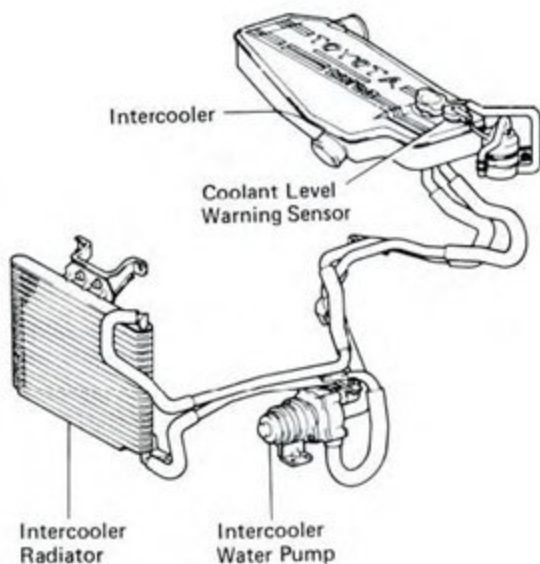
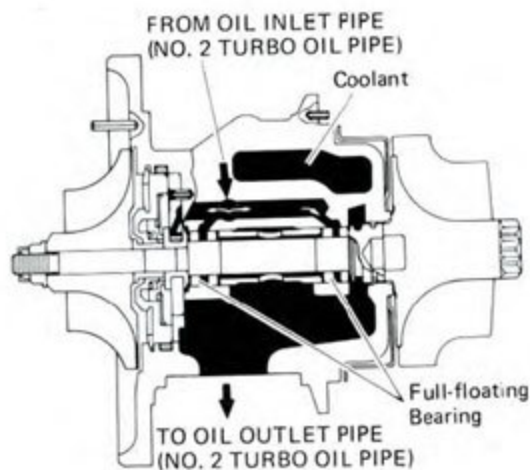
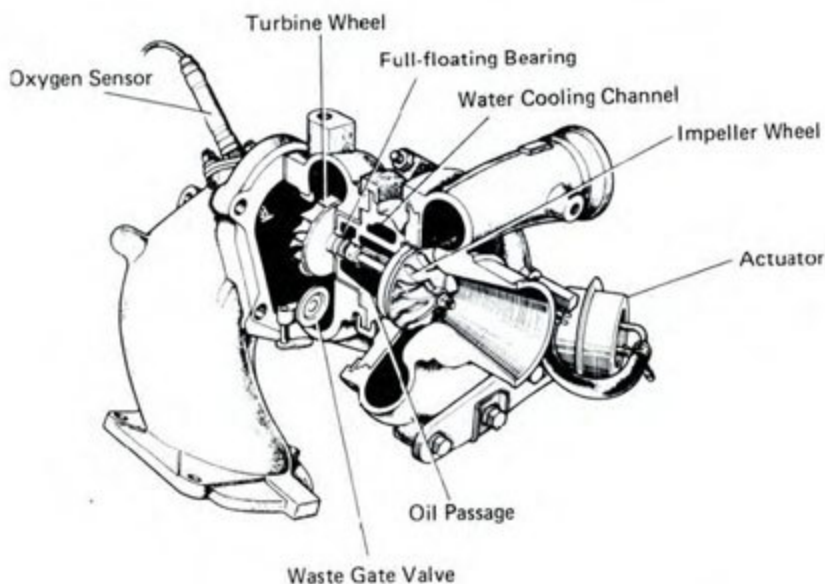


TURBOCHARGER SYSTEM

	Page
DESCRIPTION	TC-2
PRECAUTIONS	TC-4
TROUBLESHOOTING	TC-5
CHECK AND REPLACEMENT OF INTERCOOLER COOLANT	TC-7
TURBOCHARGER	TC-8
INTERCOOLER	TC-15

TC

DESCRIPTION

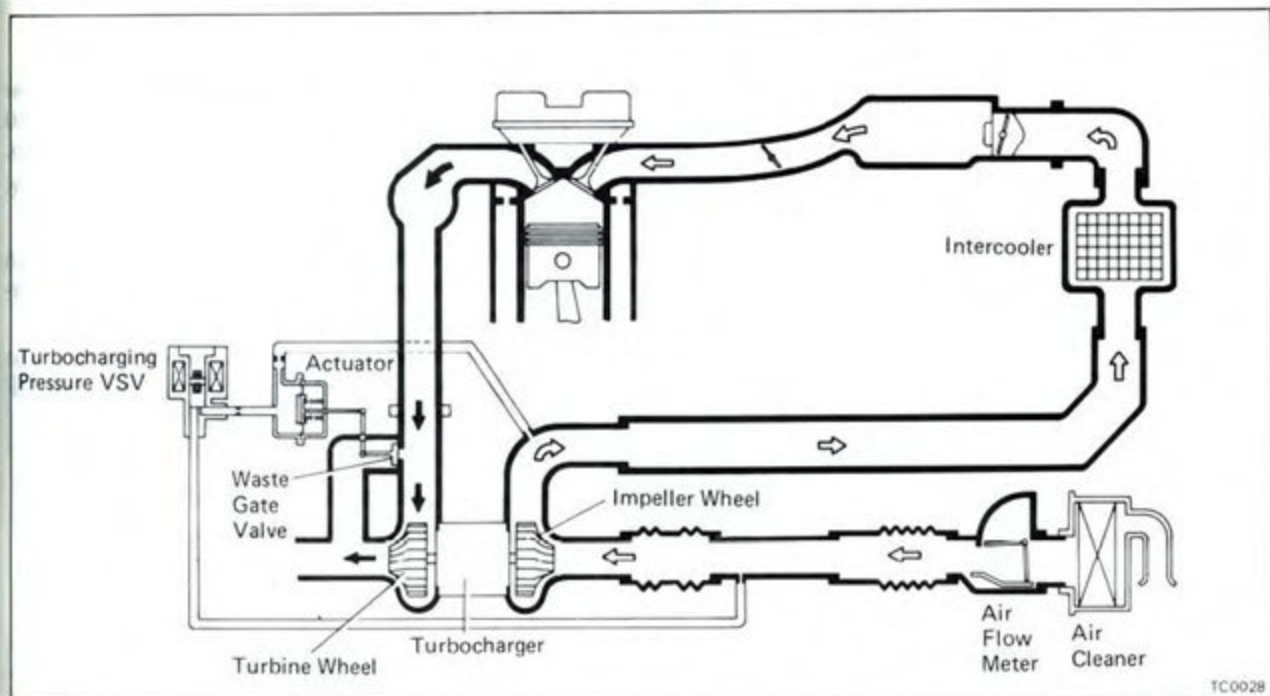
TC0018
TC0036 TC0020

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

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

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

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



TC0028

Operation of Turbocharger

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

Waste Gate Valve

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

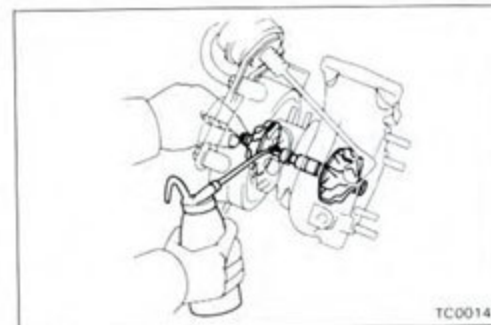
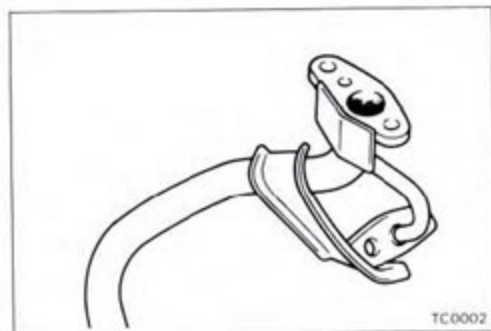
Intercooler

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

The Celica 3S-GTE intercooler is an water cooling type located at the front of the vehicle, utilizing the vehicle windstream to cool the turbocharged air.

PRECAUTIONS

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



5. Use caution when removing and reinstalling the turbocharger assembly. Do not drop it or bang it against anything or grasp it by easily-deformed parts, such as the actuator or rod, when moving it.
6. Before removing the turbocharger, plug the intake and exhaust ports and oil inlet to prevent entry of dirt or other foreign material.
7. If replacing the turbocharger, check for accumulation of sludge particles in the oil pipes and, if necessary, replace the oil pipes.
8. Completely remove the gasket adhered to the lubrication oil pipe flange and turbocharger oil flange.
9. If replacing bolts or nuts, do so only with the specified new ones to guard against breakage or deformation.
10. If replacing the turbocharger, put 20 cc (1.2 cu in.) of oil into the turbocharger oil inlet and turn the impeller wheel by hand to spread oil to the bearing.
11. If overhauling or replacing the engine, cut the fuel supply after reassembly and crank the engine for 30 seconds to distribute oil throughout the engine. Then allow the engine to idle for 60 seconds.

TROUBLESHOOTING

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

INSUFFICIENT ACCELERATION, LACK OF POWER OR EXCESSIVE FUEL CONSUMPTION

(Possible Cause)

(Check Procedure and Correction Method)

1. TURBOCHARGING PRESSURE TOO LOW

Check turbocharging pressure. (See page TC-8)

Turbocharging pressure:

0.40 – 0.70 kg/cm²

(5.7 – 10.0 psi, 39 – 69 kPa)

If the pressure is below specification, begin diagnosis from item 2.

2. RESTRICTED INTAKE AIR SYSTEM

Check intake air system, and repair or replace parts as necessary. (See page TC-8)

3. LEAK IN INTAKE AIR SYSTEM

Check intake air system, and repair or replace parts as necessary. (See page TC-8)

4. RESTRICTED EXHAUST SYSTEM

Check exhaust system, and repair or replace parts as necessary. (See page TC-8)

5. LEAK IN EXHAUST SYSTEM

Check exhaust system, and repair or replace parts as necessary. (See page TC-8)

6. ERRATIC TURBOCHARGER OPERATION

Check rotation of impeller wheel. If it does not turn or turns with a heavy drag, replace the turbocharger assembly.

Check axial play of impeller wheel. (See page TC-12)

Axial play: 0.13 mm (0.0051 in.) or less

If not within specification, replace the turbocharger assembly.

ABNORMAL NOISE

(Possible Cause)

1. TURBOCHARGING HEAT INSULATOR RESONANCE

(Check Procedure and Correction Method)

Check for loose, improperly installed or deformed insulator mount bolts, and repair or replace as necessary.

2. EXHAUST PIPE LEAKING OR VIBRATING

Check for deformed exhaust pipe, loose mount bolts or damaged gasket, and repair or replace as necessary.

3. ERRATIC TURBOCHARGER OPERATION

Refer to Item 6 of INSUFFICIENT ACCELERATION, LACK OF POWER OR EXCESSIVE FUEL CONSUMPTION.

EXCESSIVE OIL CONSUMPTION OR WHITE EXHAUST

(Possible Cause)

FAULTY TURBOCHARGER SEAL

(Check Procedure and Correction Method)

Check for oil leakage in exhaust system.

- Remove the turbine elbow from the turbocharger and check for excessive carbon deposits on the turbine wheel. Excessive carbon deposits indicate a faulty turbocharger.

Check for oil leakage in intake air system.

- Check for axial play in impeller wheel, and replace the turbocharger if necessary. (See page TC-12)

Axial play: 0.13 mm (0.0051 in.) or less

CAUTION: There is some oil mist from the PCV in the blowby gas so care must be taken not to diagnosis this as an oil leakage from the turbocharger.

CHECK AND REPLACEMENT OF INTERCOOLER COOLANT

CHECK OF INTERCOOLER COOLANT

1. CHECK INTERCOOLER COOLANT LEVEL

Check whether the intercooler (tank) is filled with coolant. If not, add coolant.

2. CHECK INTERCOOLER COOLANT QUALITY

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

If excessively dirty, replace the coolant.

REPLACEMENT OF INTERCOOLER COOLANT

1. DRAIN INTERCOOLER COOLANT

(a) Remove the filler cap.

(b) Loosen the drain cock and drain coolant from the intercooler and radiator.

2. FILL INTERCOOLER WITH COOLANT

CAUTION:

- If the intercooler is not filled to capacity, its performance decreases, so check that air is removed from the system.
- There is no need to pour coolant into the reservoir tank.
- Do not reuse in the intercooler coolant which has already been poured into the engine.
- A reduction in the strength of the coolant can result in rust occurring, so add coolant until the coolant and water are equal in volume.

(a) Close the drain cock.

(b) Fill with coolant.

Use a good brand of ethylene-glycol base coolant, mixed according to the manufacturer's directions.

Capacity: 1.7 liters (1.8 US qts, 1.5 Imp. qts)

(c) Turn the ignition switch ON.

(d) Open the throttle valve, which causes the intercooler water pump to operate.

(e) Check and refill with coolant.

When the water pump operates the coolant level drops, so add coolant when the water pump is stopped.

NOTE: When the coolant level falls more than 33 mm (1.29 in.) below the full tank level, the coolant level switch turns ON and the water pump stops.

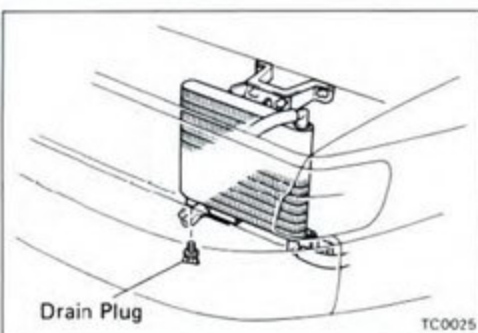
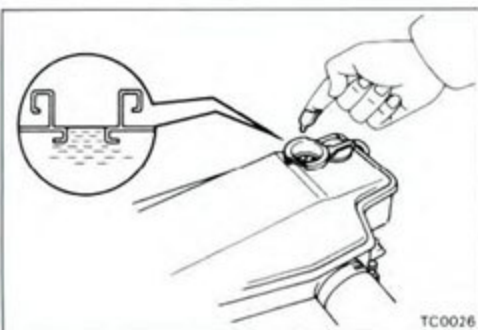
(f) Repeat steps (d) and (e), and add coolant until the intercooler (tank) remains full when the water pump is switched from OFF to ON.

(g) Install the filler cap.

(h) Start the engine and race the engine a few times at approx. 3,000 rpm. Then stop the engine.

(i) Recheck and refill with coolant.

(j) Leave the engine and water pump stopped for approx. 20 minutes. Then repeat steps (c) to (f). Recheck the coolant level.



TURBOCHARGER

ON-VEHICLE INSPECTION OF TURBOCHARGER

1. INSPECT INTAKE AIR SYSTEM

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

- Clogged air cleaner Clean or replace the element
- Hoses collapsed or deformed Check each connection and repair
- Cracks in components Check and replace

2. INSPECT EXHAUST SYSTEM

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

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

3. INSPECT ACTUATOR OPERATION

- (a) Remove the air cleaner assembly (from the turbocharger).
(See step 11 on page EM-43)
- (b) Disconnect the actuator hose.
- (c) Using SST (turbocharger pressure gauge), apply approx. 0.66 kg/cm^2 (9.4 psi, 65 kPa) of pressure to the actuator and check that the rod moves.

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

SST 09992-00241

CAUTION: Never apply more than 0.8 kg/cm^2 (11.4 psi 78 kPa) of pressure to the actuator.

4. CHECK TURBOCHARGING PRESSURE

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

SST 09992-00241

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

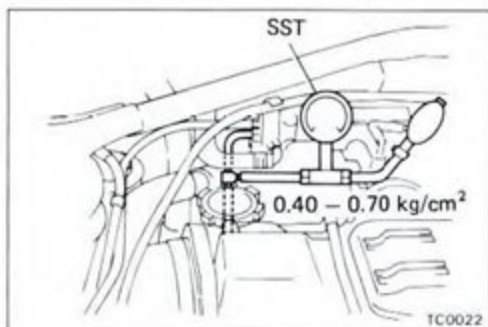
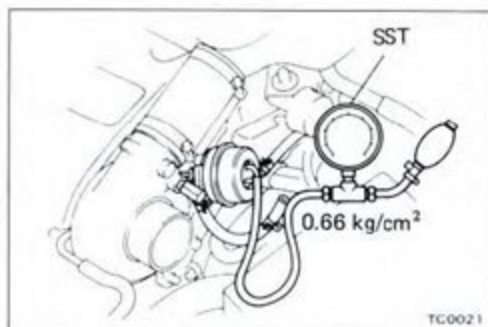
Standard pressure: $0.40 - 0.70 \text{ kg/cm}^2$
(5.7 — 10.0 psi, 39 — 69 kPa)

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

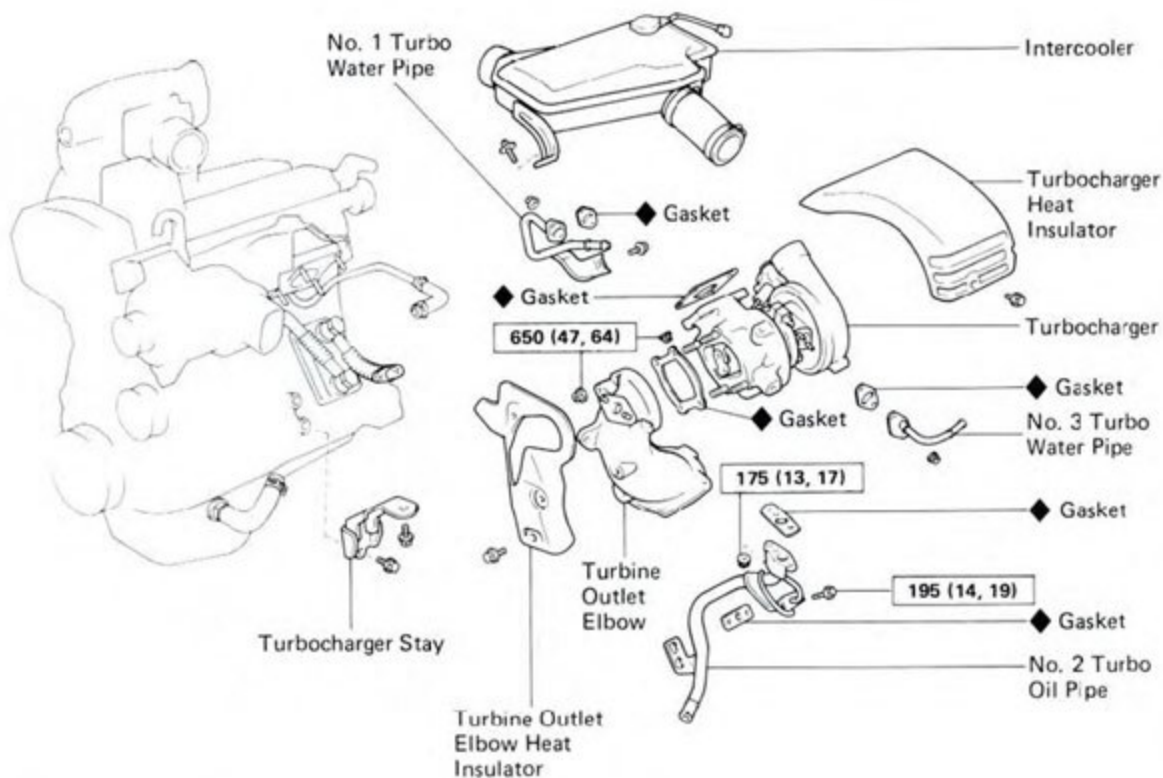
If the pressure is above specification, check if the actuator hose is disconnected or cracked. If not, replace the turbocharger assembly.

5. INSPECT IMPELLER WHEEL ROTATION

(See step 1 on page TC-12)



COMPONENTS



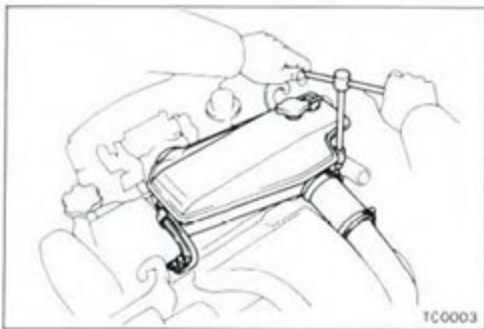
kg-cm (ft-lb, N-m) : Specified torque

◆ Non-reusable part

TC0019

REMOVAL OF TURBOCHARGER

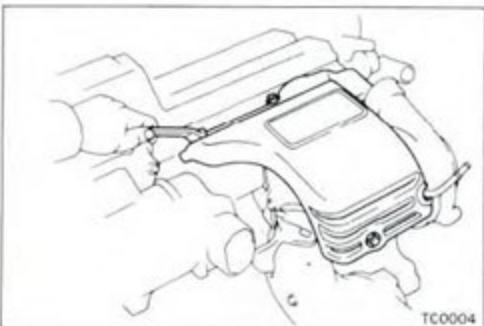
1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. DRAIN ENGINE COOLANT (See page CO-4)
3. DRAIN INTERCOOLER COOLANT (See page TC-7)
4. REMOVE AIR CLEANER ASSEMBLY (See step 11 on page EM-43)
5. REMOVE CATALYTIC CONVERTER (See steps 11 to 14 on page EM-27)
6. REMOVE OXYGEN SENSOR



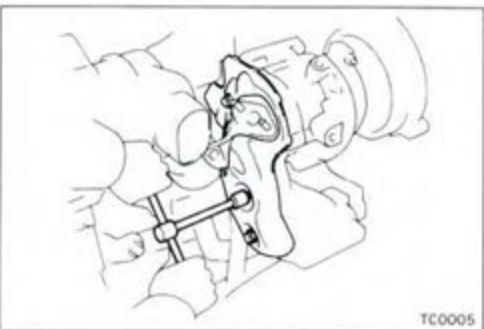
TC0003

7. REMOVE INTERCOOLER

- (a) Disconnect the following hoses and connector:
 - (1) Two intercooler radiator water hoses
 - (2) Reservoir tank water hose
 - (3) Intercooler coolant level warning sensor connector
- (b) Loosen the two hose clamps, and remove the three bolts.
- (c) Disconnect the air hoses, and remove the intercooler together with the hose.



TC0004

8. REMOVE ALTERNATOR DUCT**9. REMOVE NO.2 ALTERNATOR BRACKET**
(See step 15 on page EM-28)**10. REMOVE TURBOCHARGER HEAT INSULATOR**
Remove the three bolts and heat insulator.

TC0005

11. REMOVE HEAT INSULATOR OF TURBINE OUTLET ELBOW

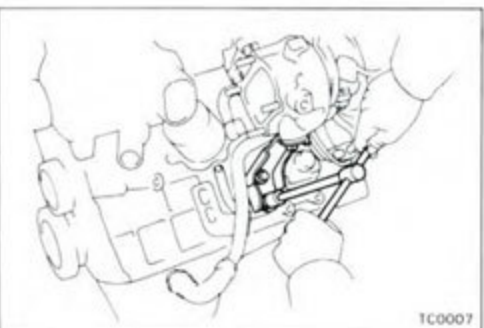
- (a) Remove the oil dipstick.
- (b) Remove the three bolts and heat insulator.



TC0006

12. REMOVE TURBINE OUTLET ELBOW

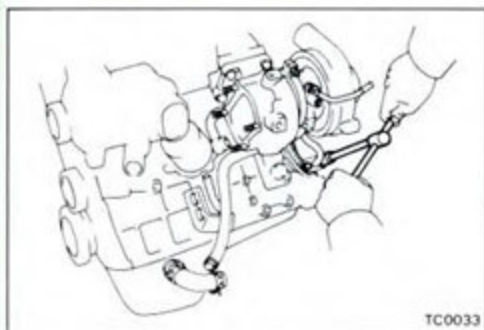
Remove the four nuts, turbine outlet elbow and gasket.



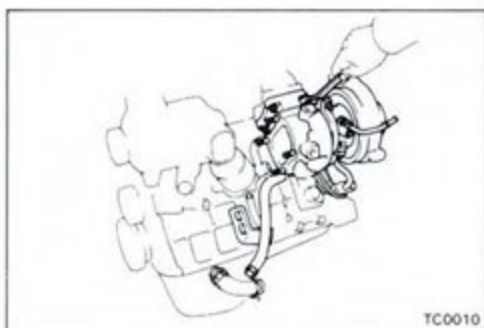
TC0007

13. REMOVE TURBOCHARGER STAY

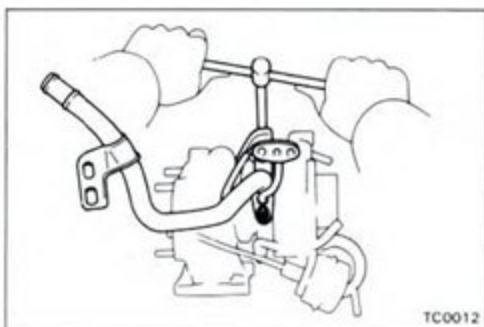
Remove the three bolts and turbocharger stay.

**14. REMOVE TURBOCHARGER**

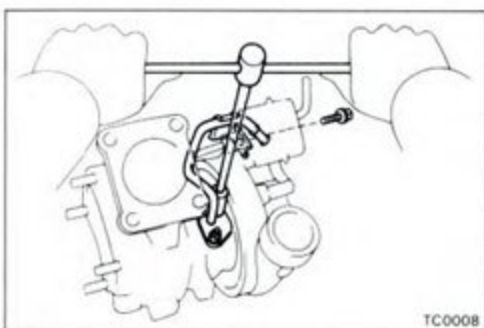
- (a) Remove the two bolts holding the No.1 turbo oil pipe to the No.2 oil pipe.



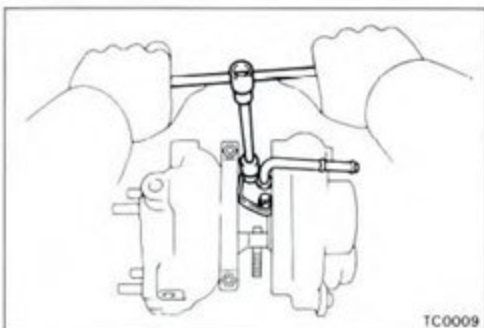
- (b) Remove the four nuts, turbocharger and two gaskets.

**15. REMOVE NO.2 TURBO OIL PIPE**

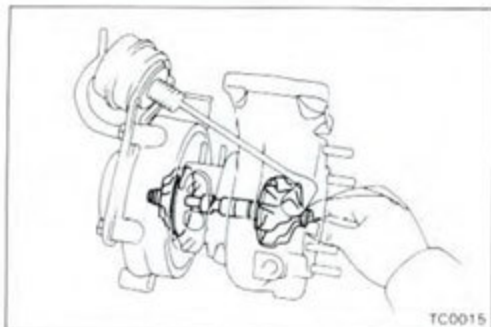
- Remove the two nuts, oil pipe and gasket.

**16. REMOVE NO.1 TURBO WATER PIPE**

- Remove the two nuts, bolt, water pipe and gasket.

**17. REMOVE NO.3 TURBO WATER PIPE**

- Remove the two nuts, water pipe and gasket.



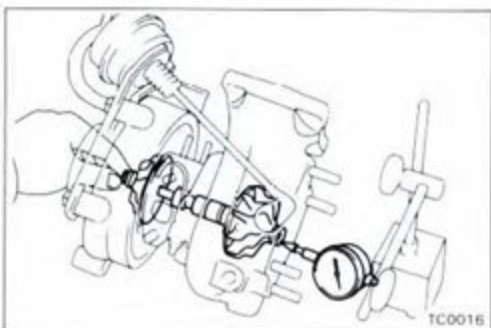
TC0015

INSPECTION OF TURBOCHARGER

1. INSPECT IMPELLER WHEEL ROTATION

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

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



TC0016

2. INSPECT AXIAL PLAY OF IMPELLER WHEEL

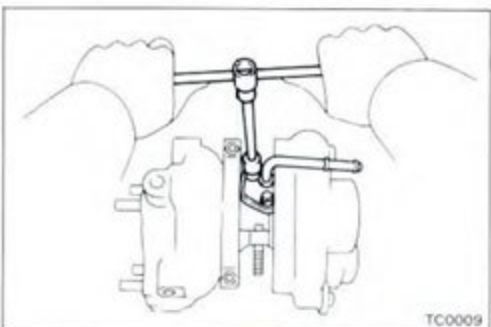
Insert a dial indicator into the intake side hole the turbine wheel edge by and check the axial play.

Axial play: 0.13 mm (0.0051 in.) or less

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

3. INSPECT TURBOCHARGER PRESSURE VSV

(See page FI-54)



TC0009

INSTALLATION OF TURBOCHARGER

(See page TC-9)

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

1. INSTALL NO.3 TURBO WATER PIPE

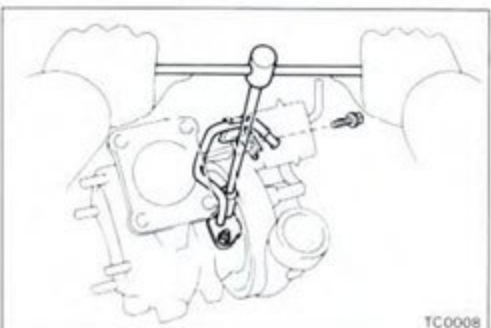
Install a new gasket and the water pipe with the two nuts.

Torque: 120 kg-cm (9 ft-lb, 11 N·m)

2. INSTALL NO.1 TURBO WATER PIPE

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

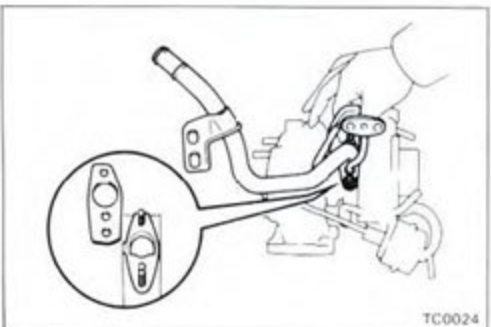
Torque: 120 kg-cm (9 ft-lb, 11 N·m)



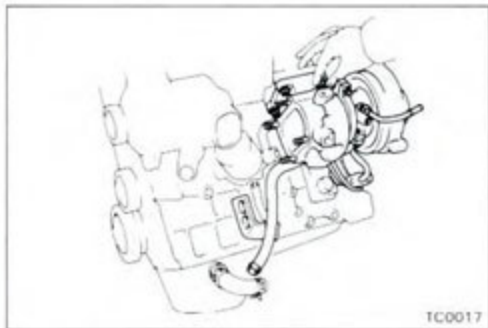
TC0008

3. INSTALL NO.2 TURBO OIL PIPE

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



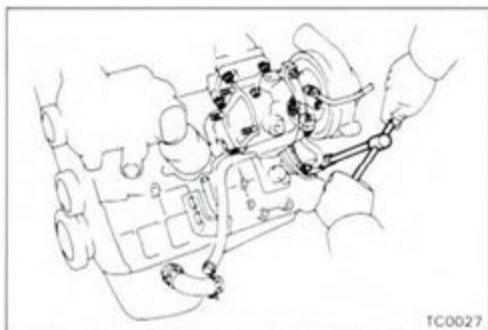
TC0024



TC0017

4. INSTALL TURBOCHARGER

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



TC0027

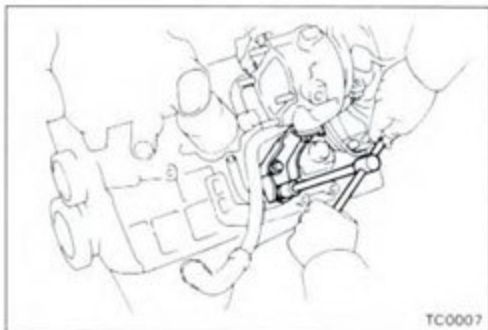
- (b) Install the oil pipe with the two bolts and nuts.
 (c) Torque the bolts and nuts.

Torque:

Turbocharger to exhaust manifold	650 kg-cm (47 ft-lb, 64 N·m)
No.2 oil pipe to turbocharger	175 kg-cm (13 ft-lb, 17 N·m)
No.2 oil pipe to No.1 oil pipe	195 kg-cm (14 ft-lb, 19 N·m)

- (d) Connect the following hoses:

- (1) Oil hose
- (2) Water hoses
- (3) Vacuum hose



TC0007

5. INSTALL TURBOCHARGER STAY

Install the turbocharger stay with the three bolts.

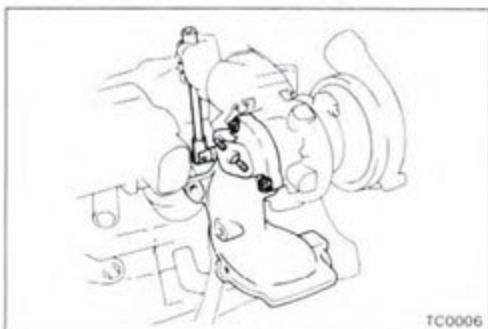
Torque:

To turbocharger	810 kg-cm (59 ft-lb, 79 N·m)
To cylinder block	530 kg-cm (38 ft-lb, 52 N·m)

6. INSTALL TURBINE OUTLET ELBOW

Install a new gasket and the turbine outlet elbow with the four nuts.

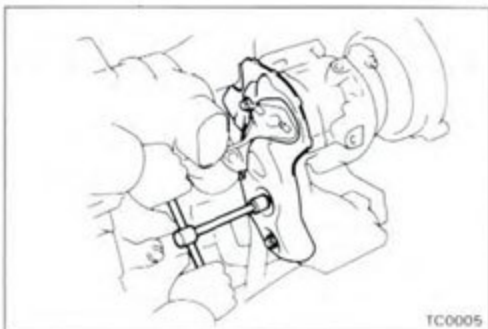
Torque: 650 kg-cm (47 ft-lb, 64 N·m)



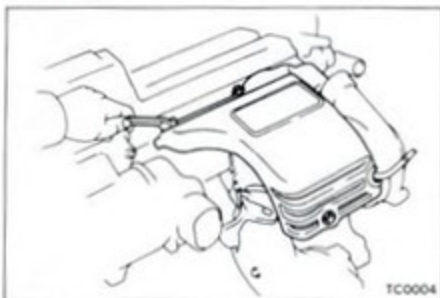
TC0006

7. INSTALL HEAT INSULATOR OF TURBINE OUTLET ELBOW

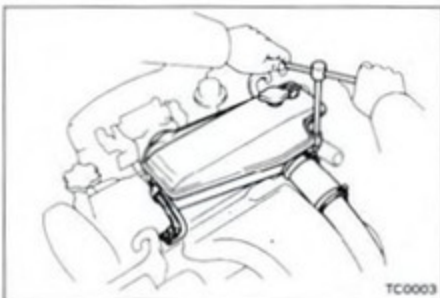
- (a) Install the heat insulator with the three bolt.
 (b) Install the oil dipstick gauge.



TC0005

**8. INSTALL TURBOCHARGER HEAT INSULATOR**

Install the heat insulator with the three bolt.

**9. INSTALL NO.2 ALTERNATOR BRACKET
(See step 32 on page EM-40)****10. INSTALL ALTERNATOR DUCT****11. INSTALL INTERCOOLER**

(a) Connect the air hoses, and install the intercooler with the three bolts.

(b) Connect the following hoses and connector:

- (1) Two intercooler radiator water hoses
- (2) Reservoir tank water hose
- (3) Intercooler coolant level warning sensor connector

12. INSTALL OXYGEN SENSOR**13. INSTALL CATALYTIC CONVERTER**

(See steps 33 to 36 on pages EM-40 and 41)

14. INSTALL AIR CLEANER ASSEMBLY

(See step 21 on page EM-51)

15. FILL ENGINE WITH COOLANT (See page CO-4)

Capacity (w/ Heater):

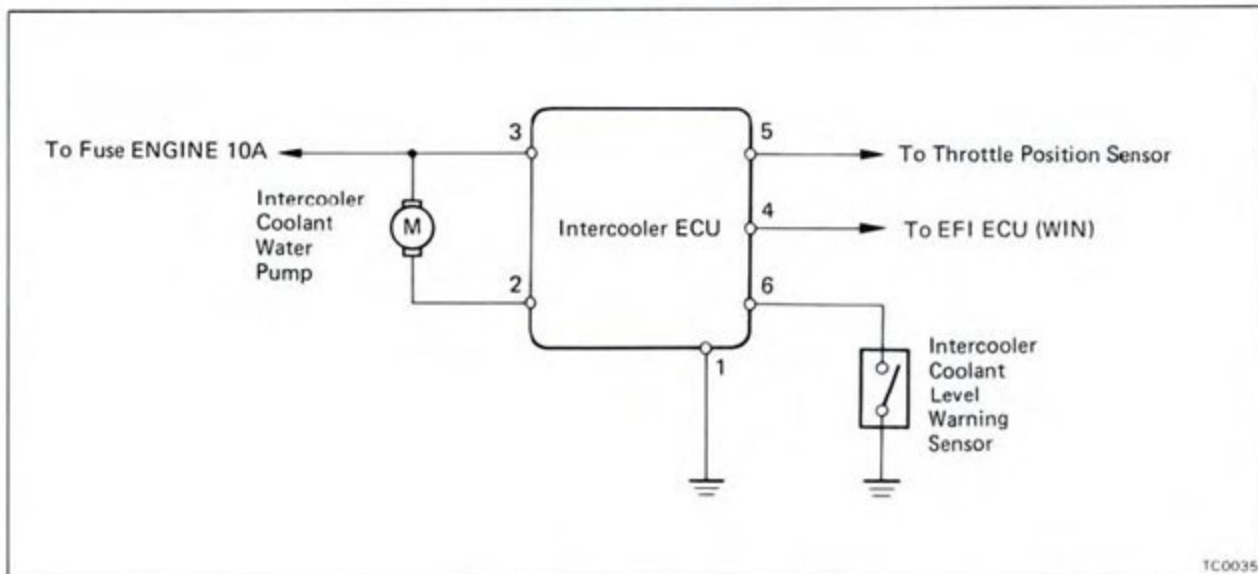
8.0 liters (8.5 US qts, 7.0 Imp. qts)

16. FILL INTERCOOLER WITH COOLANT (See page TC-7)

Capacity: 1.7 liters (1.8 US qts, 1.5 Imp. qts)

17. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**18. START ENGINE AND CHECK FOR LEAKS****19. CHECK ENGINE OIL LEVEL**

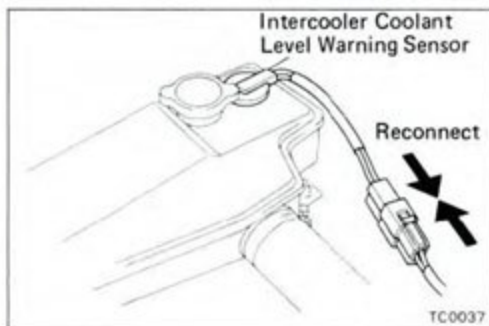
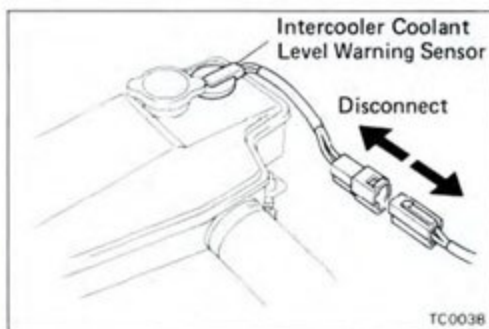
INTERCOOLER SYSTEM CIRCUIT



ON-VEHICLE INSPECTION OF INTERCOOLER

1. INSPECT OPERATION OF CHECK ENGINE WARNING LIGHT

- (a) Turn the ignition switch ON.
- (b) Check that the warning light comes on.
- (c) When the engine is started, check that the warning light goes out.
- (d) Disconnect the intercooler coolant level warning sensor connector.
- (e) Check that the warning light does not light up.
- (f) Open the throttle valve, and check that the warning light comes on after approx. 20 seconds.

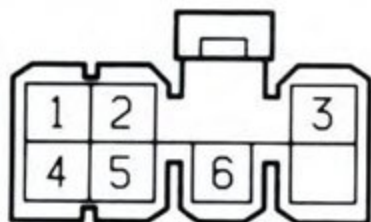


- (g) Reconnect the intercooler coolant level warning sensor connector.
- (h) Check that the warning light goes out.

2. INSPECT OPERATION OF INTERCOOLER WATER PUMP

- (a) Turn the ignition switch ON.
- (b) Open the throttle valve, and check that the water pump rotates.
- (c) When the throttle valve is closed, check that the water pump stops after approx. 30 seconds.

Wire Harness Side



G-7-1

INSPECTION OF INTERCOOLER ECU CIRCUIT

INSPECT INTERCOOLER ECU FOR CIRCUIT

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

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

Check for	Tester connection	Condition	Specified value
Continuity	1 – Ground	–	Continuity
Voltage	2 – Ground	Ignition S/W ON	Battery voltage
	3 – Ground		
Continuity	6 – Ground	Level warning sensor ON (float up)	Continuity
		Level warning sensor OFF (float down)	No continuity

CLEANING OF INTERCOOLER RADIATOR

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

CAUTION: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. If the cleaner nozzle pressure is 30 – 35 kg/cm² (427 – 498 psi, 2,942 – 3,432), keep a distance of at least 40 – 50 cm (15.75 – 19.69 in.) between the radiator core and cleaner nozzle.

INSPECTION OF INTERCOOLER RADIATOR

1. INSPECT INTERCOOLER COOLANT FILLER CAP

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

Standard opening pressure:

0.75 – 1.05 kg/cm²
(10.7 – 14.9 psi, 74 – 103 kPa)

Minimum opening pressure:

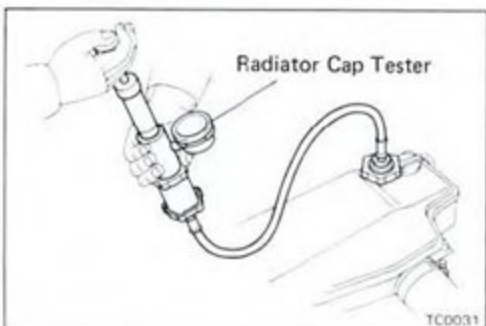
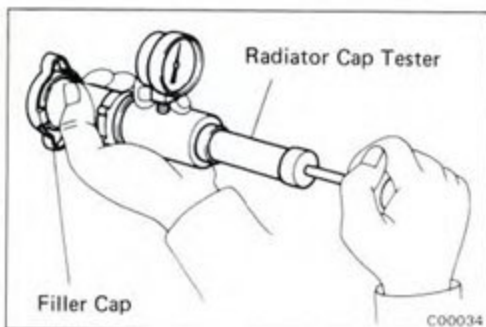
0.6 kg/cm² (8.5 psi, 59 kPa)

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

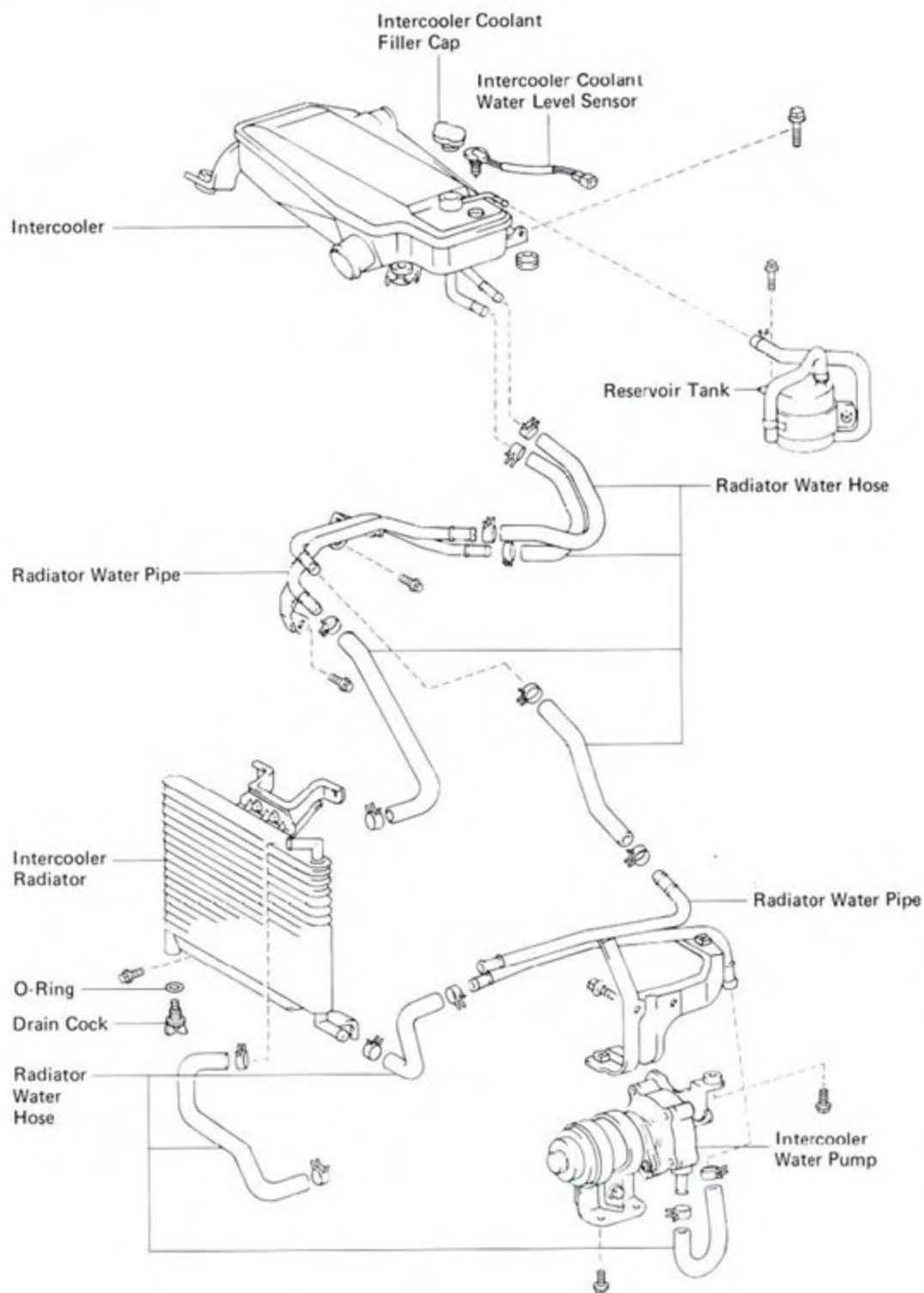
2. INSPECT INTERCOOLER COOLING SYSTEM FOR LEAKS

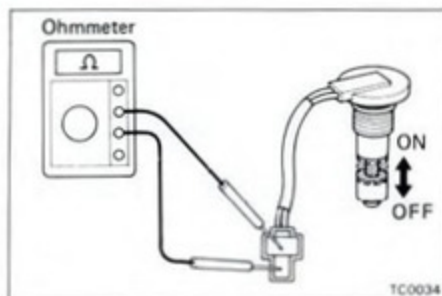
- Fill the cooling system with coolant and attach a radiator cap tester.
- Warm up the engine.
- Pump it to 1.2 kg/cm² (17.1 psi, 118 kPa), check that pressure does not drop.

If the pressure drops, check for leaks the hoses, radiator or water pump.



COMPONENTS



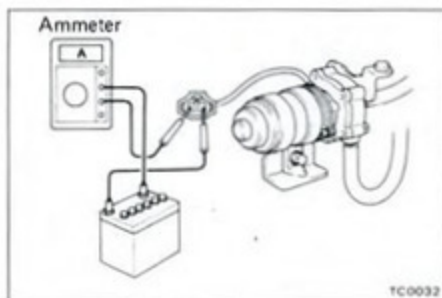


INSPECTION OF INTERCOOLER COMPONENTS

1. INSPECT INTERCOOLER COOLANT LEVEL WARNING SENSOR

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

If operation is not as specified, replace the sensor.



2. INSPECT INTERCOOLER WATER PUMP

- Connect the battery and ammeter to the water pump connector.
- Check that the pump rotates smoothly, and check the reading on the ammeter.

Standard amperage: 1.5 – 2.1 A