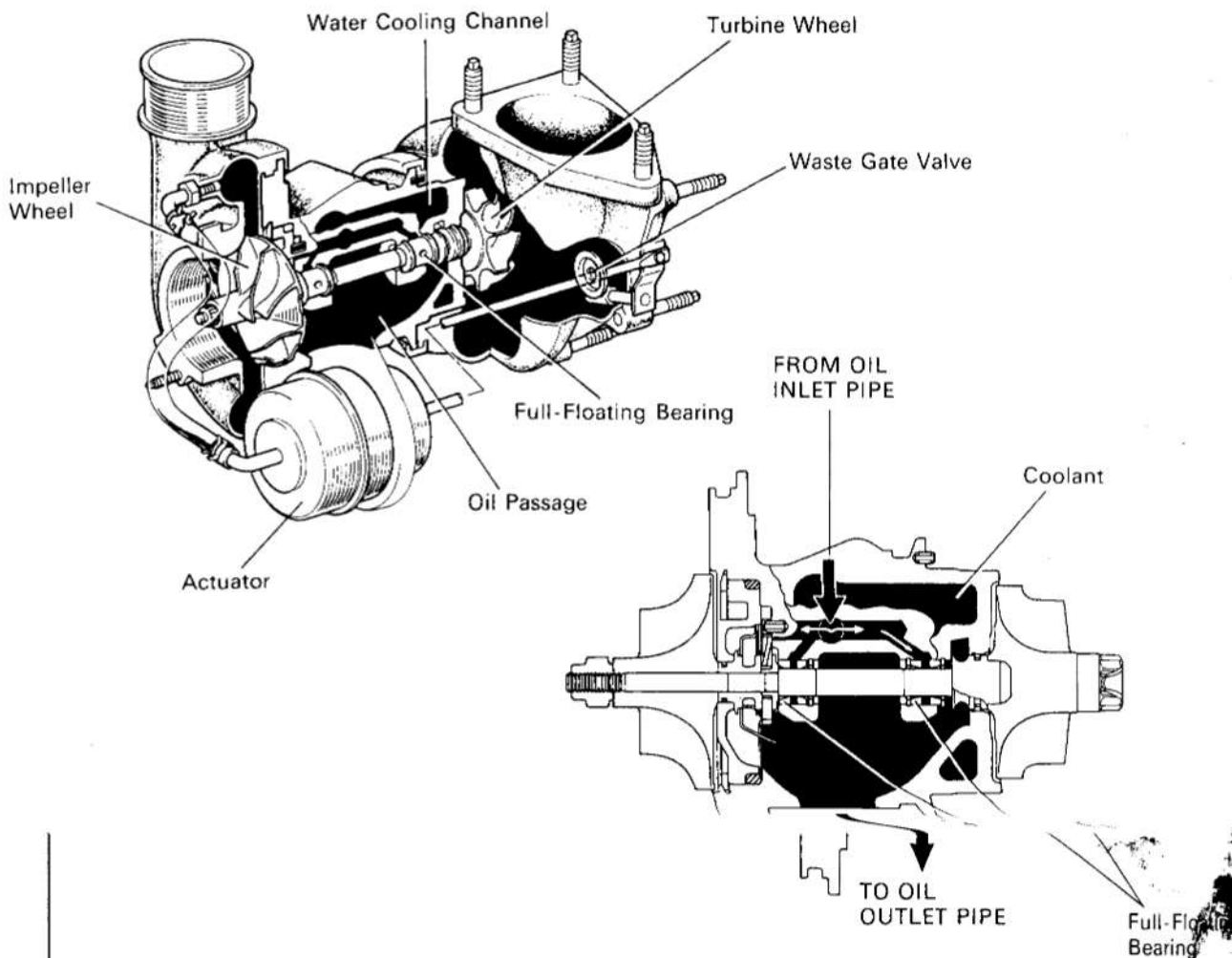


# TURBOCHARGER SYSTEM

## DESCRIPTION

EGOWW-02

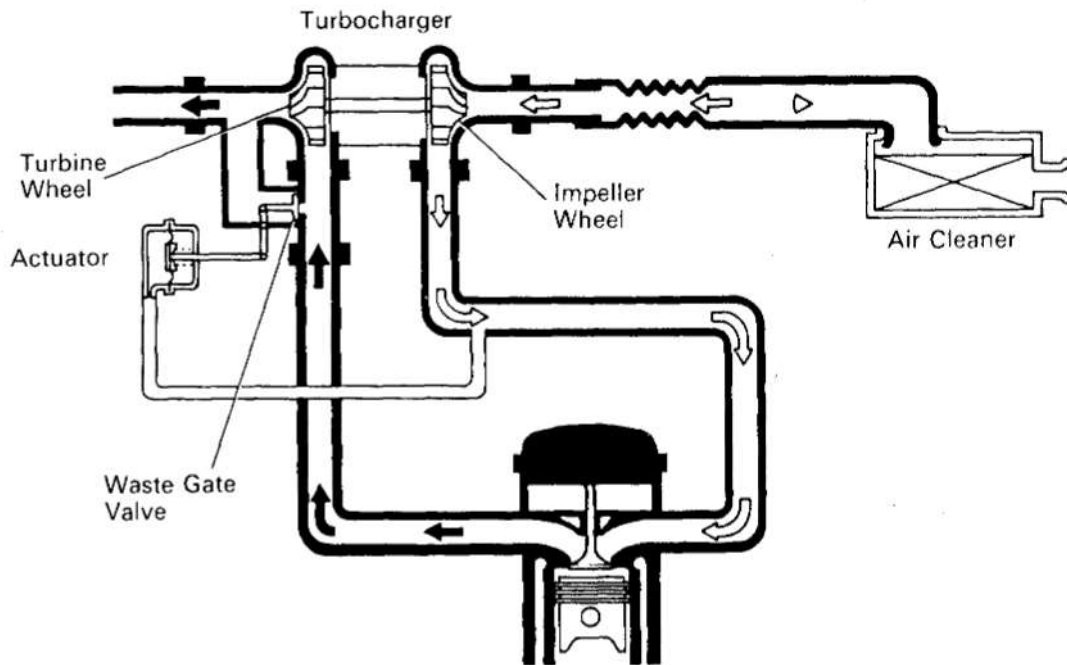


P13125  
P13126

The compact, advanced design uses lightweight high performance materials through optimum turbocharging efficiency.

The turbocharger has been designed to withstand the high operating temperatures (800°F) from the exhaust gasses, and the very high operating speeds required for this application. Primary cooling and lubrication of the turbocharger is provided by the engine oil. Additional cooling is provided by the engine coolant.

## OPERATION



EGOWX-08

T00002

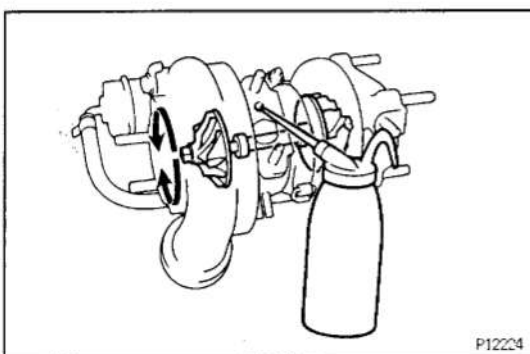
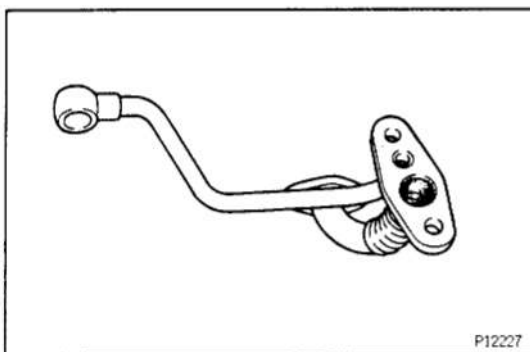
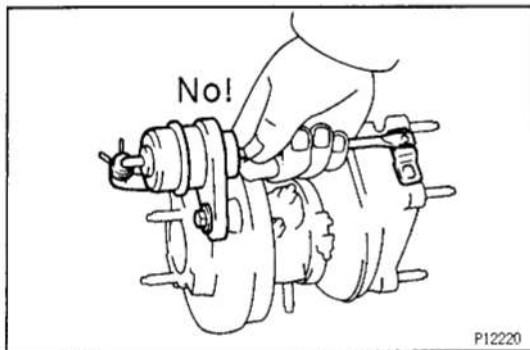
Exhaust gas acts on the turbine wheel inside the turbine housing, causing it to revolve. When the turbine wheel revolves, the impeller which is located on the same shaft also revolves, compressing the intake air which has passed through the air cleaner. When expelled from the compressor housing the compressed 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—120,000 rpm), thus the turbocharged air pressure grows greater and engine output increases.

**Waste Gate Valve**

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.

## PRECAUTION

1. Do not stop the engine immediately after pulling a trailer or after high speed or uphill driving. Idle the engine for 20 — 120 seconds, depending on how hard the vehicle has been driven.
2. Avoid sudden acceleration or racing immediately after starting a cold engine.
3. Do not run the engine with air cleaner removed, as this may cause foreign material to enter and damage the impeller wheel operating at high speed.
4. If a turbocharger is found to be defective and must be replaced, check for the cause, and repair or replace the following items as 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. When replacing bolt or nuts, use only authorized replacement parts to prevent breakage or deformation.
10. If replacing the turbocharger, put 20 cm<sup>3</sup> (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

HINT: Before troubleshooting the turbocharger, first check the engine itself. (Valve clearance, engine compression, ignition timing etc.) EGOWZ-02

### 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 EG-130)  
**Turbocharging pressure:**  
**57 – 67 kPa**  
**(0.52 – 0.68 kgf/cm<sup>2</sup>, 7.4 – 9.7 psi)**  
 If the 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 EG-130)

3. LEAK IN INTAKE AIR SYSTEM

Check intake air system, and repair or replace parts as necessary. (See page EG-130)

4. RESTRICTED EXHAUST SYSTEM

Check exhaust system, and repair or replace parts as necessary. (See page EG-130)

5. LEAK IN EXHAUST SYSTEM

Check exhaust system, and repair or replace parts as necessary. (See page EG-130)

6. ERRATIC TURBOCHARGER OPERATION

Check rotation of impeller wheel. If it does not turn on turns with a heavy drag, replace the turbocharger assembly.  
 Check axial and radial plays of impeller wheel. (See page EG-135)  
**Maximum axial play: 0.162 mm (0.0064 in.)**  
**Maximum radial play: 0.173 mm (0.0068 in.)**  
 If not within specification, replace the turbocharger assembly.

**ABNORMAL NOISE**

(Possible Cause)

(Check Procedure and Correction Method)

1. **TURBOCHARGING HEAT INSULATOR RESONANCE**

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

2. **EXHAUST PIPE LEAKING OR VIBRATING**

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

3. **ERRATIC TURBOCHARGER OPERATION**

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

**EXCESSIVE OIL CONSUMPTION OR WHITE EXHAUST**

(Possible Cause)

(Check Procedure and Correction Method)

**FAULTY TURBOCHARGER SEAL**

Check for oil leakage in exhaust system.

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

Check for oil leakage in intake air system.

- Check for axial and radial plays in impeller wheel, and replace the turbocharger if necessary.

(See page EG-135)

**Maximum axial play: 0.173 mm (0.0068 in.)**

**Maximum radial play: 0.110 mm (0.0045 in.)**

**NOTICE: Some oil mist in the blowby from the PCV is normal.**

**Do not mistake it for an oil leak from the turbocharger.**

## TURBOCHARGER ON — VEHICLE INSPECTION

EGM-X-01

### 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 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. CHECK TURBOCHARGING PRESSURE

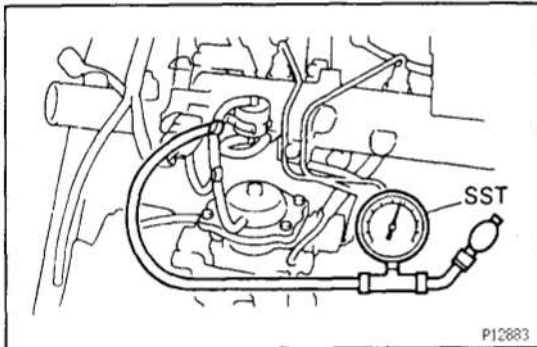
- (a) Warm up engine.
- (b) Using a 3-way connector, connect SST, a turbocharger pressure gauge, to the hose between the intake manifold and manifold absolute pressure sensor. SST 09992-00241
- (c) Press in the clutch pedal, then press the accelerator pedal down as far as it will go. Measure the turbocharging pressure at maximum speed (4,600 rpm).

**Standard pressure:**

**51 — 67 kPa (0.52 — 0.68 kgf/cm<sup>2</sup>, 7.4 — 9.7 psi)**

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

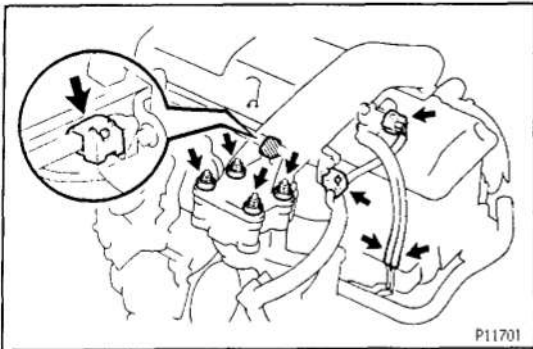
If the pressure is above specification, check if the actuator hose is disconnected or cracked. If not, replace the turbocharger assembly.



P12883







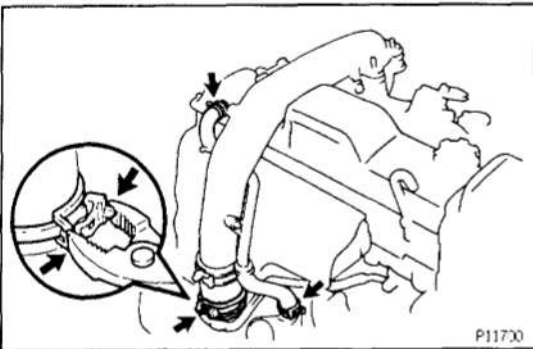
## TURBOCHARGER REMOVAL

(See Components for removal and installation)

### 1. DRAIN ENGINE COOLANT

### 2. REMOVE INTAKE PIPE

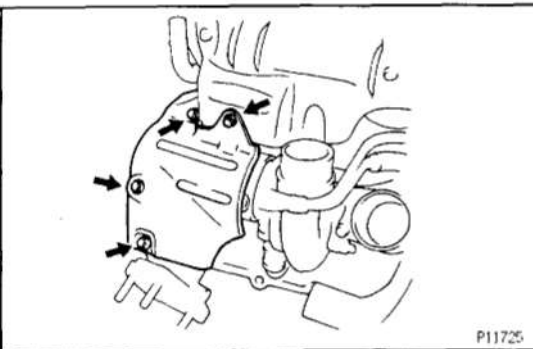
- (a) Disconnect the VSV connector and 2 vacuum hoses.
- (b) Disconnect the 2 wire harness clamps.
- (c) Remove the 4 nuts and seal washers.



- (d) Disconnect the 2 PCV hoses.
- (e) Use pliers to pinch the ends of the clamp together until the lock plate engages the catch.

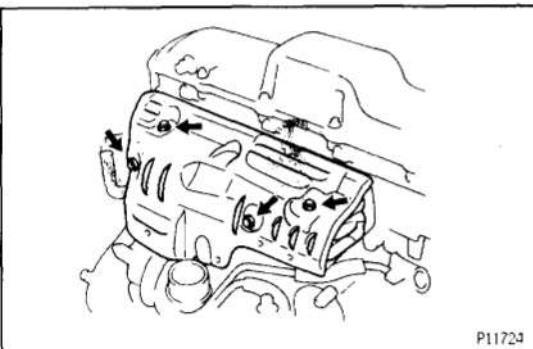
**NOTICE:** Make sure the lock plate and catch are engaged securely.

- (f) Remove the intake pipe and gasket.



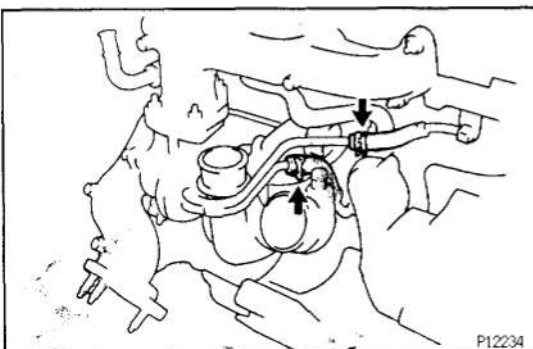
### 3. REMOVE TURBOCHARGER HEAT INSULATOR

Remove the 4 bolts and heat insulator.



### 4. REMOVE EXHAUST MANIFOLD HEAT INSULATOR

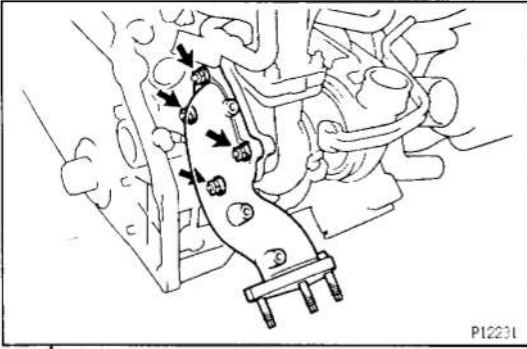
Remove the 4 bolts and heat insulator.



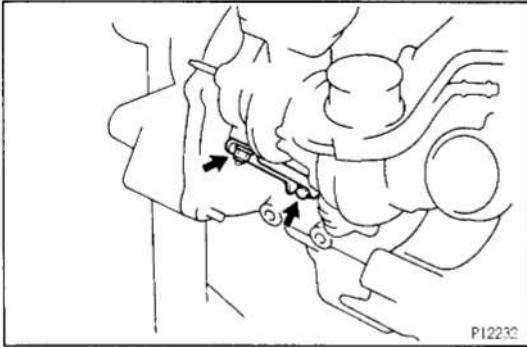
### 5. DISCONNECT WATER BY PASS HOSES

Disconnect the 2 water by pass hoses from the No.1 turbo water pipe.

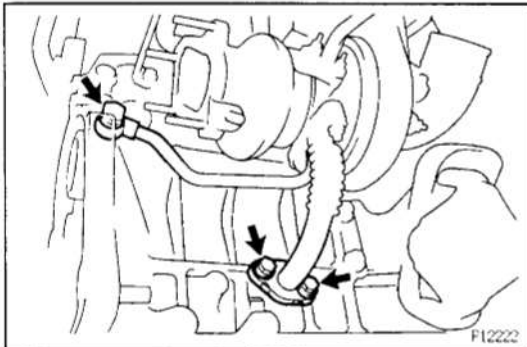


**6. REMOVE TURBINE OUTLET ELBOW**

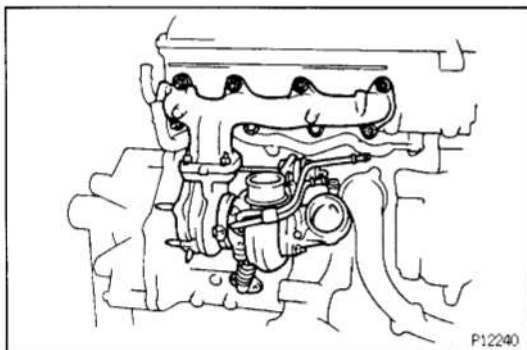
Remove the 4 nuts, turbine outlet elbow and gasket.

**7. REMOVE TURBOCHARGER STAY**

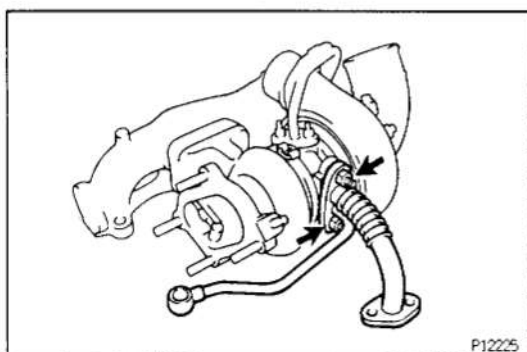
Remove the bolt, nut and turbocharger stay.

**8. REMOVE TURBOCHARGER AND EXHAUST MANIFOLD**

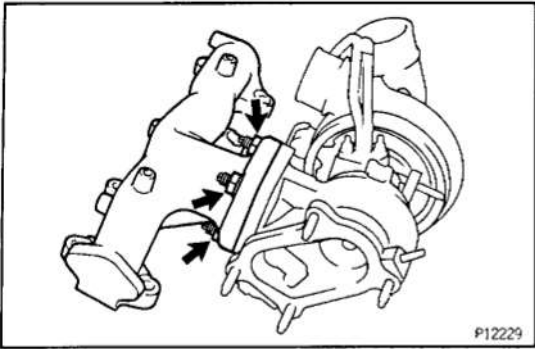
(a) Remove the 2 bolts and union bolt from the turbo oil pipe.



(b) Remove the 6 nuts, 2 bolts, turbocharger and exhaust manifold assembly and 3 gaskets.

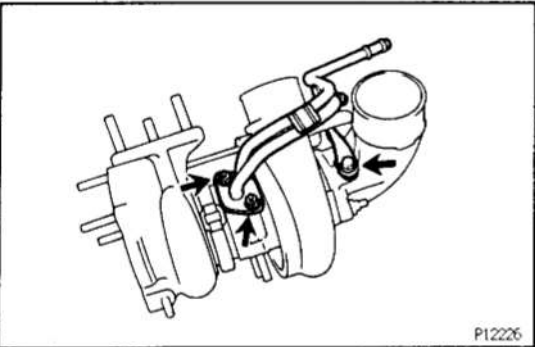
**9. REMOVE TURBO OIL PIPE**

Remove the 2 nuts, oil pipe and gasket.



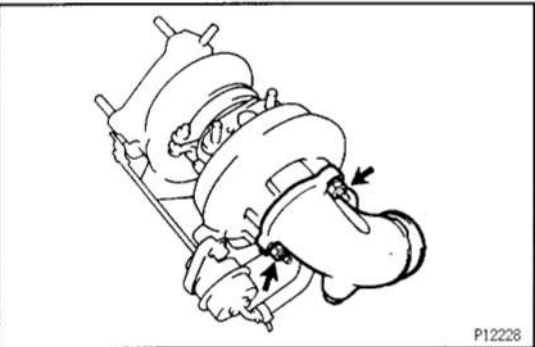
**10. REMOVE EXHAUST MANIFOLD FROM TURBOCHARGER**

Remove the 3 nuts, exhaust manifold and gasket.



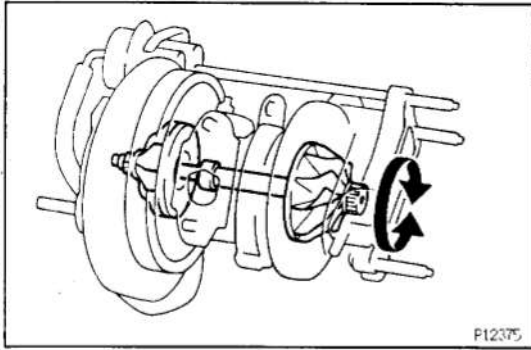
**11. REMOVE TURBO WATER PIPE**

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



**12. REMOVE TURBINE AIR INLET ELBOW**

Remove the 2 nuts, inlet elbow and gasket.

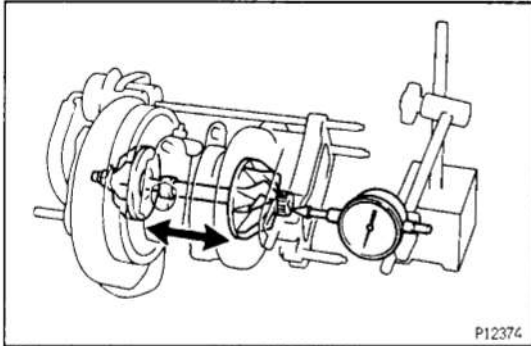
**TURBOCHARGER INSPECTION**

P12375

**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 heavy drag, replace the turbocharger assembly.



P12374

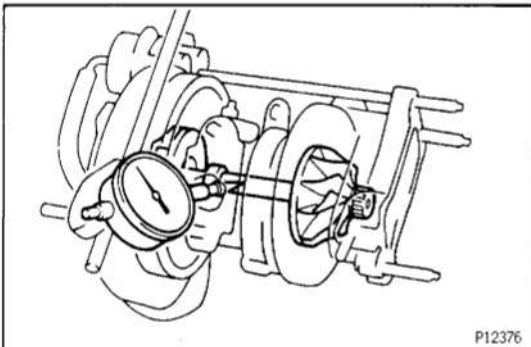
**2. INSPECT AXIAL PLAY OF IMPELLER WHEEL**

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

**Maximum oil clearance:**

**0.173 mm (0.0068 in.)**

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



P12376

**3. INSPECT RADIAL PLAY OF IMPELLER WHEEL**

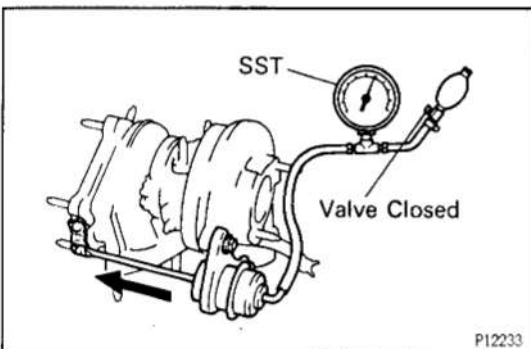
(a) From oil outlet hole, insert a dial indicator and set it in the center of the impeller shaft.

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

**Maximum oil clearance:**

**0.110 mm (0.0045 in.)**

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



P12233

**4. INSPECT ACTUATOR OPERATION**

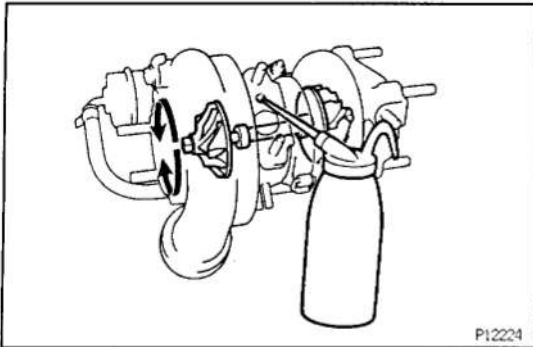
(a) Disconnect the actuator hose.

(b) Using SST, apply approx. 116 kPa (1.18 kgf/cm<sup>2</sup>, 16.7 psi) of pressure to the actuator and check that the rod moves.

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

SST 09992-00241

**NOTICE:** Never apply more than 127 kPa (1.30 kgf/cm<sup>2</sup>, 18.5 psi) of pressure to the actuator.

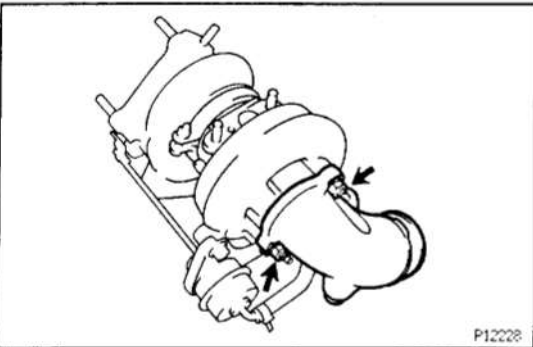


P12224

## TURBOCHARGER INSTALLATION

(See Components for removal and installation)

**NOTICE:** After replacing the turbocharger assembly, pour approx. 20 cm<sup>3</sup> (1.2 cu in.) of fresh oil into the oil inlet and turn the impeller wheel by hand to splash oil on the bearing.

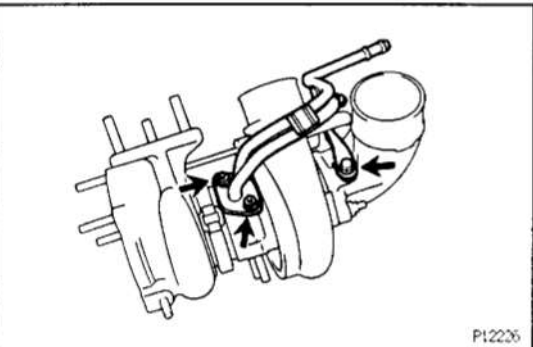


P12228

### 1. INSTALL TURBINE AIR INLET ELBOW

Install a new gasket and the inlet elbow with the 2 nuts.

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



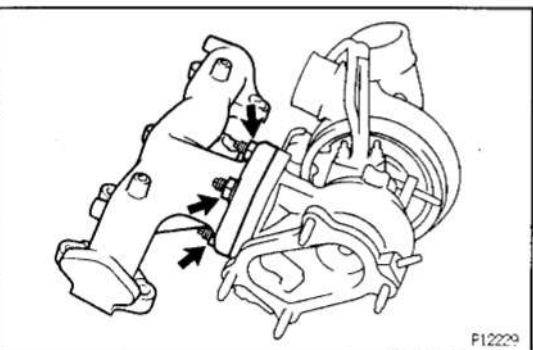
P12235

### 2. INSTALL TURBO WATER PIPE

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

Torque: 12 N·m (120 kgf·cm, 9 ft·lbf) for Nut

Torque: 8 N·m (80 kgf·cm, 69 in·lbf) for Bolt

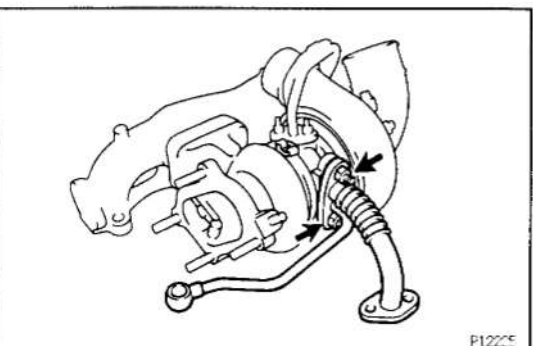


P12229

### 3. INSTALL EXHAUST MANIFOLD TO TURBOCHARGER

Install a new gasket and the exhaust manifold with the 3 nuts.

Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

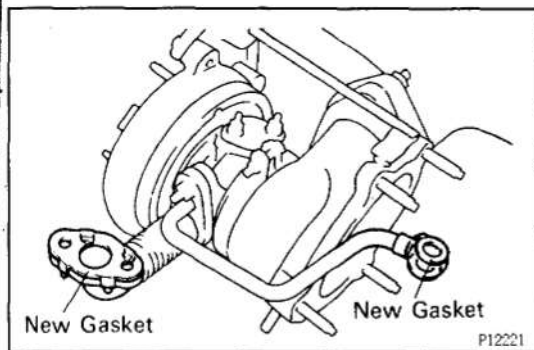


P12225

### 4. INSTALL TURBO OIL PIPE

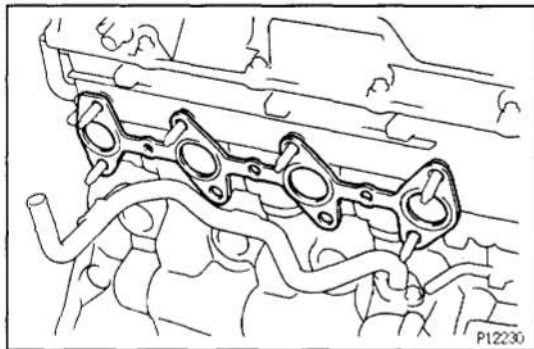
Install a new gasket and oil pipe with the 2 nuts.

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

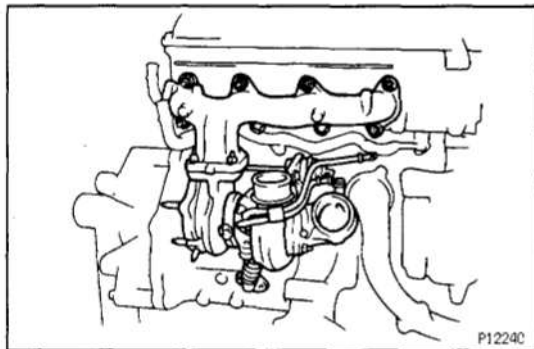


## 5. INSTALL TURBOCHARGER AND EXHAUST MANIFOLD ASSEMBLY

- (a) Install 2 new gasket to the turbo oil pipe.

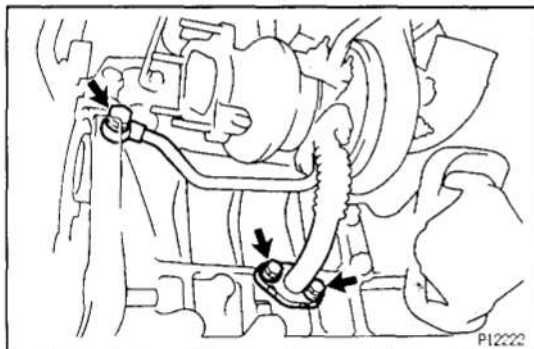


- (b) Install a new gasket to the cylinder head.



- (c) Tighten the 6 nuts and 2 bolts holding the exhaust manifold to the cylinder head.

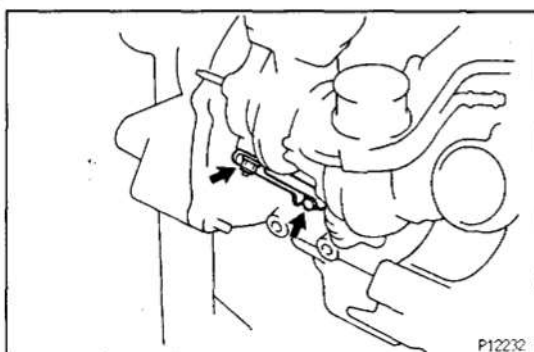
**Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)**



- (e) Tighten the union bolt and 2 bolts holding the oil pipe to the cylinder block.

**Torque: 26 N·m (260 kgf·cm, 19 ft·lbf) for Union bolt**

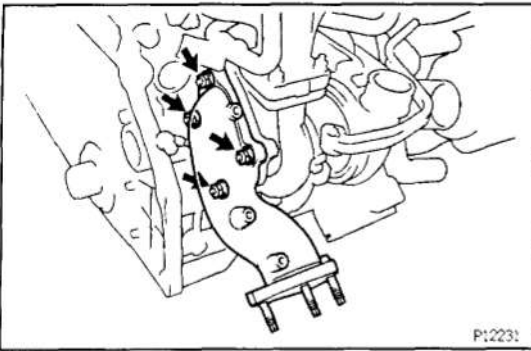
**Torque: 12 N·m (125 kgf·cm, 9 ft·lbf) for Bolt**



## 6. INSTALL TURBOCHARGER STAY

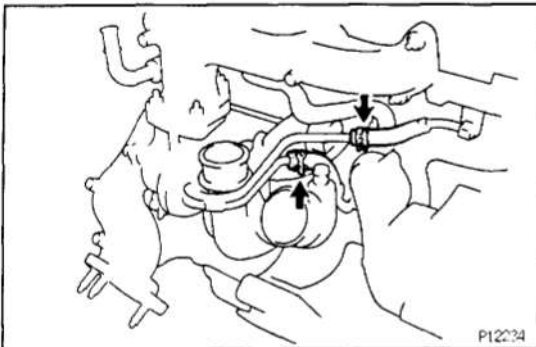
Install the turbocharger stay with the bolt and nut.

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

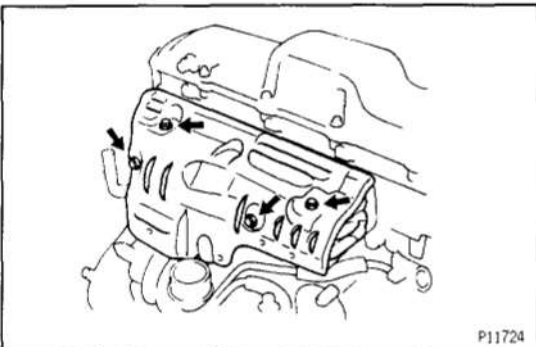
**7. INSTALL TURBINE OUTLET ELBOW**

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

Torque: 39 N·m (390 kgf·cm, 28 ft·lbf)

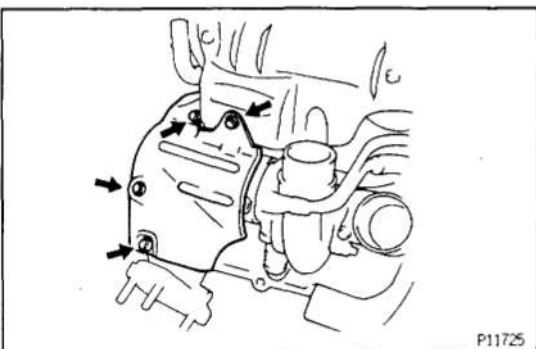
**8. CONNECT WATER BY PASS HOSES**

Connect the 2 water by pass hoses to the No.1 turbo water pipe.

**9. INSTALL EXHAUST MANIFOLD HEAT INSULATOR**

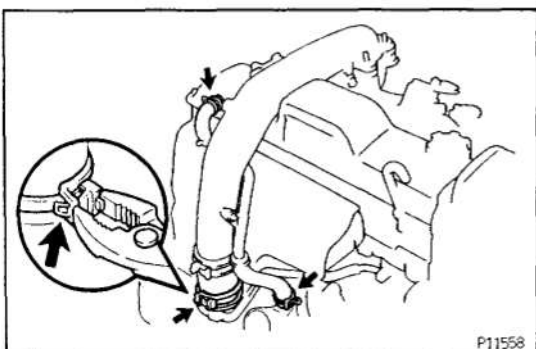
Install the heat insulator with the 4 bolts.

Torque: 8 N·m (80 kgf·cm, 69 in·lbf)

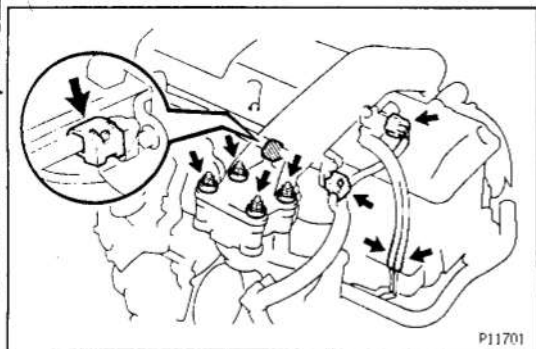
**10. INSTALL TURBOCHARGER HEAT INSULATOR**

Install the heat insulator with the 4 bolts.

Torque: 8 N·m (80 kgf·cm, 69 in·lbf)

**11. INSTALL INTAKE PIPE**

- (a) Place a new gasket on the intake manifold.
- (b) Connect the air hose and install the intake pipe.
- (c) Press the clamp lock together with pliers and press down the tip of the lock plate. Carefully let the lock spread apart.  
**NOTICE:** Take care not to let the pliers slip.
- (d) Connect the 2 PCV hoses.

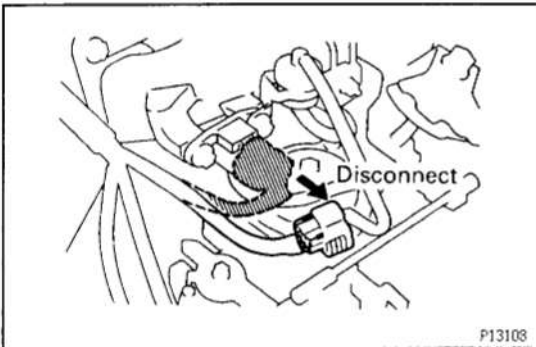
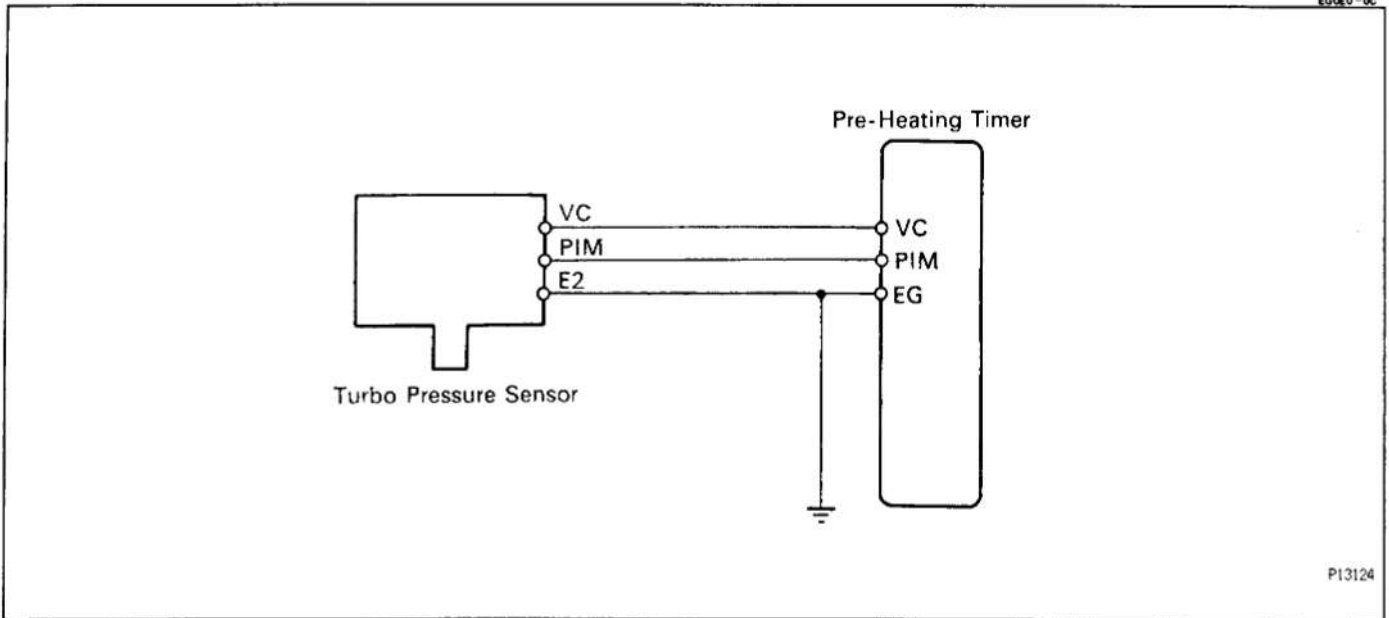


- (e) Install the 4 seal washers and nuts.  
**Torque: 11 N·m (120 kgf·cm, 9 ft·lbf)**
- (f) Connect the 2 wire harness clamps.
- (g) Connect the VSV connector and 2 vacuum hoses.

- 12. **FILL WITH ENGINE COOLANT**
- 13. **START ENGINE AND CHECK FOR LEAKS**
- 14. **CHECK ENGINE OIL LEVEL**



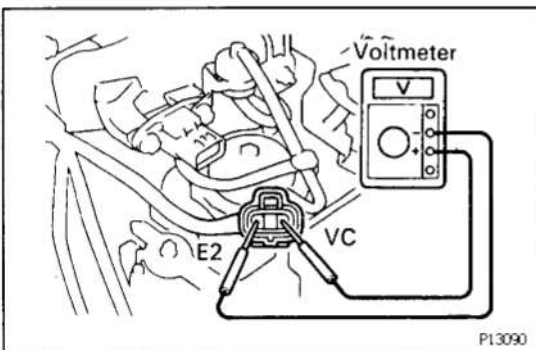
## TURBO PRESSURE SENSOR



### TURBO PRESSURE SENSOR INSPECTION <sup>EG381-01</sup>

#### 1. INSPECT POWER SOURCE VOLTAGE OF TURBO PRESSURE SENSOR

- (a) Disconnect the pressure sensor connector.
- (b) Turn the ignition switch ON.

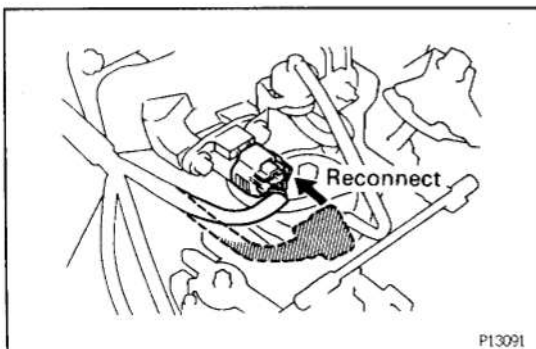


- (c) Using a voltmeter, measure the voltage between connector terminals VC and E2 of the wiring harness side.

**Voltage:**

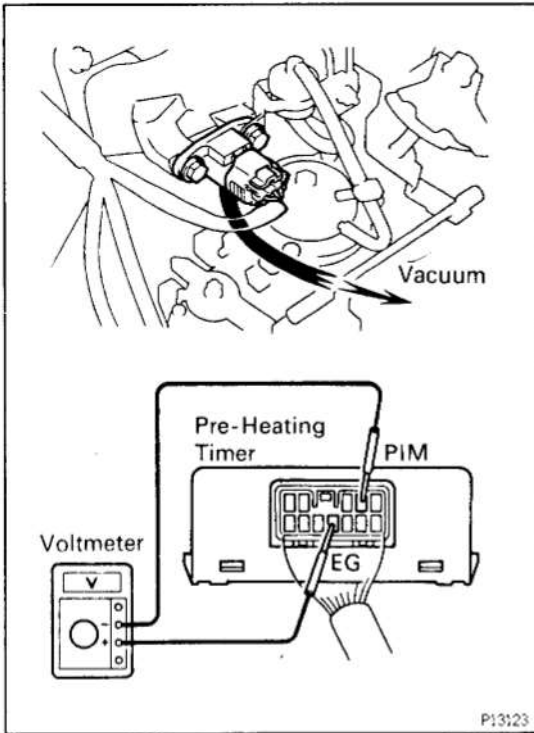
**4.75 – 5.25 V**

- (d) Turn the ignition switch OFF.
- (e) Reconnect the pressure sensor connector.



#### 2. INSPECT SUPPLY POWER OF TURBO PRESSURE SENSOR CONNECTOR

- (a) Turn the ignition switch ON.



- (b) Disconnect the vacuum hose on the intake manifold side.
- (c) Connect a voltmeter to terminals PIM and EG of the pre-heating timer, and measure the output voltage under ambient atmospheric pressure.
- (d) Apply vacuum to the turbo pressure sensor in 13.3 kPa (100 mmHg, 3.94 in.Hg) segments to 66.7 kPa (500 mmHg, 19.69 in.Hg).
- (e) Measure the voltage drop from step (c) above for each segment.

**Voltage drop:**

Applied Vacuum kPa (mmHg) (in.Hg.)	13.3 (100) (3.94)	26.7 (200) (7.87)	40.0 (300) (11.81)	53.3 (400) (15.75)	66.7 (500) (19.69)
Voltage drop V	0.15 – 0.35	0.4 – 0.6	0.65 – 0.85	0.9 – 1.1	1.15 – 1.35

## SERVICE SPECIFICATIONS

### SERVICE DATA

EGOXE-02

Turbocharger	Turbocharging pressure		51 — 67 kPa (0.52 — 0.68 kgf/cm <sup>2</sup> , 7.4 — 9.7 psi)
	Impeller wheel axial play	Maximum	0.173 mm (0.0068 in.)
	Impeller wheel radial play	Maximum	0.110 mm (0.0045 in.)
Turbocharger pressure sensor	Voltage		4.75 — 5.25 V

## TORQUE SPECIFICATIONS

EGOXE-02

Part tightened		N·m	kgf·cm	ft·lbf
Turbine inlet elbow x Turbocharger		19	195	14
Turbo water pipe x Turbocharger	Nut	12	120	9
	Bolt	8	80	69 in·lbf
Turbocharger x Exhaust manifold		52	530	38
Oil pipe x Turbocharger		19	195	14
Exhaust manifold x Cylinder block		52	530	38
Oil pipe x Cylinder block	Union bolt	26	260	19
	Bolt	12	125	12
Turbocharger stay x Turbocharger		19	195	14
Turbocharger stay x Cylinder block		19	195	14
Turbine outlet elbow x Turbocharger		39	390	28
Exhaust manifold heat insulator x Exhaust manifold		8	80	69 in·lbf
Turbocharger heat insulator x Turbocharger		8	80	69 in·lbf
Intake pipe x Intake manifold		11	120	9

