washer	9.0	92	80 in.·lbf
	w/o Washer	11	113	8
	2ZZ–GE	10	100	7
No. 1 ventilation pipe x Cylinder head cover		10	100	7
No. 1 ventilation pipe x Intake manifold	2ZZ–GE	25	255	18
RH engine mounting insulator		52	530	38
PS pump x Engine		36	370	27
Camshaft bearing cap x Cylinder head	1ZZ–FE No. 1	23	235	17
	No. 3	13	133	10
	2ZZ–GE	18.5	189	14
Rocker No. 1 and No. 2 shaft x Cylinder head	2ZZ–GE	7.5	76	66 in.·lbf
Oil control valve housing x Cylinder head	2ZZ–GE	9.0	92	80
Oil pressure switch x Cylinder head	2ZZ–GE	13	130	9
Oil control valve filter x Cylinder head	2ZZ–GE	29	300	22
Cylinder head x Cylinder block	1ZZ–FE 1st	49	500	36
	2nd	Turn 90°	Turn 90°	Turn 90°
	2ZZ–GE 1st	35	375	26
	2nd	Turn 180°	Turn 180°	Turn 180°
Water bypass pipe x Cylinder head		9.0	92	80 in.·lbf

Intake manifold x Cylinder head				
1ZZ–FE:		18.5	189	14
2ZZ–GE: (See page EM–66)	Bolt A	27	275	20
	Bolt B	46	469	34
	Bolt others	34	347	25
Intake manifold stay	2ZZ–GE	24	245	18
Exhaust manifold x Cylinder head	1ZZ–FE	37	377	27
	2ZZ–GE	50	510	37
Lower heat insulator x Exhaust manifold	1ZZ–FE	12	123	9
	2ZZ–GE	20	204	15
Upper heat insulator x Exhaust manifold	1ZZ–FE	12	123	9
	2ZZ–GE	20	204	15
Exhaust manifold stay	1ZZ–FE	49	500	37
	2ZZ–GE	50	510	37
Exhaust pipe		43	440	32
Engine ECU box		6.9	70	61 in.·lbf
Engine ECU cover		6.9	70	61 in.·lbf
Air cleaner case		5.0	51	44 in.·lbf
Bearing cap sub–assembly x Cylinder block	12 pointed head 1st	22	225	16
	2nd	44	449	32
	3rd	Turn 45°	Turn 45°	Turn 45°
	4th	Turn 45°	Turn 45°	Turn 45°
	Hexagon head 1ZZ–FE	18.5	189	14
	2ZZ–GE	18	185	13
Screw plug x Bearing cap sub–assembly	2ZZ–GE	43	438	32
Connecting rod cap	1ZZ–FE 1st	20	204	15
	2nd	Turn 90°	Turn 90°	Turn 90°
	2ZZ–GE 1st	30	306	22
	2nd	Turn 90°	Turn 90°	Turn 90°
Oil strainer		9.0	92	80 in.·lbf
Oil pan baffle	2ZZ–GE	9.0	92	80 in.·lbf
Oil pan		9.0	92	80 in.·lbf
Oil filter union		30	306	21
Engine coolant drain union	1ZZ–FE	20	200	14
	2ZZ–GE	25	255	18
Knock sensor		39	400	29
Ventilation case	2ZZ–GE	8.5	87	75 in.·lbf
Water bypass pipe x Cylinder block	1ZZ–FE	9.0	92	80 in.·lbf
	2ZZ–GE			
	Bolt	8.5	87	75 in.·lbf
	Nut	10	100	7
Dipstick guide	1ZZ–FE	11	113	8
	2ZZ–GE	25	255	18
Fly wheel	1st	49	500	36
	2nd	Turn 90°	Turn 90°	Turn 90°
Drive plate		88	897	65

EMISSION CONTROL

SS0MK–02

TORQUE SPECIFICATION

Part tightened	N·m	kgf·cm	ft·lbf
Charcoal canister x Body	18	184	13

ELECTRONIC FUEL INJECTION

SS0MM–03

SERVICE DATA

Fuel pressure regulator	Fuel pressure		301 – 347 kPa (3.1 – 3.5 kgf/cm^2, 44 – 50 psi)
Fuel pump	Resistance	at 20°C (68°F)	0.2 – 3.0 Ω
Injector	Resistance	at 20°C (68°F)	13.4 – 14.2 Ω
	Injection volume		47 – 58 cm^3 (2.7 – 3.3 cu in.) per 15 seconds
	Difference between each cylinder		10 cm^3 (0.6 cu in.) or less
	Fuel leakage		One drop or less per 12 minutes
Air flow meter	Resistance	at –20°C (–4°F)	13.6 – 18.4 kΩ
		at 20°C (68°F)	2.21 – 2.69 kΩ
		at 60°C (140°F)	0.49 – 0.67 kΩ
Throttle position sensor	Clearance between stop screw and lever		
	0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
	Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
	–	VC – E2	2.5 – 5.9 kΩ
Camshaft timing oil control valve	Resistance	at 20°C (68°F)	6.9 – 7.9 Ω
VSV (EVAP)	Resistance	at 20°C (68°F)	27 – 33 Ω
VSV (Intake air control valve)	Resistance	at 20°C (68°F)	37 – 44 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 – 3 kΩ
		at 40°C (104°F)	0.9 – 1.3 kΩ
		at 60°C (140°F)	0.4 – 0.7 kΩ
		at 80°C (176°F)	0.2 – 0.4 kΩ
Heated oxygen sensor	Heater coil resistance		11 – 16 Ω
Fuel cut rpm	Fuel return rpm		1,500 rpm

SS0MN–03

TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Delivery pipe x Cylinder head	1ZZ–FE	19	190	14
	2ZZ–GE	29	290	21
Fuel pump x Fuel tank		4.0	40	35 in.·lbf
Fuel tank band x Body		39	400	29
Throttle body x Intake manifold	1ZZ–FE	21	210	15
	2ZZ–GE	22	220	16
Camshaft timing oil control valve x Cylinder head		7.5	80	66 in.·lbf
Knock sensor 1 x Cylinder block		44	450	33
Oxygen sensor x Front exhaust pipe		44	450	33

COOLING

SERVICE DATA

SS0MO–02

Thermostat	Valve opening temperature Valve lift at 90°C (194°F)	80.0 – 84.0°C (176 – 183°F) 10 mm (0.39 in.)
Radiator cap	Relief valve opening pressure STD Minimum	93 – 123 kPa (0.95 – 1.25 kgf/cm^2, 13.5 – 17.8 psi) 79 kPa (0.8 kgf/cm^2, 11.5 psi)
Electric cooling fan	Rotating amperage	5.2 – 8.2 A

SS0MP–02

TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Drain plug x Radiator		12.7	130	9
Water pump x Timing chain cover	1ZZ–FE			
(See page CO–7)	Bolt A	9.0	92	80 in.·lbf
	Bolt B	11	113	8
	2ZZ–GE	9.0	92	80 in.·lbf
Water pump pulley x Water pump		15	153	11
Water inlet x Cylinder block		10	100	7
Electric cooling fan x Radiator		6.0	60	53 in.·lbf
Engine coolant reservoir x Radiator upper support		5.0	51	44 in.·lbf
Fan motor x Fan shroud		2.55	26	23 in.·lbf
Fan x Fan motor		6.18	63	55 in.·lbf

LUBRICATION

SERVICE DATA

SS0MQ–03

Oil pressure		1ZZ–FE	
		at idle speed	29 kPa (0.3 kgf/cm^2, 43 psi) or more
		at 3,000 rpm	294 – 539 kPa (3.0 – 5.5 kgf/cm^2, 43 – 78 psi)
		2ZZ–GE	
		at idle speed	39.2 kPa (0.4 kgf/cm^2, 5.7 psi) or more
	Oil control valve housing	2ZZ–GE	
		at idle speed	39.2 kPa (0.4 kgf/cm^2, 5.7 psi) or more
Oil pump	Side clearance	STD	0.025 – 0.075 mm (0.0010 – 0.0030 in.)
		Maximum	0.15 mm (0.0059 in.)
	Tip clearance	STD	0.060 – 0.180 mm (0.0024 – 0.0071 in.)
		Maximum	0.35 mm (0.0138 in.)
	Body clearance	STD	0.100 – 0.180 mm (0.0039 – 0.0071 in.)
		Maximum	0.30 mm (0.0118 in.)

SS0MR–03

TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Oil pressure switch x Cylinder block		13	130	9
Oil pressure switch x Oil control valve housing		13	130	9
Drain plug x Oil pan		37	378	27
Oil pump body cover x Oil pump body		10.5	107	8
Plug x Oil pump	1ZZ–FE	37	375	27
	2ZZ–GE	49	500	36
Oil pump x Cylinder block		9.0	92	80 in.·lbf
Relief valve x Oil cooler		78.5	800	58
Oil nozzle x Cylinder block		9.0	92	80 in.·lbf

IGNITION

SERVICE DATA

SS0MS–07

Spark plug	Recommended spark plug	1ZZ–FE	
		Except Australia spec	
		DENSO	K16RU11
		NGK	BKR5EYA11
		Australia spec	
		DENSO	SK16R11
		NGK	IFR5A11
		2ZZ–GE	
		DENSO	SK20R11
		NGK	IFR6A11
Camshaftposition-sensor	Resistance	at cold	835 – 1,400 Ω
		at hot	1,060 – 1,645 Ω
Crankshaft position sensor	Resistance	at cold	1,630 – 2,740 Ω
		at hot	2,065 – 3,225 Ω

SS0MT–06

TORQUE SPECIFICATION

Part tightened	N·m	kgf·cm	ft·lbf
Spark plug x Cylinder head	18	184	13
Ignition coil (w/ Igniter) x Cylinder head cover	9.0	92	79 in.·lbf
Camshaft position sensor x Cylinder head	8.8	90	78 in.·lbf
Crankshaft position sensor x Timing chain cover	8.8	90	78 in.·lbf

STARTING

SERVICE DATA

SS0UY–04

Starter	Rated voltage and output power STD	12 V 0.8 kW
	Cold area spec.	12 V 1.0 kW
	No–load characteristics (Current)	90 A or less at 11.5 V
	No–load characteristics (rpm)	3,000 rpm or more
	Brush length (STD)	14.0 mm (0.551 in.)
	Brush installed load	9.0 mm (0.354 in.)
	Spring installed load	13.7 – 17.6 N (1.4 – 1.8 kgf, 3.1 – 4.0 lbf)
	Commutator	
	Diameter (STD)	28 mm (1.10 in.)
	Diameter (Minimum)	27 mm (1.06 in.)
	Undercut depth (STD)	0.6 mm (0.024 in.)
	Undercut depth (Minimum)	0.2 mm (0.008 in.)
	Circle runout (Maximum)	0.05 mm (0.0020 in.)
	Planet carrier shaft diameter	14.982 – 15.000 mm (0.5898 – 0.5906 in.)
	Center bearing inside diameter	15.008 – 15.050 mm (0.5909 – 0.5925 in.)
	Center bearing oil clearance (STD)	0.01 – 0.06 mm (0.0004 – 0.0024 in.)
	Center bearing oil clearance (Maximum)	0.2 mm (0.0078 in.)
	Pinion clearance (STD)	0.1 – 5.0 mm (0.004 – 0.20 in.)

SS0UZ–04

TORQUE SPECIFICATION

Part tightened	N·m	kgf·cm	ft·lbf
Commutator end frame x Brush holder	1.5	15	13 in.·lbf
Commutator end frame x Starter housing	5.9	60	52 in.·lbf
Starter housing x Magnetic switch	8.3	85	73 in.·lbf
Lead wire x Terminal C of starter	9.8	100	87 in.·lbf

CHARGING

SERVICE DATA

SS0MW–03

Battery	Voltage	at 20°C (68°F)	12.7 – 12.9 V
	Specific gravity	at 20°C (68°F)	1.25 – 1.29 V
Alternator	Rated output		12 V 80 A
	Rotor coil resistance	M/T	2.7 – 3.1 Ω
		A/T	2.1 – 2.5 Ω
	Slip ring diameter	STD	14.2 – 14.4 mm (0.559 – 0.567 in.)
		Minimum	12.8 mm (0.504 in.)
	Brush exposed length	STD	10.5 mm (0.413 in.)
		Minimum	1.5 mm (0.059 in.)
Voltage regulator	Regulating voltage		13.2 – 14.8 V

SS0MX–03

TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Bearing retainer x Drive end frame		3.0	31	27 in.·lbf
Rectifier end frame x Drive end frame	Nut A	4.5	46	40 in.·lbf
	Nut B	5.4	55	48 in.·lbf
Alternator pulley x Rotor		111	1,125	81
Rectifier end frame x Brush holder, Voltage regulator		2.0	20	17 in.·lbf
Rectifier holder x Coil lead on rectifier end frame		2.9	30	25 in.·lbf
Rear end cover x Rectifier holder		4.4	45	39 in.·lbf
Plate terminal x Rectifier holder	Nut	4.4	45	39 in.·lbf
	Bolt	3.9	39	35 in.·lbf
Terminal insulator x Rectifier holder		4.1	42	36 in.·lbf

STARTING SYSTEM

ST0HN–01

ON–VEHICLE INSPECTION

NOTICE:

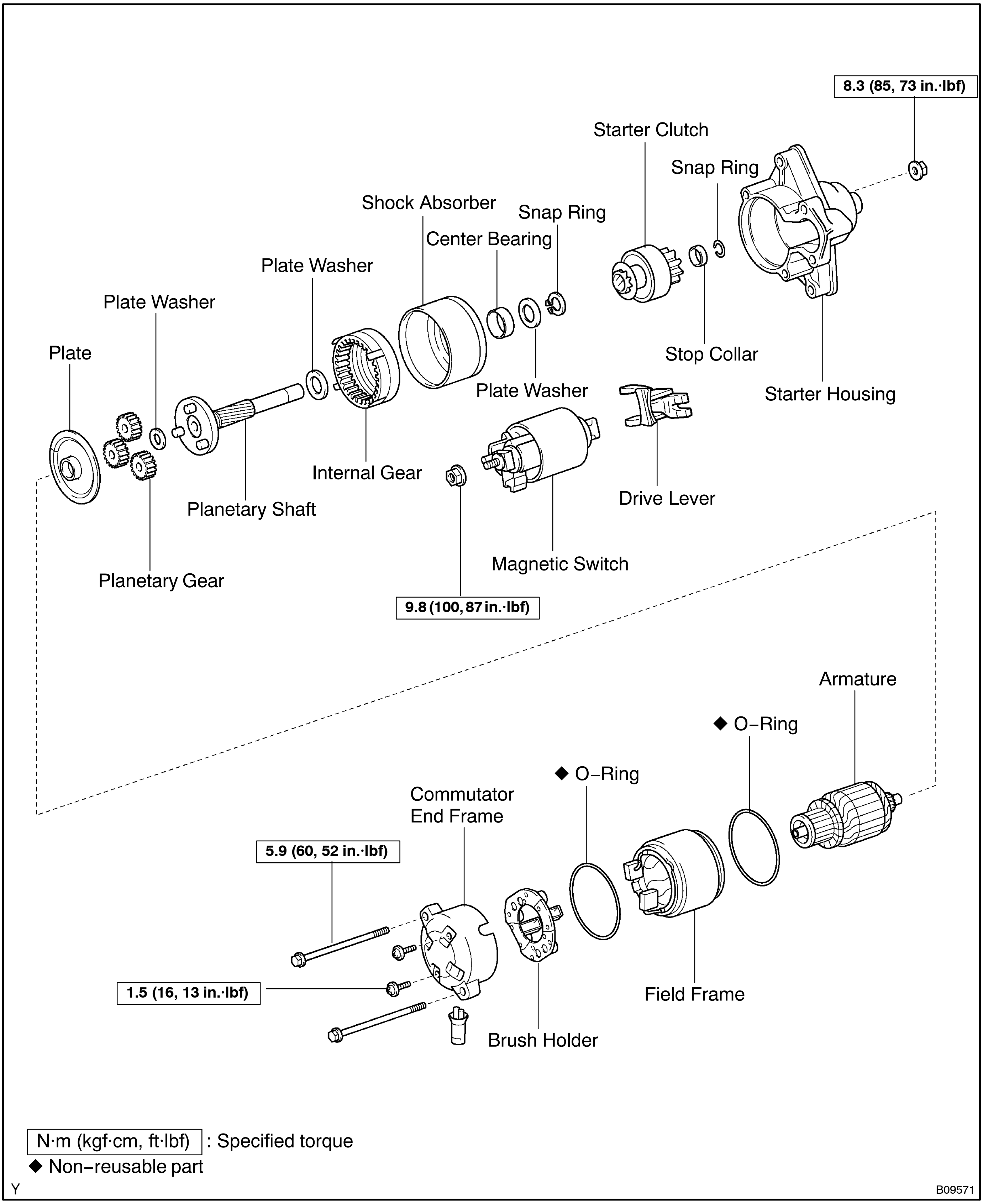
Before changing the starter, check these items again:

- **Connector connection**
- **Accessory installation, e.g.:theft deterrent system**

STARTER

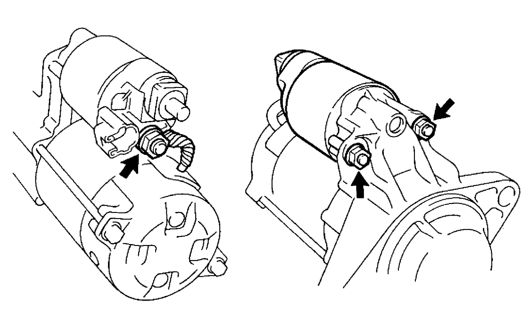
COMPONENTS

ST0C9–03



ST0FW–02

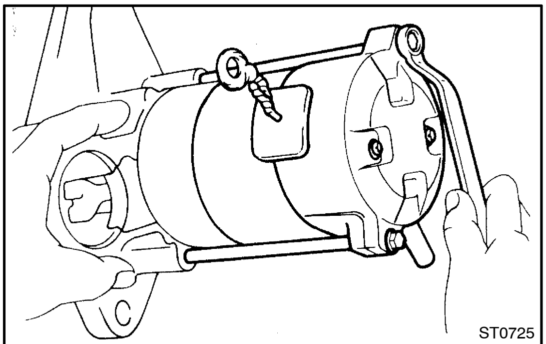
DISASSEMBLY



P24910

1. REMOVE MAGNETIC SWITCH

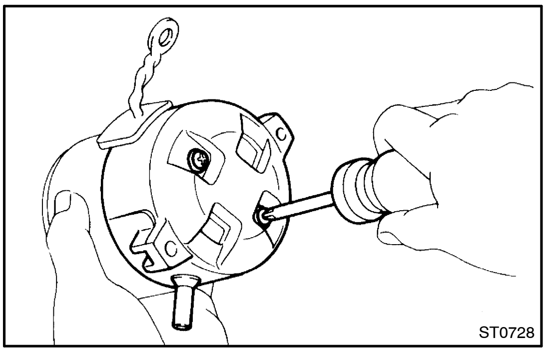
(a) Remove the nut, and disconnect the lead wire from the magnetic switch terminal.
(b) Loosen the 2 nuts holding the magnetic switch to the starter housing.
(c) Pull the magnetic switch and while lifting the front part of the magnetic switch, release the plunger hook from the drive lever, then release the magnetic switch.
(d) Remove the plunger cover.



ST0725

2. REMOVE FIELD FRAME AND ARMATURE

Remove the 2 through bolts, and pull out the field frame together with the armature.



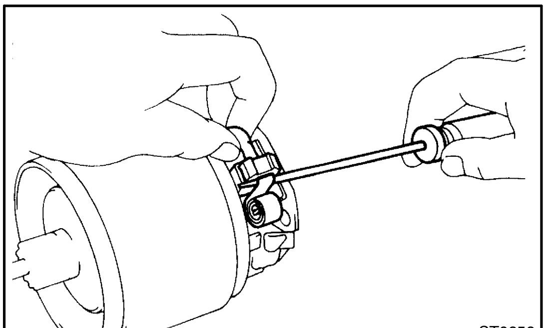
ST0728

3. REMOVE COMMUTATOR END FRAME

Remove the 2 screws and commutator end frame, and hold down the lead wire while releasing the commutator end frame.

NOTICE:

To avoid interference between the brush holder and the dust protector pull the commutator end frame away at an angle.



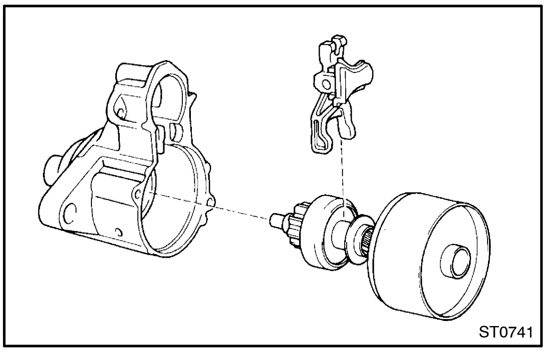
ST0656

4. REMOVE BRUSH HOLDER

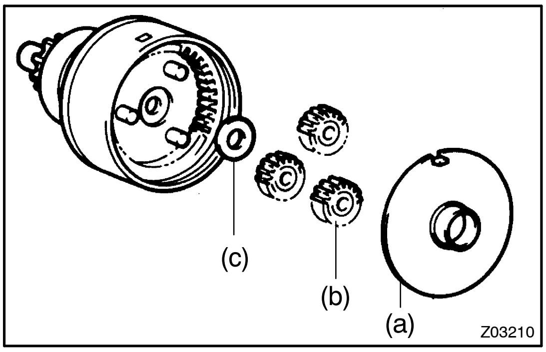
(a) Using a screwdriver, hold the spring back and disconnect the brush holder.
(b) Disconnect the 4 brushes, and remove the brush holder.

5. REMOVE ARMATURE FROM FIELD FRAME

6. REMOVE 2 O–RINGS FROM FIELD FRAME

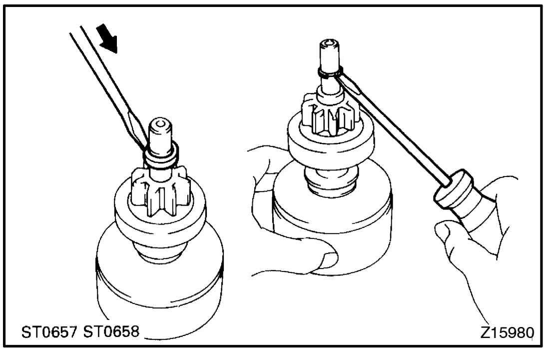


7. REMOVE DRIVE LEVER AND STARTER CLUTCH WITH SHOCK ABSORBER FROM STARTER HOUSING



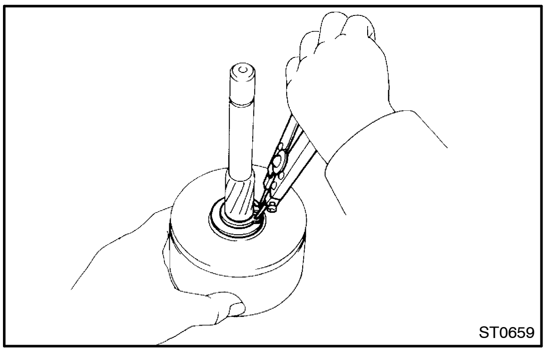
8. REMOVE PLANETARY GEARS

(a) Remove the plate.
(b) Remove the 3 planetary gears.
(c) Remove the plate washer.



9. REMOVE STARTER CLUTCH

(a) Using a screwdriver, tap in the stop collar towards the starter clutch.
(b) Using a screwdriver, pry off the snap ring.
(c) Remove the rear collar and starter clutch from the planetary shaft.

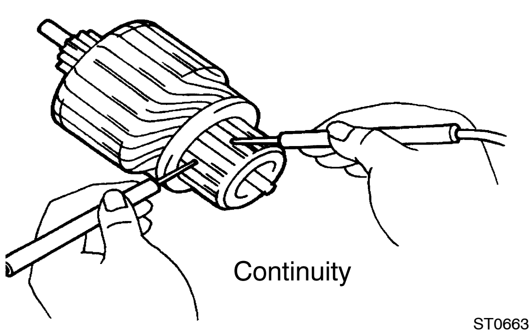


10. REMOVE PLANETARY SHAFT AND INTERNAL GEAR

(a) Using snap ring pliers, remove the snap ring and plate washer.
(b) Remove the planetary shaft and plate washer.

ST0FX–01

INSPECTION

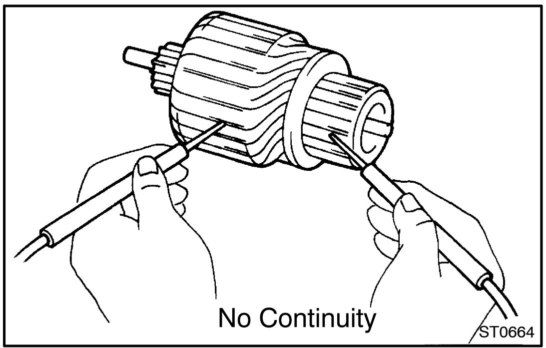


ST0663

1. INSPECT COMMUTATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the segments of the commutator.

If there is no continuity between any segment, replace the armature.



ST0664

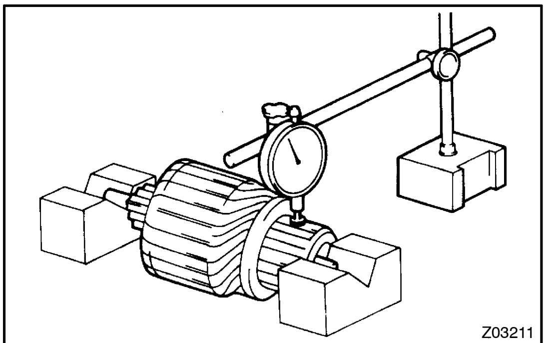
2. INSPECT COMMUTATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.

3. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES

If the surface is dirty or burnt, correct with sandpaper (No.400) or a lathe.


Z03211

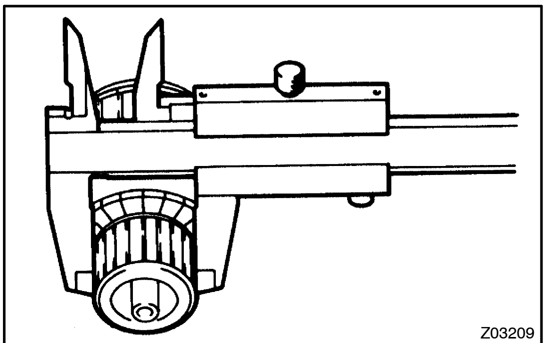
4. INSPECT COMMUTATOR CIRCLE RUNOUT

(a) Place the commutator on V – blocks.

(b) Using a dial gauge, measure the circle runout.

Maximum circle runout: 0.05 mm (0.0020 in.)

If the circle runout is greater than maximum, correct it on a lathe.


Z03209

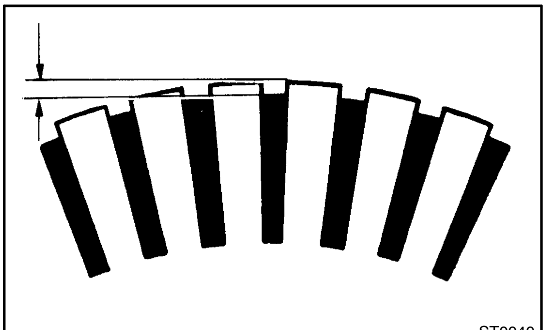
5. INSPECT COMMUTATOR DIAMETER

Using vernier calipers, measure the commutator diameter.

Diameter:

Standard	28 mm (1.10 in.)
Minimum	27 mm (1.06 in.)

If the diameter is less than minimum, replace the armature.


ST0040

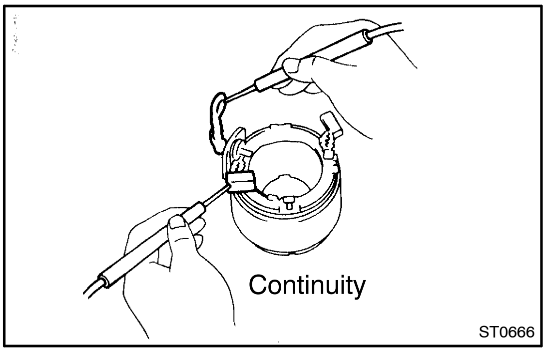
6. INSPECT UNDERCUT DEPTH

Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

Undercut depth:

Standard	0.6 mm (0.024 in.)
Minimum	0.2 mm (0.008 in.)

If the undercut depth is less than minimum, correct it with a hacksaw blade.

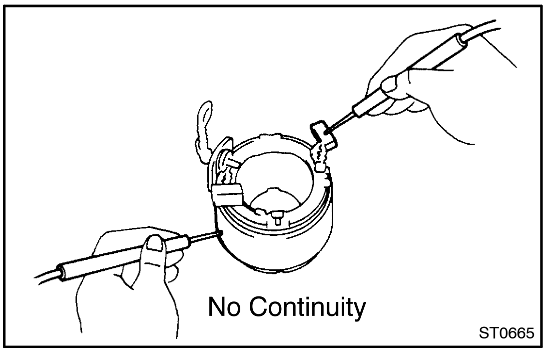


ST0666

7. INSPECT FIELD COIL FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

If there is no continuity, replace the field frame.

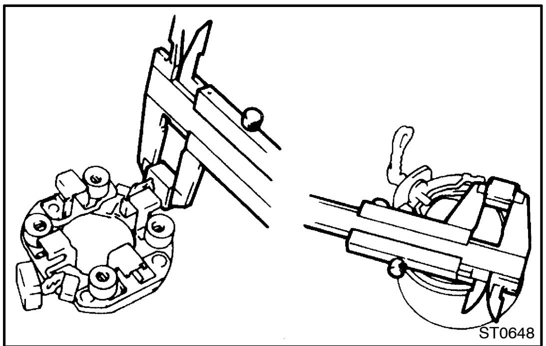


ST0665

8. INSPECT FIELD COIL GROUND

Using an ohmmeter, check that there is no continuity between the field coil end and field frame.

If there is continuity, repair or replace the field frame.


ST0648

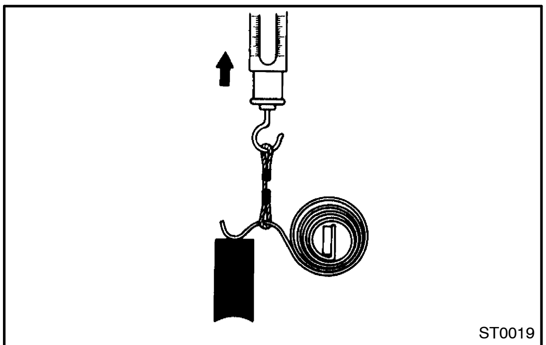
9. INSPECT BRUSH LENGTH

Using vernier calipers, measure the brush length.

Length:

Standard	14.0 mm (0.551 in.)
Minimum	9.0 mm (0.354 in.)

If the length is less than minimum, replace the brush holder and field frame.


ST0019

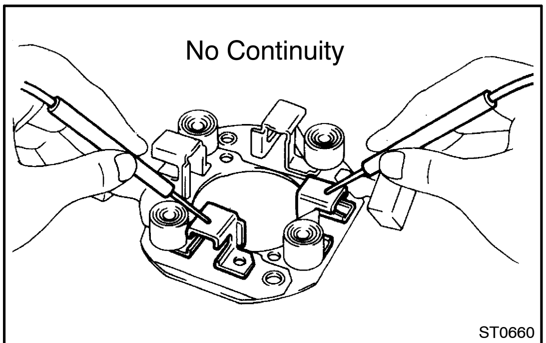
10. INSPECT BRUSH SPRING LOAD

Take the pull scale reading the instant the brush spring separates from the brush.

Spring installed load:

13.7 – 17.6 N (1.4 – 1.8 kgf, 3.1 – 4.0 lbf)

If the installed load is not within specification, replace the brush springs.



ST0660

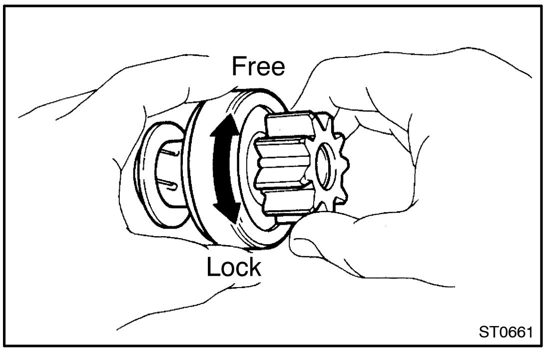
11. INSPECT BRUSH HOLDER INSULATION

Using an ohmmeter, check that there is no continuity between the positive (+) and negative (–) brush holders.

If there is continuity, repair or replace the brush holder.

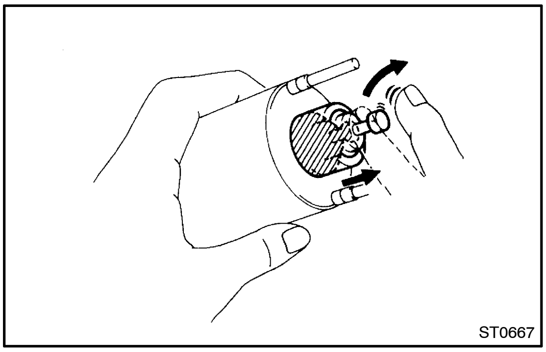
12. INSPECT GEAR TEETH

Check the gear teeth on the planetary gear, internal gear and starter clutch for wear or damage.
If the gear is damaged, replace it.
If the starter clutch teeth are damaged, replace the starter clutch and also inspect the flywheel ring gear for wear or damage.



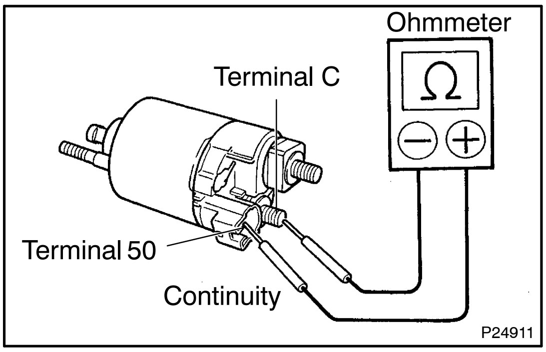
13. INSPECT STARTER CLUTCH

Rotate the clutch pinion gear clockwise and check that it turns freely.
Try to rotate the clutch pinion gear counterclockwise and check that it locks.
If necessary, replace the starter clutch.



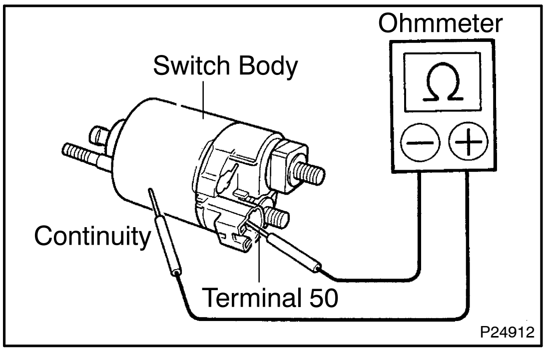
14. INSPECT PLUNGER

Push in the plunger and replace it.
Check that it returns quickly to its original position.
If necessary, replace the magnetic switch.



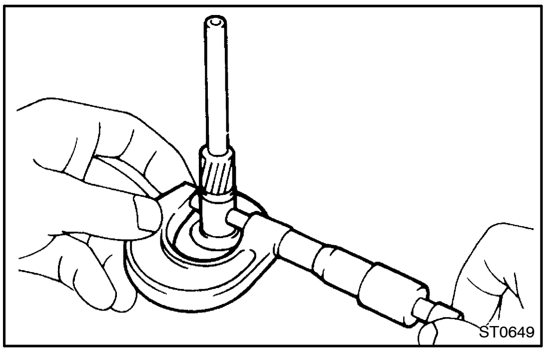
15. DO PULL–IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminals 50 and C.
If there is no continuity, replace the magnetic switch.



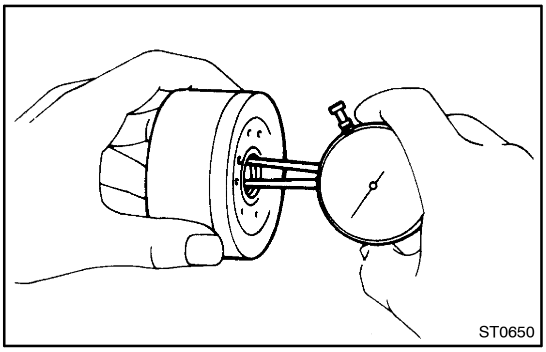
16. DO HOLD–IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.
If there is no continuity, replace the magnetic switch.



17. INSPECT PLANETARY SHAFT AND CENTER BEARING

(a) Using a micrometer, measure the outer diameter of the surface in contact with the center bearing of the planetary shaft.
Standard shaft diameter:
14.982 – 15.000 mm (0.5898 – 0.5906 in.)



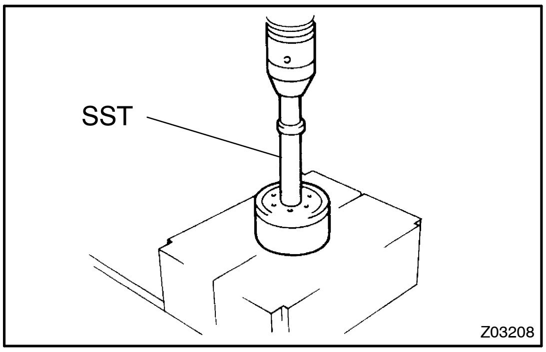
(b) Using a caliper gauge, measure the inside diameter of the center bearing.
Center bearing inside diameter:
15.008 – 15.050 mm (0.5909 – 0.5925 in.)

(c) Subtract the planetary shaft diameter from the bearing inside diameter measurement.
Center bearing oil clearance:

Standard	0.01 – 0.06 mm (0.0004 – 0.0024)
Maximum	0.2 mm (0.008in.)

If the clearance is greater than maximum, replace the planet carrier shaft and center bearing.

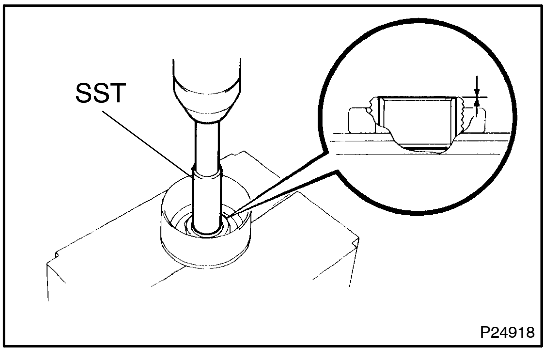
ST0FY–01



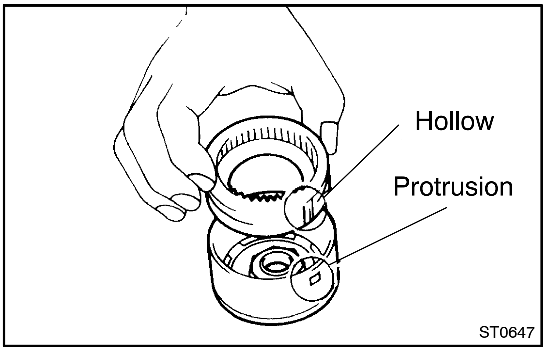
REPLACEMENT

REPLACE CENTER BEARING

(a) Using SST and press, press out the center bearing.
SST 09221–25026 (09221–00090)



(b) Using SST and a press, press in a new center bearing to the position shown in the illustration.
SST 09221–25026 (09221–00071)

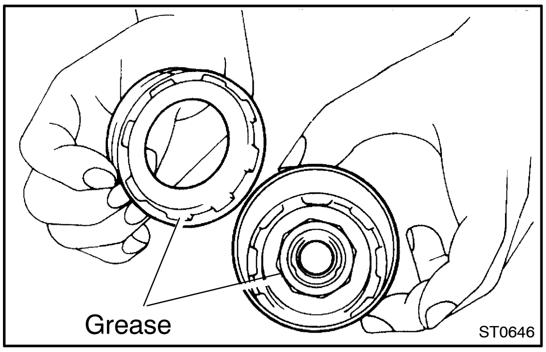


(c) Align the hollow of the internal gear with the protrusion inside the shock absorber, and remove the internal gear.

ST0FZ–01

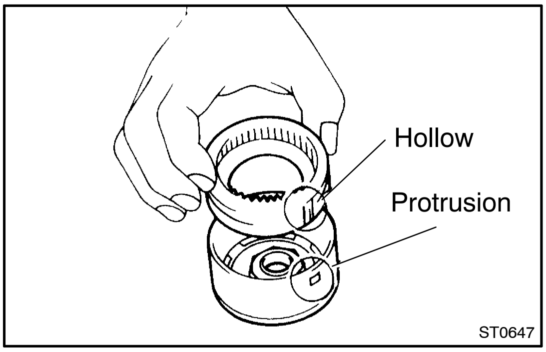
REASSEMBLY

HINT:
Use high temperature–resistant grease to lubricate the bearings and sliding parts when assembling the starter.

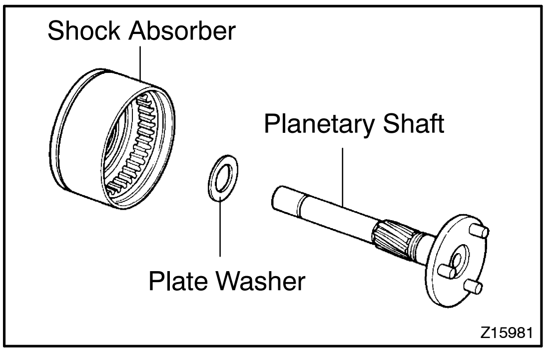


1. **INSTALL INTERNAL GEAR AND PLANETARY SHAFT**

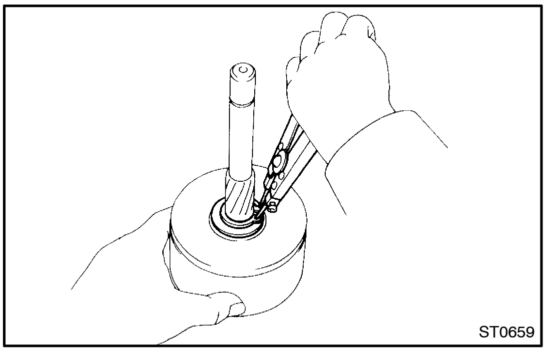
(a) Apply grease to the internal gear touching the sock absorber and planetary gears.



(b) Align the hollow of the internal gear with the protrusion inside the shock absorber.
(c) Inset and turn the internal gear so that it interlocks with the shock absorber.
(d) Apply turbine oil with additives to the center bearing.
(e) Apply grease to the plate washer, and install it to the planetary shaft.



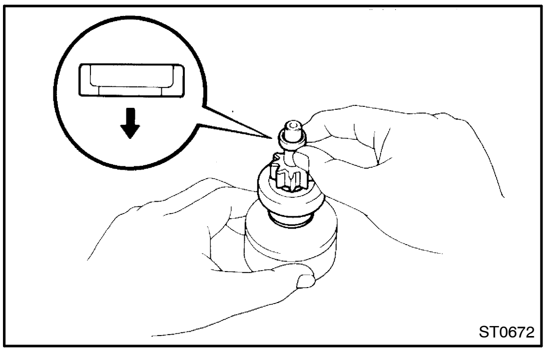
(f) Install the planetary shaft to the shock absorber.



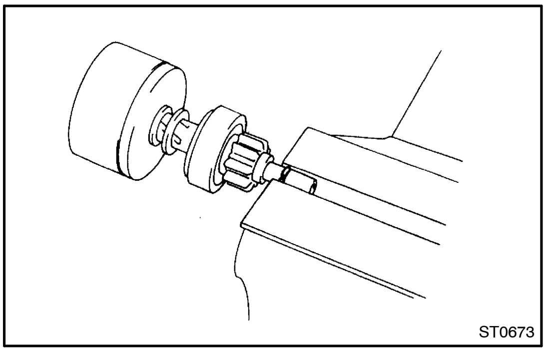
(g) Using snap ring pliers, install the plate washer and snap ring.

2. **INSTALL STARTER CLUTCH**

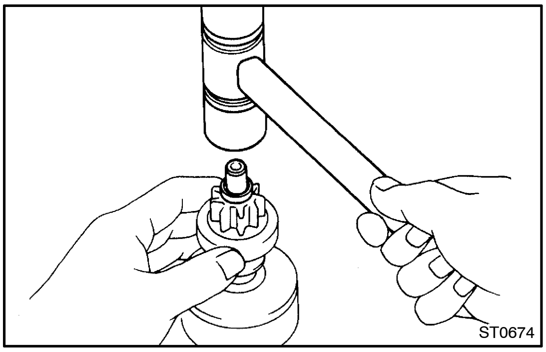
(a) Apply grease to the bushing and spline of the starter clutch and stop collar.


ST0672

(b) Place the starter clutch and stop collar on the planetary shaft.
(c) Apply grease to the snap ring, and install it to the planetary shaft groove.


ST0673

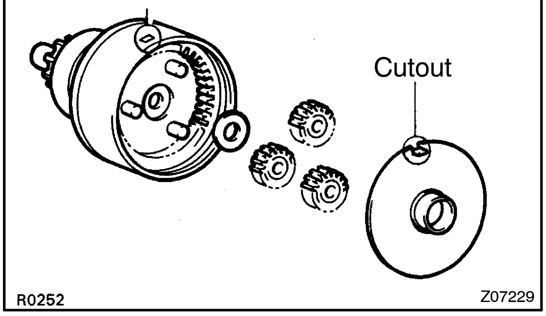
(d) Using a vise, compress the snap ring.


ST0674

(e) Hold the starter clutch, tap the planetary shaft and install the stop collar onto the snap ring with a plastic–faced hammer.

3. INSTALL PLANETARY GEARS

(a) Apply grease to the planetary gears and flange pin parts of the planetary shaft.

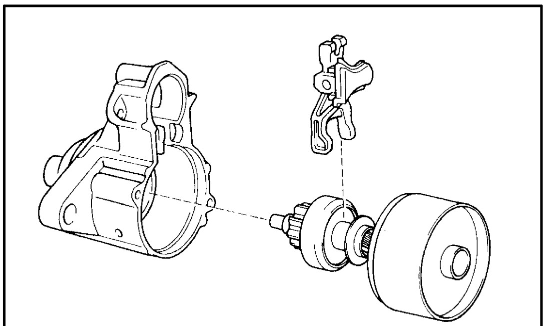


R0252 Z07229

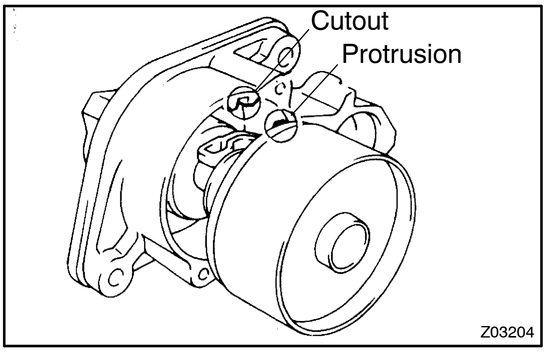
(b) Install the plate washer and 3 planetary gears.
(c) Align the cutout of the plate with the protrusion inside the shock absorber, and install the plate.

4. INSTALL DRIVE LEVER AND STARTER CLUTCH WITH SHOCK ABSORBER

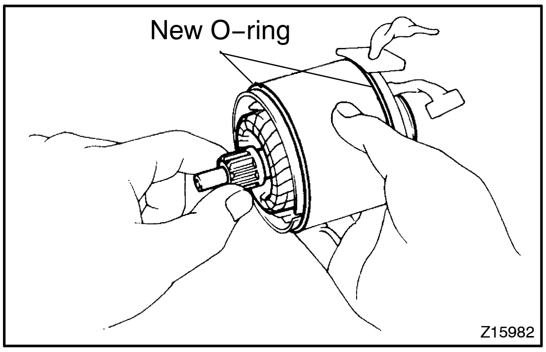
(a) Apply turbine oil with additives to the bearing of the starter housing.
(b) Apply grease to the drive lever touching the starter pivot part of the drive lever.


ST0741

(c) Install the drive lever to the starter clutch.



(d) Align the protrusion of the shock absorber with the cutout of the starter housing and install them.



5. INSTALL 2 NEW O–RINGS TO FIELD FRAME

6. PLACE ARMATURE INTO FIELD FRAME

7. INSTALL BRUSH HOLDER

(a) Place the brush holder in position on the armature.

(b) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder.
Connect the 4 brushes.

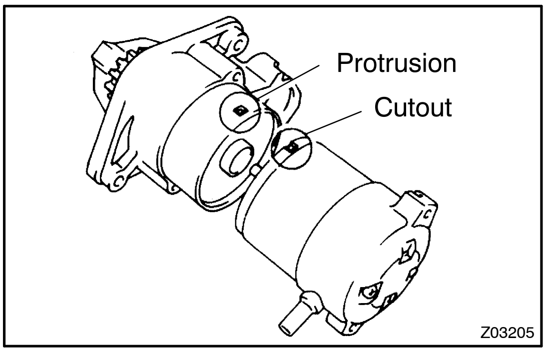
HINT:
Check that positive (+) lead wires are not grounded.

8. INSTALL COMMUTATOR END FRAME

(a) Apply turbine oil with additives to the bearing of the end frame.

(b) Install the end frame with 2 new screws.
Torque: 1.5 N·m (15 kgf·cm, 13 in.·lbf)

NOTICE:
To avoid interference between the brush holder and the dust protector pull the commutator end frame away at an angle.



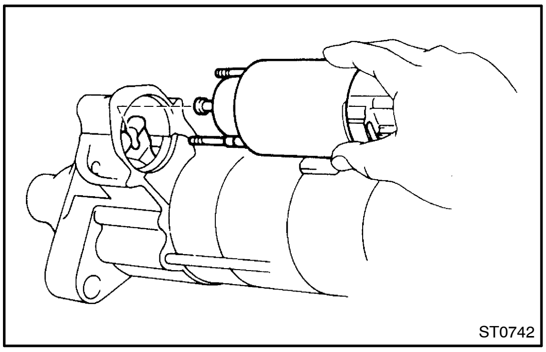
9. INSTALL FIELD FRAME AND ARMATURE ASSEMBLY

(a) Align the cutout of the field frame with the protrusion of the shock absorber.

(b) Install the field frame and armature assembly with the 2 through bolts.
Torque: 5.9 N·m (60 kgf·cm, 52 in.·lbf)

10. INSTALL MAGNETIC SWITCH

(a) Install the plunger cover to the magnetic switch.



(b) Hang the plunger of the magnetic switch to the drive lever from the upper side.

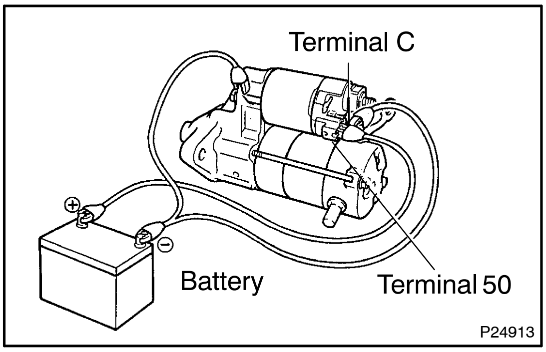
(c) Install the magnetic switch with the 2 nuts.
Torque: 8.3 N·m (85 kgf·cm, 73 in.·lbf)

(d) Connect the lead wire to the terminal, and install the nut.
Torque: 9.8 N·m (100 kgf·cm, 87 in.·lbf)

ST0HS–01

TEST

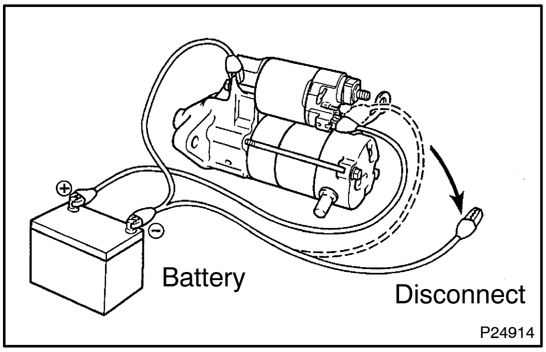
NOTICE:
These tests must be done within 3 to 5 seconds to avoid burning out the coil.



1. DO PULL–IN TEST

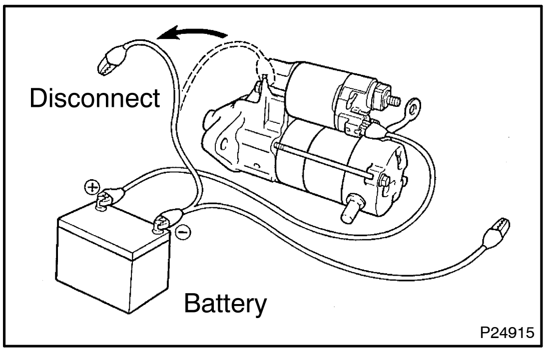
(a) Disconnect the field coil lead from terminal C.
(b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.

If the clutch pinion gear does not move, replace the magnetic switch.



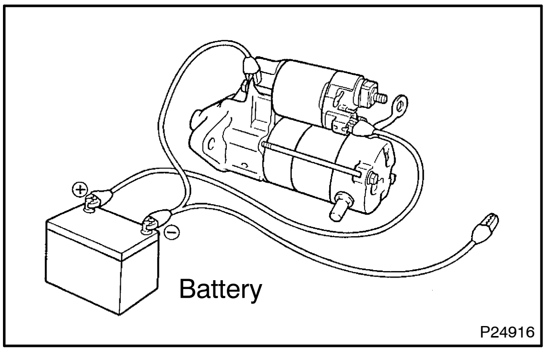
2. DO HOLD–IN TEST

With the battery connected as above and with the clutch pinion gear out disconnect the negative (–) lead from terminal C.
Check that the clutch pinion gear remains out.
If the clutch pinion gear returns inward, replace the magnetic switch.



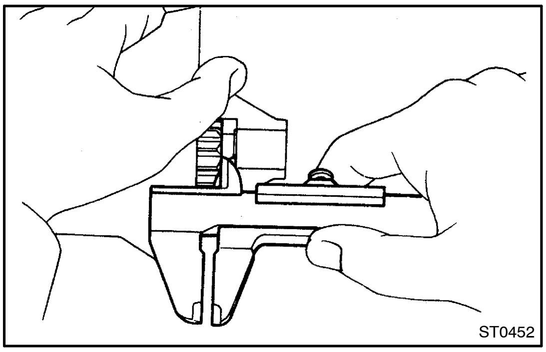
3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (–) lead from the switch body.
Check that the clutch pinion gear returns inward.
If the clutch pinion gear does not return, replace the magnetic switch.

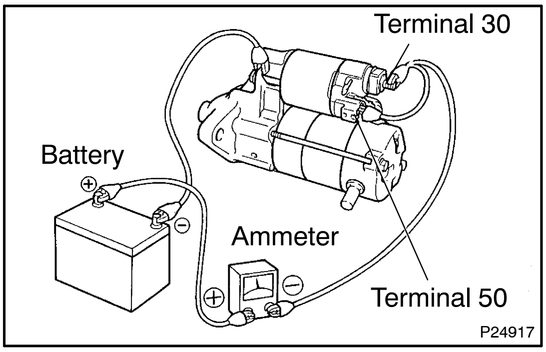


4. INSPECT CLUTCH PINION GEAR CLEARANCE

(a) Connect the battery to the magnetic switch as shown.



(b) Move the pinion gear toward the armature to remove slack and measure the clearance between the pinion gear end and stop collar.
Standard clearance: 0.1 – 5.0 mm (0.004 – 0.20 in.)

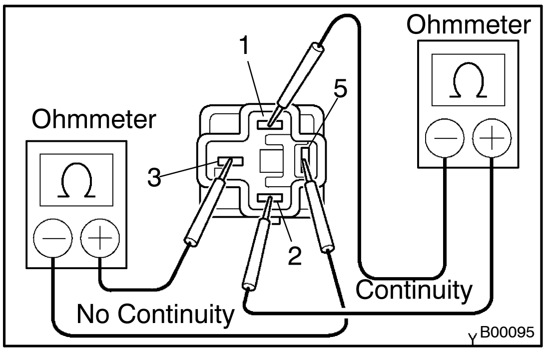


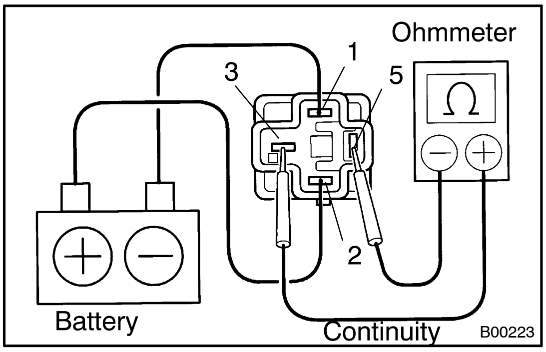
5. DO NO–LOAD PERFORMANCE TEST

(a) Connect the field coil lead to terminal C.
Make sure the lead is not grounded.

(b) Connect the battery and ammeter to the starter as shown.

(c) Check that the starter rotates smoothly and steadily with the clutch pinion gear moving out.
Check that the ammeter reads the specified current.
Specified current: Less than 90 A at 11.5 V





STARTER RELAY
INSPECTION

ST0G0–02

1. **REMOVE STARTER RELAY**
2. **INSPECT STARTER RELAY CONTINUITY**

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

If there is no continuity, replace the relay.

(b) Check that there is no continuity between terminals 3 and 5.

If there is continuity, replace the relay.

3. **INSPECT STARTER RELAY OPERATION**

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

(b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If there is continuity, replace the relay.

4. **REINSTALL STARTER RELAY**