

# **N - REMOVE/INSTALL/OVERHAUL**

## **1998 Toyota Supra**

1998 ENGINE PERFORMANCE

Toyota - Removal, Overhaul & Installation - 6-Cylinder

Supra

### **INTRODUCTION**

#### **\* PLEASE READ FIRST \***

**CAUTION:** When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

Removal, overhaul and installation procedures are covered in this article. If component removal and installation is primarily an unbolt and bolt-on procedure, only a torque specification may be furnished.

### **VARIABLE VALVE TIMING (VVT) SYSTEM**

**NOTE:** Intake camshaft sprocket may also be referred to as VVT controller. Oil control valve may also be referred to as OCV or camshaft timing oil control valve. For servicing of intake camshaft sprocket or VVT controller, see appropriate article in ENGINE MECHANICAL section. For servicing of oil control valve, see OIL CONTROL VALVE under ENGINE SENSORS, SWITCHES & VALVES.

### **COMPUTERIZED ENGINE CONTROLS**

#### **ENGINE CONTROL MODULE (ECM)**

Removal & Installation (Non-Turbo)

1) The ECM is located below passenger's side of instrument panel, underneath carpet on the floor, just below the glove box. Ensure ignition is off. Disconnect negative battery cable.

2) Remove passenger's side door scuff plate. Remove carpet below instrument panel on passenger's side for access to ECM protector and ECM. Remove nuts, ECM protector and ECM. Disconnect electrical connectors and remove ECM. To install, reverse removal procedure.

Removal & Installation (Turbo)

1) The ECM is located below passenger's side of instrument panel, underneath carpet on the floor, just below the glove box. Ensure ignition is off. Disconnect negative battery cable.

2) Remove passenger's side door scuff plate. Remove carpet below instrument panel on passenger's side for access to ECM protector and ECM. Remove nuts, ECM protector and ECM. Fully loosen bolt and disconnect electrical connectors from ECM.

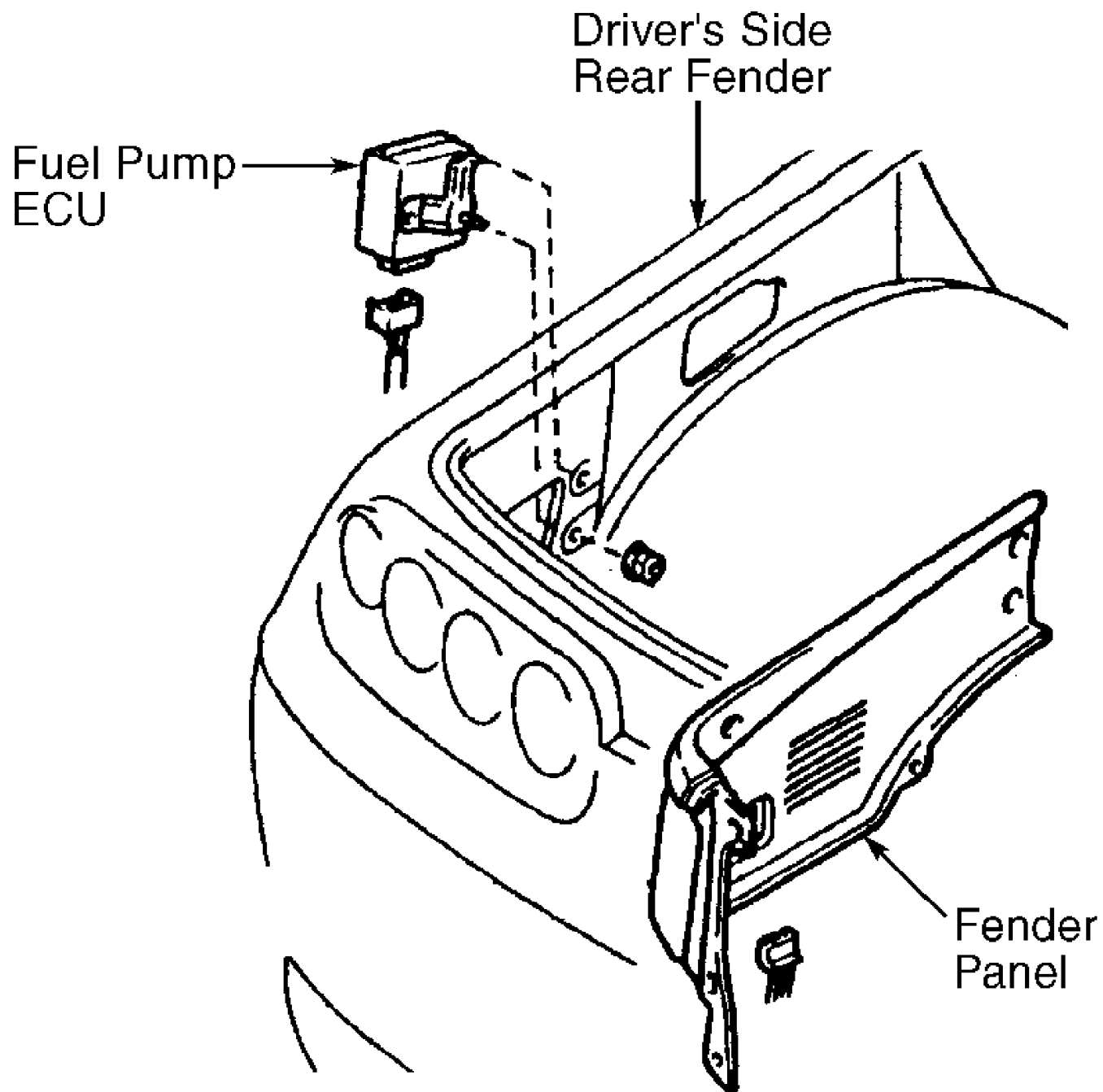
3) To install, reverse removal procedure. Ensure electrical connectors are fully seated on ECM after bolt is tightened.

#### **FUEL PUMP ELECTRONIC CONTROL UNIT (ECU)**

Removal & Installation

Fuel pump ECU is attached to the driver's side rear fender panel, behind the taillight. See Fig. 1. Remove carpet and necessary panels for access to fuel pump ECU. Remove bolts and fuel pump ECU. To

install, reverse removal procedure.



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Fig. 1: Locating Fuel Pump ECU  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## ENGINE SENSORS, SWITCHES & VALVES

### ACCELERATOR PEDAL POSITION SENSOR

Removal & Installation (Non-Turbo)

For servicing of accelerator pedal position sensor, see THROTTLE BODY under FUEL SYSTEM.

## AIRFLOW METER

NOTE: Airflow meter may be referred to Mass Airflow (MAF) meter.

### Removal & Installation (Non-Turbo)

1) Ensure ignition is off. Disconnect electrical connector at airflow meter. Airflow meter is located at passenger's side front corner of engine compartment, attached to air intake hose near upper cap on air cleaner assembly.

2) Remove airflow meter-to-air intake hose bolts, airflow meter and gasket from air intake hose. To install, reverse removal procedure using NEW gasket. Tighten airflow meter-to-air intake hose bolts to specification. See TORQUE SPECIFICATIONS.

### Removal & Installation (Turbo)

1) Ensure ignition is off. Disconnect electrical connector at airflow meter. Airflow meter is located at passenger's side front corner of engine compartment, between air intake hose and the upper cap on air cleaner assembly.

2) Remove air intake hoses as necessary. Remove airflow meter mounting bolts from side of airflow meter. Remove airflow meter. To install, reverse removal procedure. Tighten airflow meter mounting bolts to specification. See TORQUE SPECIFICATIONS.

## BRAKELIGHT SWITCH

### Removal & Installation

1) Disconnect electrical connector at brakelight switch. Brakelight switch is located near top of brake pedal. Loosen lock nut on brakelight switch. Remove brakelight switch from mounting bracket.

2) Depress brake pedal about .39" (10.0 mm) and hold brake pedal in this position. Install electrical connector on brakelight switch. Install brakelight switch in mounting bracket.

3) Rotate brakelight switch until brakelights go off. Tighten lock nut on brakelight switch. Release brake pedal. Ensure brakelights are off when brake pedal is released and brakelights come on when brake pedal is depressed about .39" (10.0 mm).

## CAMSHAFT POSITION SENSOR

### Removal & Installation

See CAMSHAFT POSITION SENSOR (IGNITION SYSTEM) .

## CRANKSHAFT POSITION SENSOR

### Removal & Installation

See CRANKSHAFT POSITION SENSOR (IGNITION SYSTEM) .

## EGR GAS TEMPERATURE SENSOR

### Removal & Installation (Turbo)

1) Disconnect electrical connector at EGR gas temperature sensor. The EGR gas temperature is screwed into a gas passage, near bottom of EGR valve and contains a Gray 2-pin electrical connector.

2) Remove EGR gas temperature sensor. To install, reverse removal procedure. Tighten EGR gas temperature sensor to specification. See TORQUE SPECIFICATIONS.

## ENGINE COOLANT TEMPERATURE (ECT) SENSOR

#### Removal & Installation

1) Ensure ignition is off. Disconnect electrical connector from ECT sensor. See ENGINE COOLANT TEMPERATURE (ECT) SENSOR LOCATION table.

2) Drain cooling system. Remove ECT sensor and gasket. To install, reverse removal procedure using NEW gasket. Tighten ECT sensor to specification (if available). See TORQUE SPECIFICATIONS. Refill cooling system.

#### ENGINE COOLANT TEMPERATURE (ECT) SENSOR LOCATION TABLE

Model	Location
Non-Turbo .....	Front Sensor On Driver's Side Front Of Cylinder Head, Near Power Steering Pump & Contains Green 2-Pin Electrical Connector With Blue & White/Black Wires
Turbo .....	On Coolant Pipe At Passenger's Side Front Corner Of Cylinder Head & Contains Dark Gray 2-Pin Electrical Connector With Blue/Yellow & White/Black Wires

### HEATED OXYGEN SENSOR

#### Removal (Non-Turbo)

1) Four heated oxygen sensors are used. On front exhaust manifold, one heated oxygen sensor is mounted on exhaust manifold above catalytic converter (bank No. 1 sensor No. 1) and another heated oxygen sensor is mounted on exhaust manifold below catalytic converter (bank No. 1 sensor No. 2). On rear exhaust manifold, one heated oxygen sensor is mounted on exhaust manifold above catalytic converter (bank No. 2 sensor No. 1) and another heated oxygen sensor is mounted on exhaust pipe behind catalytic converter (bank No. 2 sensor No. 2).

2) If removing heated oxygen sensor from front exhaust manifold, remove air cleaner with airflow meter and necessary air intake hoses for access to exhaust manifolds. Disconnect electrical connector for heated oxygen sensor. Unscrew heated oxygen sensor from exhaust manifold.

3) If removing heated oxygen sensor from rear exhaust manifold, it may be necessary to remove exhaust manifolds for access to heated oxygen sensor. Remove exhaust manifolds if necessary. Unscrew heated oxygen sensor from exhaust manifold.

4) If removing heated oxygen sensor from pipe behind catalytic converter, remove driver's side front seat for access to electrical connector for heated oxygen sensor. Electrical connector is located near side of center console, just below emergency brake lever. Disconnect electrical connector for heated oxygen sensor. Unscrew heated oxygen sensor from exhaust pipe.

#### Installation

To install, reverse removal procedure. Tighten heated oxygen sensor to specification. See TORQUE SPECIFICATIONS. If exhaust manifold was removed, use NEW gasket when installing exhaust manifold. Tighten exhaust manifold nuts and exhaust pipe-to-exhaust manifold bolt/nut to specification. See TORQUE SPECIFICATIONS.

#### Removal (Turbo)

1) One heated oxygen sensor is mounted on exhaust gas control valve assembly on rear of turbocharger (bank No. 1 sensor No. 1). Another heated oxygen sensor is located on exhaust pipe in front of rear catalytic converter (bank No. 1 sensor No. 2).

2) If removing heated oxygen sensor from exhaust gas control valve assembly on rear of turbocharger, disconnect electrical connector for heated oxygen sensor. It may be necessary to remove support braces for access to heated oxygen sensor. Remove retaining nuts, heated oxygen sensor and gasket from exhaust gas control valve assembly.

3) If removing heated oxygen sensor from exhaust pipe in front of rear catalytic converter, remove driver's side front seat for access to electrical connector for heated oxygen sensor. Electrical connector is located near side of center console, just below emergency brake lever. Disconnect electrical connector for heated oxygen sensor. Remove retaining nuts, heated oxygen sensor and gasket from exhaust pipe.

#### Installation

To install, reverse removal procedure using NEW gasket. Use NEW retaining nuts when installing heated oxygen sensor on exhaust gas control valve assembly. Tighten retaining nuts to specification. See TORQUE SPECIFICATIONS.

### INTAKE CAMSHAFT SPROCKET OR VVT CONTROLLER

NOTE: Intake camshaft sprocket or VVT controller is used with the Variable Valve Timing (VVT) system.

#### Removal & Installation (Non-Turbo)

For servicing of intake camshaft sprocket or VVT controller, see appropriate article in ENGINE MECHANICAL section.

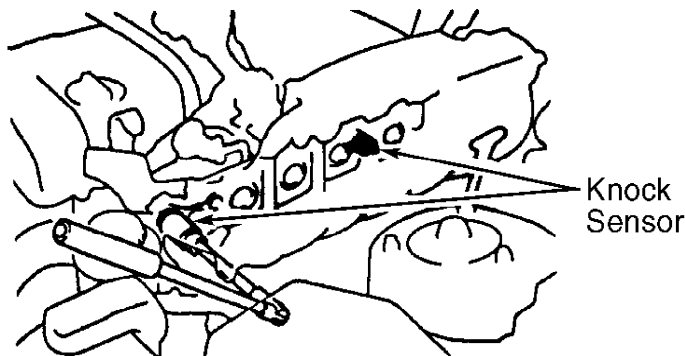
### KNOCK SENSOR

#### Removal & Installation

1) Knock sensors are located on driver's side of cylinder block, just below the cylinder head and intake manifold. See Fig. 2. Knock sensor No. 1 is at the front of cylinder block and knock sensor No. 2 is at the rear of cylinder block.

2) On turbo models, remove throttle body. See THROTTLE BODY under FUEL SYSTEM. On all models, remove starter. Disconnect electrical connector at knock sensor. Using Socket (SST 09816-30010), remove knock sensor from cylinder block.

3) To install, reverse removal procedure. Tighten knock sensor and all bolts to specification. See TORQUE SPECIFICATIONS.



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Fig. 2: Locating Knock Sensors  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

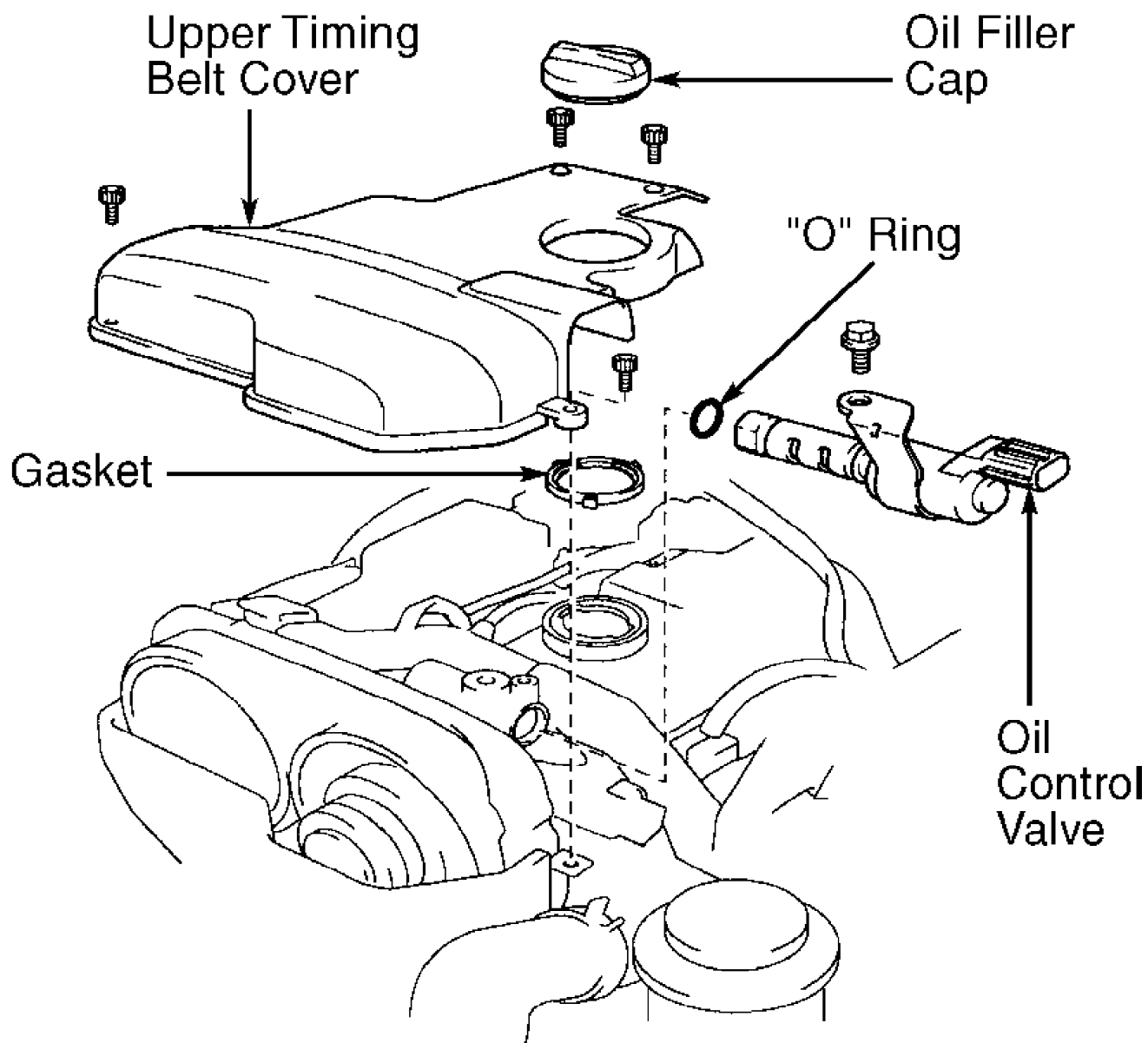
### OIL CONTROL VALVE

NOTE: Oil control valve may also be referred to as OCV or camshaft timing oil control valve. Oil control valve is used with the Variable Valve Timing (VVT) system.

#### Removal & Installation (Non-Turbo)

1) Disconnect electrical connector at oil control valve located on driver's side front corner of valve cover, just in front of oil filler cap. See Fig. 3. Remove bolts, upper timing belt cover and gasket. Remove bolt and oil control valve with "O" ring.

2) To install, reverse removal procedure using NEW "O" ring. Tighten bolts to specification. See TORQUE SPECIFICATIONS.



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Fig. 3: Locating Oil Control Valve (Non-Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

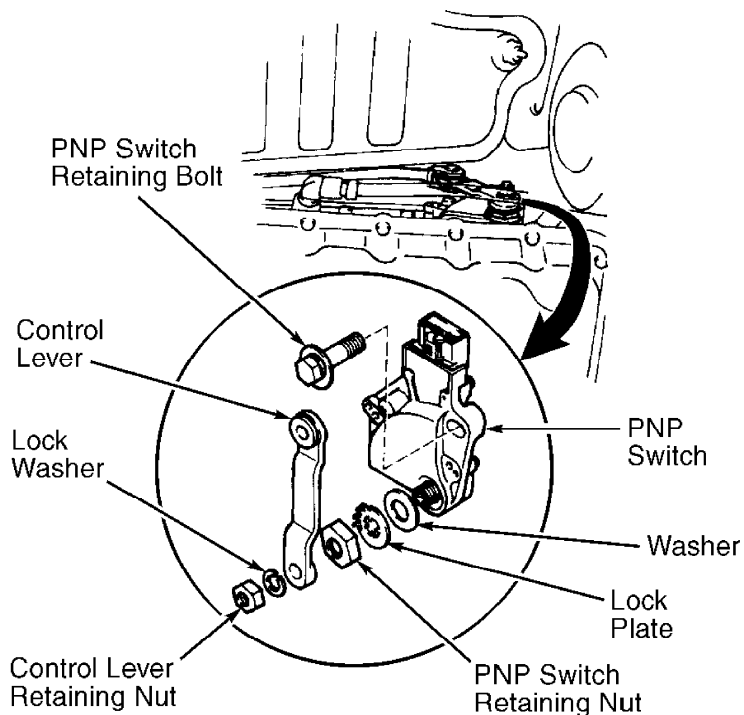
PARK/NEUTRAL POSITION (PNP) SWITCH

#### Removal (A/T Models)

- 1) The PNP switch is located on side of transmission. See Fig. 4. Remove necessary components for access to PNP switch.
- 2) Disconnect electrical connector from PNP switch. Disconnect shift linkage from control lever on transmission for access to PNP switch.
- 3) Remove control lever retaining nut, lock washer and control lever from transmission. Bend tabs upward on lock plate, away from PNP switch retaining nut. Remove PNP switch retaining nut, lock plate, washer, PNP switch retaining bolt and PNP switch.

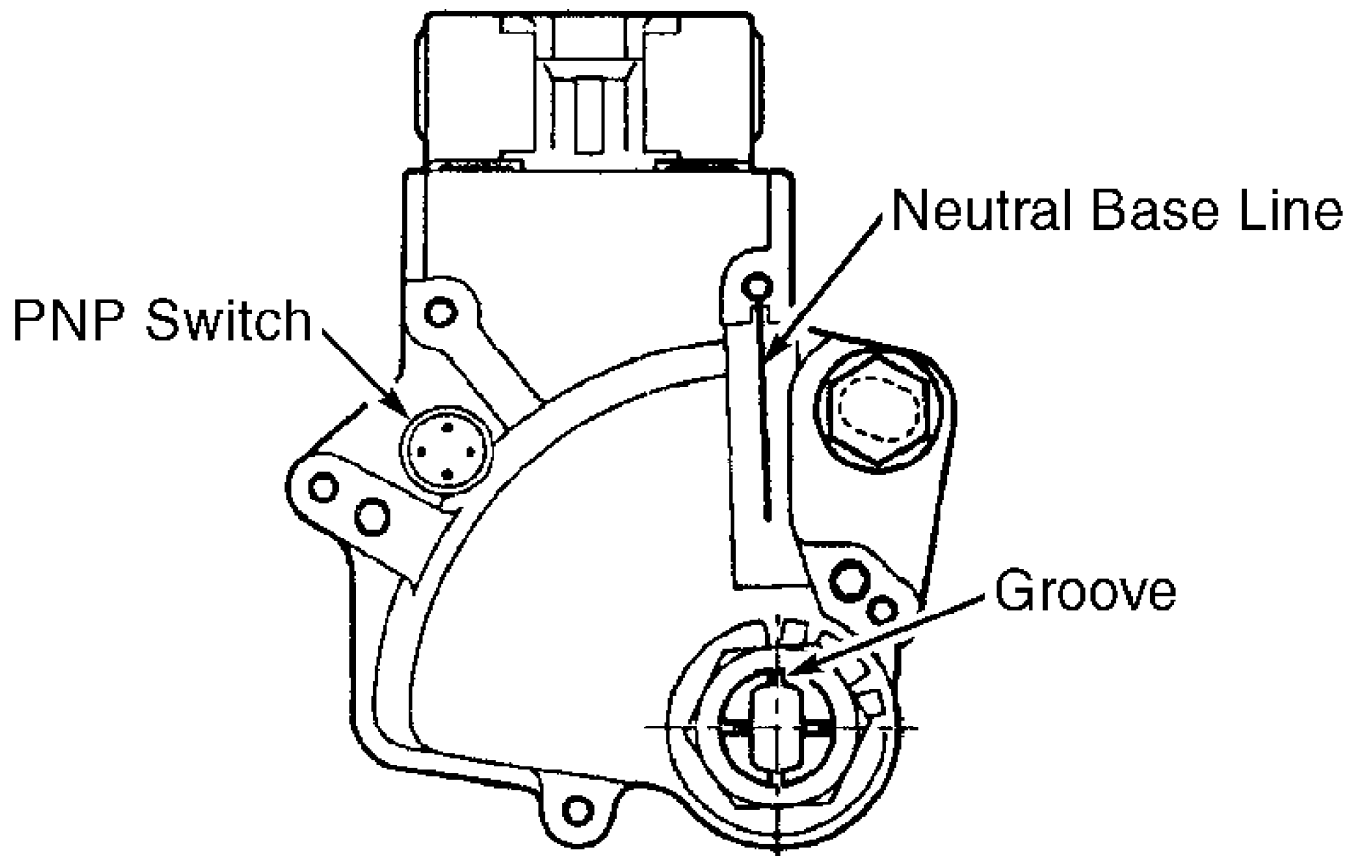
#### Installation

- 1) Using NEW lock plate, install PNP switch on transmission. Install and tighten PNP switch retaining nut and PNP switch retaining bolt to specification. See TORQUE SPECIFICATIONS. Bend over tab on lock plate against PNP switching retaining nut.
- 2) Reinstall control lever, lock washer and control lever retaining nut. Tighten control lever retaining nut to specification. See TORQUE SPECIFICATIONS. Reconnect shift linkage on control lever. Check that engine starts only with shift lever in Park and Neutral. If PNP switch adjustment is required, go to next step.
- 3) Ensure parking brake is applied. Place shift lever in Neutral. Loosen PNP switch retaining bolt.
- 4) Rotate PNP switch so neutral base line aligns with the groove. See Fig. 5. Hold PNP switch in this position and tighten PNP switch retaining bolt to specification. See TORQUE SPECIFICATIONS.
- 5) Ensure continuity exists between specified terminals on PNP switch in relation to shift lever position. See appropriate I - SYSTEM/COMPONENT TESTS article. Reinstall electrical connector.



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Fig. 4: Locating PNP Switch & Components  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Fig. 5: Adjusting PNP Switch  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

### SUB-THROTTLE POSITION SENSOR

#### Removal & Installation (Turbo)

The sub-throttle position sensor is mounted on throttle body. Service information is not available. For adjustment of sub-throttle position sensor, see appropriate D - ADJUSTMENTS article.

### THROTTLE POSITION (TP) SENSOR

#### Removal & Installation

The TP sensor is mounted on throttle body. Service information is not available. For adjustment of TP sensor, see appropriate D - ADJUSTMENTS article.

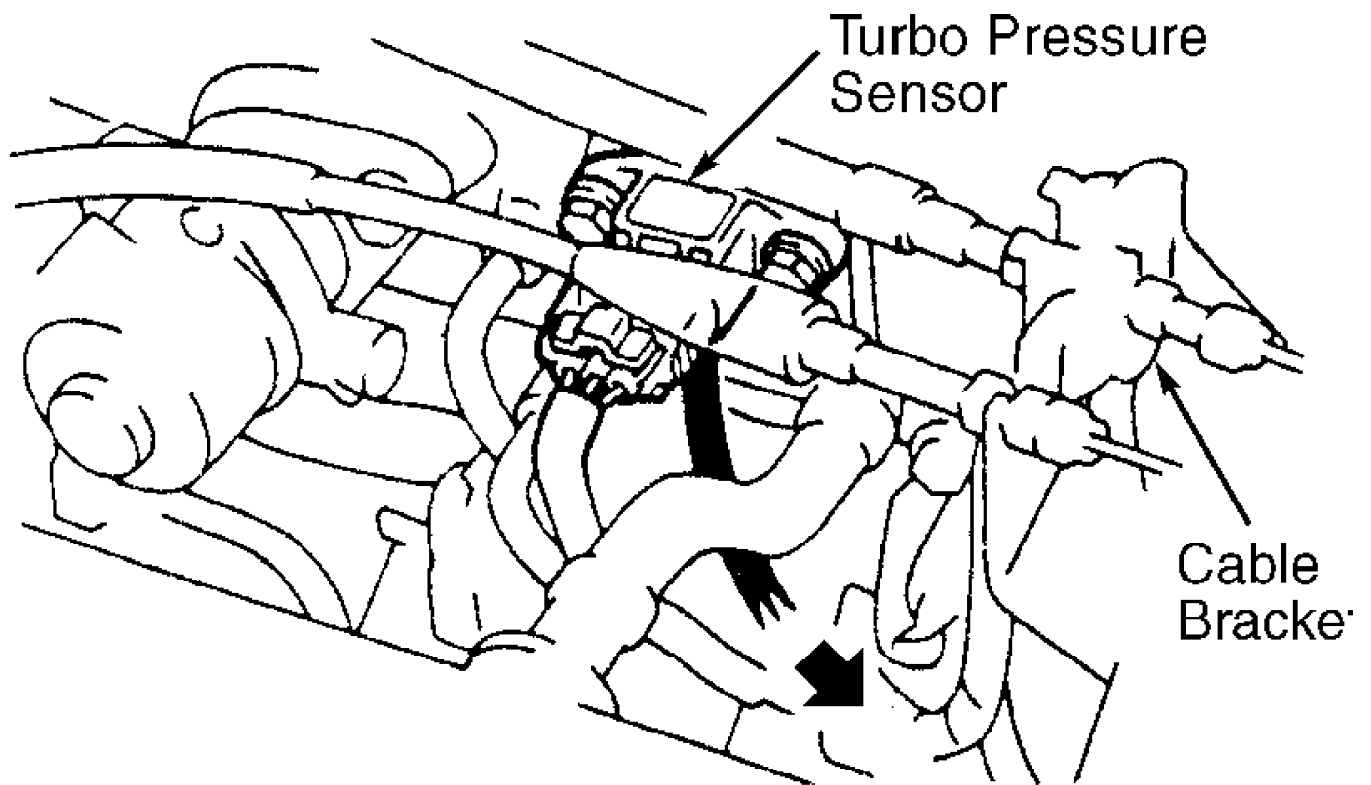
### TURBO PRESSURE SENSOR

#### Removal & Installation (Turbo)

1) Disconnect electrical connector and vacuum hose from turbo pressure sensor. Turbo pressure sensor is mounted on intake manifold, near cable bracket. See Fig. 6. Turbo pressure sensor contains a Black 3-pin electrical connector with White/Black, Black/Yellow and Blue/Red wires.

2) Remove bolts and turbo pressure sensor. To install, reverse removal procedure.





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Fig. 6: Locating Turbo Pressure Sensor (Turbo)  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

## VAPOR PRESSURE SENSOR

Removal & Installation (Non-Turbo)

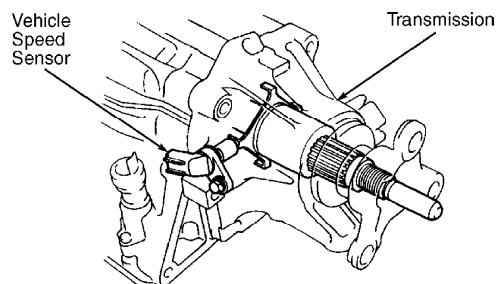
For servicing of vapor pressure sensor, see VAPOR PRESSURE SENSOR under EMISSION SYSTEMS & SUB-SYSTEMS.

## VEHICLE SPEED SENSOR

Removal & Installation

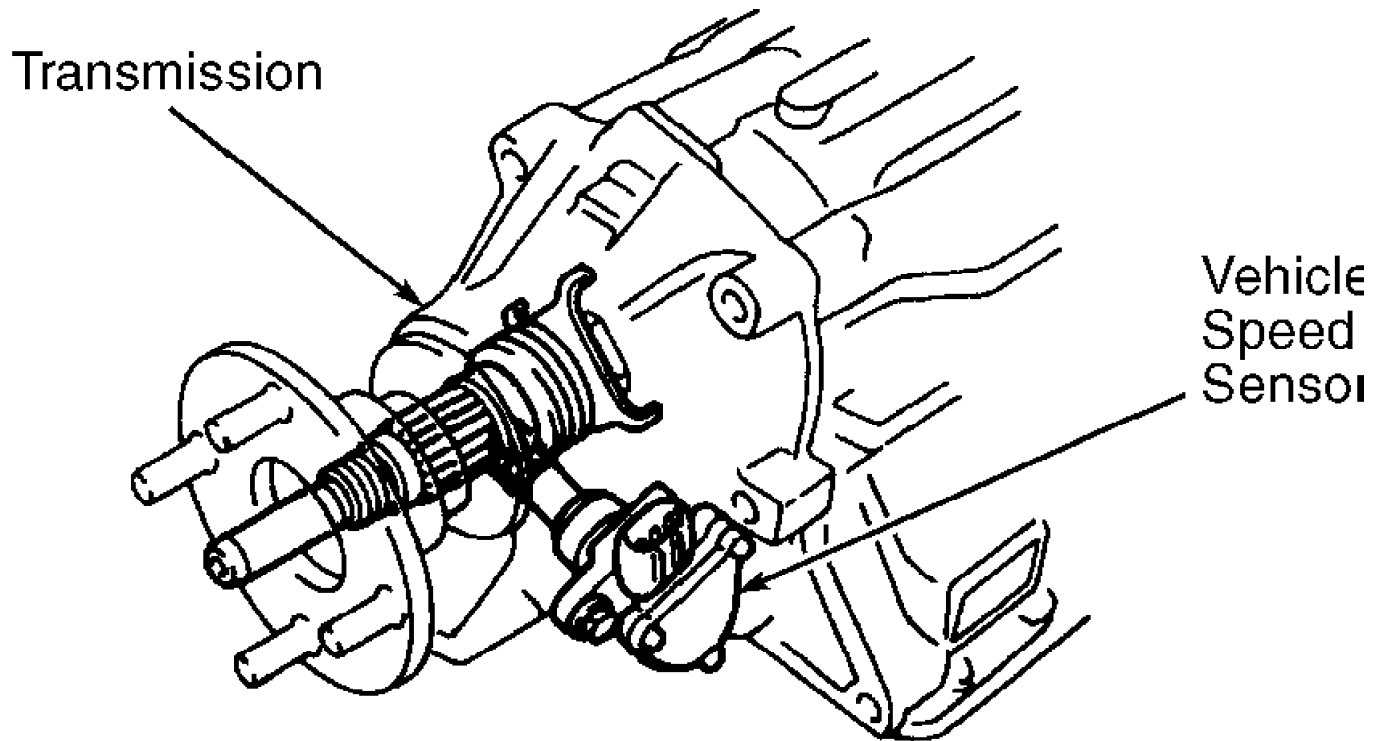
1) Disconnect electrical connector from vehicle speed sensor located on the transmission. See Figs. 7-8. Remove retaining bolt and vehicle speed sensor with "O" ring from transmission.

2) To install, reverse removal procedure using NEW "O" ring. Coat "O" ring with ATF before installing on vehicle speed sensor. Tighten retaining bolt to specification. See TORQUE SPECIFICATIONS.



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Fig. 7: Locating Vehicle Speed Sensor Non-Turbo  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Fig. 8: Locating Vehicle Speed Sensor Turbo  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

## IGNITION SYSTEM

### CAMSHAFT POSITION SENSOR (IGNITION SYSTEM)

#### Removal (Non-Turbo)

1) Manufacturer states that air intake chamber and intake manifold must be removed for servicing of camshaft position sensor. See Fig. 9.

2) Drain cooling system. Remove engine oil dipstick and tube with "O" ring. On A/T models, remove transmission dipstick and tube with "O" ring. On all models, disconnect necessary hoses for removal of air intake chamber. See Fig. 9.

3) Remove intake air connector-to-air intake chamber bolts/nuts. Intake air connector bolts to inside of air intake chamber. See Fig. 9.

4) Remove air intake chamber-to-intake manifold bolts/nuts, air intake chamber and gasket. Disconnect necessary electrical connectors and hoses for removal of vacuum tank assembly. Remove retaining nuts and vacuum tank assembly.

5) Remove bolts, upper timing belt cover and gasket. Disconnect necessary hoses, ground straps and electrical connectors for removal of engine wiring harness bracket and intake manifold. See Fig. 9. Remove retaining nuts and separate engine wiring harness bracket from intake manifold.

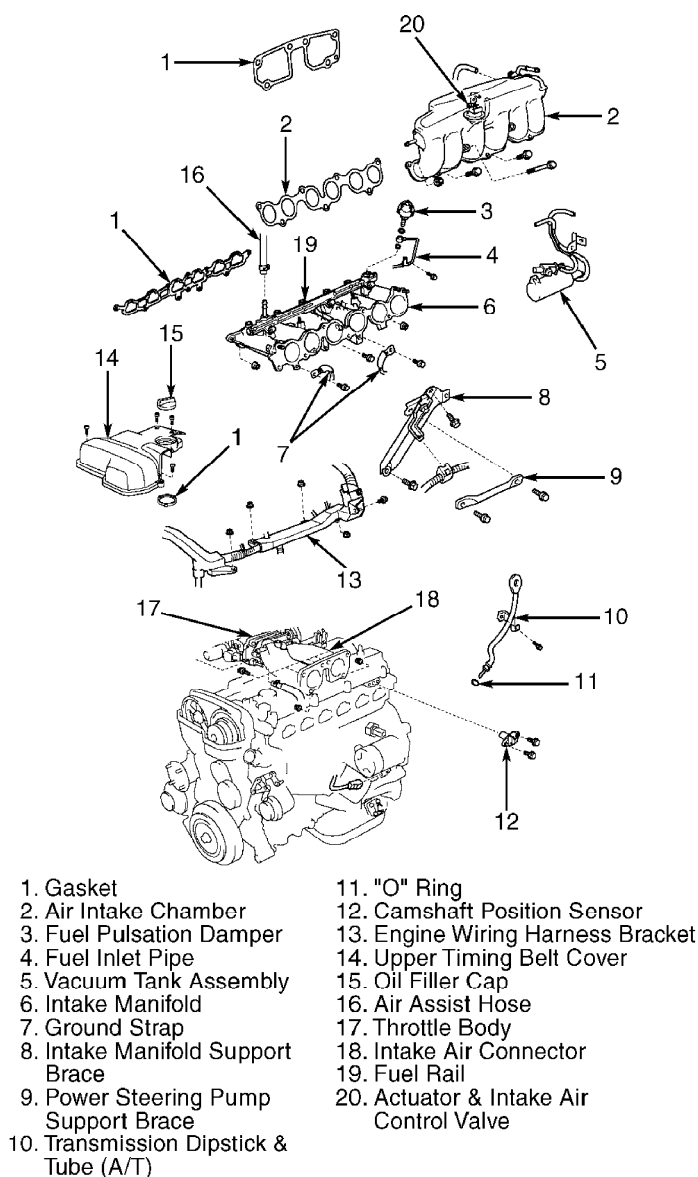
**CAUTION:** Use care when removing fuel pulsation damper, as some pressure may exist in the fuel system.

6) Slowly remove fuel pulsation damper with gaskets from fuel inlet pipe. Remove fuel inlet pipe-to-intake manifold bolt. Remove fuel inlet pipe as necessary for intake manifold removal.

7) Remove bolts and power steering pump support brace. Remove bolts and intake manifold support brace. Remove bolts/nuts, intake manifold and gasket. Remove retaining bolts and camshaft position sensor from cylinder head.

#### Installation

To install, reverse removal procedure using NEW gaskets and NEW "O" rings. Tighten bolt/nuts and fuel pulsation damper to specification. See TORQUE SPECIFICATIONS. Fill cooling system.



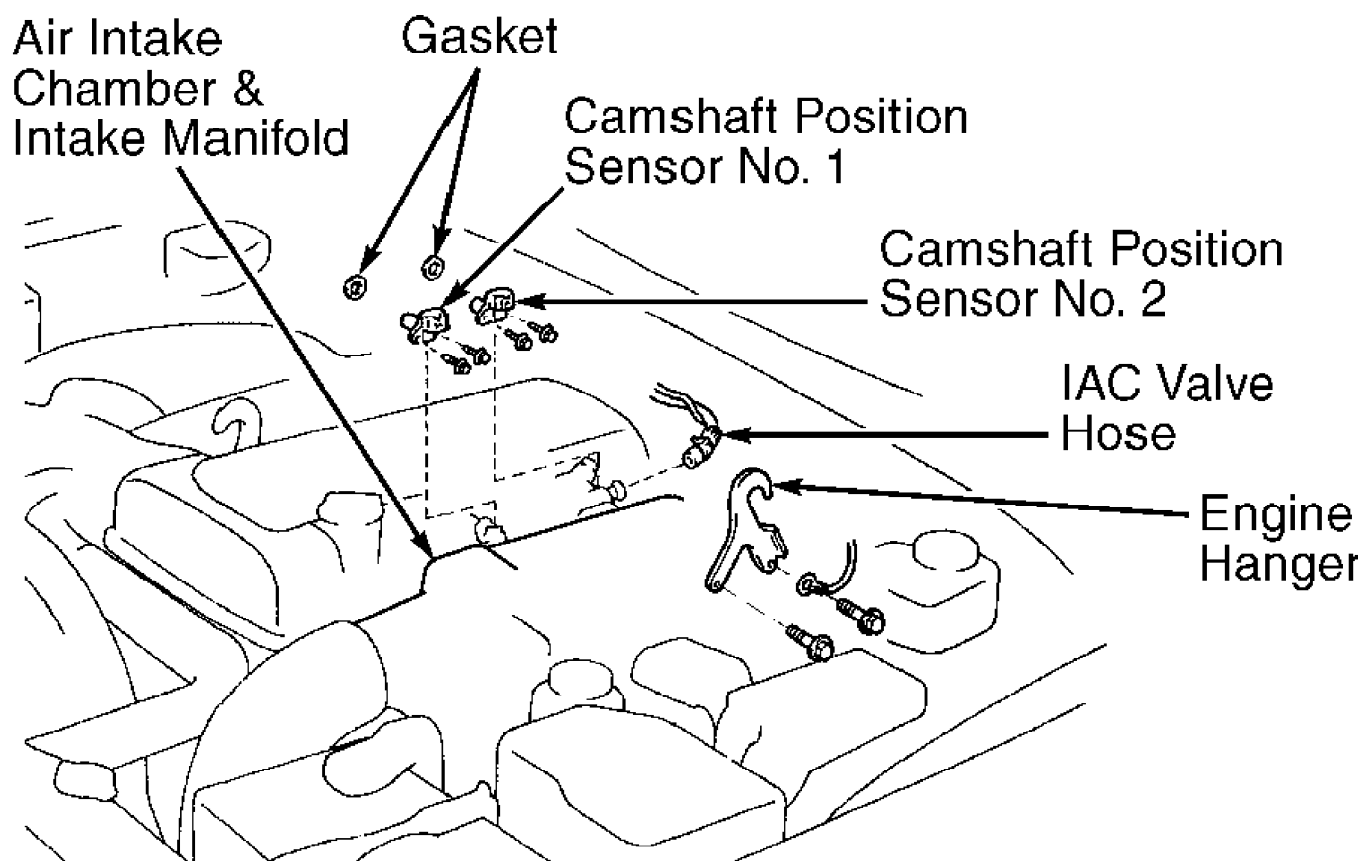
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Fig. 9: Locating Camshaft Position Sensor, Air Intake Components & Fuel Rail (Non-Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Removal & Installation (Turbo)

1) Camshaft position sensors are located on intake manifold side of cylinder head. See Fig. 10.

2) Disconnect hose from IAC valve. Remove bolts and engine hanger for access to camshaft position sensor. Disconnect electrical connector from camshaft position sensor. Remove retaining bolts, camshaft position sensor and gasket from cylinder head.

3) To install, reverse removal procedure using NEW gasket. Tighten camshaft position sensor retaining bolts and engine hanger bolts to specification. See TORQUE SPECIFICATIONS.



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Fig. 10: Locating Camshaft Position Sensors (Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

### CRANKSHAFT POSITION SENSOR (IGNITION SYSTEM)

#### Removal & Installation

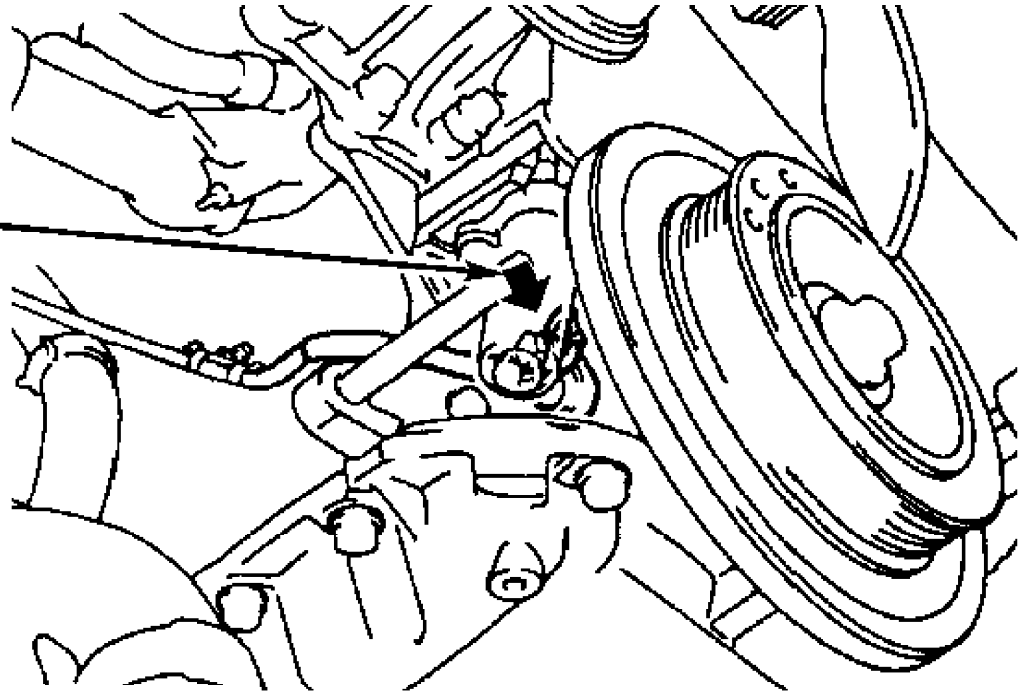
1) Crankshaft position sensor is located on front (timing belt end) of engine, near generator, just behind the crankshaft pulley. See Fig. 11. Remove lower engine cover.

2) On turbo models, remove air tube to the charge air cooler for access to generator. On all models, remove lower cooling fan shroud.

3) Remove drive belt and generator. Disconnect electrical connector at crankshaft position sensor. Remove bolt and crankshaft position sensor.

4) To install, reverse removal procedure. Tighten bolt for crankshaft position sensor to specification. See TORQUE SPECIFICATIONS

## Crankshaft Position Sensor



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Fig. 11: Locating Typical Crankshaft Position Sensor  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

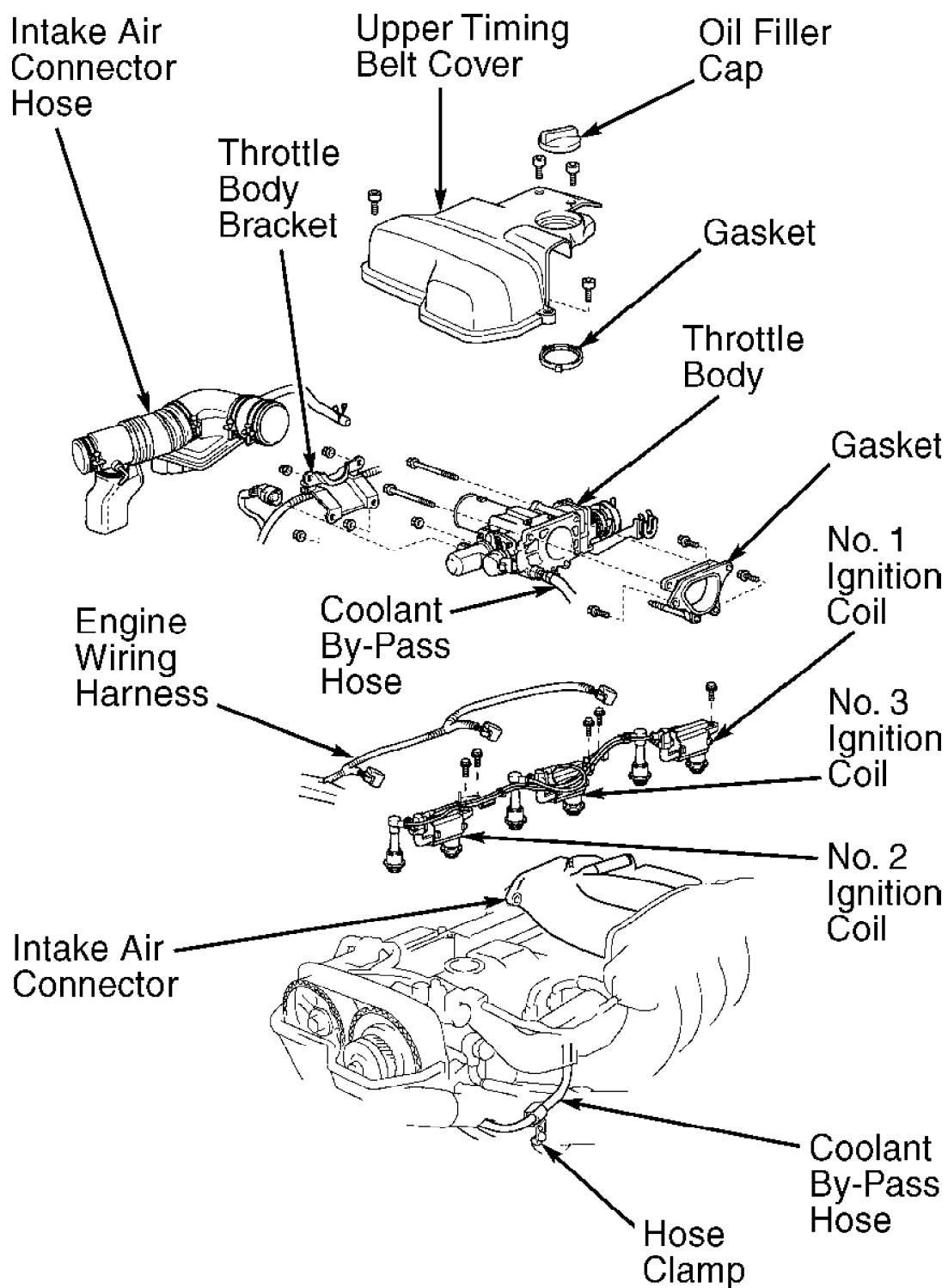
### IGNITION COIL

#### Removal (Non-Turbo)

- 1) Remove intake air connector hose. See Fig. 12. Remove bolt, upper timing belt cover and gasket.
- 2) Disconnect control cables and electrical connectors for removal of throttle body. It is not necessary to disconnect coolant by-pass hose from rear of throttle body for removal of throttle body. See Fig. 12.
- 3) Remove throttle body-to-intake air connector bolts/nuts. Remove nuts and throttle body bracket. Disconnect coolant by-pass hose from hose clamp near oil filter.
- 4) Slightly slide throttle body from intake air connector without damaging coolant by-pass hose. Remove bolts and throttle body gasket. See Fig. 12.
- 5) Disconnect electrical connectors at ignition coils. Remove bolts and disconnect clamps from engine wiring harness. Remove bolts from ignition coils. Remove ignition coils with spark plug wires.
- 6) To disconnect spark plug wire from ignition coil, use screwdriver to lift lock claw from spark plug wire. See Fig. 13. Remove holder and spark plug wire from ignition coil.

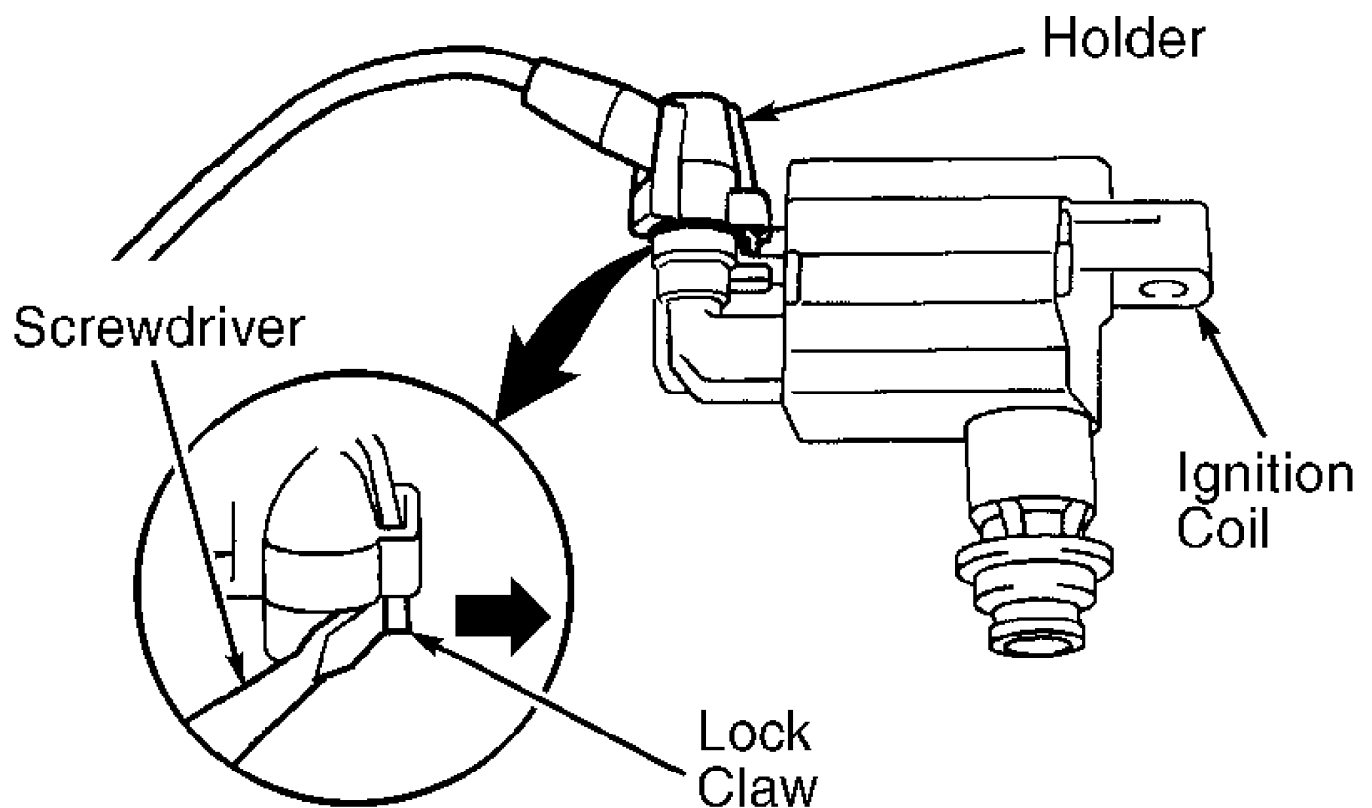
#### Installation

- 1) To install, reverse removal procedure using NEW gaskets. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.
- 2) When installing spark plug wire on ignition coil, ensure spline on holder aligns with spline on ignition coil. Lightly pull upward on holder to ensure lock claw is securely locked in place.



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Fig. 12: Locating Ignition Coils & Components (Non-Turbo)  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



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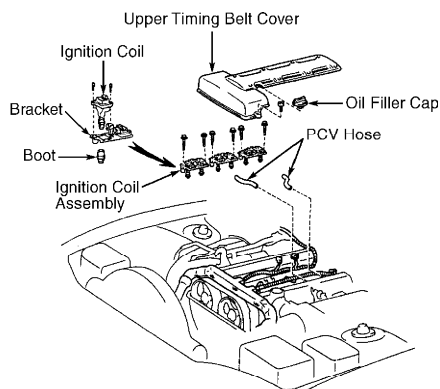
Fig. 13: Removing Spark Plug Wire From Ignition Coil (Non-Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### Removal & Installation (Turbo)

1) Remove upper timing belt cover for access to ignition coil. See Fig. 14. Remove PCV hoses. Disconnect electrical connectors at ignition coils.

2) Remove bolts from ignition coil assembly. Remove ignition coil assembly. To remove ignition coil from bracket, remove boot and ignition coil-to-bracket screws.

3) To install, reverse removal procedure. Tighten ignition coil assembly bolts to specification. See TORQUE SPECIFICATIONS.



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Fig. 14: Locating Ignition Coils & Components (Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## FUEL SYSTEM

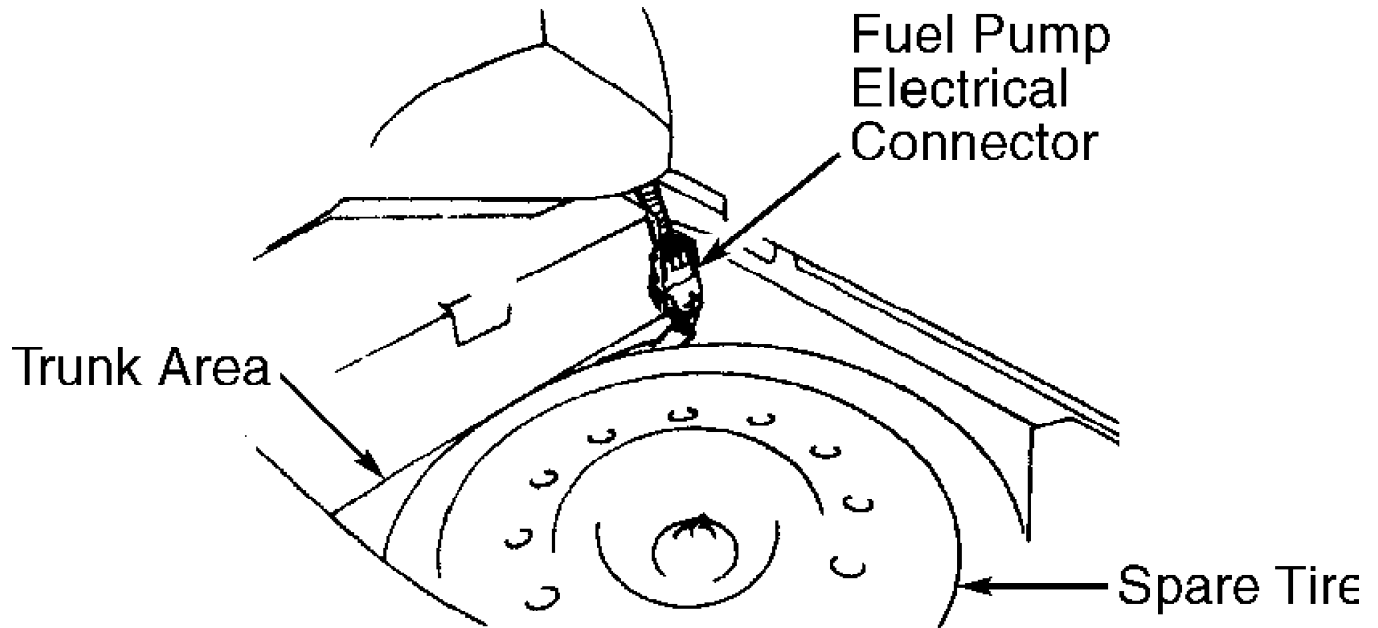
### FUEL SYSTEM PRESSURE RELEASE

**WARNING:** ALWAYS release fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

1) Disconnect fuel pump electrical connector located in trunk area, near spare tire. See Fig. 15.

2) Start engine and allow engine to idle until engine stalls. Turn ignition off. Reinstall fuel pump electrical connector.

3) Disconnect negative battery cable. Place suitable container under fuel line connection. Cover fuel line connection with shop towel. Slowly loosen fuel line connection, allowing any fuel pressure to be released. Once fuel pressure is released, fuel system components may be serviced.



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Fig. 15: Locating Fuel Pump Electrical Connector  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

### FUEL FILTER ON FUEL PUMP

#### Removal & Installation (Non-Turbo)

Two fuel filters are located on fuel pump assembly in the fuel tank. For servicing of fuel filters on fuel pump assembly, see FUEL PUMP under FUEL SYSTEM.

#### Removal & Installation (Turbo)

One fuel filter is located on bottom of fuel pump assembly in the fuel tank. For servicing of this fuel filter, see FUEL PUMP under FUEL SYSTEM.

### FUEL PUMP

#### Removal (Non-Turbo)



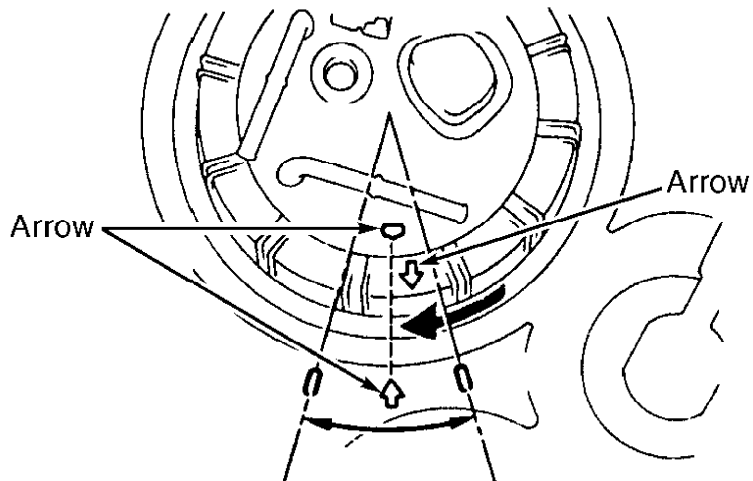
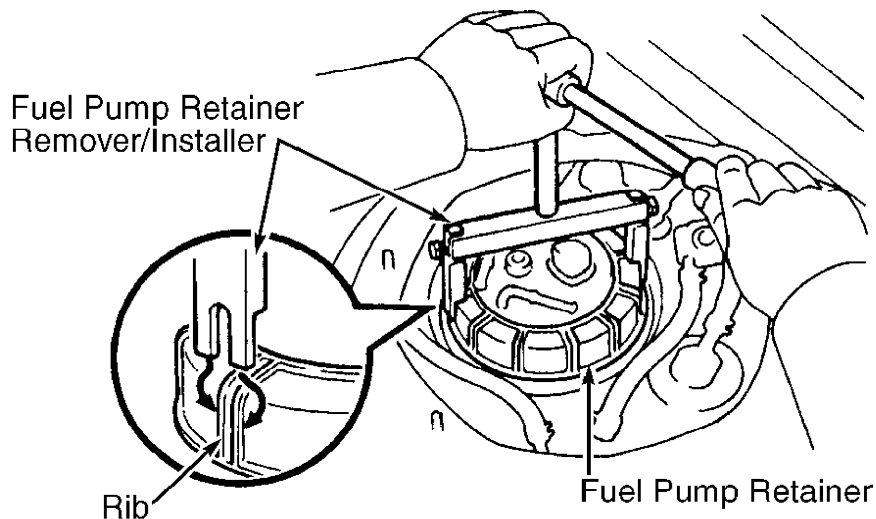
1) Release fuel pressure. See FUEL SYSTEM PRESSURE RELEASE under FUEL SYSTEM. Remove fuel tank filler cap to release any fuel pressure from fuel tank.

2) Remove carpet, spare tire cover, spare tire and cover plate on trunk floor panel for access fuel pump. Disconnect electrical connector from fuel pump.

3) Remove fuel outlet line-to-fuel pump mounting bracket union bolt with gaskets, and disconnect fuel outlet line from fuel pump mounting bracket. Disconnect fuel breather hose from fuel pump mounting bracket.

4) Remove retainer clamp from outside of fuel pump retainer. Fuel pump retainer secures fuel pump in the fuel tank. See Fig. 16. Using Fuel Pump Retainer Remover/Installer (SST 09808-14010), loosen fuel pump retainer. Remove fuel pump retainer.

5) Remove fuel pump assembly and gasket from fuel tank. Use care not to damage fuel filter on bottom of fuel pump and fuel gauge sending unit when removing fuel pump.



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Fig. 16: Removing & Installing Fuel Pump Assembly  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### Disassembly & Reassembly

1) Remove wiring harness from fuel pump and fuel pump

mounting bracket. See Fig. 17. Disconnect electrical connector for fuel gauge sending unit from fuel pump mounting bracket. Remove screws and fuel gauge sending unit from fuel pump mounting bracket.

2) Remove bolt and disconnect ground strap from fuel pump clamp. See Fig. 17. Remove bolt and fuel pump clamp. Pull bottom of fuel pump from fuel pump mounting bracket.

3) Remove rubber cushion from bottom of fuel pump. Disconnect fuel hose from top of fuel pump. Remove fuel pump. Using small screwdriver, remove retaining clip that holds fuel filter on bottom of fuel pump. Remove fuel filter from bottom of fuel pump.

4) To remove fuel filter from fuel pressure regulator, remove fuel filter-to-fuel pressure regulator retaining screw. Remove fuel filter with "O" ring from fuel pressure regulator.

5) To reassemble, reverse disassembly procedure using NEW "O" ring on fuel filter and NEW retaining clip on fuel filter. Tighten fuel filter-to-fuel pressure regulator retaining screw, ground strap-to-fuel pump clamp bolt and fuel pump clamp bolt to specification. See TORQUE SPECIFICATIONS.

#### Installation

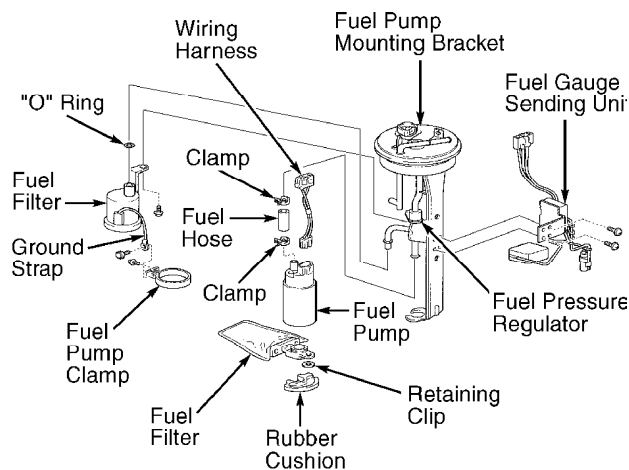
1) Install NEW gasket on fuel tank. Install fuel pump assembly in fuel tank so arrow on fuel pump mounting bracket aligns with arrow on fuel tank. See Fig. 16.

NOTE: Ensure arrow on fuel pump mounting bracket aligns with arrow on fuel tank when installing fuel pump assembly.

2) Install fuel pump retainer. Using fuel pump retainer remover/installer, tighten fuel pump retainer until arrow on fuel pump retainer is within the lines on the fuel tank. See Fig. 16. Ensure arrow on fuel pump mounting bracket is still aligned with arrow on fuel tank.

3) Install retainer clamp. To install remaining components, reverse removal procedure using NEW gaskets on fuel outlet line-to-fuel pump mounting bracket union bolt. Tighten fuel outlet line-to-fuel pump mounting bracket union bolt to specification. See TORQUE SPECIFICATIONS.

4) Operate fuel pump and check for fuel leaks. See FUEL PUMP OPERATION under FUEL SYSTEM in appropriate F - BASIC TESTING article.



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Fig. 17: Exploded View Of Fuel Pump & Components (Non-Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### Removal (Turbo)

1) Release fuel pressure. See FUEL SYSTEM PRESSURE RELEASE

under FUEL SYSTEM. Remove fuel tank filler cap to release any fuel pressure from fuel tank.

2) Remove carpet, spare tire cover, spare tire and cover plate on trunk floor panel for access fuel pump. Disconnect electrical connector from fuel pump.

3) Remove fuel outlet line-to-fuel pump mounting bracket union bolt with gaskets, and disconnect fuel outlet line from fuel pump mounting bracket. Disconnect fuel breather hose and fuel return hose from fuel pump mounting bracket.

4) Remove retainer clamp from outside of fuel pump retainer. Fuel pump retainer secures fuel pump in the fuel tank. See Fig. 16. Using Fuel Pump Retainer Remover/Installer (SST 09808-14010), loosen fuel pump retainer. Remove fuel pump retainer.

5) Remove fuel pump assembly and gasket from fuel tank. Use care not to damage fuel filter on bottom of fuel pump and fuel gauge sending unit when removing fuel pump.

#### Disassembly & Reassembly

1) Disconnect electrical connector for fuel gauge sending unit from fuel pump mounting bracket. See Fig. 18. Remove screws and fuel gauge sending unit from fuel pump mounting bracket.

2) Disconnect electrical connectors for wiring harness at fuel pump. Pull bottom of fuel pump from fuel pump mounting bracket. Remove rubber cushion from bottom of fuel pump. Disconnect fuel hose from top of fuel pump. Remove fuel pump from the fuel pump mounting bracket.

3) Using small screwdriver, remove retaining clip that holds fuel filter on bottom of fuel pump. Remove fuel filter from bottom of fuel pump. To reassemble, reverse disassembly procedure using NEW retaining clip on fuel filter.

#### Installation

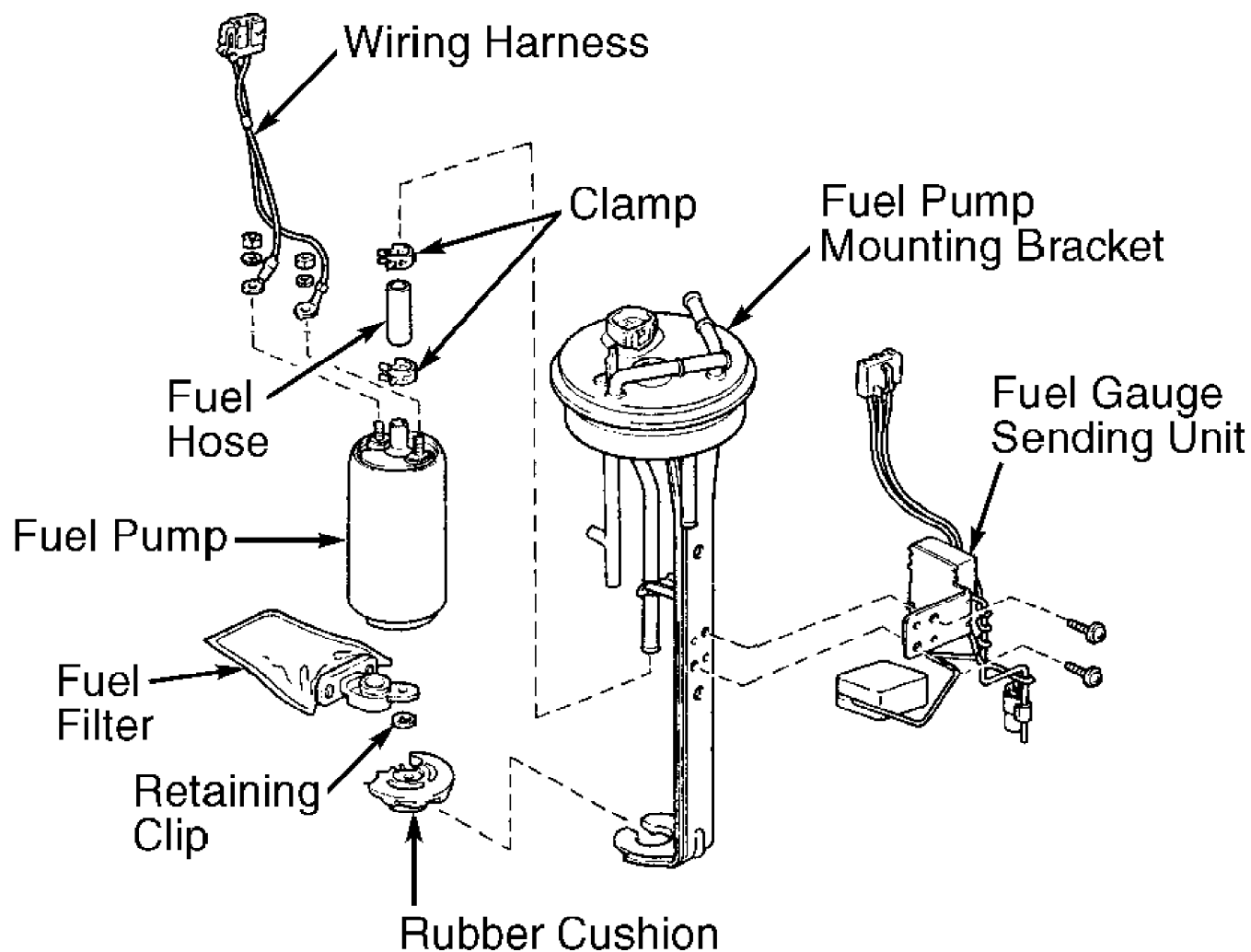
1) Install NEW gasket on fuel tank. Install fuel pump assembly in fuel tank so arrow on fuel pump mounting bracket aligns with arrow on fuel tank. See Fig. 16.

NOTE: Ensure arrow on fuel pump mounting bracket aligns with arrow on fuel tank when installing fuel pump assembly.

2) Install fuel pump retainer. Using fuel pump retainer remover/installer, tighten fuel pump retainer until arrow on fuel pump retainer is within the lines on the fuel tank. See Fig. 16. Ensure arrow on fuel pump mounting bracket is still aligned with arrow on fuel tank.

3) Install retainer clamp. To install remaining components, reverse removal procedure using NEW gaskets on fuel outlet line-to-fuel pump mounting bracket union bolt. Tighten fuel outlet line-to-fuel pump mounting bracket union bolt to specification. See TORQUE SPECIFICATIONS.

4) Operate fuel pump and check for fuel leaks. See FUEL PUMP OPERATION under FUEL SYSTEM in appropriate F - BASIC TESTING article.



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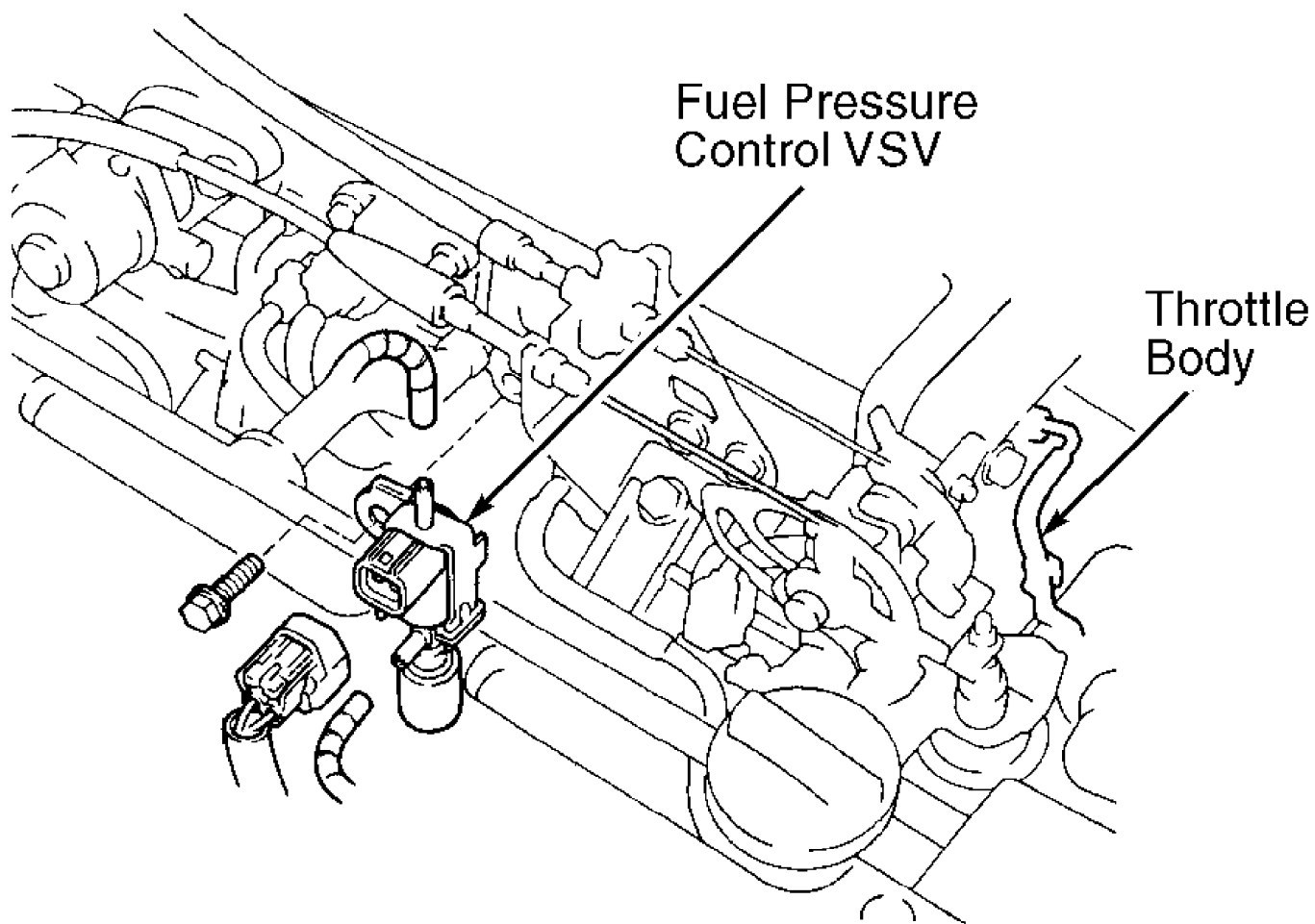
Fig. 18: Exploded View Of Fuel Pump & Components (Turbo)  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### FUEL PRESSURE CONTROL VACUUM SWITCHING VALVE (VSV)

##### Removal & Installation (Turbo)

1) Fuel pressure control VSV is located on driver's side of engine, near throttle body and contains a Blue 2-pin electrical connector. See Fig. 19.

2) Disconnect electrical connector and vacuum hoses from fuel pressure control VSV. Remove fuel pressure control VSV. To install, reverse removal procedure.



**97J06450**

Fig. 19: Locating Fuel Pressure Control VSV (Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## FUEL PULSATION DAMPER

**NOTE:** Fuel pulsation damper may also be referred to as fuel pressure pulsation damper.

### Removal (Non-Turbo)

1) Release fuel pressure. See FUEL SYSTEM PRESSURE RELEASE under FUEL SYSTEM. Ensure negative battery cable is disconnected.

**CAUTION:** Use care when removing fuel pulsation damper, as some pressure may exist in the fuel system.

2) Fuel pulsation damper is located at top of fuel inlet pipe. See Fig. 9. Remove fuel pulsation damper with gasket from fuel inlet pipe.

3) It may be necessary to remove fuel inlet pipe to for access to the lower gasket. Remove fuel inlet pipe-to-intake manifold bolt. Remove fuel inlet pipe as necessary for removal of lower gasket.

### Installation

1) To install, reverse removal procedure using NEW gaskets. Tighten fuel pulsation damper and fuel inlet pipe-to-intake manifold

bolt to specification. See TORQUE SPECIFICATIONS.

2) Operate fuel pump and check for fuel leaks. See FUEL PUMP OPERATION under FUEL SYSTEM in appropriate F - BASIC TESTING article.

#### Removal (Turbo)

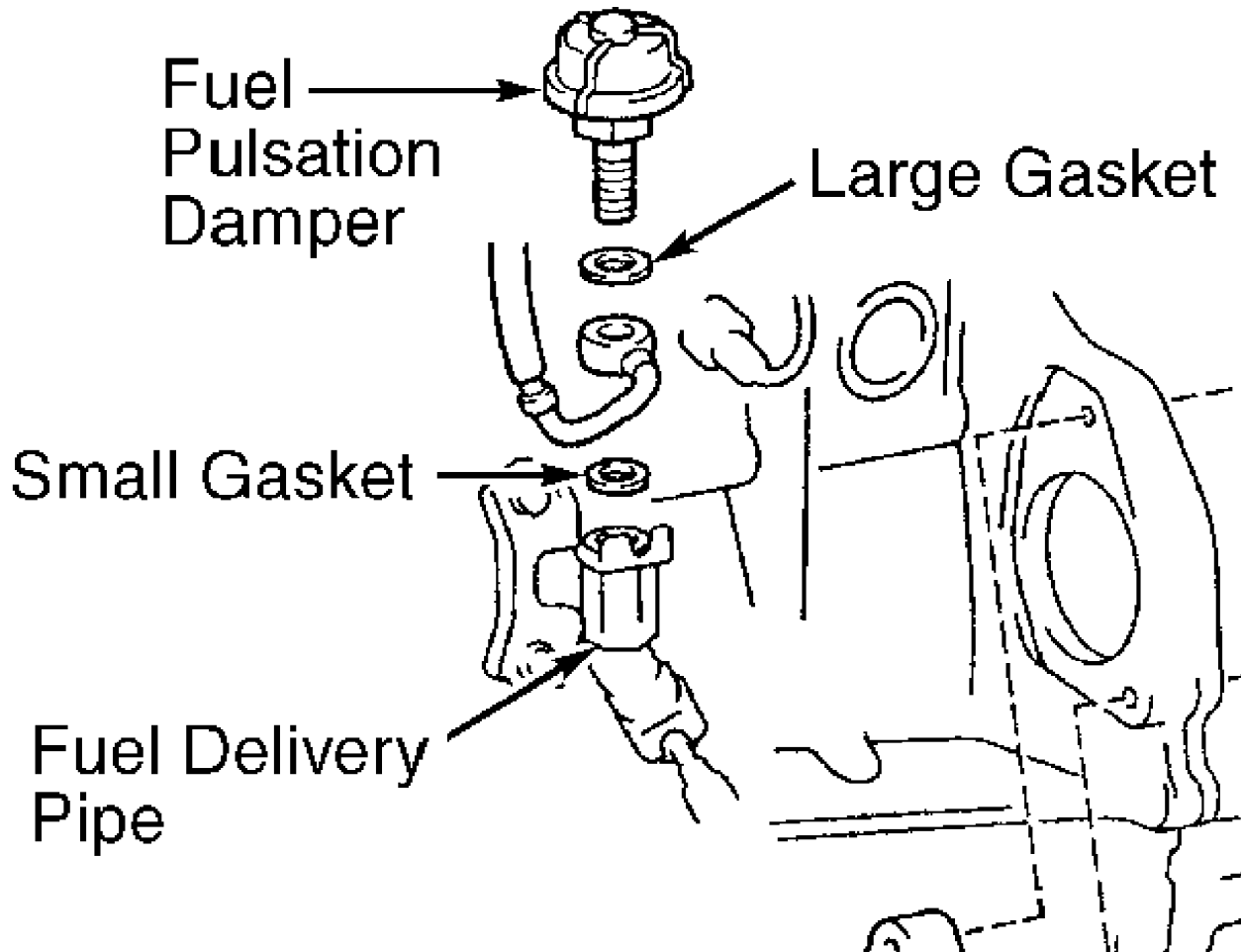
1) Release fuel pressure. See FUEL SYSTEM PRESSURE RELEASE under FUEL SYSTEM. Ensure negative battery cable is disconnected.

2) Fuel pulsation damper is mounted on fuel delivery pipe, just above the starter and uses different size gaskets. See Fig. 20. Remove starter. Remove fuel pulsation damper with gaskets from fuel delivery pipe.

#### Installation

1) To install, reverse removal procedure using NEW gaskets. Tighten fuel pulsation damper and starter bolts to specification. See TORQUE SPECIFICATIONS.

2) Operate fuel pump and check for fuel leaks. See FUEL PUMP OPERATION under FUEL SYSTEM in appropriate F - BASIC TESTING article.



96F10715

Fig. 20: Locating Fuel Pulsation Damper (Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: On non-turbo models, fuel pressure regulator is mounted on the fuel pump assembly in the fuel tank. See Fig. 17. On turbo models, fuel pressure regulator is located on front end of fuel rail, near throttle body. See Fig. 21.

#### Removal (Non-Turbo)

1) Remove fuel pump. See FUEL PUMP under FUEL SYSTEM. Once fuel pump is removed from fuel pump mounting bracket, pull fuel filter with fuel pressure regulator and "O" ring from fuel pump mounting bracket.

2) Remove fuel filter-to-fuel pressure regulator retaining screw. Remove fuel filter with "O" ring from fuel pressure regulator.

#### Installation

1) Apply light coat of gasoline on NEW "O" rings and install "O" rings on fuel pressure regulator and fuel filter. Install fuel filter on fuel pressure regulator. Ensure fuel filter rotates smoothly on fuel pressure regulator. If fuel filter fails to rotate smoothly, check for improper "O" ring installation.

2) Install and tighten fuel filter-to-fuel pressure regulator retaining screw to specification. See TORQUE SPECIFICATIONS.

3) Install fuel pressure regulator on fuel pump mounting bracket. Ensure fuel pressure regulator rotates smoothly in fuel pump mounting bracket and sits flat against surface of fuel pump mounting bracket. If fuel pressure regulator fails to rotate smoothly, check for improper "O" ring installation. Reinstall fuel pump using proper procedure.

#### Removal (Turbo)

1) Release fuel pressure. See FUEL SYSTEM PRESSURE RELEASE under FUEL SYSTEM. Remove throttle body. See THROTTLE BODY under FUEL system.

2) Disconnect vacuum hose from fuel pressure regulator. See Fig. 21. Remove fuel return pipe-to-fuel pressure regulator union bolt with gaskets, and disconnect fuel return line from fuel pressure regulator.

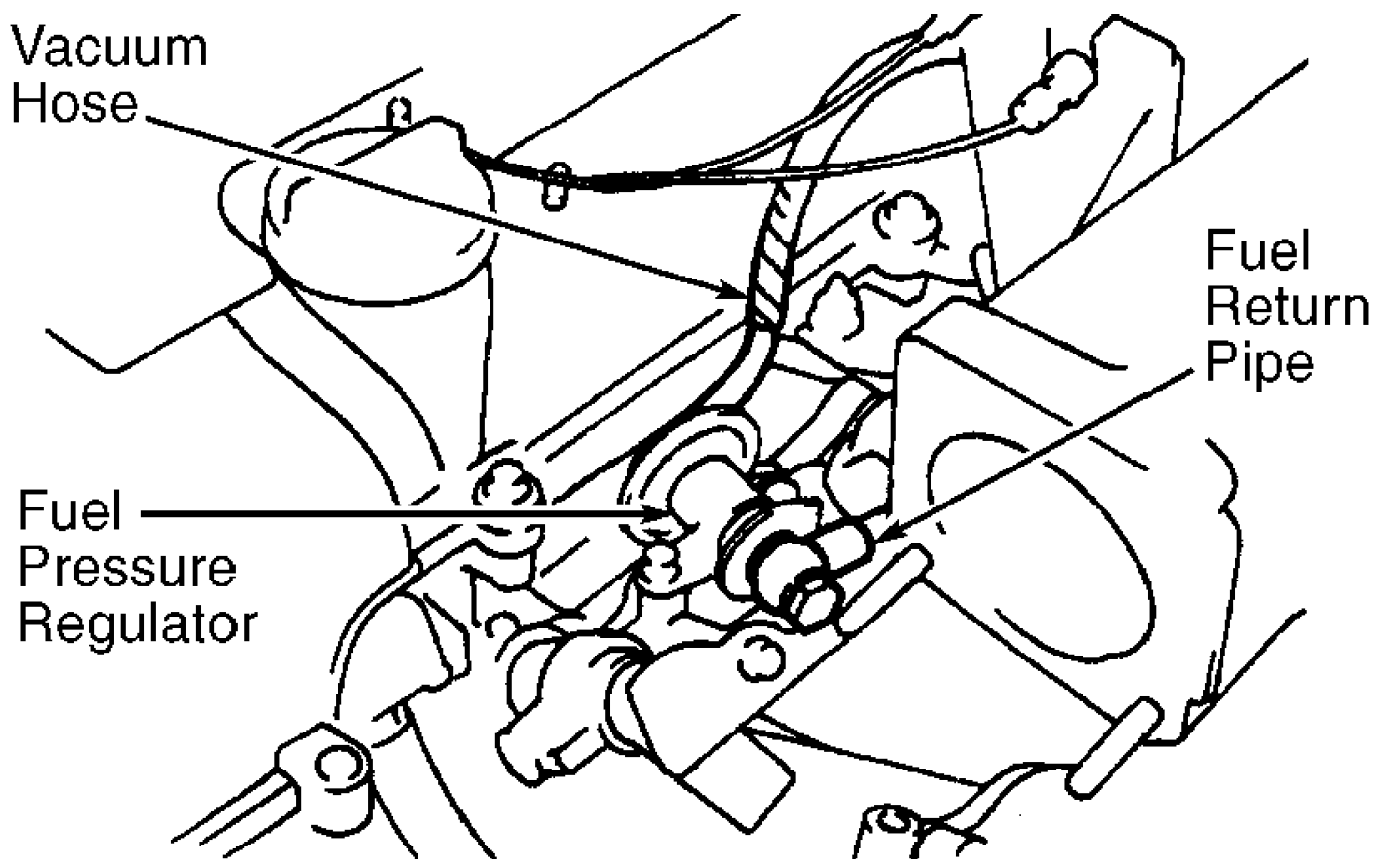
3) Remove bolts and fuel pressure regulator with "O" ring from fuel rail. Remove "O" ring from fuel pressure regulator.

#### Installation

1) Apply light coat of gasoline on NEW "O" ring and install "O" ring on fuel pressure regulator. Install fuel pressure regulator on fuel rail. Ensure fuel pressure regulator rotates smoothly on fuel rail and sits flat against surface of fuel rail. If fuel pressure regulator fails to rotate smoothly, check for improper "O" ring installation.

2) Install and tighten fuel pressure regulator bolts to specification. See TORQUE SPECIFICATIONS. Using NEW gaskets, install fuel return pipe on fuel pressure regulator. Tighten fuel return pipe-to-fuel pressure regulator union bolt to specification. See TORQUE SPECIFICATIONS.

3) Operate fuel pump and check for fuel leaks. See FUEL PUMP OPERATION under FUEL SYSTEM in appropriate F - BASIC TESTING article.



98G11904

Fig. 21: Locating Fuel Pressure Regulator (Turbo)  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

## FUEL RAIL & FUEL INJECTORS

### Removal (Non-Turbo)

1) Release fuel pressure. See FUEL SYSTEM PRESSURE RELEASE under FUEL SYSTEM. Manufacturer states that air intake chamber must be removed for servicing of fuel rail and fuel injectors. See Fig. 9.

2) Remove engine oil dipstick and tube with "O" ring. On A/T models, remove transmission dipstick and tube with "O" ring. On all models, disconnect necessary hoses for removal of air intake chamber. See Fig. 9.

3) Remove intake air connector-to-air intake chamber bolts/nuts. Intake air connector bolts to inside of air intake chamber. See Fig. 9.

4) Remove air intake chamber-to-intake manifold bolts/nuts, air intake chamber and gasket. Remove fuel pulsation damper with gasket from fuel inlet pipe. See Fig. 9. Remove fuel inlet pipe-to-intake manifold bolt. Remove fuel inlet pipe as necessary for removal of lower gasket.

5) Note location of electrical connectors on fuel injectors for installation reference. Disconnect electrical connectors at fuel injectors and various components so engine wiring harness and engine wiring harness bracket may be removed for access to the fuel rail. Engine wiring harness and engine wiring harness bracket are bolted to the top of the intake manifold. See Fig. 9. Remove bolts/nuts for engine wiring harness protector from the intake manifold and the



throttle body.

**CAUTION:** When removing fuel rail, use care not to allow fuel injectors to fall from fuel rail.

6) Remove fuel rail-to-intake manifold bolts. Remove fuel rail with fuel injectors. See Fig. 22. Remove spacers from intake manifold. Remove fuel injectors from fuel rail. Remove "O" rings, insulator and grommet from fuel injector.

#### Installation

1) Install NEW insulators and NEW grommets on fuel injectors. Coat NEW "O" rings with gasoline and install on fuel injectors.

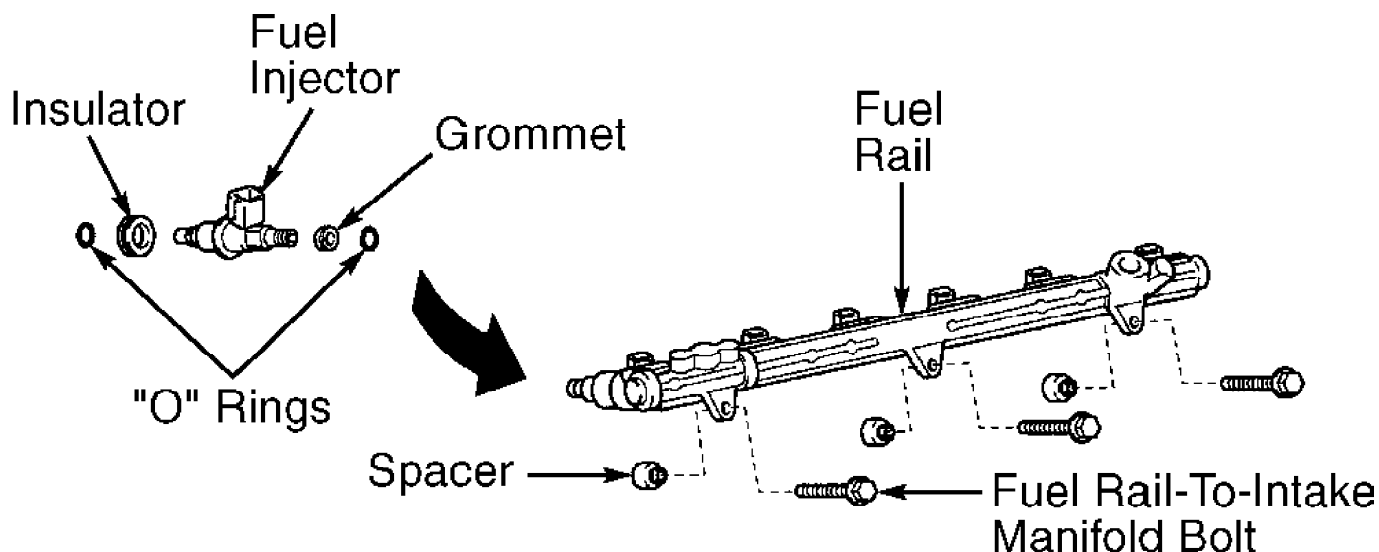
2) Using twisting motion, installing fuel injectors on fuel rail. Ensure spacers are installed on intake manifold. Install fuel rail with fuel rail-to-intake manifold bolts loosely installed.

3) Ensure fuel injectors rotate smoothly. If fuel injectors fail to rotate smoothly, check for improper "O" ring installation. Ensure electrical connector on each fuel injector is facing upward, toward top of engine.

4) Tighten fuel rail-to-intake manifold bolts to specification. See TORQUE SPECIFICATIONS.

5) To install remaining components, reverse removal procedure using NEW gaskets and NEW "O" rings. Tighten bolt/nuts and fuel pulsation damper to specification. See TORQUE SPECIFICATIONS.

6) Ensure Dark Gray electrical connectors are installed on fuel injectors on cylinders No. 1, 3 and 5, and the Brown electrical connectors are installed on fuel injectors on cylinders No. 2, 4 and 6. Operate fuel pump and check for fuel leaks. See FUEL PUMP OPERATION under FUEL SYSTEM in appropriate F - BASIC TESTING article.



98H11905

Fig. 22: Exploded View Of Fuel Rail & Components (Non-Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### Removal (Turbo)

1) Release fuel pressure. See FUEL SYSTEM PRESSURE RELEASE under FUEL SYSTEM. Remove lower engine cover.

2) Remove throttle body. See THROTTLE BODY under FUEL SYSTEM. Remove engine oil dipstick and tube with "O" ring. On A/T models, remove transmission dipstick and tube with "O" ring.

3) On all models, remove bolts/nuts and air intake chamber

support bracket from air intake chamber. Air intake chamber support bracket is located on inside of air intake chamber, below control cable bracket. Remove bolts and control cable bracket from air intake chamber.

4) Remove bolt and disconnect engine wire protector from firewall. Engine wire protector is located on firewall, just behind the valve cover. Disconnect necessary electrical connectors, ground straps, vacuum hoses, air hoses and coolant hoses for removal of air intake chamber. See Fig. 23.

5) Remove bolts/nuts, EGR pipe and gasket. Remove coolant bypass pipe from bottom of air intake chamber. See Fig. 23. Remove bolts and air intake chamber support brace from air intake chamber.

6) Remove engine wire protector from lower rear corner of air intake chamber. Remove bolts/nuts, air intake chamber and gasket from intake manifold. Note location of electrical connectors on fuel injectors for installation reference. Disconnect electrical connectors from fuel injectors.

7) Disconnect electrical connectors at camshaft position sensors. Camshaft position sensors are located on intake manifold side of cylinder head. See Fig. 10. Remove clamps for wiring for access to fuel rail.

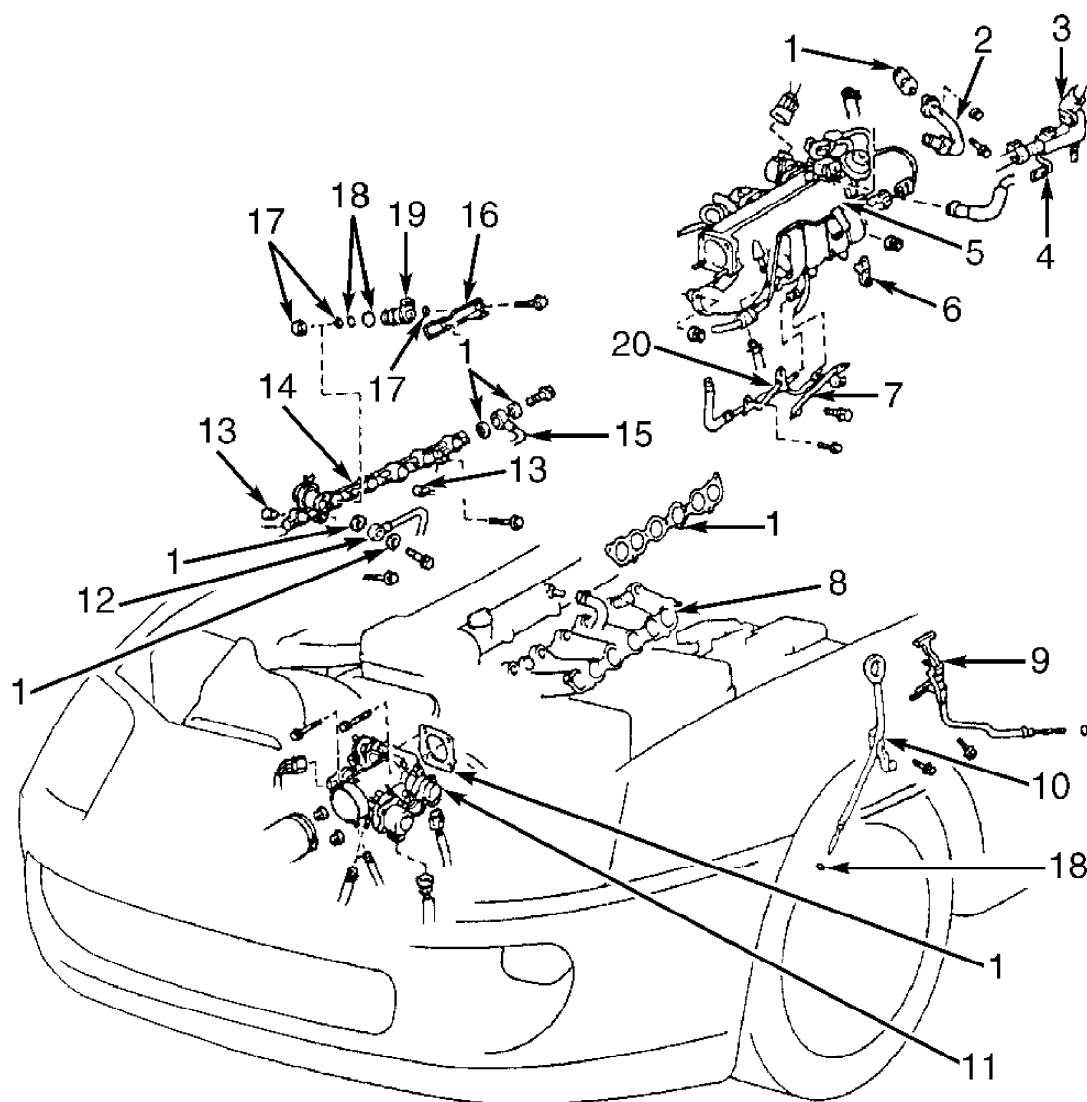
8) Remove union bolt with gaskets, and disconnect fuel inlet pipe from rear of fuel rail. Remove union bolt with gaskets, and disconnect fuel return pipe from fuel pressure regulator.

9) Remove bolts and fuel injector holders from fuel rail. See Fig. 23. Remove insulators from top of fuel injectors.

10) Remove fuel rail-to-intake manifold bolts. Remove fuel rail with fuel injectors from intake manifold. Remove the 2 spacers from intake manifold. Remove insulators from bottom off fuel rail.

11) Apply gasoline at fuel injector-to-fuel rail areas at top and bottom of fuel injector. Install Fuel Injector Remover (SST 09268-74010) on tip of fuel injector. See Fig. 24.

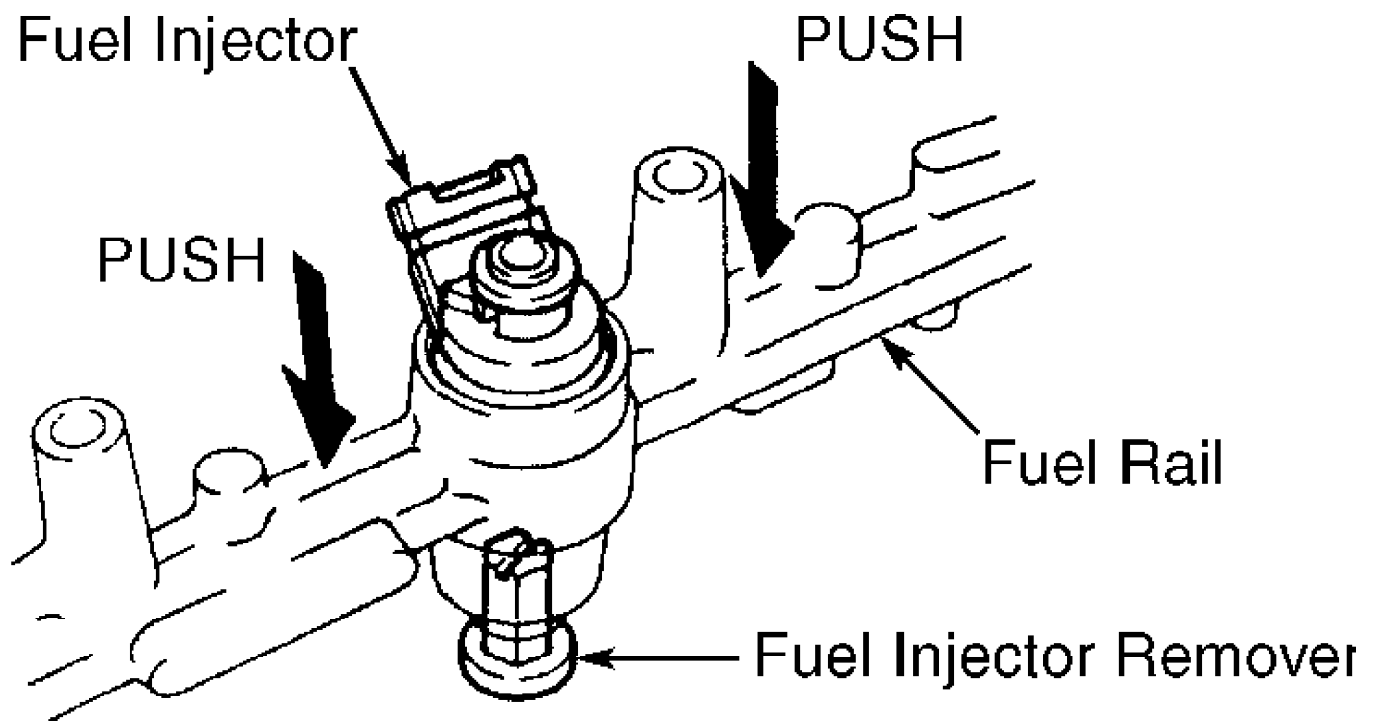
12) Place fuel injector remover on a flat surface. Push downward on fuel rail at each side of fuel rail to press fuel injector from fuel rail. See Fig. 24. Remove insulator and "O" rings from fuel injector.



- |                                       |                          |
|---------------------------------------|--------------------------|
| 1. Gasket                             | 11. Throttle Body        |
| 2. EGR Pipe                           | 12. Fuel Return Pipe     |
| 3. Engine Wire Protector              | 13. Spacer               |
| 4. Ground Strap                       | 14. Fuel Rail            |
| 5. Air Intake Chamber                 | 15. Fuel Inlet Pipe      |
| 6. Engine Wire Clamp                  | 16. Fuel Injector Holder |
| 7. Air Intake Chamber Support Brace   | 17. Insulator            |
| 8. Intake Manifold                    | 18. "O" Ring             |
| 9. A/T Dipstick Tube Assembly         | 19. Fuel Injector        |
| 10. Engine Oil Dipstick Tube Assembly | 20. Coolant By-Pass Pipe |

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Fig. 23: Exploded View Of Fuel Rail & Components (Turbo)  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



## 97A06511

Fig. 24: Removing Fuel Injector From Fuel Rail (Turbo)  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

### Installation

1) To install, reverse removal procedure using NEW "O" rings, NEW insulators and NEW gaskets. Coat "O" rings with gasoline before installing "O" rings on fuel injector. Use twisting motion when installing fuel injector on fuel rail.

**NOTE:** Fuel injectors must be properly positioned in fuel rail. All fuel injectors except the end fuel injector next to the fuel pressure regulator should be positioned in fuel rail with electrical connector on fuel injector facing upward, toward fuel pressure regulator side of fuel rail. The end fuel injector next to fuel pressure regulator should be positioned with electrical connector on fuel injector facing downward, away from fuel pressure regulator side of fuel rail.

2) Ensure NEW insulator is installed on top of each fuel injector before installing fuel injector holder. Tighten fuel injector holder bolts to specification. See TORQUE SPECIFICATIONS.

3) Ensure spacers are installed on intake manifold. Tighten fuel rail-to-intake manifold bolts to specification. See TORQUE SPECIFICATIONS.

**NOTE:** Ensure Dark Gray electrical connectors are installed on fuel injectors on cylinders No. 1, 3 and 5, and the Gray or Brown electrical connectors are installed on fuel injectors on cylinders No. 2, 4 and 6.

4) To install remaining components, reverse removal

procedure. Tighten air intake chamber bolts/nuts evenly to specification using several steps. See TORQUE SPECIFICATIONS.

5) Apply engine oil on "O" ring for engine oil dipstick tube assembly or ATF for on dipstick tube assembly for A/T before installing. Operate fuel pump and check for fuel leaks. See FUEL PUMP OPERATION under FUEL SYSTEM in appropriate F - BASIC TESTING article.

## THROTTLE BODY

### Removal (Non-Turbo)

1) Drain cooling system. Remove intake air connector hose. See Fig. 12. Disconnect control cables and electrical connectors for removal of throttle body.

2) Remove throttle body-to-intake air connector bolts/nuts. Remove nuts and throttle body bracket. Disconnect coolant by-pass hose from hose clamp near oil filter.

CAUTION: DO NOT pull on throttle control motor on side of throttle body when removing throttle body. See Fig. 25.

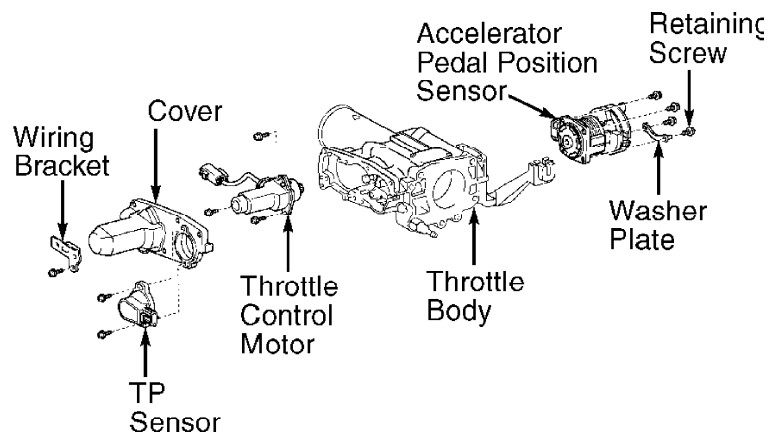
3) Slightly slide throttle body from intake air connector for access to remaining coolant by-pass hoses on throttle body. Note direction that clamps are installed on coolant by-pass hoses for installation reference. Disconnect coolant by-pass hoses from throttle body. Remove throttle body.

### Disassembly

1) If necessary to remove Throttle Position (TP) sensor, remove retaining screws and TP sensor from throttle body. See Fig. 25.

2) If necessary to remove throttle control motor, ensure Throttle Position (TP) sensor is removed from throttle body. Disconnect electrical connector for throttle control motor from wiring bracket. See Fig. 25. Remove retaining screws and cover for access to throttle control motor. Remove retaining screws and throttle control motor from throttle body.

3) If necessary to remove accelerator pedal position sensor, using small screwdriver, bend tabs on washer plate away from retaining screws for accelerator pedal position sensor. See Fig. 25. Remove retaining screws, washer plate and accelerator pedal position sensor from throttle body.



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Fig. 25: Exploded View Of Throttle Body & Components (Non-Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

### Reassembly

1) To install accelerator pedal position sensor, install

accelerator pedal position sensor, washer plate and retaining screws on throttle body. Tighten retaining screws to specification in sequence. See Fig. 26. See TORQUE SPECIFICATIONS. Bend tabs on washer plate against retaining screws. See Fig. 26.

2) To check accelerator pedal position sensor operation after installation on throttle body, install electrical connector on accelerator pedal position sensor.

3) Connect scan tool to Data Link Connector (DLC) No. 3. See Fig. 27. Turn ignition on. DO NOT depress accelerator pedal after ignition is turned on. Using scan tool, check that ACCEL POS#1 (VPA) voltage of the CURRENT DATA is .3-.9 volt. This is the standard accelerator pedal position sensor voltage. Turn ignition off. Disconnect electrical connector for accelerator pedal position sensor.

4) To install throttle control motor, ensure all gears on throttle control motor and throttle body are clean. Apply thin coat of grease on the entire surface of the gear teeth on the throttle body. Install throttle control motor on throttle body. Ensure holes on throttle control motor align with pins on throttle body.

5) Rotate throttle control motor clockwise and install retaining screw "A". See Fig. 28. Ensure throttle control motor is tight against the pins on throttle body. Install remaining retaining screws in throttle control motor. Tighten retaining screws to specification. See TORQUE SPECIFICATIONS.

6) Install cover and retaining screws. Ensure grommet on throttle control motor is not pinched. Tighten cover retaining screws to specification. See TORQUE SPECIFICATIONS. Reinstall electrical connector for throttle control motor on wiring bracket.

7) To install TP sensor, ensure throttle valve opening on throttle body is about 3.5 degrees. Install TP sensor on throttle body so it is at position No. 1 (30 degrees). See Fig. 29. Rotate TP sensor counterclockwise to position No. 2 until it contacts throttle valve. See Fig. 29. Install retaining screws.

8) To check TP sensor adjustment, reinstall electrical connector on TP sensor. Connect scan tool to data link connector No. 3. See Fig. 27. Turn ignition on.

NOTE: Ensure accelerator pedal is not depressed after turning ignition on when adjusting TP sensor.

9) Use scan tool to read throttle valve opening which is displayed as a percentage. Throttle valve opening may be read by accessing THROTTLE POS under CURRENT DATA on scan tool.

10) While reading throttle valve opening, rotate TP sensor counterclockwise (toward throttle control motor on throttle body) until throttle valve opening is 15.6 percent, as this is the center of the standard throttle valve opening of 14.4-16.8 percent. Tighten TP sensor retaining screws to specification. See TORQUE SPECIFICATIONS.

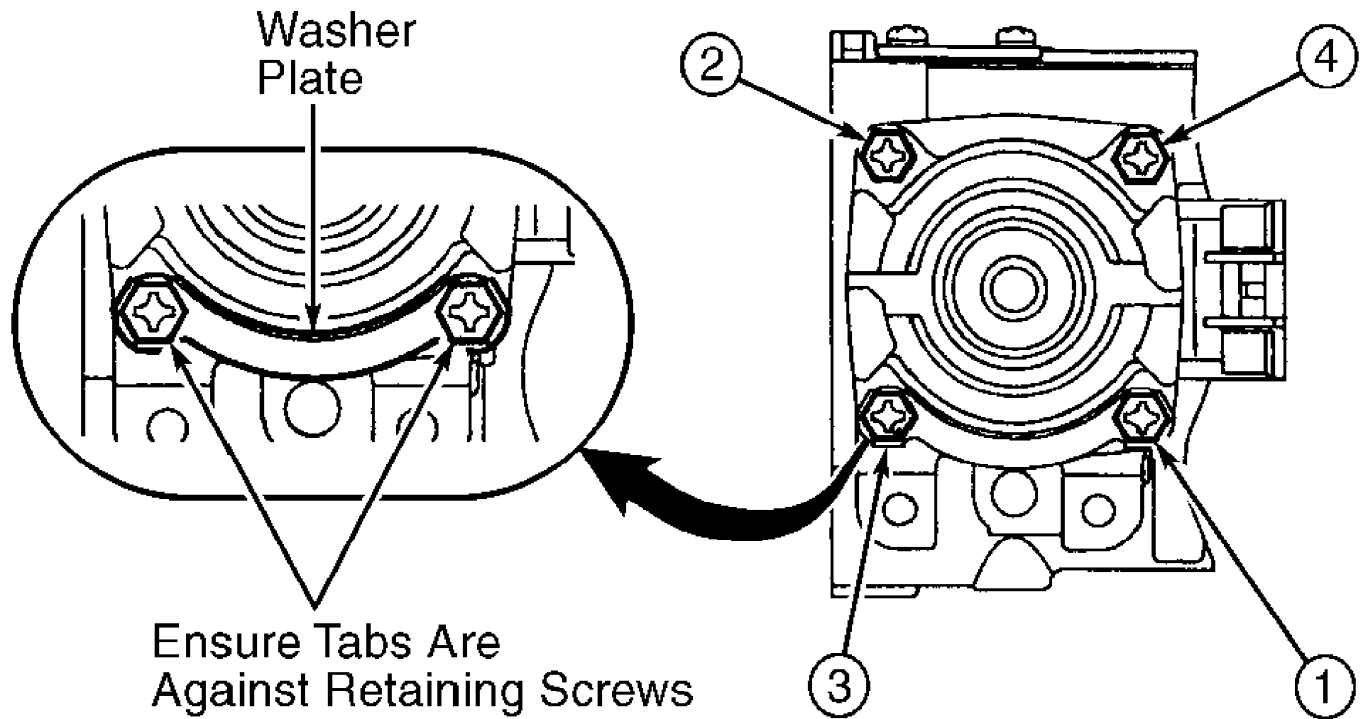
NOTE: When TP sensor retaining screws are tightened, this may cause the throttle valve opening to change. Ensure throttle valve opening remains at 15.6 percent after TP sensor retaining screws are tightened. Readjust TP sensor if necessary.

11) Using screwdriver, fully close throttle valve on throttle body. Use scan tool to read throttle valve opening by accessing THROTTLE POS under CURRENT DATA on scan tool. With throttle valve fully closed, throttle valve opening should be 10-14 percent.

12) If throttle valve opening is not within specification with throttle valve fully closed, repeat steps 9) through 11) until correct throttle valve opening is obtained. Turn ignition off. Remove scan tool.

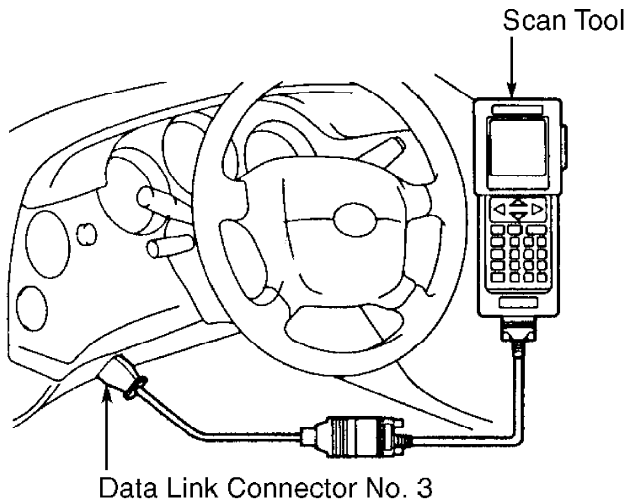
#### Installation

To install, reverse removal procedure using NEW gaskets.  
Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Fill cooling system.



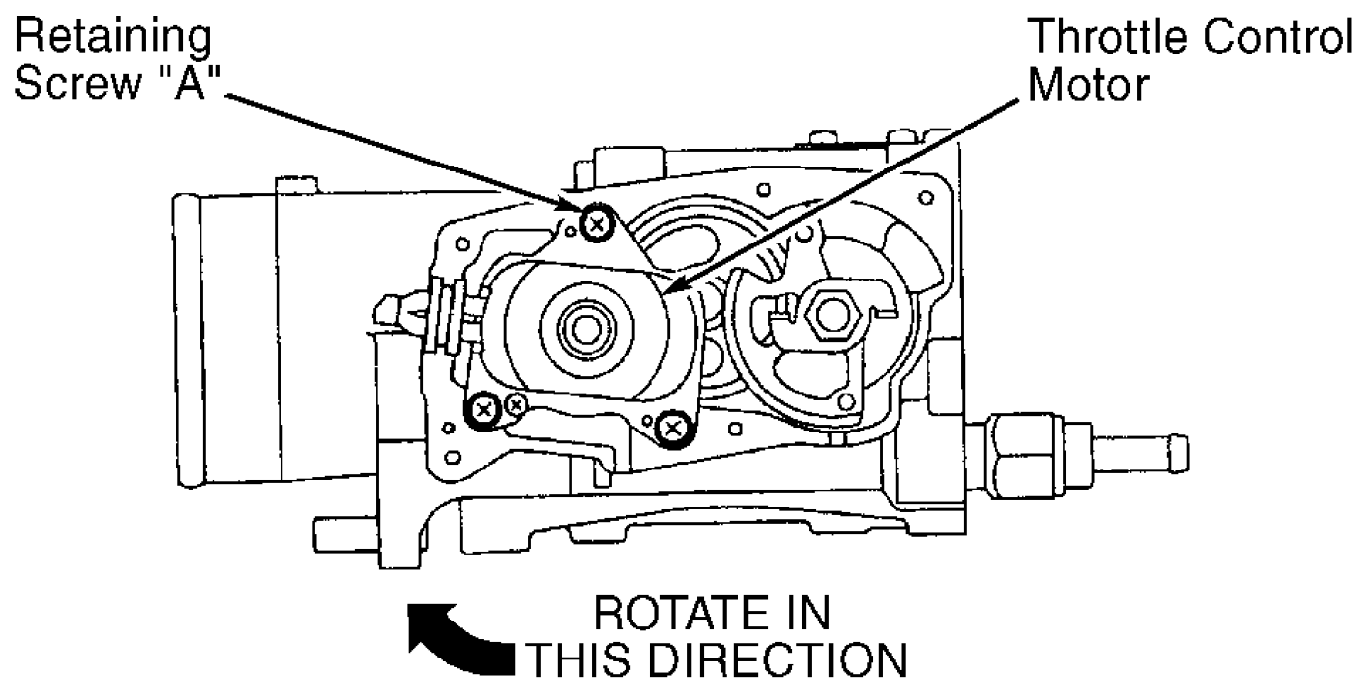
98J11907

Fig. 26: Accelerator Position Sensor Retaining Screw Installation Sequence & Positioning Of Tabs On Washer Plate (Non-Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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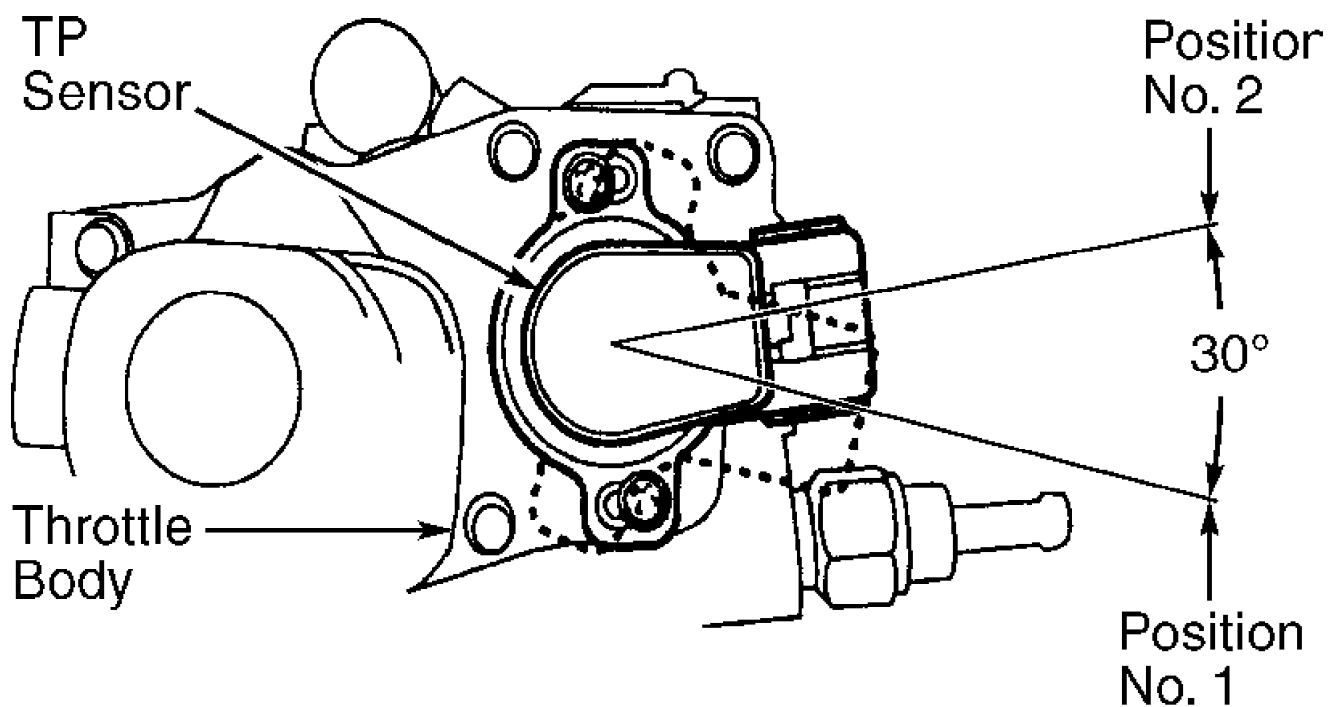
Fig. 27: Connecting Scan Tool  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



98A11908

Fig. 28: Rotating Throttle Control Motor & Installing Retaining Screw "A" (Non-Turbo)

Courtesy of Toyota Motor Sales, U.S.A., Inc.



98B11909

Fig. 29: Installing TP Sensor (Non-Turbo)

Courtesy of Toyota Motor Sales, U.S.A., Inc.

Removal (Turbo)

1) Drain cooling system. Disconnect air intake hose at



throttle body. Disconnect control cables, air hoses, vacuum hoses and electrical connectors at throttle body.

2) Remove bolts/nuts for throttle body. Slide throttle body slightly outward and disconnect coolant hoses from throttle body. Remove throttle body and gasket.

#### Installation

To install, reverse removal procedure using NEW gasket. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Fill cooling system.

### IDLE AIR CONTROL (IAC) VALVE

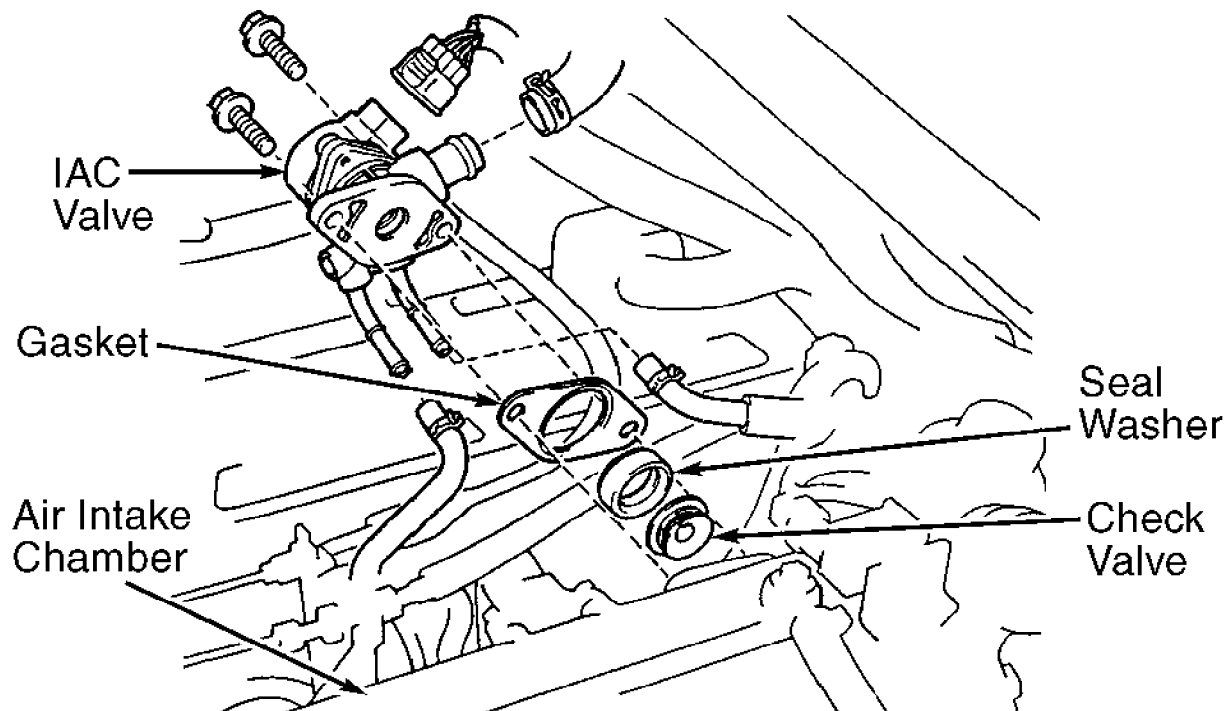
#### Removal (Turbo)

1) Drain cooling system. Disconnect electrical connector at IAC valve. IAC valve is located on rear of air intake chamber, near valve cover. See Fig. 30.

2) Remove bolts and disconnect IAC valve from air intake chamber. Disconnect air hose and coolant hoses from IAC valve. Remove IAC valve and gasket. Note direction of seal washer and check valve installation for installation reference. Remove seal washer and check valve.

#### Installation

To install, reverse removal procedure using NEW gasket. Ensure check valve and seal washer are installed in the correct direction. See Fig. 30. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Fill cooling system.



96H11277

Fig. 30: Locating IAC Valve & Components (Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

### AIR INDUCTION SYSTEM

## INTAKE AIR CONTROL VALVE

NOTE: Turbo models uses an intake air control valve located on turbocharger. For servicing of intake air control valve, see TURBOCHARGERS under AIR INDUCTION SYSTEM.

### Removal (Non-Turbo)

1) Intake air control valve is located in center of air intake chamber, near the actuator. See Fig. 21.

NOTE: Manufacturer provides information for removal of air intake chamber with intake air control valve. Replacement information for just the intake air control valve in the intake air intake chamber is not available.

2) Remove engine oil dipstick and tube with "O" ring. On A/T models, remove transmission dipstick and tube with "O" ring. On all models, disconnect necessary hoses for removal of air intake chamber. See Fig. 9.

3) Remove intake air connector-to-air intake chamber bolts/nuts. Intake air connector bolts to the inside of air intake chamber. See Fig. 9. Remove air intake chamber-to-intake manifold bolts/nuts, air intake chamber and gasket.

### Installation

To install, reverse removal procedure using NEW gaskets and NEW "O" rings. Tighten bolt/nuts to specification. See TORQUE SPECIFICATIONS.

## INTAKE AIR CONTROL VALVE VACUUM SWITCHING VALVE (VSV)

### Removal (Non-Turbo)

1) Intake air control valve VSV is located on side of vacuum tank assembly at lower rear corner of air intake chamber. See Fig. 31.

2) On A/T models, remove transmission dipstick and tube with "O" ring. On all models, retaining nuts and separate vacuum tank assembly from air intake chamber.

3) Disconnect electrical connector and vacuum hoses from intake air control valve VSV. Remove bolt and intake air control valve VSV from vacuum tank.

### Installation

To install, reverse removal procedure. Tighten retaining nuts for vacuum tank assembly to specification. See TORQUE SPECIFICATIONS. On A/T models, use NEW "O" ring when installing transmission dipstick tube.

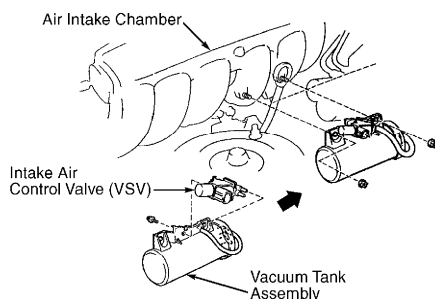


Fig. 31: Locating Intake Air Control Valve VSV (Non-Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## TURBOCHARGERS

#### Removal (Turbo)

1) Disconnect negative battery cable. Drain cooling system. Remove lower engine cover. See Fig. 32. Disconnect cruise control actuator cable from throttle body. Remove No. 1 air hose and air cleaner duct.

2) Disconnect electrical connector at airflow meter. Remove air cleaner and airflow meter assembly. Remove theft deterrent horn from body. Remove bolts/nuts, front lower arm bracket support and upper front crossmember extension. See Fig. 32.

3) Remove bolts/nuts and disconnect exhaust pipe from No. 2 front exhaust pipe. Remove bolts and pipe support bracket. Remove nuts, No. 2 front exhaust pipe and gasket. Remove bolts/nuts and No. 2 front exhaust pipe heat insulator.

4) On A/T models, remove tube clamps for A/T oil cooler pipes at generator and cylinder block. On all models, disconnect engine wire protector from the body. Disconnect coolant hose from No. 3 coolant by-pass pipe. See Fig. 34. Disconnect vacuum hose from No. 1 vacuum pipe. See Fig. 33.

5) Disconnect air hose from IAC valve pipe. See Fig. 33. Disconnect IAC valve pipe from No. 2 air tube. Disconnect electrical connectors and vacuum hoses as necessary for removal of No. 1 vacuum pipe. Remove bolts and No. 1 vacuum pipe. Disconnect electrical connectors and hoses at VSV assembly. See Fig. 33. Remove bolt and VSV assembly.

6) Disconnect crankshaft position sensor connector from clamp. Disconnect coolant by-pass hoses from No. 1 and 2 turbo coolant pipes. See Fig. 34. Remove bolt and disconnect No. 2 turbo coolant pipe from No. 4 air tube.

7) Remove bolts, No. 1 air tube and gasket from No. 1 turbocharger. See Fig. 33. Remove bolts, No. 4 air tube with air by-pass valve assembly from No. 1 turbocharger. See Fig. 33. Remove nuts, intake air control valve and gasket.

8) Disconnect necessary hoses and remove intake air connector and No. 1 air tube. Remove air inlet duct and turbocharger heat insulator.

9) Remove nuts, exhaust by-pass pipe and gasket. Remove bolt/nut and exhaust gas control valve support. Remove retaining nuts and heated oxygen sensor from end of exhaust gas control valve.

**CAUTION:** When removing exhaust gas control valve, DO NOT hit or drop exhaust gas control valve, as the valve is ceramic and may be damaged.

10) Remove nuts and exhaust gas control valve. DO NOT hit or drop exhaust gas control valve. Remove bolts/nuts and No. 1 and 2 turbocharger supports. See Fig. 33. Remove No. 1 and 2 turbo oil pipes and gaskets.

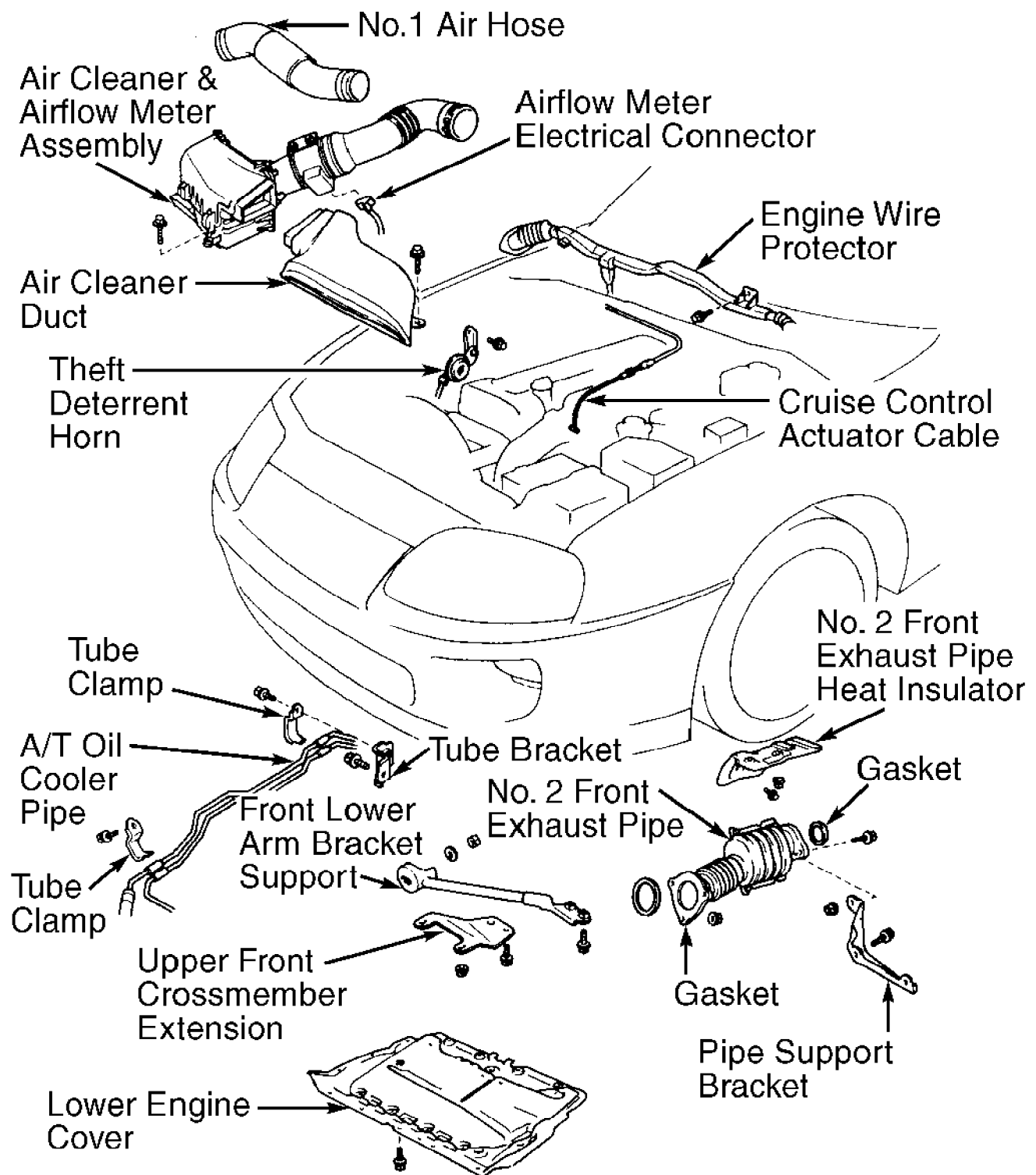
11) Disconnect remaining coolant hoses for turbocharger removal. Remove turbocharger retaining nuts, turbochargers with turbine outlet elbow and gaskets from exhaust manifold.

#### Disassembly

1) Remove vacuum pipe assembly from No. 2 turbocharger. Remove bolts, No. 2 air tube and No. 3 coolant by-pass pipe with gasket from No. 2 turbocharger. See Fig. 34.

2) Remove nuts, No. 2 turbo coolant pipe and gasket from No. 2 turbocharger. Remove nuts, No. 1 turbo coolant pipe and gasket from No. 1 turbocharger.

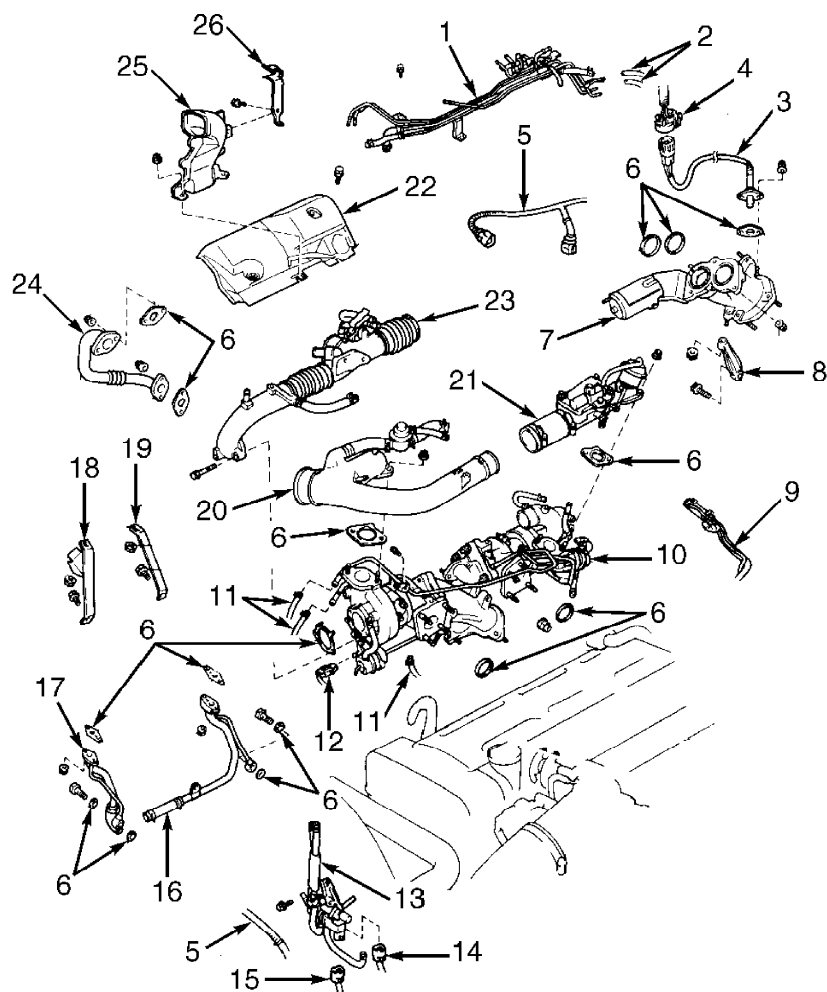
3) Remove nuts, bearing housing side plates and gaskets from turbochargers. Remove turbocharger-to-turbine outlet elbow nuts. Remove turbochargers and gaskets from turbine outlet elbow. See Fig. 31.



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Fig. 32: Locating Components For Turbocharger Removal & Installation (Turbo)

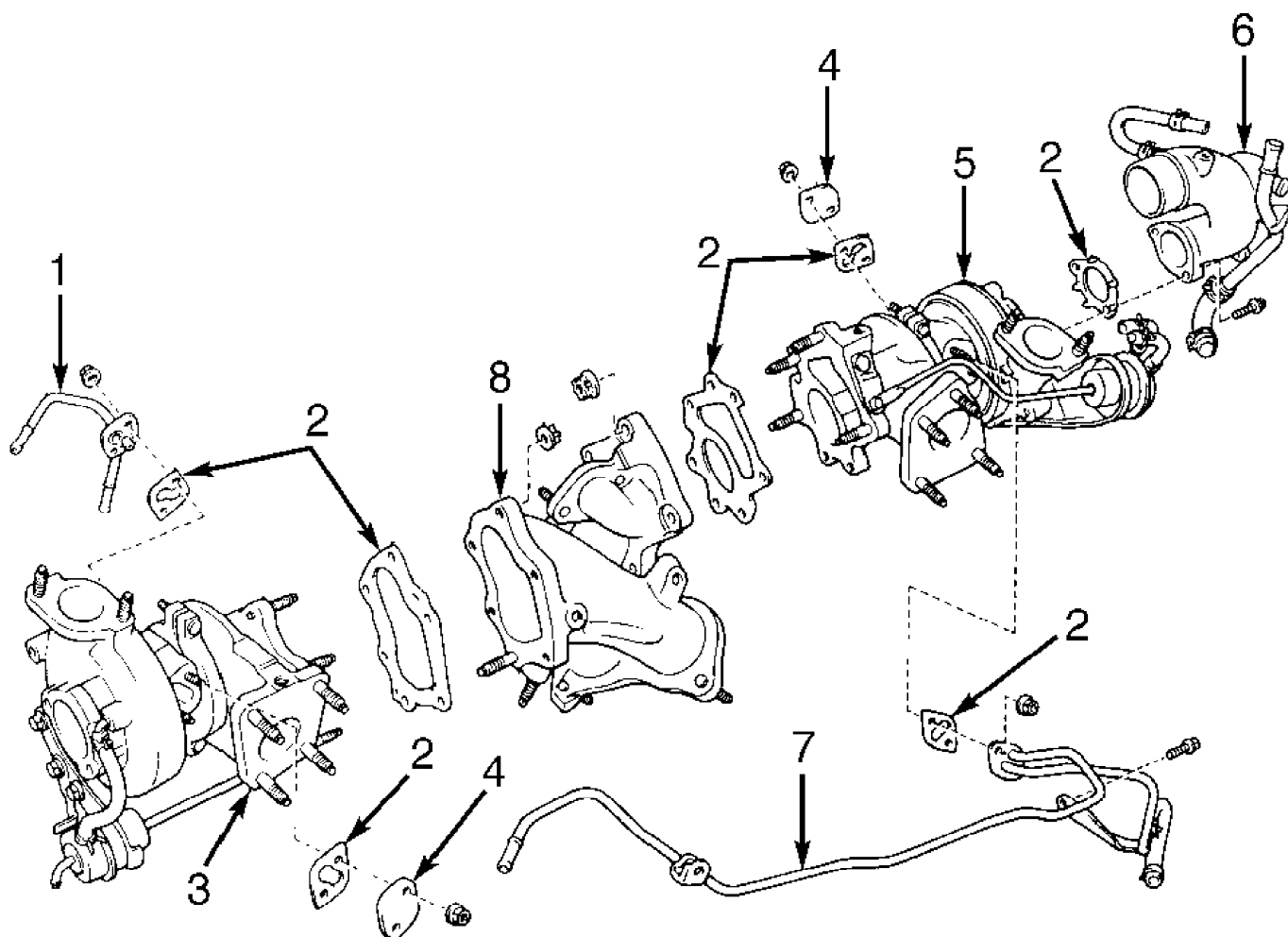
Courtesy of Toyota Motor Sales, U.S.A., Inc.



- |   |   |
|---|---|
| 1. No. 1 Vacuum Pipe                              | 14. Exhaust Gas Control Valve VSV Connector     |
| 2. Air Hose                                       | 15. Wastegate Valve VSV Connector               |
| 3. Heated Oxygen Sensor                           | 16. No. 2 Turbo Oil Pipe                        |
| 4. Heated Oxygen Sensor Connector                 | 17. No. 1 Turbo Oil Pipe                        |
| 5. Engine Wire                                    | 18. No. 1 Turbocharger Support                  |
| 6. Gasket   | 19. No. 2 Turbocharger Support                  |
| 7. Exhaust Gas Control Valve                      | 20. No. 4 Air Tube & Air By-Pass Valve Assembly |
| 8. Exhaust Gas Control Valve Support              | 21. Intake Air Control Valve                    |
| 9. IAC Valve Pipe                                 | 22. Turbocharger Heat Insulator                 |
| 10. Turbochargers & Turbine Outlet Elbow Assembly | 23. Intake Air Connector & No. 1 Air Tube       |
| 11. Coolant By-Pass Hose                          | 24. Exhaust By-Pass Pipe                        |
| 12. Crankshaft Position Sensor Connector          | 25. Air Inlet Duct                              |
| 13. VSV Assembly                                  | 26. Cable Bracket                               |

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Fig. 33: Identifying Turbochargers & Components (Turbo)  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



1. No. 1 Turbo Coolant Pipe
2. Gasket
3. No. 1 Turbocharger
4. Bearing Housing Side Plate
5. No. 2 Turbocharger

6. No. 2 Air Tube & No. 3 Coolant By-Pass Pipe
7. No. 2 Turbo Coolant Pipe
8. Turbine Outlet Elbow

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Fig. 34: Exploded View Of Turbochargers & Components (Turbo)  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### Inspection

1) Rotate impeller wheel in air intake side of each turbocharger and verify smooth rotation. Replace turbocharger if impeller wheel binds, drags or does not rotate smoothly.

2) To check turbine shaft end play, install dial indicator with stem resting against end of shaft on of turbocharger. See Fig. 35

3) Move turbine shaft back and forth while noting turbine shaft end play on dial indicator. See Fig. 35. Remove dial indicator.

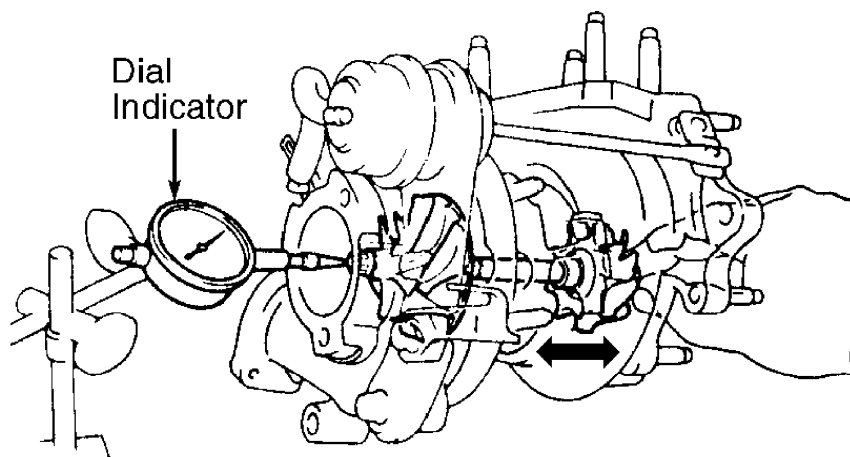
4) To check turbine shaft radial play, install dial indicator

with stem extending into oil drain tube hole and against center of turbine shaft. See Fig. 35.

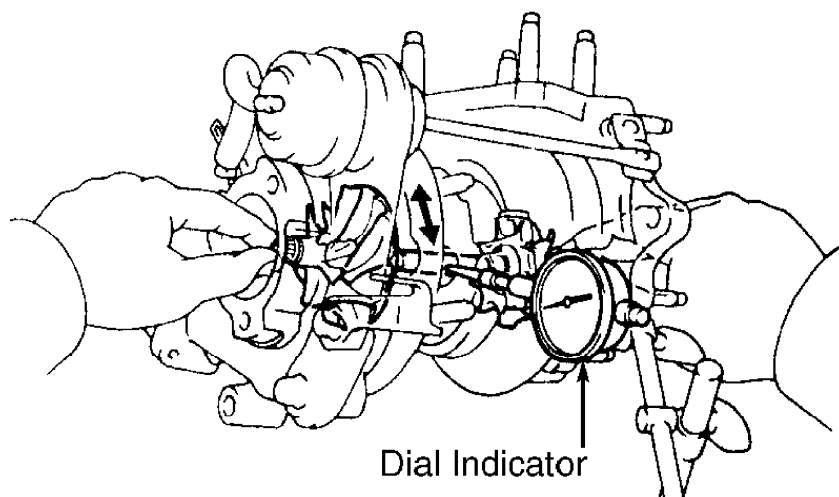
5) Move turbine shaft inward and outward while noting turbine shaft radial play on dial indicator. See Fig. 35. Repeat procedure on both turbochargers. Replace turbocharger if end play or radial play exceeds specification. See TURBOCHARGER SPECIFICATIONS table.

#### TURBOCHARGER SPECIFICATIONS TABLE

Measurement	In. (mm)
Turbine Shaft End Play .....	.0043 (.110)
Turbine Shaft Radial Play .....	.0068 (.173)



CHECKING TURBINE SHAFT END PLAY



CHECKING TURBINE SHAFT RADIAL PLAY

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Fig. 35: Checking Turbine Shaft End Play & Radial Play On Turbocharger (Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: For testing of air by-pass valve, exhaust by-pass valve

actuator and valve, exhaust gas control valve actuator, intake air control valve actuator and wastegate actuator, see appropriate I – SYSTEM/COMPONENT TESTS article.

#### Reassembly

To reassemble, reverse disassembly procedure using NEW gaskets. Use NEW nuts when installing turbochargers on turbine outlet elbow. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. When tightening turbocharger-to-turbine outlet elbow nuts, tighten nuts to specification using several passes.

#### Installation

1) To install, reverse removal procedure using NEW gaskets. Before installing turbochargers, pour 20 cc of engine oil in turbocharger oil inlet while rotating impeller wheel to lube the bearings.

2) Use NEW nuts when installing the following components: turbochargers on exhaust manifold, exhaust gas control valve, heated oxygen sensor, exhaust by-pass pipe and No. 2 front exhaust pipe.

3) Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. When tightening turbocharger retaining nuts, tighten nuts to specification using several passes.

## **EMISSION SYSTEMS & SUB-SYSTEMS**

### **EGR GAS TEMPERATURE SENSOR**

#### Removal & Installation (Turbo)

See EGR GAS TEMPERATURE SENSOR under ENGINE SENSORS, SWITCHES & VALVES.

### **EGR VACUUM SWITCHING VALVE (VSV)**

#### Removal & Installation (Turbo)

EGR VSV servicing procedure is just primarily an unbolt and bolt-on procedure. EGR VSV is bolted on bracket at rear corner of air intake chamber, near EGR valve and contains a Black 2-pin electrical connector.

### **EGR VALVE**

#### Removal & Installation (Turbo)

For EGR valve servicing, procedure is just primarily an unbolt and bolt-on procedure. Tighten retaining nuts to specification. See TORQUE SPECIFICATIONS.

### **EVAP VACUUM SWITCHING VALVE (VSV)**

#### Removal & Installation (Non-Turbo)

EVAP VSV servicing procedure is just primarily an unbolt and bolt-on procedure. EVAP VSV is located at rear inside corner of air intake chamber and contains a Blue 2-pin electrical connector with Yellow and Black/Red wires.

#### Removal & Installation (Turbo)

EVAP VSV servicing procedure is just primarily an unbolt and bolt-on procedure. EVAP VSV is located below rear corner of air intake chamber and contains a Brown 2-pin electrical connector with Violet and Black/Red wires.

### **VAPOR PRESSURE SENSOR**



#### Removal & Installation (Non-Turbo)

Vapor pressure sensor is located on top of charcoal canister at driver's side front corner of engine compartment. Vapor pressure sensor has a vacuum hose connected to it and contains a Black 3-pin electrical connector with Yellow/Black, White/Black and Blue/Red wires. Service information is not available.

### VAPOR PRESSURE SENSOR VACUUM SWITCHING VALVE

#### Removal & Installation (Non-Turbo)

Vapor pressure sensor Vacuum Switching Valve (VSV) is located on top of charcoal canister at driver's side front corner of engine compartment. Vapor pressure sensor VSV has 3 vacuum hoses connected to it and contains a Brown 2-pin electrical connector with Black/Red and Red/Black wires. Service information is not available.

### TORQUE SPECIFICATIONS

#### TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Air Intake Chamber Bolt/Nut	
Turbo .....	20 (27)
Air Intake Chamber Support Brace Bolt	
Turbo .....	30 (41)
Air Intake Chamber Support Bracket Bolt/Nut	
Turbo .....	14 (19)
Air Intake Chamber-To-Intake Manifold Bolt/Nut	
Non-Turbo .....	21 (29)
Control Cable Bracket Bolt	
Turbo .....	14 (19)
Control Lever Retaining Nut .....	12 (16)
ECT Sensor	
Non-Turbo .....	15 (20)
Turbo .....	(1)
EGR Gas Temperature Sensor	
Turbo .....	15 (20)
EGR Pipe Bolt	
Turbo .....	20 (27)
EGR Pipe Nut	
Turbo .....	47 (64)
EGR Valve Retaining Nut	
Turbo .....	15 (20)
Engine Hanger Bolt	
Turbo .....	30 (41)
Exhaust By-Pass Pipe Nut	
Turbo .....	18 (24)
Exhaust Gas Control Valve Nut	
Turbo .....	51 (69)
Exhaust Gas Control Valve Support Bolt/Nut	
Turbo .....	32 (43)
Exhaust Manifold Nut	
Non-Turbo .....	30 (41)
Exhaust Pipe-To-Exhaust Manifold Bolt/Nut	
Non-Turbo .....	32 (43)
Exhaust Pipe-To-No. 2 Front Exhaust Pipe Bolt/Nut	
Turbo .....	43 (58)
Front Lower Arm Bracket Support Bolt/Nut	
Turbo	
Bolt .....	33 (45)

Nut .....	43 (58)
Fuel Inlet Pipe-To-Fuel Rail Union Bolt	
Turbo .....	31 (42)
Fuel Outlet Line-To-Fuel Pump	
Mounting Bracket Union Bolt .....	22 (30)
Fuel Pulsation Damper .....	31 (42)
Fuel Rail-To-Intake Manifold Bolt .....	15 (20)
Fuel Return Pipe-To-Fuel Pressure	
Regulator Union Bolt	
Turbo .....	20 (27)
Heated Oxygen Sensor-To-Exhaust Gas Control Valve	
Assembly Retaining Nut	
Turbo .....	15 (20)
Heated Oxygen Sensor-To-Exhaust Manifold	
Non-Turbo .....	33 (45)
Heated Oxygen Sensor-To-Exhaust Pipe	
Non-Turbo .....	33 (45)
Heated Oxygen Sensor-To-Exhaust Pipe Retaining Nut	
Turbo .....	15 (20)
IAC Valve Bolt	
Turbo .....	15 (20)
Intake Air Connector-To-Air Intake Chamber Bolt/Nut	
Non-Turbo .....	21 (29)
Intake Air Control Valve Nut	
Turbo .....	15 (20)
Intake Manifold Bolt/Nut	
Non-Turbo .....	21 (29)
Intake Manifold Support Brace Bolt	
Non-Turbo .....	30 (41)
Knock Sensor .....	33 (45)
No. 1 Air Tube-To-No. 1 Turbocharger Bolt	
Turbo .....	15 (20)
No. 1 & 2 Turbo Oil Pipe-To-Cylinder Block Union Bolt	
Turbo .....	33 (45)
No. 1 & 2 Turbo Oil Pipe-To-Turbocharger Nut	
Turbo .....	15 (20)
No. 1 & 2 Turbocharger Support Bolt/Nut	
Turbo .....	32 (43)
No. 2 Air Tube & No. 3 Coolant By-Pass	
Pipe-To-No. 2 Turbocharger Bolt	
Turbo .....	15 (20)
No. 2 Front Exhaust Pipe Nut	
Turbo .....	46 (62)
No. 4 Air Tube-To-No. 1 Turbocharger Bolt	
Turbo .....	15 (20)
Pipe Support Bracket Bolt	
Turbo .....	32 (43)
Power Steering Pump Support Brace Bolt	
Non-Turbo .....	29 (39)
Starter Bolt .....	27 (37)
Throttle Body-To-Intake Air Connector Bolt/Nut	
Non-Turbo .....	15 (20)
Throttle Body Gasket Bolt	
Non-Turbo .....	15 (20)
Throttle Body Bolt/Nut	
Turbo .....	15 (20)
Throttle Body Bracket Nut	
Non-Turbo .....	15 (20)
Turbocharger Retaining Nut	
Turbo .....	41 (56)
Turbocharger-To-Turbine Outlet Elbow Nut	
Turbo .....	18 (24)
Upper Front Crossmember Extension Bolt/Nut	

Turbo		
Bolt	22	(30)
Nut	25	(34)
Vacuum Tank Assembly Retaining Nut		
Non-Turbo	15	(20)
Vehicle Speed Sensor Retaining Bolt		
Non-Turbo		(2)
Turbo	12	(16)

INCH Lbs. (N.m)

Accelerator Pedal Position Sensor		
Retaining Screw (3)		
Non-Turbo	33	(3.7)
Airflow Meter-To-Air Intake Hose Bolt		
Non-Turbo	95	(10.7)
Airflow Meter Mounting Bolt		
Turbo	61	(6.9)
Bearing Housing Side Plate Nut		
Turbo	80	(9.0)
Camshaft Position Sensor Retaining Bolt	80	(9.0)
Cover Retaining Screw		
Non-Turbo	15	(1.7)
Crankshaft Position Sensor Bolt	80	(9.0)
Fuel Filter-To-Fuel Pressure Regulator		
Retaining Screw		
Non-Turbo	18	(2.0)
Fuel Injector Holder Bolt		
Turbo	71	(8.0)
Fuel Inlet Pipe-To-Intake Manifold Bolt		
Non-Turbo	80	(9.0)
Fuel Pressure Regulator Bolt		
Turbo	80	(9.0)
Fuel Pump Clamp Bolt		
Non-Turbo	18	(2.0)
Ground Strap-To-Fuel Pump Clamp Bolt		
Non-Turbo	18	(2.0)
Ignition Coil Bolt		
Non-Turbo	71	(8.0)
Ignition Coil Assembly Bolt		
Turbo	80	(9.0)
No. 1 Turbo Coolant Pipe-To-No. 1 Turbocharger Nut		
Turbo	80	(9.0)
No. 2 Turbo Coolant Pipe-To-No. 2 Turbocharger Nut		
Turbo	80	(9.0)
Oil Control Valve Bolt		
Non-Turbo	71	(8.0)
PNP Switch Retaining Bolt	115	(13.0)
PNP Switch Retaining Nut	35	(4.0)
Throttle Control Motor Retaining Screw		
Non-Turbo	33	(3.7)
TP Sensor Retaining Screw		
Non-Turbo	15	(1.7 N.m)
Upper Timing Belt Cover Bolt		
Non-Turbo	71	(8.0)

(1) - Information is not available.

(2) - Tighten retaining bolt to 48 INCH lbs. (5.4 N.m).

(3) - Tighten retaining screws to specification in sequence.  
See Fig. 26.

