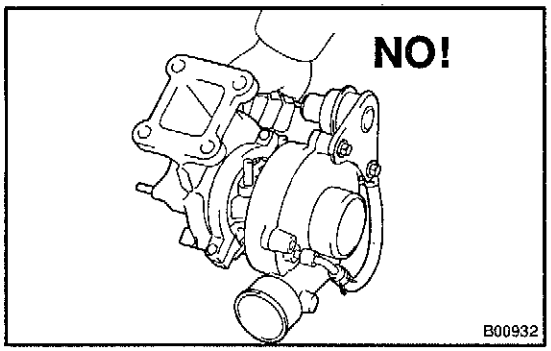
TURBOCHARGER

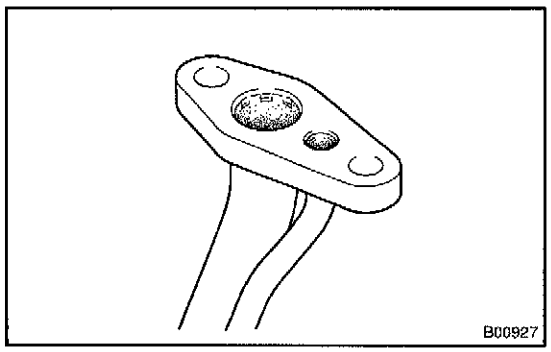
TC001 01

PRECAUTION

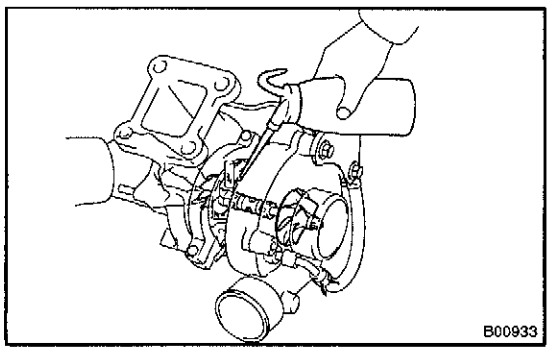
1. **DO NOT STOP ENGINE IMMEDIATELY AFTER PULLING TRAILER OR AFTER HIGH SPEED OR UPHILL DRIVING**
   IDLE ENGINE FOR 20 – 120 SECONDS, DEPENDING ON HOW HARD VEHICLE HAS BEEN DRIVEN
2. **AVOID SUDDEN ACCELERATION OR RACING IMMEDIATELY AFTER STARTING COLD ENGINE**
3. **IF TURBOCHARGER IS FOUND TO BE DEFECTIVE AND MUST BE REPLACED, CHECK FOR CAUSE, AND REPAIR OR REPLACE THESE ITEMS AS NECESSARY:**
   - Engine oil level and quality
   - Conditions under which turbocharger was used
   - Oil lines leading to turbocharger



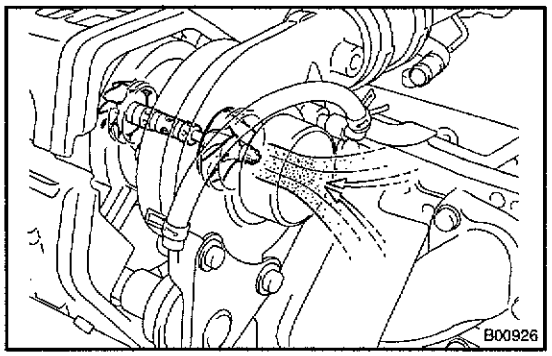
4. **USE CAUTION WHEN REMOVING AND REINSTALLING TURBOCHARGER ASSEMBLY**
   DO NOT DROP IT OR BANG IT AGAINST ANYTHING OR GRASP IT BY EASILY–DEFORMED PARTS, SUCH AS ACTUATOR OR PUSH ROD, WHEN MOVING IT
5. **BEFORE REMOVING TURBOCHARGER, PLUG INTAKE AND EXHAUST PORTS AND OIL INLET TO PREVENT ENTRY OF DIRT OR OTHER FOREIGN MATERIAL**



6. **IF REPLACING TURBOCHARGER, CHECK FOR ACCUMULATION OF SLUDGE PARTICLES IN OIL PIPE, AND IF NECESSARY, REPLACE OIL PIPE**
7. **COMPLETELY REMOVE GASKET ADHERED TO LUBRICATION OIL PIPE FLANGE AND TURBOCHARGER OIL FLANGE**
8. **WHEN REPLACING BOLT OR NUTS, USE ONLY AUTHORIZED REPLACEMENT PARTS TO PREVENT BREAKAGE OR DEFORMATION**



9. **IF REPLACING TURBOCHARGER, PUT APPROX. 20 cm^3 (1.2 cu in.) OF FRESH OIL INTO TURBOCHARGER OIL INLET HOLE AND TURN TURBINE WHEEL BY HAND TO SPREAD OIL TO BEARING**
10. **IF OVERHAULING OR REPLACING ENGINE, CUT FUEL SUPPLY AFTER REASSEMBLY AND CRANK ENGINE FOR 30 SECONDS TO DISTRIBUTE OIL THROUGHOUT ENGINE**
    THEN ALLOW ENGINE TO IDLE FOR 60 SECONDS.



11. IF ENGINE IS RUNNING WITHOUT AIR CLEANER, CASE COVER AND HOSE, ENTRY OF FOREIGN PARTICLES WILL DAMAGE WHEELS WHICH RUN AT EXTREMELY HIGH SPEED

TC002-01

TROUBLESHOOTING

HINT:

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

1. 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–5) **Turbocharging pressure:** **30 – 60 kPa (0.31 – 0.61 kgf/cm^2, 4.4 – 8.7 psi)** If pressure is below specifications, begin diagnosis from item 2.
2. RESTRICTED INTAKE 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 heavy drag, replace turbochager. Check axial and radial plays of turbine shaft. (See page TC–9) **Maximum axial play: 0.13 mm (0.0051 in.) or less** **Maximm radial play: 0.18 mm (0.0071 in.) or less** If play is greater than maximum, replace turbocharger.

2. ABNORMAL NOISE

Possible cause	Check Procedure and Correction Method
1. TURBOCHARGING HEAT INSULATOR RESONANCE	Check for loose, improperly installed or deformed Insulator nut and bolts, and repair or replace as necessary.
2. EXHAUST PIPE LEAKING OR VIBRATING	Check for deformed exhaust pipe, loose 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.

TC

3. EXCESSIVE OIL CONSUMPTION OR WHITE EXHAUST

Possible Cause	Check Procedure and Correction Method
FAULTY TURBOCHARGER OIL SEAL	Check for oil leakage in exhaust system. • Remove turbine outlet elbow from turbocharger, and check for excessive carbon deposits on turbine wheel. Excessive carbon deposits indicate a faulty turbocharger. Check for oil leakage in exhaust system. • Check for axial and radial plays of turbine shaft, and replace turbocharger if necessary. (See page TC–9) **Maximum axial play: 0.13 mm (0.0051 in.) or less** **Maximum radial play: 0.18 mm (0.0071 in.) or less** **NOTICE:** **Some oil mist in blowby from PCV is normal. Do not mistake it for oil leak from turbocharger.**

TC

TC003–01

ON–VEHICLE INSPECTION

1. INSPECT INTAKE AIR SYSTEM

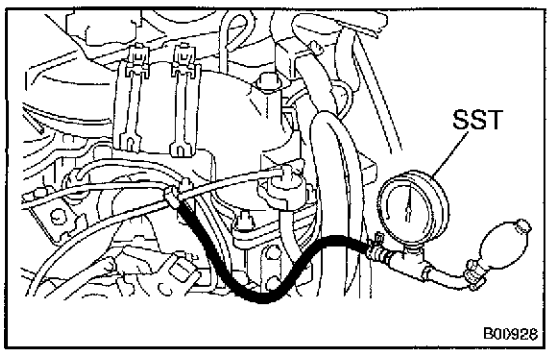
Check for leakage or clogging between the air cleaner housing and turbocharger inlet and between the turbocharger outlet and cylinder head.

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

2. INSPECT EXHAUST SYSTEM

Check for leakage or clogging between the cylinder head and turbocharger inlet and between the turbochager 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. CHECK TURBOCHARGING PRESSURE

(a) Warm up engine.

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

SST 09992–00242

(c) Press in the clutch pedal, then press the accelerator pedal down as far as it will go. Measure the turbocharging pressure at maximum speed (4,670 – 4,930 rpm).

Standard pressure:

30 – 60 kPa (0.31 – 0.61 kgf/cm^2, 4.4 – 8.7 psi)

If the pressure is less than specified, check the intake air and exhaust systems for leakage.

If there is no leakage, replace the turbocharger.

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

4. INSPECT IMPELLER WHEEL ROTATION

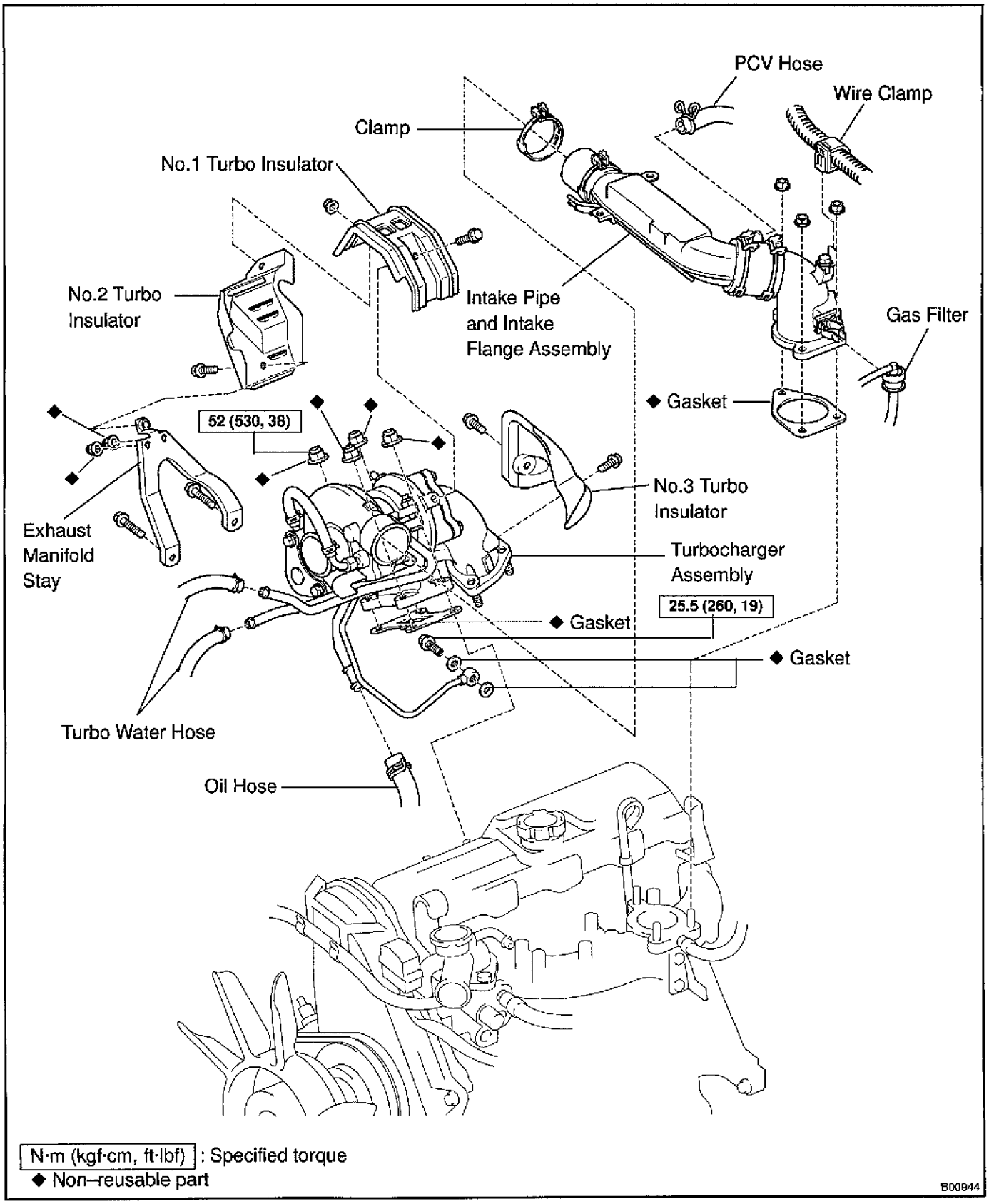
(See page TC–9)

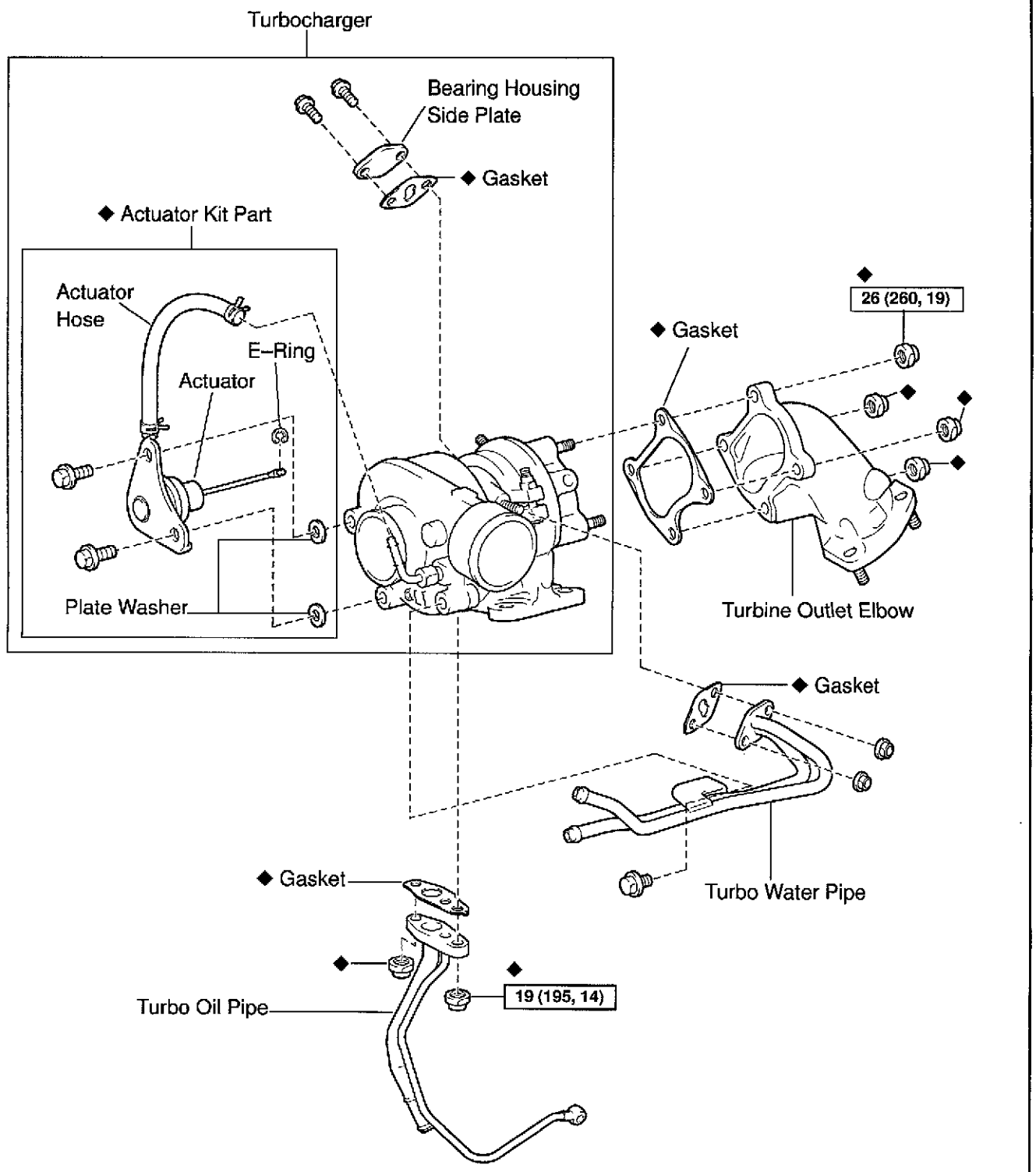
5. INSPECT ACTUATOR OPERATION

(See page TC–9)

TC004–01

COMPONENTS



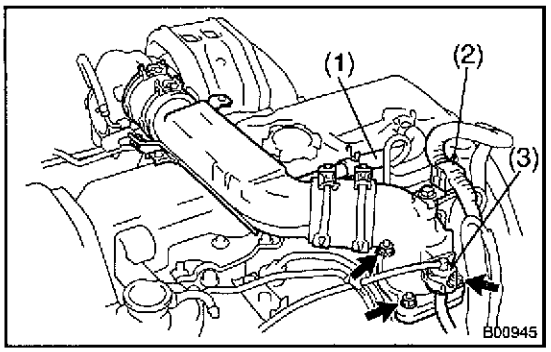


N·m (kgf·cm, ft·lbf): Specified torque
◆ Non–reusable part

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TC005-01

REMOVAL



1. DRAIN ENGINE COOLANT

2. REMOVE INTAKE PIPE AND INTAKE FLANGE ASSEMBLY

(a) Disconnect these parts:
  (1) PCV hose from intake pipe
  (2) Wire clamp from bracket
  (3) Gas filter from clamp

(b) Remove the 3 nuts, and disconnect the intake flange from the intake manifold. Remove the gasket.

(c) Loosen the hose clamp, and disconnect the air hose from the turbocharger. Remove the intake pipe and intake flange assembly.

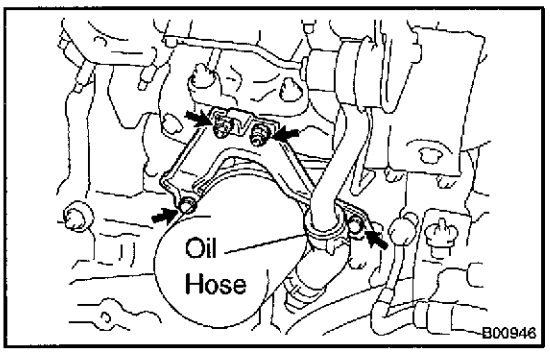
3. REMOVE TURBO HEAT INSULATORS

(a) Remove the bolt, nut and No.1 turbo heat insulator.

(b) Remove the bolt and No.2 turbo heat insulator.

(c) Remove the 2 bolts and No.3 turbo heat insulator.

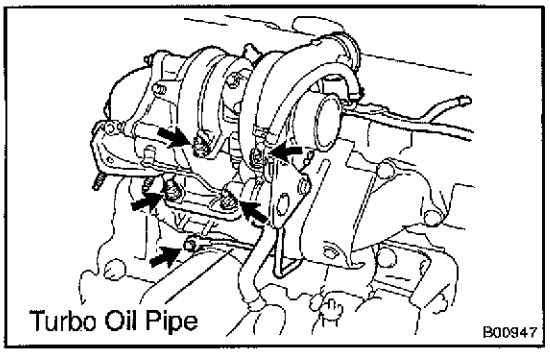
4. DISCONNECT TURBO WATER HOSES FROM TURBO WATER PIPE



5. DISCONNECT OIL HOSE FROM TURBO OIL PIPE

6. REMOVE EXHAUST MANIFOLD STAY

Remove the 2 bolts, 2 nuts and manifold stay.



7. REMOVE TURBOCHARGER ASSEMBLY

(a) Remove the union bolt holding the turbo oil pipe to the oil filter bracket. Remove the 2 gaskets.

(b) Remove the 4 nuts, the turbocharger assembly and gasket.

8. REMOVE TURBO OIL PIPE FROM TURBOCHARGER

Remove the 2 nuts, oil pipe and gasket.

9. REMOVE TURBO WATER PIPE FROM TURBOCHARGER

Remove the 2 nuts, bolt, water pipe and gasket.

10. REMOVE TURBINE OUTLET ELBOW FROM TURBOCHARGER

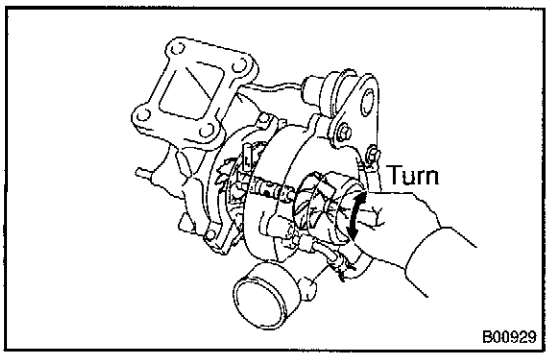
Remove the 4 nuts, outlet elbow and gasket.

11. REMOVE BEARING HOUSING SIDE PLATE FROM TURBOCHARGER

Remove the 2 bolts, side plate and gasket.

TC006-01

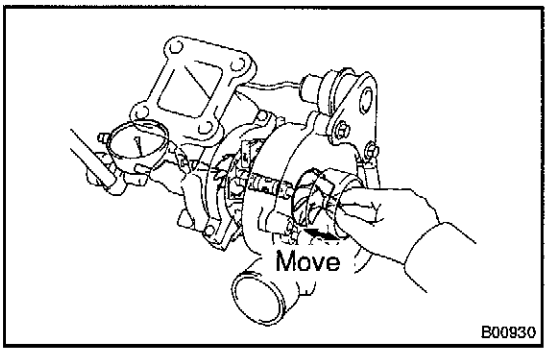
INSPECTION



1. INSPECT TURBINE SHAFT ROTATION

Grasp the edge of the turbine shaft, and turn it. Check that the turbine shaft turns smoothly.

If the turbine shaft does not turn or if it turns with a heavy drag, replace the turbocharger.



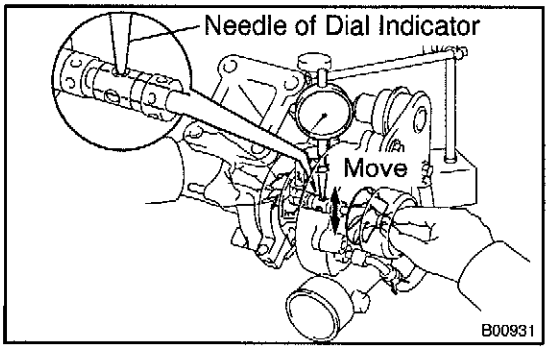
2. INSPECT AXIAL PLAY OF TURBINE SHAFT

(a) Using a dial indicator, insert the needle of the dial indicator into the exhaust side.

(b) Move the turbine shaft in an axial direction, measure the axial play of the turbine shaft.

Maximum oil clearance: 0.13 mm (0.0051 in.) or less

If the axial play is greater than maximum, replace the turbocharger.



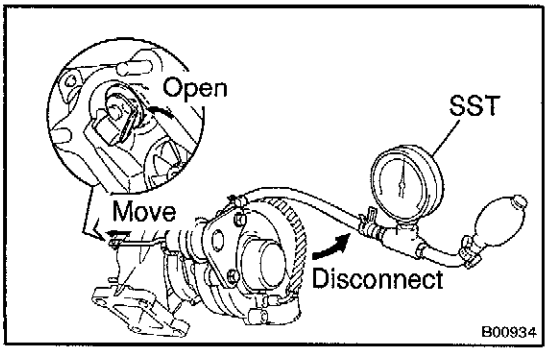
3. INSPECT RADIAL PLAY OF TURBINE SHAFT

(a) Using a dial indicator, insert the needle of the dial indicator into the oil outlet hole, and set it in the center of the turbine shaft.

(b) Move the turbine shaft in a radial direction, measure the radial play of the turbine shaft.

Maximum oil clearance: 0.18 mm (0.0071 in.) or less

If the radial play is greater than maximum, replace the turbocharger.



4. INSPECT ACTUATOR AND WASTE GATE VALVE OPERATION

(a) Disconnect the actuator air hose from the compressor housing.

(b) Using SST, apply approx. 83 kPa (0.85 kgf/cm^2, 12.0 psi) of pressure to the actuator.

SST 09992–00242

(c) Move the actuator push rod, and check that the waste gate valve is open.

If operation is not as specified, replace the turbocharger.

NOTICE:

Never apply more than 94 kPa (0.95 kgf/cm^2, 13.5 psi) of pressure to the actuator.

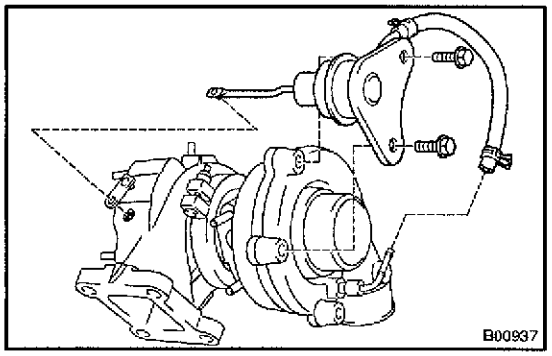
(d) Reconnect the actuator air hose to the compressor housing.

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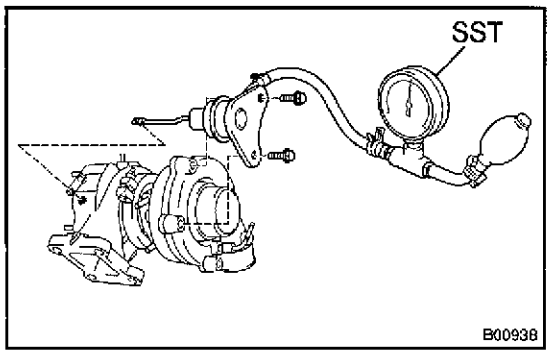
TC007-01

REPLACEMENT

REPLACE ACTUAOR



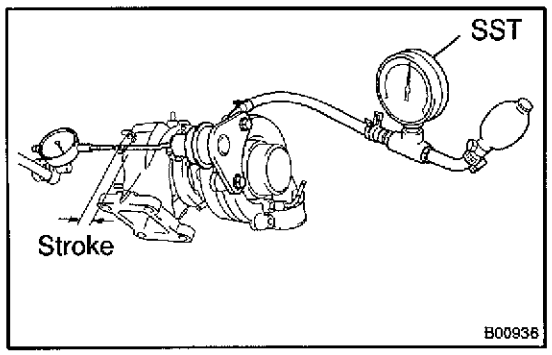
(a) Remove the actuator.
  (1) Remove the actuator hose.
  (2) Remove the 2 bolts holding the actuator to the compressor housing.
  (3) Remove the E–ring holding the actuator push rod to the waste gate valve link, and remove the actuator.



(b) Install the actuator.
  (1) Using SST, apply approx. 83 kPa (0.85 kgf/cm^2, 12.0 psi) of pressure to a new actuator.
  SST 09992–00242
  (2) Connect the actuator push rod to the waste gate valve link with a new E–ring.
  (3) Install the actuator to the compressor housing with the 2 bolts.
  Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)
  (4) Remove the SST.

NOTICE:

- **Never apply more than 94 kPa (0.95 kgf/cm^2, 13.5 psi) of pressure to the actuaor.**
- **Do not use a hammer, etc. to force the actuator push rod onto the waste gate valve link.**



(c) Adjust the actuator rod stroke.

NOTICE:

Never apply more than 125 kPa (1.27 kgf/cm^2, 11.3 psi) of pressure to the actuator.

  (1) Using a dial indicator, set the dial indicator in a straight line with the actuator push rod.
  (2) Using SST, apply 83 kPa (0.85 kgf/cm^2, 12.0 psi) of pressure to the actuator, and measure the actuator push rod stroke.
  SST 09992–00242
  (3) From the table below select the plate washer thickness to match the stroke measured in (b) above.

Stroke measurement mm (in.)	Requires plate washer thickness mm (in.)
1.20 – 1.70 (0.0472 – 0.0670)	None required
1.71 – 2.20 (0.0673 – 0.0866)	0.5 (0.020)
2.21 – 2.70 (0.0870 – 0.1063)	1.0 (0.039)
2.71 – 3.20 (0.1067 – 0.1260)	1.5 (0.059)
3.21 – 3.70 (0.1264 – 0.1457)	2.0 (0.079)

3.71 – 4.20 (0.1461 – 0.1654)	2.5 (0.098)
4.21 – 4.70 (0.1657 – 0.1850)	3.0 (0.118)
4.71 – 5.20 (0.1854 – 0.2047)	3.5 (0.138)
5.21 – 5.70 (0.2051 – 0.2244)	4.0 (0.157)
5.71 – 6.20 (0.2248 – 0.2441)	4.5 (0.177)
6.21 – 6.70 (0.2445 – 0.2638)	5.0 (0.197)
6.71 – 7.20 (0.2642 – 0.2827)	5.5 (0.217)
7.21 – 7.70 (0.2839 – 0.3031)	6.0 (0.236)
7.71 – 8.20 (0.3035 – 0.3228)	6.5 (0.256)

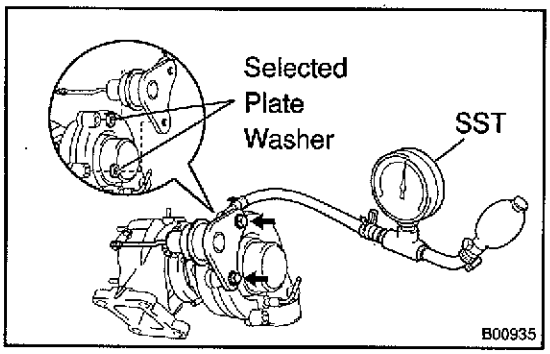
NOTICE:

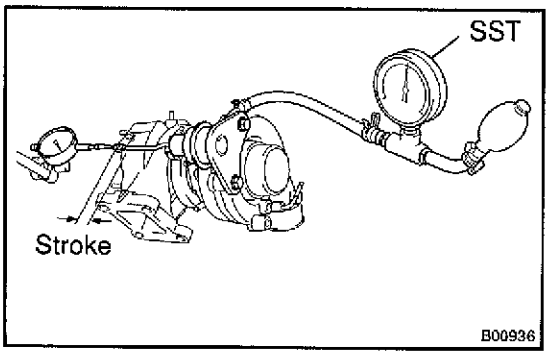
- **Use a combination of plate washers of 0.5 mm (0.020 in.), 1.0 mm (0.039 in.), 2.0 mm (0.079 in.) and 3.0 mm (0.118 In.) thickness to achieve the required thickness.**
- **Use the same thickness of plate washer for the 2 locations between the actuator and compressor housing.**
- **If the plate washer thickness exceeds 3.5 mm (0.138 in.), replace the actuator installation bolts with the bolts from the kit part.**

(4) Using SST, apply approx. 83 kPa (0.85 kgf/cm^2, 12.0 psi) of pressure to the actuator, and install the selected plate washers between the actuator and compressor housing with the 2 bolts.

SST 09992–00242

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





(5) Using SST, apply 83 kPa (0.85 kgf/cm^2, 12.0 psi) of pressure to the actuator, and measure the actuator push rod stroke.

SST 09992–00242

Standard stroke: 1.20 – 1.70 mm (0.0472 – 0.0669 in.)

If the stroke is outside specifications, reselect the plate washers.

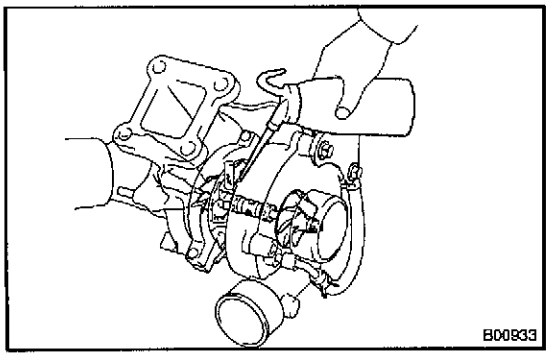
(d) Install the actuator hose.

(e) Apply yellow paint from the actuator bolts to the actuator bracket to indicate that they have been correctly installed.

(f) Check the turbocharging pressure. (See page TC–5)

TC008-01

INSTALLATION



NOTICE:

After replacing the turbocharger assembly, pour approx. 20 cm^3 (1.2 cu in.) of fresh oil into the oil inlet hole and turn the turbine wheel by hand to splash oil on the bearing.

1. **INSTALL BEARING HOUSING SIDE PLATE TO TURBOCHARGER**

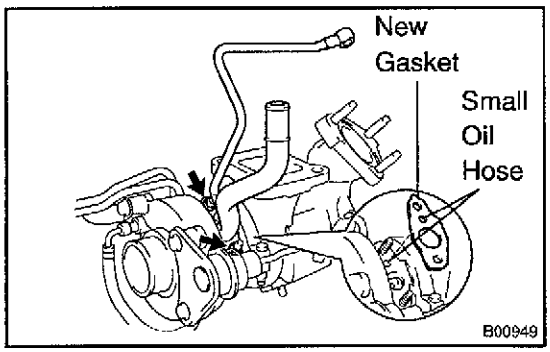
Install a new gasket and the side plate with the 2 bolts.

Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)

2. **INSTALL TURBINE OUTLET BLBOW TO TURBOCHARGER**

Install a new gasket and the outlet elbow with 4 new nuts.

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



3. **INSTALL TURBO OIL PIPE TO TURBOCHARGER**

Install a new gasket and the oil pipe with 2 new nuts.

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

NOTICE:

Be careful of the gasket installation direction. Align the small oil holes of the gasket and turbocharger.

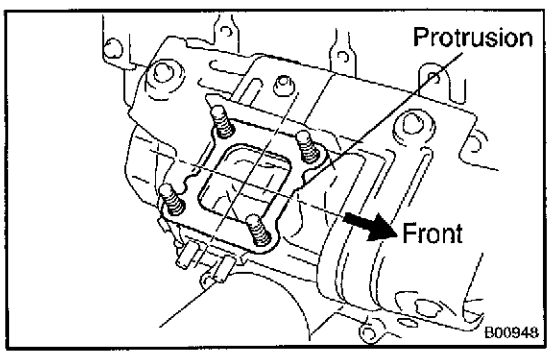
4. **INSTALL TURBO WATER PIPE TO TURBOCHARGER**

Install a new gasket and the water pipe with the 2 nuts and bolt.

Torque:

5.5 N·m (55 kgf·cm, 49 in.·lbf) for nut

12 N·m (120 kgf·cm, 9 ft·lbf) for bolt

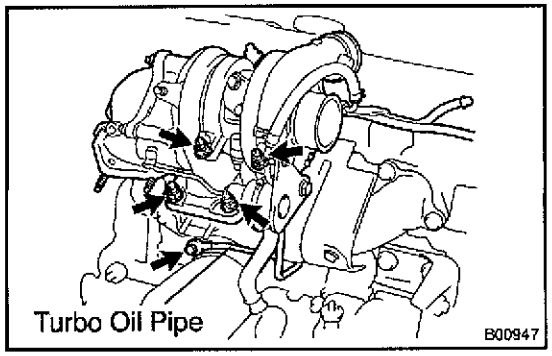


5. **INSTALL TURBOCHARGER ASSEMBLY**

(a) Place a new gasket on the exhaust manifold.

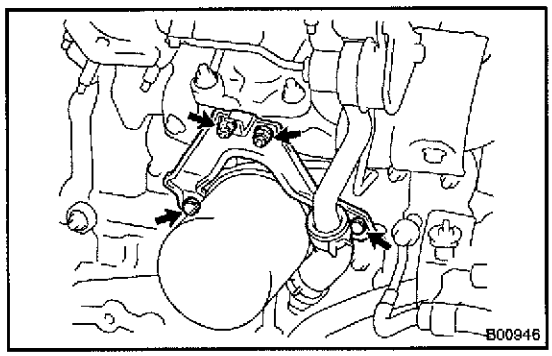
NOTICE:

Be careful of the installation direction.



(b) Install the turbocharger assembly with the 4 nuts.
Torque: 52 N·m (530 kgf/cm², 38 ft·lbf)

(c) Connect the turbo oil pipe to the oil filter bracket with 2 new gaskets and the union bolt.
Torque: 25.5 N·m (260 kgf·cm, 19 ft·lbf)



6. INSTALL EXHAUST MANIFOLD STAY

Install the manifold stay with 2 new nuts and the 2 bolts.
Torque:
19 N·m (195 kgf/cm², 14 ft·lbf) for nut
12 N·m (120 kgf/cm², 9 ft·lbf) for bolt

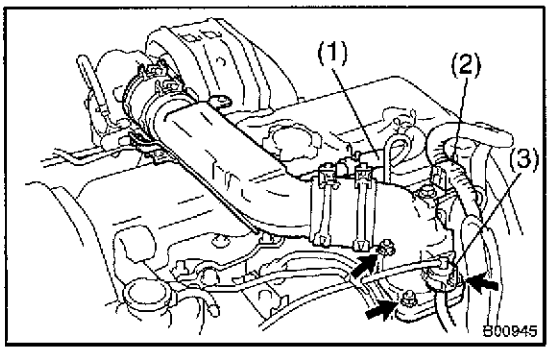
7. CONNECT OIL HOSE TO TURBO OIL PIPE

8. CONNECT TURBO WATER HOSES TO TURBO WATER PIPE

9. INSTALL TURBO INSULATORS

(a) Install the No.3 turbo heat insulator with the 2 bolts.

(b) Install the No.2 and No.3 turbo heat insulators with the 2 bolts and nut.



10. INSTALL INTAKE PIPE AND INTAKE FLANGE ASSEMBLY

(a) Connect the air hose to the turbocharger.

(b) Install a new gasket and the intake flange with the 3 nuts.
Torque: 12 N·m (120 kgf·cm, 9 ft·lbf)

(c) Connect these parts:
(1) PCV hose to intake pipe
(2) Wire clamp to bracket
(3) Gas filter to clamp

11. FILL WITH ENGINE COOLANT

12. START ENGINE AND CHECK FOR LEAKS

13. CHECK ENGINE OIL LEVEL