

TURBOCHARGER DIAGNOSIS

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 EM-15)
Standard pressure: 0.37 – 0.50 kg/cm²
(5.3 – 7.1 psi, 36 – 49 kPa)
 If the pressure is above specification, begin diagnosis from item 2.

2. RESTRICTED INTAKE AIR SYSTEM

Check intake air system, and repair or replace parts as necessary. (See page EM-15)

3. LEAK IN INTAKE AIR SYSTEM

Check intake air system, and repair or replace parts as necessary. (See page EM-15)

4. RESTRICTED EXHAUST SYSTEM

Check exhaust system, and repair or replace parts as necessary. (See page EM-15)

5. LEAK IN EXHAUST SYSTEM

Check exhaust system, and repair or replace parts as necessary. (See page EM-15)

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 bearing shaft. If not within limits, replace the turbocharger assembly.
Standard clearance: 0.13 mm (0.0051 in.) or less

EXCESSIVE KNOCKING DURING ACCELERATION

(Possible Cause)

(Check Procedure and Correction Method)

TURBOCHARGING PRESSURE TOO HIGH

Check turbocharging pressure. (See page EM-15)
Standard pressure: 0.37 – 0.50 kg/cm²
(5.3 – 7.1 psi, 36 – 49 kPa)
 If the pressure is above specification, first check if the actuator hose is disconnected or cracked. If not, replace the turbocharger assembly.

ABNORMAL NOISE

(Possible Cause)

1. TURBOCHARGER INSULATOR RESONANCE

2. EXHAUST PIPE LEAKING OR VIBRATING

3. ERRATIC TURBOCHARGER OPERATION

(Check Procedure and Correction Method)

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

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

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 would 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 EM-21).

CAUTION: Do not mistakenly diagnose ordinary oil mist from the PCV in the blow by gas as an oil leak from the turbocharger.

ENGINE TUNE-UP

1. INSPECT ENGINE COOLANT
(See page CO-3)
2. INSPECT ENGINE OIL
3. INSPECT AIR CLEANER (See page MA-5)
4. INSPECT BATTERY
(See page CH-2)
5. INSPECT HIGH-TENSION CODE
(See page IG-6)
6. INSPECT SPARK PLUGS (See page IG-5)
7. INSPECT DRIVE BELTS
(See page MA-4)
8. INSPECT VALVE CLEARANCE (See page MA-7)

Valve clearance:	Intake	0.20 mm (0.008 in.)
	Exhaust	0.30 mm (0.012 in.)
9. INSPECT IGNITION TIMING (See step 3 on page IG-15)

Ignition timing:		
22R	0° TDC @ Max. 950 rpm	(w/vacuum advancer OFF)
22R-E, 22R-TE	5° BTDC @ Idle	(T and E ₁ short circuit)
10. (22R)
INSPECT CARBURETOR FLOAT LEVEL
(See step 3 on page FU-3)
11. (22R)
INSPECT FAST IDLE SPEED
(See step 14 on page MA-9)
12. ADJUST IDLE SPEED (See page MA-8)

Idle speed:	22R	M/T 700 rpm
		A/T 750 rpm
	22R-E	750 rpm
	22R-TE	800 rpm

NOTE: Adjust idle mixture as necessary.

IDLE HC/CO CONCENTRATION CHECK METHOD

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

- (i) Carburetor fuel level about even with the correct level in the sight glass
- (j) Tachometer and HC/CO meter calibrated and at hand

PRECHECK

INITIAL CONDITIONS

- (a) Normal engine operating temperature
- (b) Choke fully open (22R)
- (c) Air cleaner installed
- (d) All pipe and hoses of air intake system connected (22R-E, 22R-TE)
- (e) All accessories switched off
- (f) All vacuum lines properly connected
- (g) EFI system wiring connectors fully plugged.
- (h) Idle speed set correctly

MEASUREMENT

1. INSERT TESTING PROBE OF HC/CO METER INTO TAILPIPE AT LEAST 40 cm (1.3 ft)

2. MEASURE HC/CO CONCENTRATION AT IDLE

Wait at least one minute before measuring to allow the concentration to stabilize.

Complete the measuring within three minutes.

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

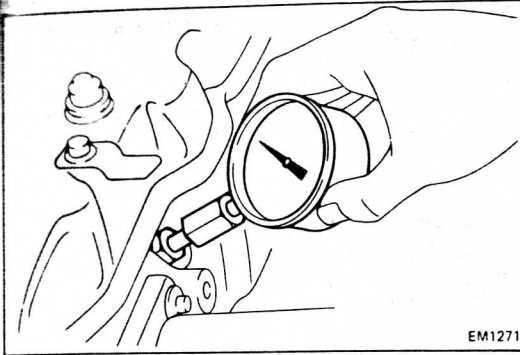
TROUBLESHOOTING

HC	CO	Problems	Causes
High	Normal	Rough idle	<ol style="list-style-type: none"> 1. Faulty ignition: <ul style="list-style-type: none"> • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed ignition wires • Cracked distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve 4. Leaky exhaust valves 5. Leaky cylinder
High	Low	Rough idle Fluctuating HC reading	<ol style="list-style-type: none"> 1. Vacuum leak: <ul style="list-style-type: none"> • Vacuum hose • Intake manifold • Intake chamber (22R-E, 22R-TE) • PCV line • Carburetor base (22R) • Throttle body (22R-E, 22R-TE) • CMH (22R) 2. Leaky MC valve (22R)
High	High	Rough idle Black smoke from exhaust	<ol style="list-style-type: none"> 1. Restricted air filter 2. Plugged PCV valve 3. AS system problem (22R) 4. Faulty carburetion: (22R) <ul style="list-style-type: none"> • Faulty choke action • Incorrect float setting • Leaking needle or seat • Leaking power valve 5. Faulty EFI system: (22R-E, 22R-TE) <ul style="list-style-type: none"> • Faulty pressure regulator • Clogged fuel return line • Faulty air flow meter • Defective water temp. sensor • Defective air temp. sensor • Faulty ECU • Faulty injector • Faulty cold start injector

COMPRESSION CHECK

NOTE: If there is lack of power, excessive oil consumption or poor fuel mileage, measure the cylinder compression pressure.

1. WARM UP ENGINE
2. REMOVE SPARK PLUGS
3. DISCONNECT HIGH-TENSION CORD FROM IGNITION COIL



4. (22R-E, 22R-TE)
DISCONNECT COLD START INJECTOR CONNECTOR
5. (22R-E, 22R-TE)
DISCONNECT SOLENOID RESISTOR CONNECTOR

6. MEASURE CYLINDER COMPRESSION PRESSURE

- (a) Insert a compression gauge into the spark plug hole.
- (b) Fully open the throttle.
- (c) While cranking the engine with the starter motor, measure the compression pressure.

CAUTION: This test must be done for as short a time as possible to avoid overheating of the catalytic converter.

NOTE: A fully charged battery must be used to obtain at least 250 rpm.

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

Compression pressure:

22R, 22R-E	12 kg/cm ² (171 psi, 1,177 kPa)
22R-TE	10.5 kg/cm ² (149 psi, 1,030 kPa)

Minimum pressure:

22R, 22R-E	10 kg/cm ² (142 psi, 981 kPa)
22R-TE	8.5 kg/cm ² (120 psi, 834 kPa)

Difference between each cylinder:

Less than 1.0 kg/cm² (14 psi, 98 kPa)

- (e) If cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for the low compression cylinder.

- If adding oil helps the compression, chances are that the piston rings and/or cylinder bore are worn or damaged.

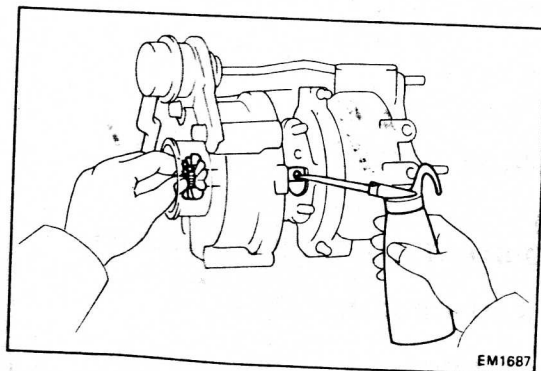
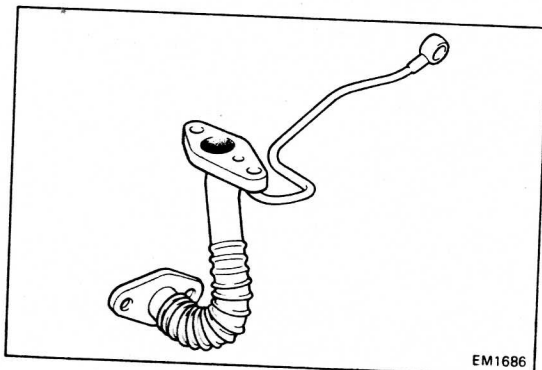
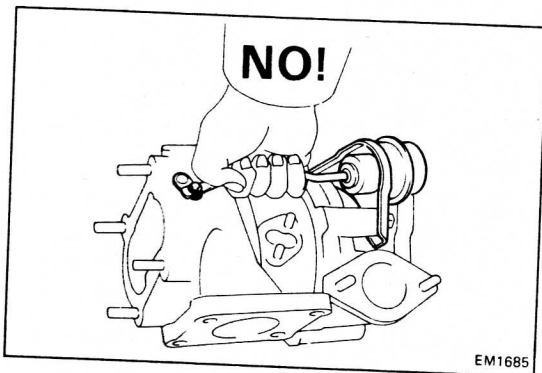
- If pressure stays low, a valve may be sticking or seating improperly, or there may be leakage past the gasket.

7. (22R-E, 22R-TE)
CONNECT SOLENOID RESISTOR CONNECTOR
8. (22R-E, 22R-TE)
CONNECT COLD START INJECTOR CONNECTOR
9. CONNECT DISTRIBUTOR CONNECTOR
10. INSTALL SPARK PLUGS

TURBOCHARGER

CAUTION:

- 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.
- Avoid sudden racing or acceleration immediately after starting a cold engine.
- 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



- 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.
- Before removing the turbocharger, plug the intake and exhaust ports and oil inlet to prevent entry of dirt or other foreign particles.
- If replacing the turbocharger, check for accumulation of sludge particles in the oil pipes and, if necessary, replace the oil pipes.
- Completely remove the gaskets adhered to the lubrication oil pipe flange and turbocharger oil flange.
- If replacing bolts or nuts, do so only with the specified new ones to guard against breakage or deformation.
- 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.
- If overhauling or replacing the engine, cut the fuel supply and ignition function after reassembly and crank the engine for 30 seconds to distribute oil throughout the engine. Then allow the engine to idle for 60 seconds.

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 Repair or replace
- Leakage from connections Check each connection and repair
- Cracks in components Check and replace

2. INSPECT EXHAUST SYSTEM

Check for leakage or clogging between the cylinder head and turbocharger inlet and between the turbocharger or let 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 OPERATION OF ACTUATOR AND WASTE GATE VALVE

- Disconnect the actuator hose.
- Using a turbocharger pressure gauge (SST), apply approx. 0.58 kg/cm^2 (8.2 psi, 57 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 0.7 kg/cm^2 (10.0 psi 69 kPa) of pressure to the actuator.

4. CHECK TURBOCHARGING PRESSURE

- Install a turbocharger pressure gauge (SST) to the gas filter.

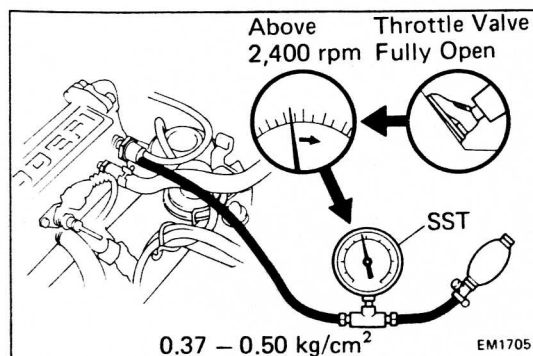
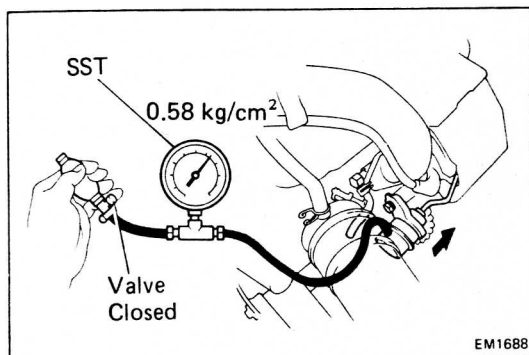
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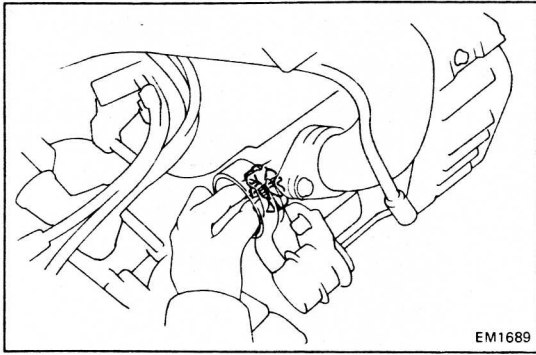
- While driving with the engine running at 2,400 rpm or more with the throttle valve fully open in the L range, check the turbocharging pressure.

Standard pressure: $0.37 - 0.50 \text{ kg/cm}^2$
(5.3 - 7.1 psi, 36 - 49 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.

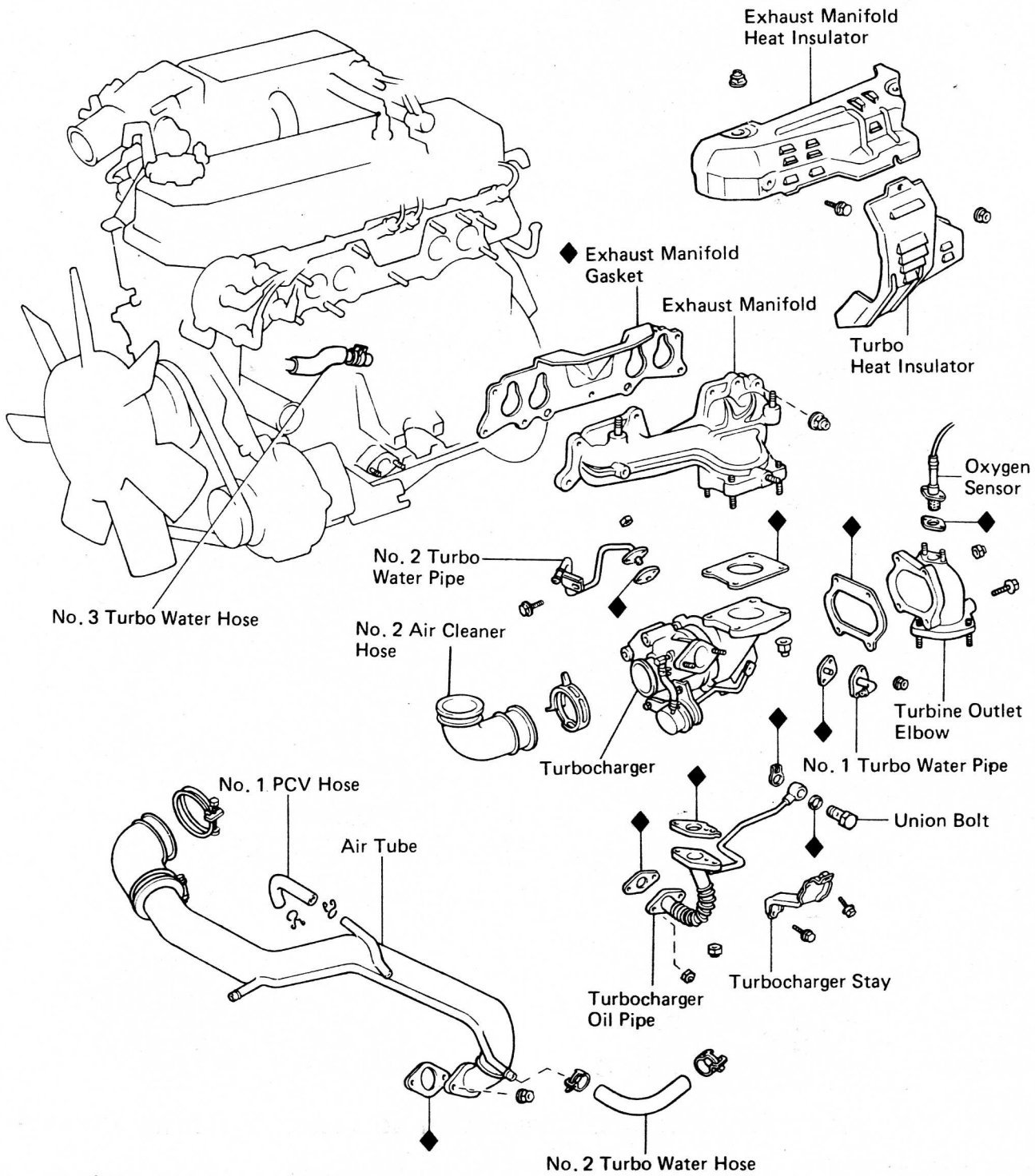


**5. INSPECT IMPELLER WHEEL ROTATION**

- (a) Disconnect the air cleaner hose.
- (b) Grasp the edge of the impeller wheel and turn it. Check that it turns smoothly.

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

COMPONENTS



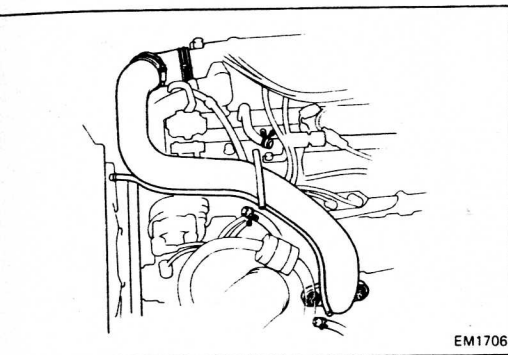
◆ Non-reusable part

REMOVAL OF TURBOCHARGER

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. DRAIN COOLANT
3. DISCONNECT OXYGEN SENSOR WIRE CLAMP AND CONNECTOR

4. REMOVE AIR TUBE ASSEMBLY

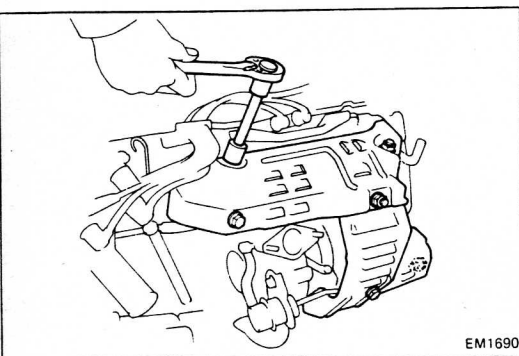
- (a) Disconnect the No.1 and No.3 PCV hoses.
- (b) Disconnect the No. 1 and No. 2 turbo water hoses.
- (c) Loosen the clamp on the throttle body.
- (d) Remove the two nuts, air tube assembly and gasket.



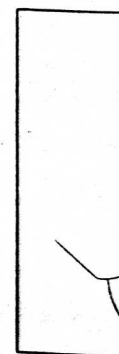
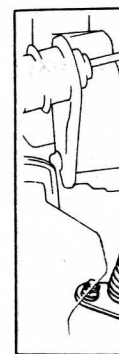
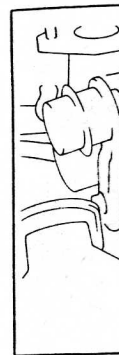
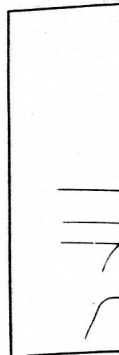
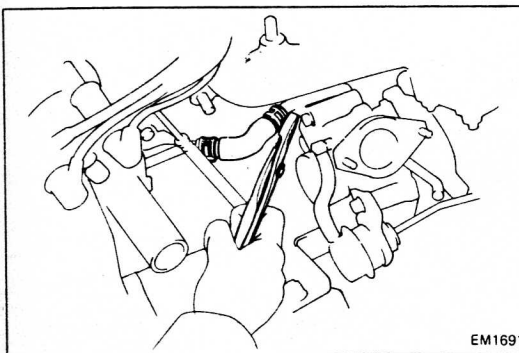
5. REMOVE NO.1 AIR CLEANER HOSE ASSEMBLY

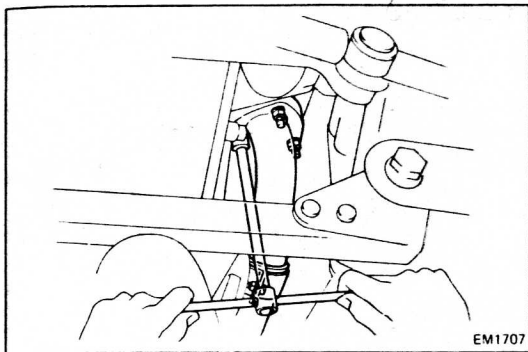
6. REMOVE NO.2 AIR CLEANER HOSE

7. REMOVE EXHAUST MANIFOLD AND TURBO HEAT INSULATORS



8. DISCONNECT NO.3 TURBO WATER HOSE

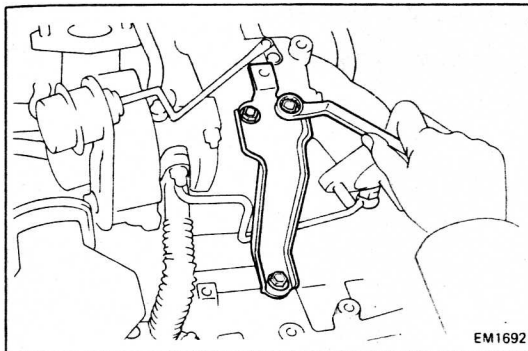
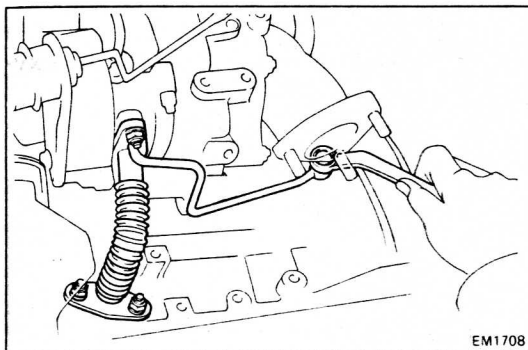


**9. RAISE VEHICLE**

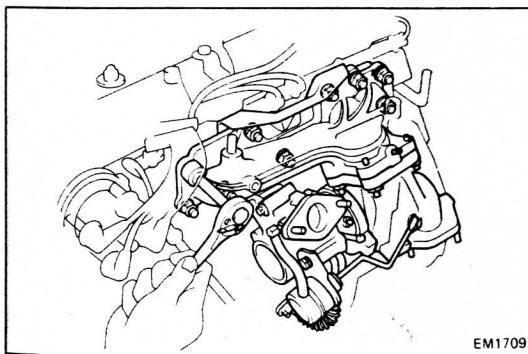
CAUTION: Be sure the vehicle is securely supported.

10. DISCONNECT EXHAUST PIPE FROM TURBINE OUTLET ELBOW

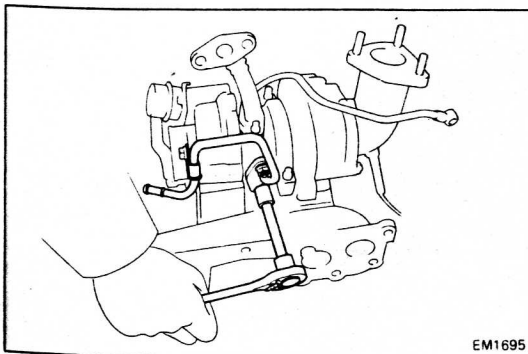
- (a) Remove the three nuts from the flange.
- (b) Loosen the pipe clamp bolt and nut, and disconnect the clamp.
- (c) Disconnect the exhaust pipe from the manifold and remove the gasket.

**11. REMOVE TURBOCHARGER STAY****12. DISCONNECT TURBO OIL PIPE**

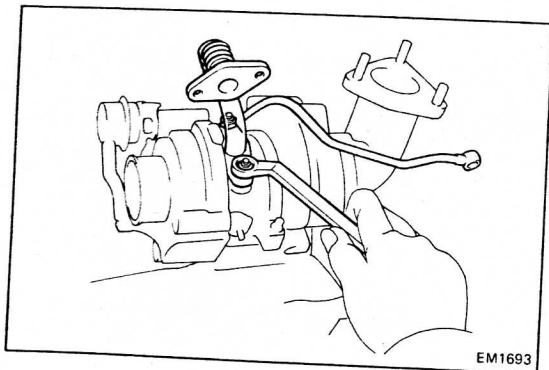
- (a) Remove the union bolt and two gaskets.
- (b) Remove the two nuts from the flange of the oil pipe.

**13. REMOVE TURBOCHARGER WITH EXHAUST MANIFOLD**

Remove the nine nuts holding the cylinder head and exhaust manifold, and remove the turbocharger with the exhaust manifold and gaskets.

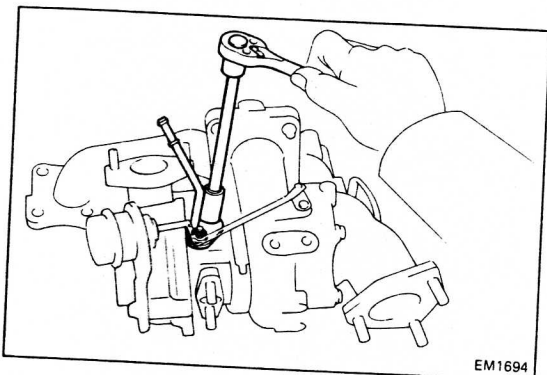
**14. REMOVE NO.2 TURBO WATER PIPE**

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



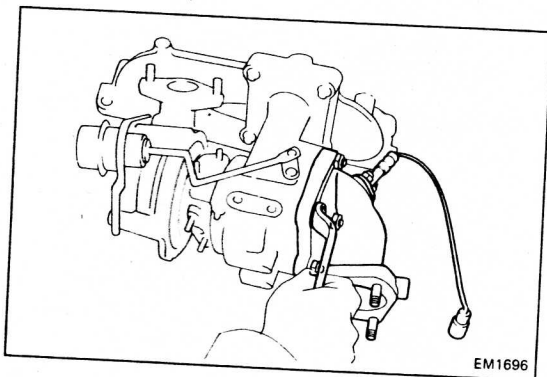
15. REMOVE TURBO OIL PIPE

Remove the two nuts, oil pipe and gasket.



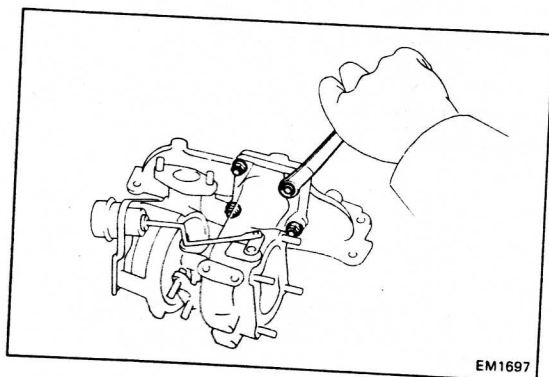
16. REMOVE NO. 1 TURBO WATER PIPE

Remove the two nuts, water pipe and gasket.



17. REMOVE TURBINE OUTLET ELBOW

Remove the four nuts, turbine outlet elbow (with the oxygen sensor) and gasket.



18. REMOVE EXHAUST MANIFOLD

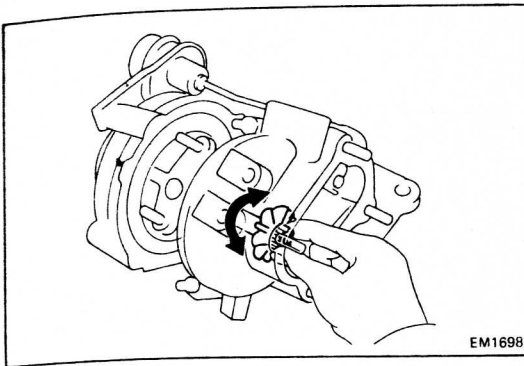
Remove the four nuts, exhaust manifold and gasket.

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.



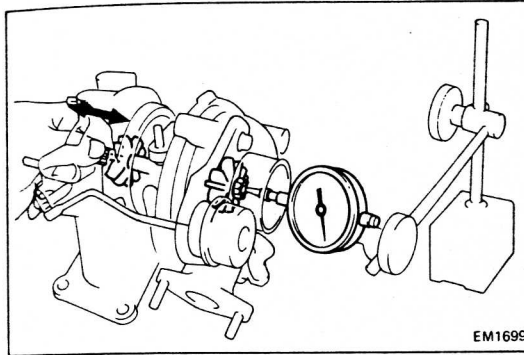
EM1698

2. INSPECT AXIAL PLAY OF SHAFT BEARING

Insert a dial gauge into the intake side, hold the turbine wheel edge by hand and check the axial play.

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

If not within specification, replace the turbocharger assembly.

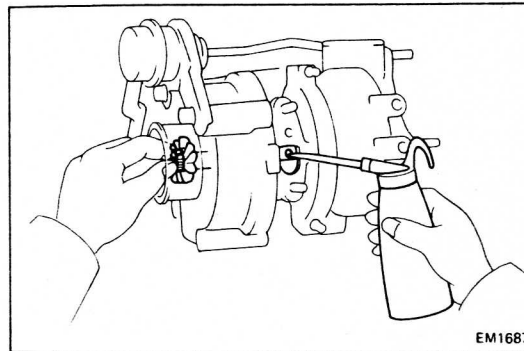


EM1699

INSTALLATION OF TURBOCHARGER

(See page EM-17)

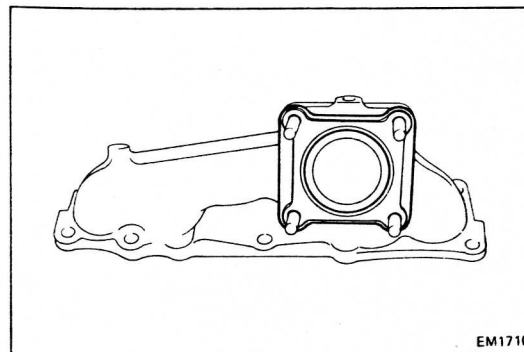
CAUTION: After replacing the turbocharger assembly, pour approx. 20 cc (1.2 cu in.) of new oil into the oil inlet and turn the impeller wheel by hand to splash oil on the bearing.



EM1687

1. INSTALL EXHAUST MANIFOLD

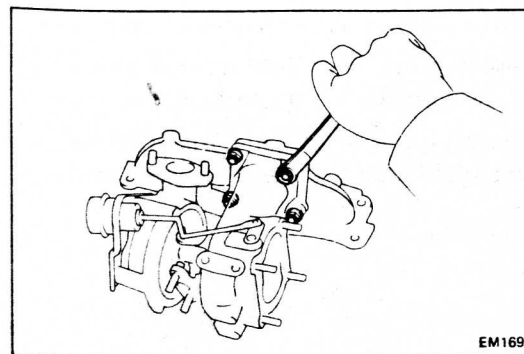
(a) Place a new gasket on the manifold with the groove of the gasket facing upward (turbocharger side).



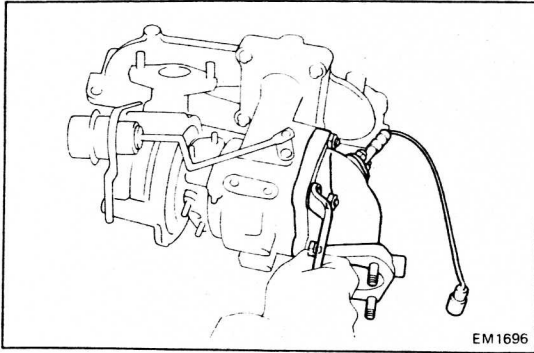
EM1710

(b) Install the exhaust manifold with the four nuts.

Torque: 400 kg-cm (29 ft-lb, 39 N·m)



EM1697

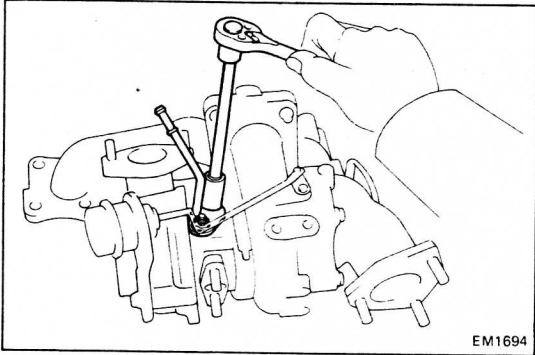


EM1696

2. INSTALL TURBINE OUTLET ELBOW

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

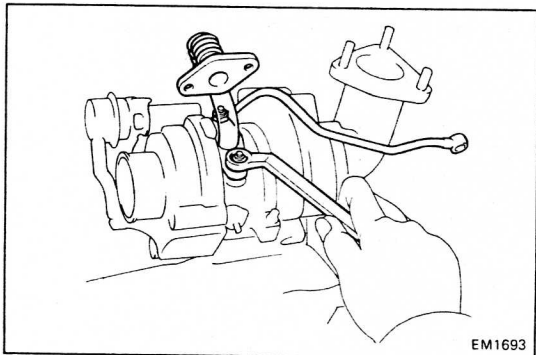
Torque: 260 kg-cm (19 ft-lb, 25 N·m)



EM1694

3. INSTALL NO.1 TURBO WATER PIPE

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

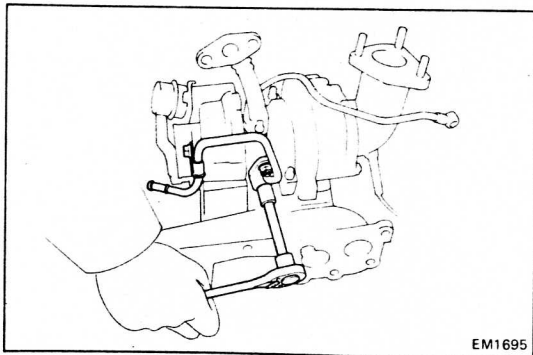


EM1693

4. INSTALL TURBO OIL PIPE

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

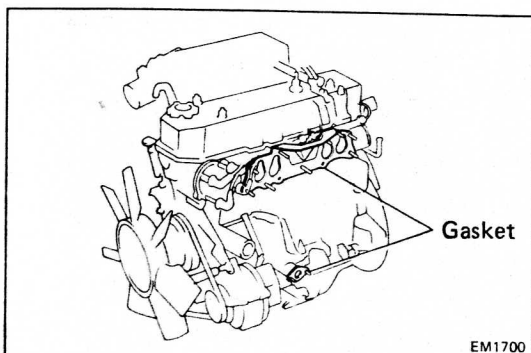
Torque: 195 kg-cm (14 ft-lb, 19 N·m)



EM1695

5. INSTALL NO.2 TURBO WATER PIPE

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



EM1700

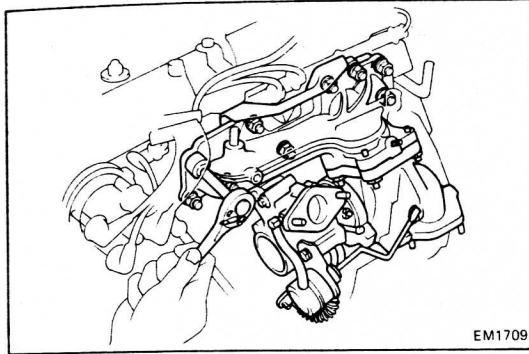
6. INSTALL TURBOCHARGER WITH EXHAUST MANIFOLD

- (a) Position a new exhaust manifold gasket and a new turbocharger oil pipe flange gasket on the engine.
- (b) Place the turbocharger with exhaust manifold through the exhaust manifold stud bolts and oil pipe stud bolts.

- (c) Temporarily install the nine nuts holding the cylinder head and exhaust manifold.
- (d) Temporarily install the oil pipe flange nuts.
- (e) Temporarily install the union bolt with two new gaskets.

- (f) Torque the exhaust manifold mounting nuts.

Torque: 450 kg-cm (33 ft-lb, 44 N·m)

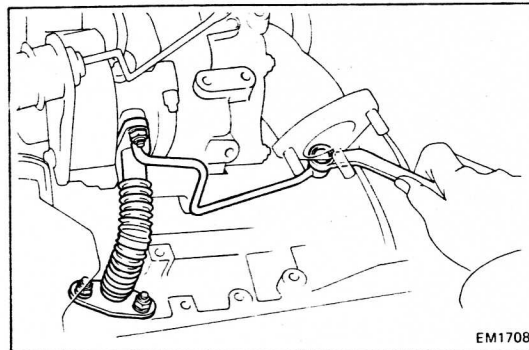


EM1709

- (g) Torque the oil pipe union bolt and flange mounting nuts.

Torque: Bolt 280 kg-cm (20 ft-lb, 27 N·m)

Nut 195 kg-cm (14 ft-lb, 19 N·m)



EM1708

7. INSTALL TURBOCHARGER STAY

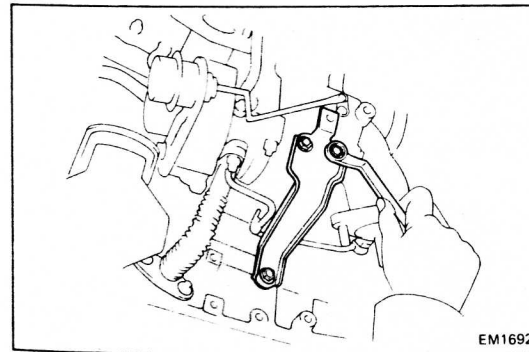
Torque:

Turbocharger to stay

195 kg-cm (14 ft-lb, 19 N·m)

Cylinder block to stay

400 kg-cm (29 ft-lb, 39 N·m)



EM1692

8. CONNECT EXHAUST PIPE TO TURBINE OUTLET ELBOW

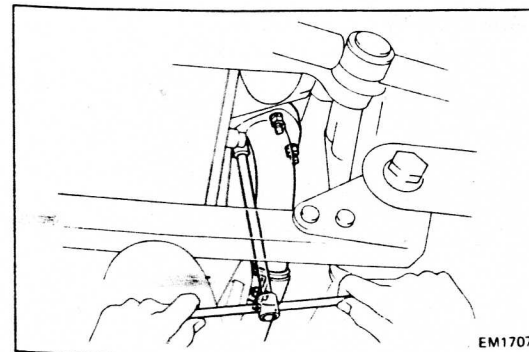
- (a) Place a new gasket on the exhaust pipe.

- (b) Connect the exhaust pipe and torque new flange nuts.

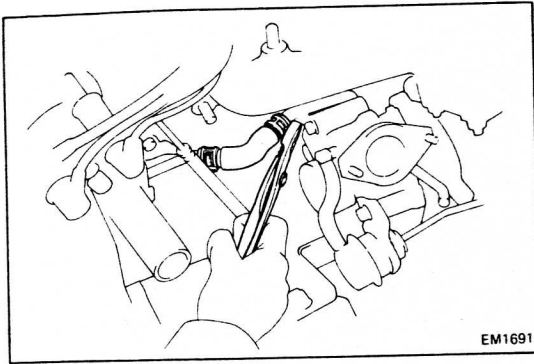
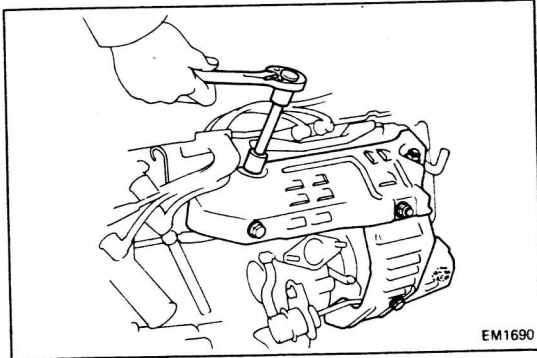
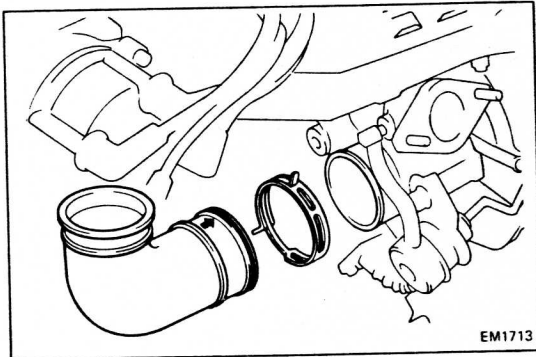
Torque: 440 kg-cm (32 ft-lb, 43 N·m)

- (c) Connect the clamp and tighten the bolt and nut.

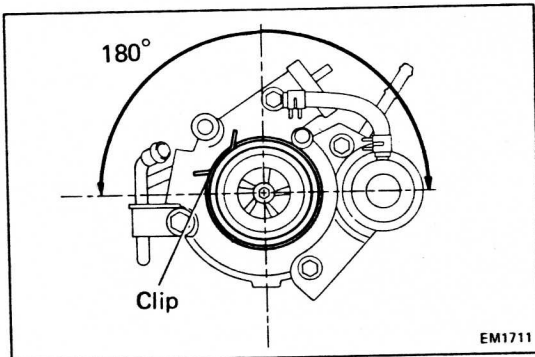
9. LOWER VEHICLE



EM1707

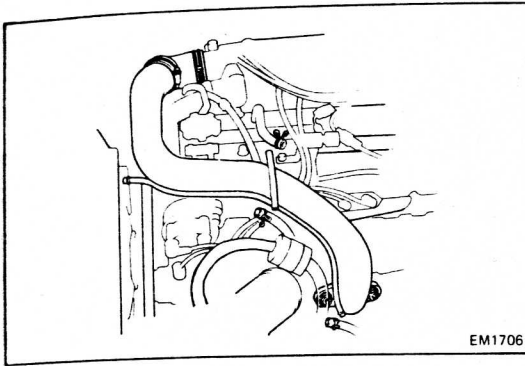
**10. CONNECT NO.3 TURBO WATER HOSE****11. INSTALL TURBO AND EXHAUST MANIFOLD HEAT INSULATORS****12. INSTALL NO.2 AIR CLEANER HOSE**

Install the No.2 air cleaner hose with the arrow facing the turbocharger side as shown in the figure, and fasten with the clip.



NOTE: Fasten the clip as shown.

13. INSTALL NO. 1 AIR CLEANER HOSE ASSEMBLY

**14. INSTALL AIR TUBE ASSEMBLY**

- (a) Install the air tube assembly with the two nuts and clamp.
- (b) Connect the No. 1 and No. 2 turbo water hoses.
- (c) Connect the No.2 and No.3 PCV hoses.

15. CONNECT OXYGEN SENSOR CONNECTOR AND CLAMP**16. FILL ENGINE WITH COOLANT****17. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY****18. START ENGINE AND CHECK FOR LEAKS**