

# SECTION 03-04B Fuel Charging and Controls—3.0L/3.2L SHO

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## VEHICLE APPLICATION

Taurus SHO.

## DESCRIPTION

The sequential multiport fuel injection (SFI) system is classified as a multi-point, pulse time, speed density control, fuel injection system. Fuel is metered into each intake port in sequence with the engine firing order in accordance with engine demand through six fuel injectors (9F593) mounted on a tuned intake manifold.

**WARNING: DO NOT SMOKE, CARRY LIGHTED TOBACCO, OR OPEN FLAME OF ANY TYPE WHEN WORKING ON OR NEAR ANY FUEL-RELATED COMPONENT. HIGHLY FLAMMABLE MIXTURES ARE ALWAYS PRESENT AND MAY BE IGNITED, RESULTING IN POSSIBLE PERSONAL INJURY.**

An on-board vehicle powertrain control module (PCM) (12A650) accepts inputs from various engine sensors to compute the fuel flow rate necessary to maintain a prescribed air/fuel ratio throughout the entire engine operational range. The PCM then outputs a command to the fuel injectors to meter the appropriate quantity of fuel.

The EEC-IV engine control system also determines and compensates for the age of the vehicle and its uniqueness. The system will automatically sense and compensate for changes in altitude (i.e. from sea level to mountains) and will also permit push-starting the vehicle if necessary (manual transaxle only).

All engines use a closed-type positive crankcase ventilation (PCV) system and an exhaust emission system to control engine emissions within Government specifications.

To maintain the required exhaust emission levels, the fuel metering system must be kept in good operating condition and adjusted to specifications listed in the applicable Section of the Powertrain Control/Emissions Diagnosis Manual<sup>1</sup>, the applicable Section of this Group, or on the Vehicle Emission Control Information (VECI) decal.

Additional engine performance checks are required to keep the exhaust emissions at the specified minimum pollutant level. Refer to the Pre-Delivery manual, Section 00-03, for these performance checks and recommended intervals.

Always refer to the Master Parts List for parts usage and interchangeability before replacing a throttle body (9E926) or a component part of a throttle body.

<sup>1</sup> Can be purchased as a separate item.

## OPERATION (Continued)

The fuel delivery sub-system consists of a high-pressure in-tank mounted fuel pump (9350) and a fuel filter / reservoir delivering fuel from the fuel tank (9002) through a 20-micron fuel filter to a fuel charging manifold assembly.

The fuel charging manifold assembly incorporates electrically actuated fuel injectors directly above each of the engine's six intake ports. The injectors, when energized, spray a metered quantity of fuel into the intake air stream.

A constant fuel pressure drop is maintained across the fuel injectors by a fuel pressure regulator (9C968). The regulator is connected in series with the fuel injectors and is positioned downstream from them. Excess fuel supplied by the pump, but not required by the engine, passes through the fuel pressure regulator and returns to the fuel tank through a fuel return line.

Each fuel injector is energized once every other crankshaft revolution in sequence with engine firing order. The period of time that the fuel injectors are energized (injector "on time" or pulse width) is controlled by the vehicle's powertrain control module (PCM). Air entering the engine is monitored by speed, pressure and temperature sensors. The outputs of these sensors are processed by the powertrain control module (PCM). The PCM determines the needed injector pulse width and outputs a command to the fuel injector to meter the exact quantity of fuel.

**Air Intake Manifold**

The air intake manifold for the 3.0L SHO is made up of three sections: surge plenums, the primary intake runners and the secondary intake runners. Runner lengths are tuned to optimize engine torque and horsepower output.

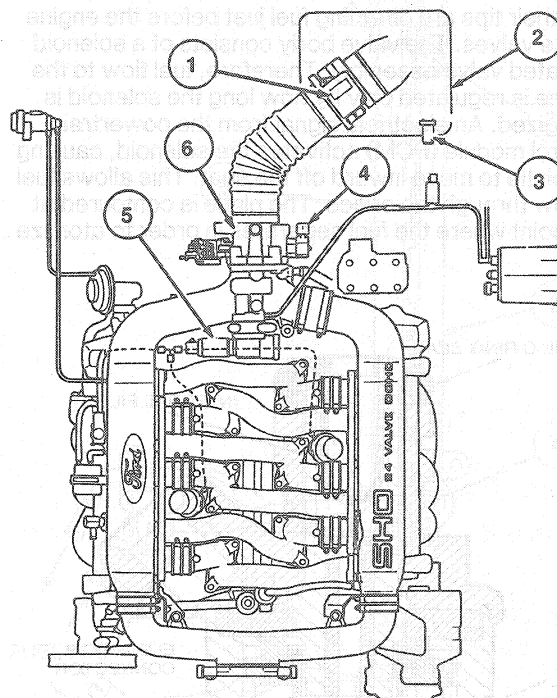
The entire intake system can be removed as an assembly to allow access to the fuel injectors and fuel injection supply manifold (9D280).

The manifold provides mounting flanges for the throttle body assembly, and the ignition control module (ICM) (12A297) on the surge plenum assembly.

The unique air intake manifold (9424) for the 3.0L SHO engine features the following items:

1. Two surge plenums connected by a crossover tube.
2. Primary and secondary intake runners. The primary runner (longer length) is always open. A secondary runner (shorter length) is controlled by a vacuum-operated idle air control valve (9F715) and is open at high engine rpm. Each secondary port has a tuning horn upstream of the idle air control valve and inside surge tanks.

3. Vacuum taps for EGR valve (9D475), fuel pressure regulator, idle air control valve, canister purge and brake booster are provided on the surge plenums.



A12905-B

Item	Part Number	Description
1	12B579	Mass Air Flow Sensor
2	9600	Engine Air Cleaner
3	12A697	Intake Air Temperature Sensor
4	9B989	Throttle Position Sensor
5	9F715	Idle Air Control Valve
6	9E926	Throttle Body

## REMOVAL AND INSTALLATION

**Fuel Charging Assembly**

Throttle Body, Upper and Lower Manifolds

**Pre-Service Procedure**

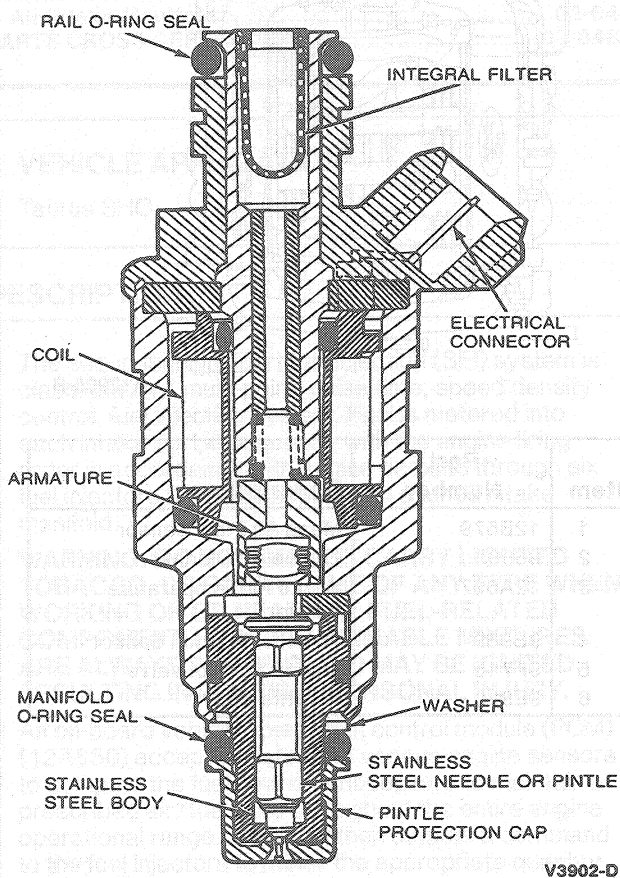
The fuel charging assembly consists of the throttle body, upper and lower intake manifolds. Prior to service or removal of the fuel charging assembly, the following steps must be taken:

1. Disconnect and install protective covers.

## COMPONENTS

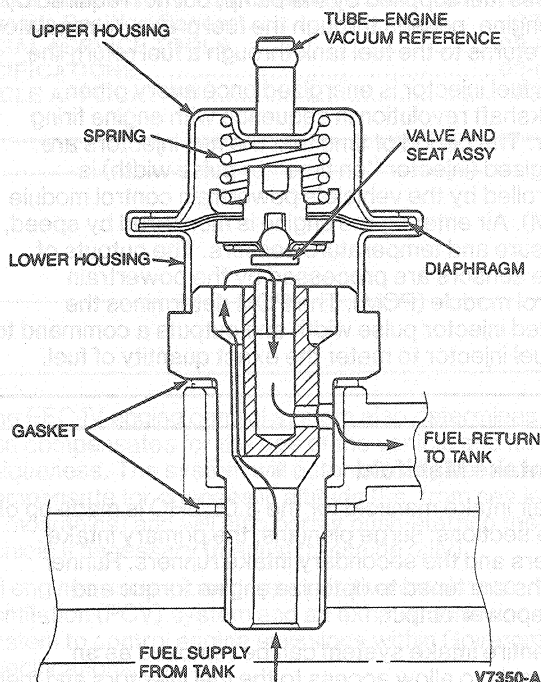
## Fuel Injectors

The fuel injectors are electro-mechanical devices which meter and atomize fuel delivered to the engine. The multiport fuel injection (MFI) fuel injectors are mounted in the lower intake manifold and positioned so that their tips are directing fuel just before the engine intake valves. The valve body consists of a solenoid actuated valve assembly. Therefore, fuel flow to the engine is regulated only by how long the solenoid is energized. An electrical signal from the powertrain control module (PCM) activates the solenoid, causing the pintle to move inward off the seat. This allows fuel to flow through the orifice. The pintle is contoured at the point where the fuel separates in order to atomize it.



## Fuel Pressure Regulator

The fuel pressure regulator is attached to the fuel injection supply manifold downstream of the fuel injectors. It regulates the fuel pressure supplied to the fuel injectors. The fuel pressure regulator is a diaphragm-operated relief valve in which one side of the diaphragm senses fuel pressure and the other side is subjected to intake manifold vacuum. The nominal fuel pressure is established by a spring preload applied to the diaphragm. Balancing one side of the diaphragm with manifold pressure maintains a constant fuel pressure drop across the fuel injectors. Excess fuel is bypassed through the fuel pressure regulator and returned to the fuel tank.



## Fuel Injection Pulse Dampener

The fuel injection pulse dampener (9F775) is attached to the fuel injection supply manifold upstream of the fuel injector to reduce fuel pressure pulsation.

## COMPONENTS (Continued)

**Throttle Body Assembly**

The throttle body assembly controls airflow to the engine via a butterfly-type valve. The throttle position is controlled by a single lever and cable linkage. The body is a single-piece die casting made of aluminum. It has a single bore with an idle air control (IAC) channel around the throttle valve. This bypass channel controls both cold and warm engine idle airflow control as regulated by an idle air control valve assembly mounted directly to the throttle body. The valve assembly is an electro-mechanical device controlled by the powertrain control module (PCM). It incorporates a linear actuator which positions a variable area metering valve.

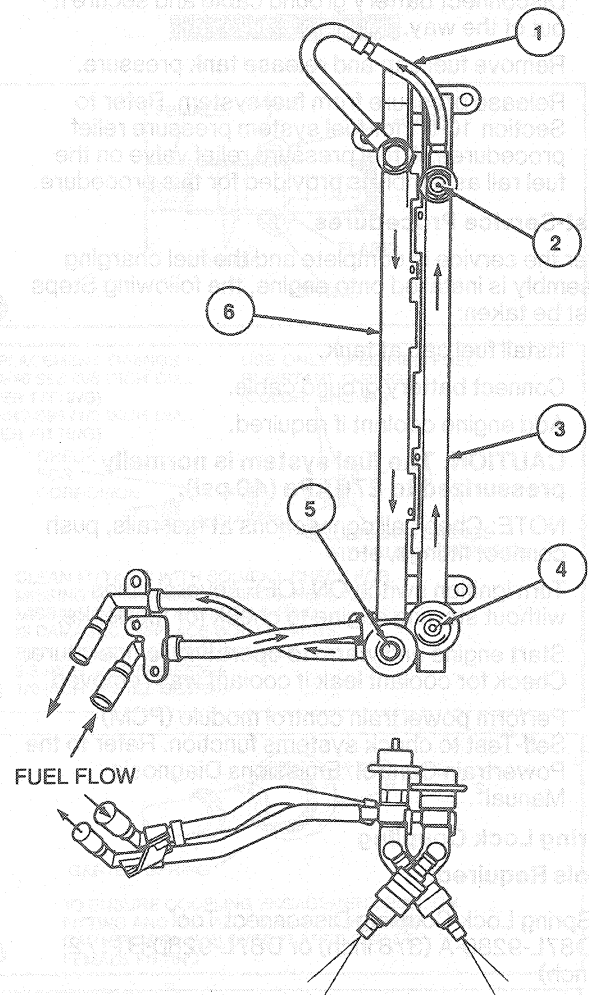
Other features of the throttle body assembly include:

1. An adjustment screw to set the throttle valve at a minimum idle airflow position with a disconnected idle air control (IAC) valve.
2. A throttle body-mounted throttle position sensor (9B989).
3. A PCV fresh-air source upstream of the throttle valve.
4. Two PCV orifices for air and crankcase mixture upstream of the throttle valve, and two downstream of the throttle valve.

**Fuel Injection Supply Manifold Assembly**

The fuel injection supply manifold assembly is the component that delivers high-pressure fuel from the vehicle fuel supply line to the six fuel injector. The assembly consists of two fuel rails with injector connectors, mounting flanges for the fuel injection pulse dampener and fuel pressure regulator and mounting attachments which locate the fuel injection supply manifold assembly and provide fuel injector retention. The fuel inlet and outlet connections have push-connect (CCD) fittings.

A fuel pressure relief valve (9H321) is located on the fuel injection supply manifold assembly for diagnostic tests and field service fuel pressure bleed.



Item	Part Number	Description
1	—	Fuel Rail Connector
2	9H321	Fuel Pressure Relief Valve
3	—	RH Fuel Rail
4	9F775	Fuel Injection Pulse Dampener
5	9C968	Fuel Pressure Regulator
6	—	LH Fuel Rail

**REMOVAL AND INSTALLATION****Fuel Charging Assembly****Throttle Body, Upper and Lower Manifolds****Pre-Service Procedures**

The fuel charging assembly consists of the throttle body, and the upper and lower intake manifolds. Prior to service or removal of the fuel charging assembly, the following Steps must be taken:

1. Open hood and install protective covers.



## REMOVAL AND INSTALLATION (Continued)

2. Disconnect battery ground cable and secure it out of the way.
3. Remove fuel cap and release tank pressure.
4. Release pressure from fuel system. Refer to Section 10-01 for fuel system pressure relief procedures. A fuel pressure relief valve on the fuel rail assembly is provided for this procedure.

**Post-Service Procedures**

After the service is complete and the fuel charging assembly is installed onto engine, the following Steps must be taken:

1. Install fuel cap at tank.
2. Connect battery ground cable.
3. Add engine coolant if required.

**CAUTION: The fuel system is normally pressurized to 276 kPa (40 psi).**

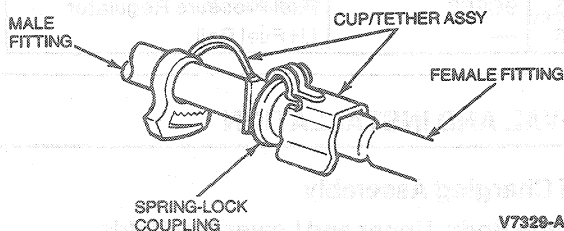
**NOTE:** Check all connections at fuel rails, push connect fittings, etc.

4. Turn ignition switch ON/OFF several times without starting engine to check for fuel leaks.
5. Start engine and warm to operating temperature. Check for coolant leak if coolant was removed.
6. Perform powertrain control module (PCM) Self-Test to check systems function. Refer to the Powertrain Control/Emissions Diagnosis Manual<sup>2</sup>.

**Spring Lock Coupling****Tools Required:**

- Spring Lock Coupling Disconnect Tool D87L-9280-A (3/8 inch) or D87L-9280-B (1/2 inch)

The spring lock coupling is a fuel line coupling held together by a garter spring inside a circular cage. When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting. The garter spring and cage then prevent the flared end of the female fitting from pulling out of the cage. As a redundant locking feature, a horseshoe-shaped retaining clip is incorporated to improve the retaining reliability of the spring lock coupling.

**Removal**

1. Release fuel system pressure. Refer to Section 10-01 for fuel system pressure relief procedures. A fuel pressure relief valve on the fuel injection supply manifold assembly is provided for this procedure.
2. Remove retaining clip from spring lock coupling by hand only. Do not use any sharp tool or screwdriver as it may damage the spring lock coupling.
3. Twist fitting to free it from any adhesion at the O-ring seals.
4. Fit Spring Lock Coupling Disconnect Tool D87L-9280-A (3/8 inch) or D87L-9280-B (1/2 inch) or equivalent to coupling.
5. Close tool and push into open side of the cage to expand garter spring and release female fitting.
6. After garter spring is expanded, pull fittings apart.
7. Remove tool from disconnected coupling.

**Installation**

1. Ensure that garter spring is in cage of male fitting. If garter spring is missing, install a new spring by pushing it into cage opening. If garter spring is damaged, remove it from cage with a small wire hook (do not use a screwdriver) and install a new spring.
  2. Clean all dirt or foreign material from both pieces of coupling.
- WARNING: USE ONLY THE SPECIFIED O-RINGS AS THEY ARE MADE OF A SPECIAL MATERIAL. THE USE OF ANY O-RING OTHER THAN THE SPECIFIED O-RING MAY ALLOW THE CONNECTION TO LEAK INTERMITTENTLY DURING VEHICLE OPERATION.**

3. Replace missing or damaged O-rings. Use only O-rings listed in Spring Lock Coupling illustrations.
4. Lubricate male fitting and O-rings and inside of female fitting with clean engine oil XO-10W30-QSP (ESE-M2C 153-E) or equivalent.
5. Fit female fitting to male fitting and push until garter spring snaps over flared end of female fitting.
6. Ensure coupling engagement by pulling on fitting and visually checking to ensure garter spring is over flared end of female fitting.

**NOTE:** All vehicles require the large black clip to be installed on the supply side fuel line and the small gray clip to be installed on the return side fuel line.

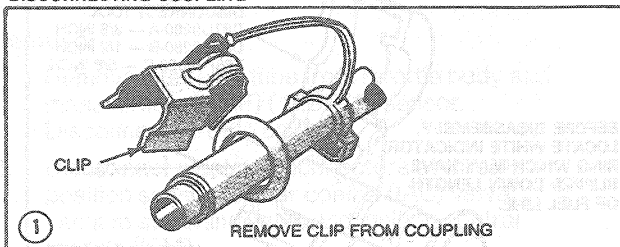
7. Position retaining clip over metal portion of spring lock coupling. Firmly push retaining clip onto spring lock coupling. Ensure that horseshoe portion of clip is over the coupling. Do not install retaining clip over rubber fuel line.

<sup>2</sup> Can be purchased as a separate item.

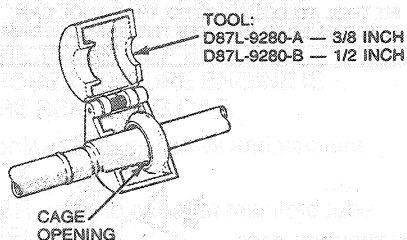
## REMOVAL AND INSTALLATION (Continued)

**TO DISCONNECT COUPLING**

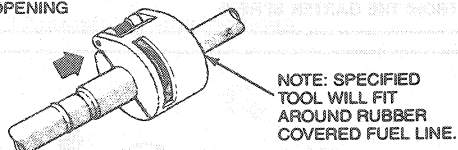
**CAUTION — RELIEVE FUEL PRESSURE BEFORE DISCONNECTING COUPLING**



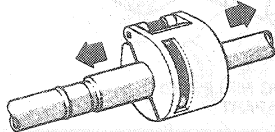
USE SPECIFIED TOOL OR EQUIVALENT



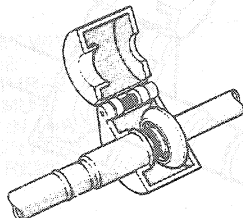
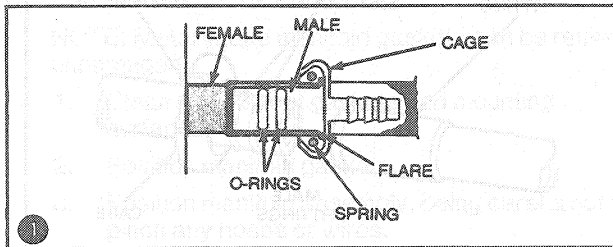
PUSH TOOL INTO CAGE OPENING



4 PULL THE COUPLING MALE AND FEMALE FITTINGS APART



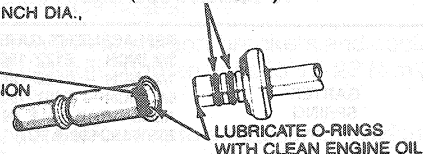
5 REMOVE THE TOOL FROM THE DISCONNECTED SPRING LOCK COUPLING

**TO CONNECT COUPLING**

REPLACEMENT O-RINGS  
390846-S96 (3/8 INCH DIA.,  
2 PER FITTING)  
390847-S96 (1/2 INCH DIA.,  
2 PER FITTING)

USE ONLY SPECIFIED FUEL  
RESISTANT O-RINGS  
(COLOR: BROWN)

CHECK  
FOR  
CORROSION



CLEAN FITTINGS WITH SOLVENT. CHECK FOR MISSING OR DAMAGED O-RINGS. REPLACE MISSING O-RINGS. IF EITHER O-RING IS DAMAGED, REPLACE BOTH O-RINGS.

REPLACEMENT GARTER SPRINGS:

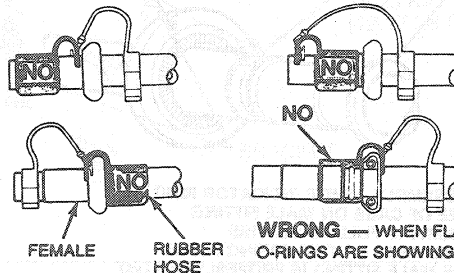
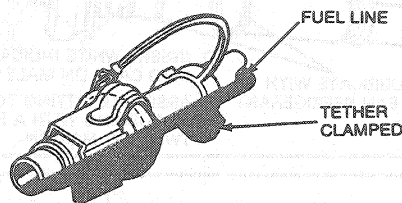
3/8-INCH — E1ZZ-18E576-A  
1/2-INCH — E1ZZ-18E576-B

GARTER SPRING

TO ENSURE COUPLING ENGAGEMENT, PULL ON FITTING AND VISUALLY CHECK TO BE SURE GARTER SPRING IS OVER FLARED END OF FEMALE FITTING

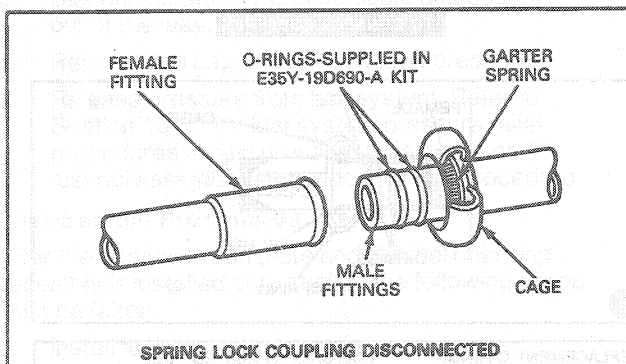
3

YES

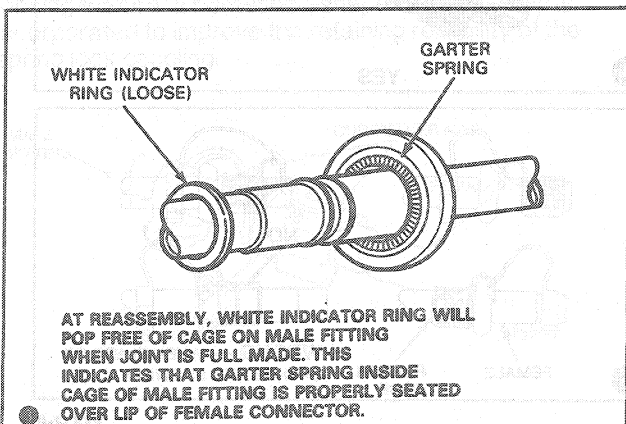
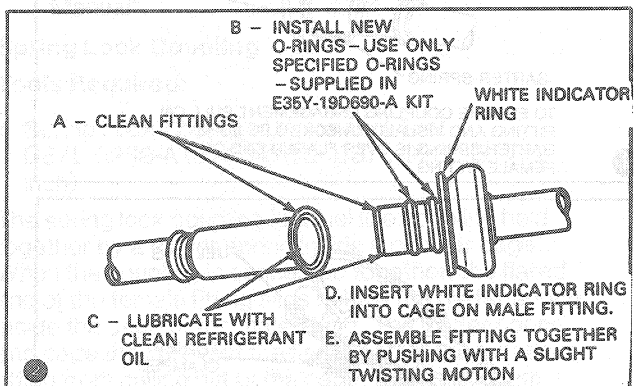
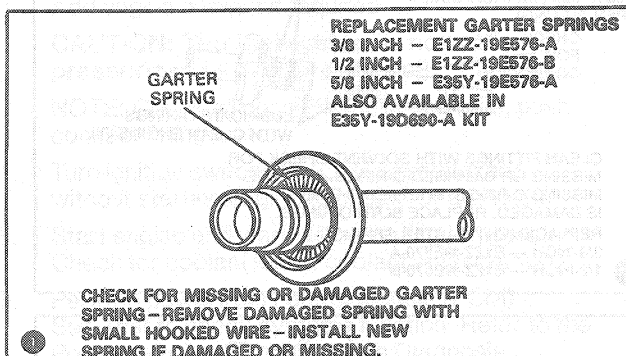
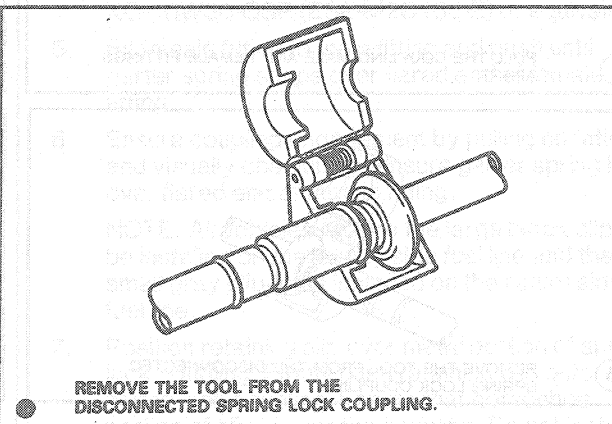
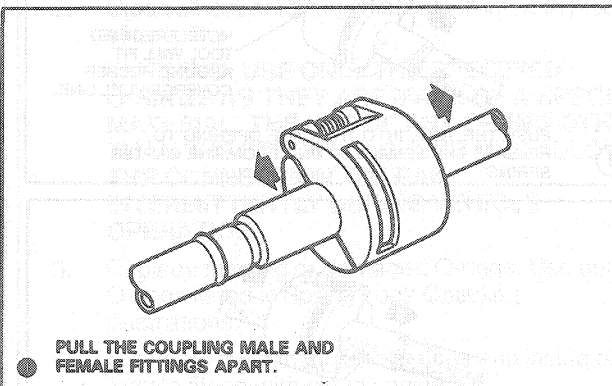
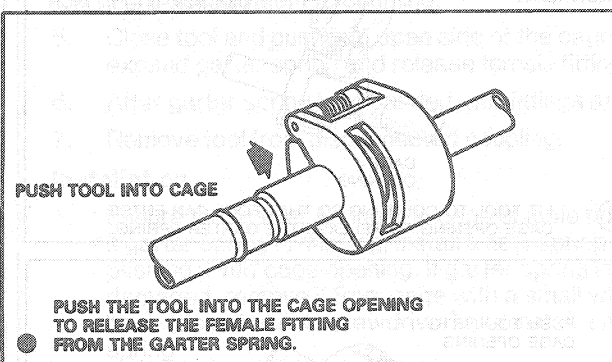
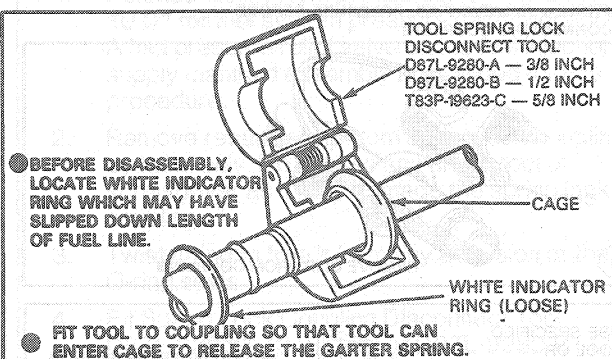


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## REMOVAL AND INSTALLATION (Continued)



## TO CONNECT COUPLING

TO DISCONNECT COUPLING  
CAUTION - DISCHARGE SYSTEM BEFORE DISCONNECTING COUPLING

K6816-D

## REMOVAL AND INSTALLATION (Continued)

## Intake Manifold and Throttle Body

NOTE: Any reference to EGR pertains only to California vehicles.

## Removal

1. Remove intake air tube from throttle body and mass airflow (MAF) (12B579) sensor. Disconnect throttle cables.
2. Disconnect electrical connectors at throttle position sensor, idle air control (IAC) valve, vacuum switching valve and ignition control module (ICM).

**WARNING: COOLING SYSTEM MAY BE UNDER PRESSURE. RELEASE PRESSURE AT RADIATOR PRESSURE CAP BEFORE REMOVING HOSES. ENSURE ENGINE IS COOL BEFORE REMOVING CAP.**

3. Disconnect coolant bypass hoses and vacuum lines.
4. Disconnect EGR valve to exhaust manifold tube (9D477) from EGR valve.
5. Remove eight bolts at intake manifold support brackets and remove brackets.
6. Remove bolt retaining coolant hose bracket.
7. Disconnect PCV hoses.
8. Remove 12 manifold retaining bolts.

9. Remove intake manifold and throttle body assembly.

## Installation

NOTE: Metal intake manifold gaskets can be reused if undamaged.

1. Clean and inspect gaskets and mounting surfaces.
2. Position manifold gaskets.
3. Position manifold assembly, being careful not to pinch any hoses or wires.
4. Install 12 intake manifold retaining bolts. Tighten bolts to 15-23 N·m (11-17 lb-ft).
5. Connect PCV hoses.
6. Install manifold support brackets and coolant hose bracket. Tighten bolts to 15-23 N·m (11-17 lb-ft).
7. Connect EGR valve to exhaust manifold tube to EGR valve.
8. Connect coolant bypass hoses and vacuum lines.
9. Connect electrical connectors at ignition control module (ICM), vacuum switching valve, throttle position sensor and idle air control (IAC) valve.
10. Install throttle cables and intake air tube.
11. Check and top-off coolant.

STUD  
1 REQ'D  
TIGHTEN TO  
16-23 N·m  
(12-17 LB-FT)

UPPER INTAKE  
MANIFOLD AND  
THROTTLE BODY  
ASSY

BOLT 7 REQ'D  
TIGHTEN TO  
16-23 N·m  
(12-17 LB-FT)

NOTE: BRACKET WITH  
STUD IS UNIQUE  
FROM OTHER THREE  
BRACKETS. IT MUST  
BE INSTALLED IN THE  
SAME LOCATION FROM  
WHICH IT WAS REMOVED.

BRACKET

V7352-C

## Air Intake Throttle Body

## Removal

1. Remove intake air tube and throttle cables.



## REMOVAL AND INSTALLATION (Continued)

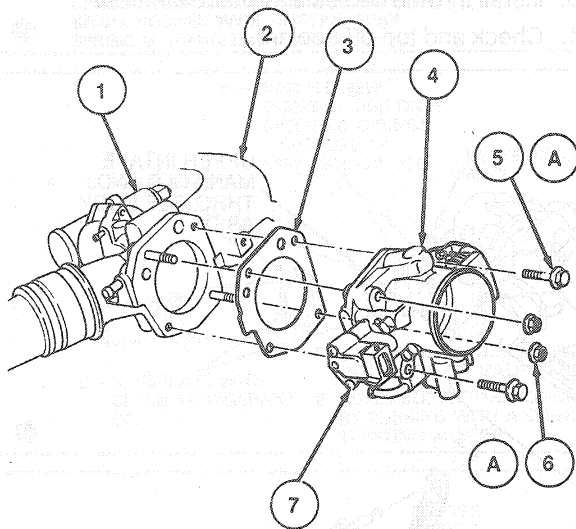
2. Disconnect electrical connectors at throttle position sensor and idle air control (IAC) valve.

**WARNING: COOLING SYSTEM MAY BE UNDER PRESSURE. RELEASE PRESSURE AT RADIATOR PRESSURE CAP BEFORE REMOVING HOSES.**

3. Remove coolant bypass hoses.
4. Disconnect PCV hoses.
5. Remove throttle body retaining bolts and nuts and remove throttle body.

**Installation**

1. Clean and inspect mounting surfaces.
2. Install new air charge control to intake manifold gasket (9E936).
3. Position throttle body and install retaining bolts and nuts. Tighten to 16-23 N·m (12-17 lb-ft).
4. Connect PCV hoses.
5. Connect coolant bypass hoses.
6. Connect electrical connectors at throttle position sensor and idle air control (IAC) valve.
7. Install throttle cables and intake air tube.



A12859-C

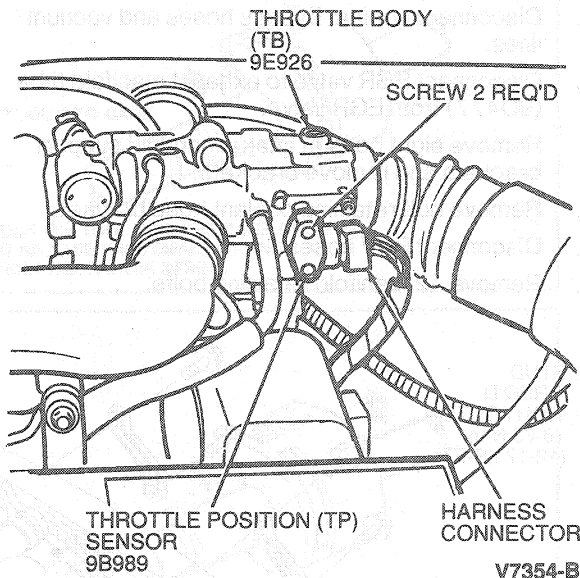
Item	Part Number	Description
1	9F715	Idle Air Control Valve
2	9424	Intake Manifold
3	9E936	Air Charge Control to Intake Manifold Gasket
4	9E926	Throttle Body Assy
5A	—	Bolt
6A	—	Nut
7	9B989	Throttle Position Sensor
A		Tighten to 16-23 N·m (12-17 Lb-Ft)

**Throttle Position Sensor****Removal**

1. Remove electrical connector from throttle position sensor.
2. Remove screws retaining sensor to throttle body and remove throttle position sensor.

**Installation**

1. Align tab on throttle shaft with slot in throttle position sensor and rotate throttle position sensor into position.
2. Install two sensor retaining screws. Tighten to 1.6-1.8 N·m (14-16 lb-in).
3. Connect electrical connector to throttle position sensor.



V7354-B

**Idle Air Control (IAC) Valve Assembly****Removal**

1. Disconnect electrical connector at idle air control (IAC) valve.

**NOTE:** Remove top screw first and swing valve up to provide clearance to remove lower screw.

2. Remove mounting screws and remove idle air control (IAC) valve.

**Installation**

1. Inspect gaskets for damage and replace if necessary.
2. Position idle air control (IAC) valve and install screws. Tighten screws to 7.1-11 N·m (63-97 lb-in).
3. Connect electrical connection at valve.

## REMOVAL AND INSTALLATION (Continued)

## Fuel Rail Assembly

## Removal

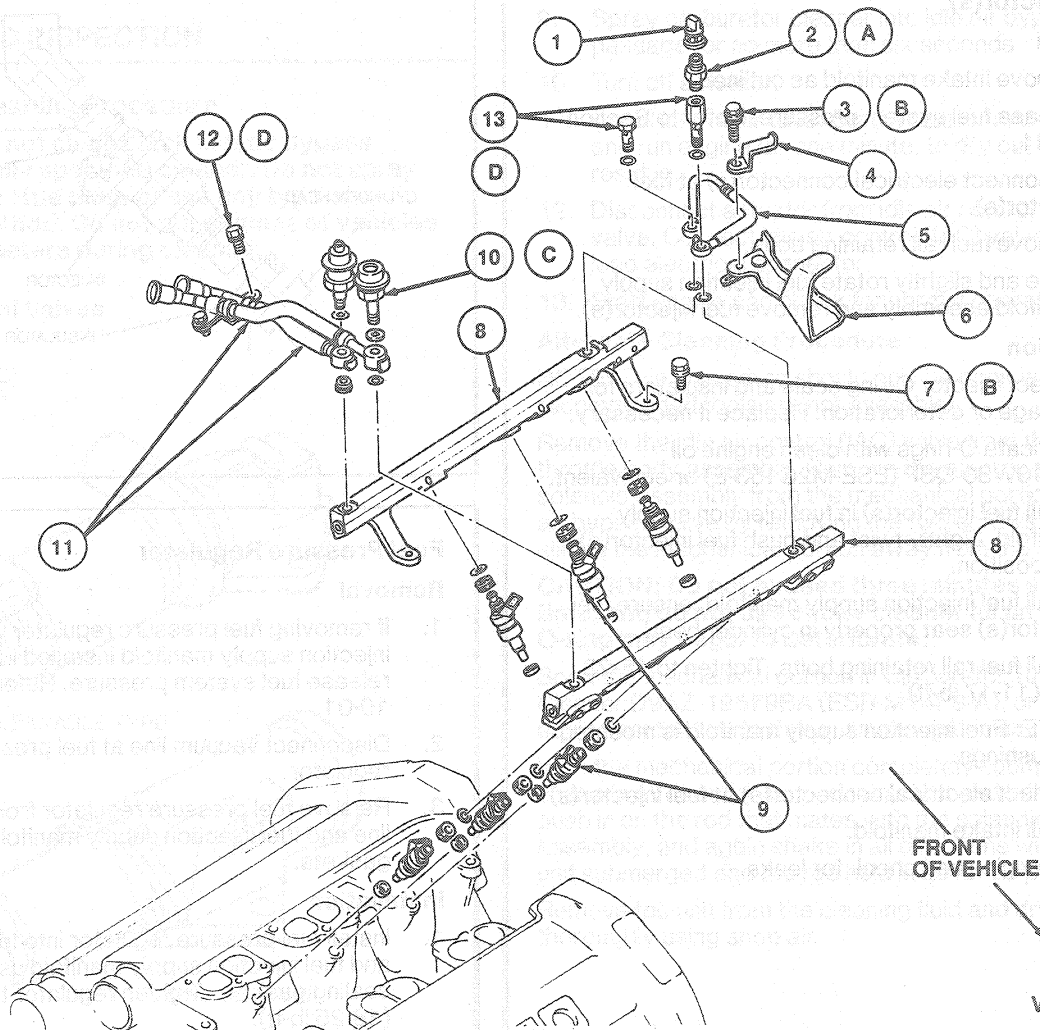
1. Remove intake manifold assembly as outlined.  
**WARNING: THE FUEL SYSTEM IS NORMALLY PRESSURIZED TO 276KPA (39 PSI). RELEASE PRESSURE FROM FUEL SYSTEM BEFORE DISCONNECTING FUEL LINES. REFER TO SECTION 10-01.**
2. Disconnect fuel line spring lock couplings.
3. Disconnect electrical connectors at fuel injectors. Disconnect vacuum connection at fuel pressure regulator assembly.
4. Remove four fuel rail retaining bolts and remove fuel injection supply manifold assembly.

**NOTE:** Fuel injection supply manifold is mounted on bushings. Retain bushings for installation.

## Installation

**WARNING: ALWAYS USE NEW GASKETS WHEN ASSEMBLING FUEL RAIL COMPONENTS TO AVOID COMBUSTION FROM FUEL LEAKAGE.**

1. Install fuel injection supply manifold assembly, ensure all fuel injectors are properly seated.
2. Install four fuel rail retaining bolts. Tighten to 15-23 N·m (11-17 lb-ft).
3. Connect electrical connectors at fuel injectors.
4. Connect fuel line spring lock couplings.
5. Install intake manifold.
6. Connect vacuum lines and remaining electrical connectors.
7. Run engine and check for leaks.



V7355-C

## REMOVAL AND INSTALLATION (Continued)

Item	Part Number	Description
1	9H323	Fuel Pressure Relief Valve Cap
2A	9H321	Fuel Pressure Relief Valve
3B	—	Bolt
4	—	Clip
5	—	Fuel Rail Connector
6	—	Bracket
7B	—	Bolt (4 Req'd)
8	9D280	Fuel Injection Supply Manifold
9	9F593	Fuel Injector Assy (6 Req'd)

(Continued)

Item	Part Number	Description
10C	9F775	Fuel Injection Pulse Dampener
11	—	Fuel Supply and Return Lines
12D	—	Bolt (2 Req'd)
13D	—	Bolt
A	—	Tighten to 5-9 N·m (44-80 Lb·In)
B	—	Tighten to 15-23 N·m (11-17 Lb·Ft)
C	—	Tighten to 25-34 N·m (18-25 Lb·Ft)
D	—	Tighten to 24-34 N·m (18-25 Lb·Ft)

## Fuel Injector(s)

## Removal

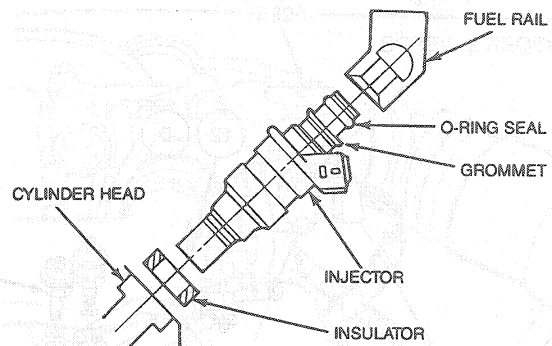
1. Remove intake manifold as outlined.
2. Release fuel system pressure. Refer to Section 10-01.
3. Disconnect electrical connector(s) at fuel injector(s).
4. Remove fuel rail retaining bolts.
5. Raise and slightly rotate fuel injection supply manifold assembly and remove fuel injector(s).

## Installation

1. Inspect injector O-ring seals and insulators for damage or deterioration. Replace if necessary.
2. Lubricate O-rings with clean engine oil XO-10W30-QSP (ESE-M2C153-E) or equivalent.
3. Install fuel injector(s) in fuel injection supply manifold. Lightly twist and push fuel injector(s) into position.
4. Install fuel injection supply manifold, ensure fuel injector(s) seat properly in cylinder head.
5. Install fuel rail retaining bolts. Tighten to 15-23 N·m (11-17 lb-ft).

NOTE: Fuel injection supply manifold is mounted on bushings.

6. Connect electrical connector(s) at fuel injector(s).
7. Install intake manifold.
8. Run engine and check for leaks.



V7356-A

## Fuel Pressure Regulator

## Removal

1. If removing fuel pressure regulator with fuel injection supply manifold installed in vehicle, release fuel system pressure. Refer to Section 10-01.
2. Disconnect vacuum line at fuel pressure regulator.
3. Remove fuel pressure regulator from fuel return line and fuel injection supply manifold and discard gaskets.

## Installation

1. Install fuel pressure regulator into fuel return line and fuel injection supply manifold using new sealing gaskets. Tighten regulator to 25-34 N·m (18-25 lb-ft).
2. Connect vacuum hose to fuel pressure regulator.
3. Run engine and check for leaks.

## REMOVAL AND INSTALLATION (Continued)

## Fuel Injection Pulse Dampener

## Removal

1. If removing fuel pressure regulator with fuel injection supply manifold installed in vehicle, release fuel system pressure. Refer to Section 10-01.
2. Remove fuel injection pulse dampener from fuel injection supply manifold and supply line. Discard sealing gaskets.

## Installation

1. Install fuel injection pulse dampener through supply line and into fuel injection supply manifold using new sealing gaskets. Tighten fuel injection pulse dampener screws to 25-34 N·m (18-25 lb-ft).
2. Run engine and check for leaks.

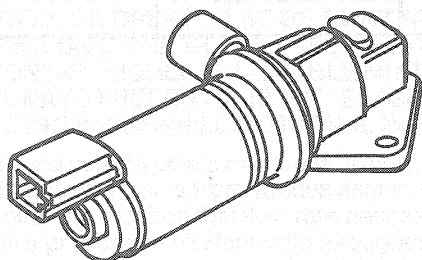
## CLEANING AND INSPECTION

## Preferred Cleaning Procedure

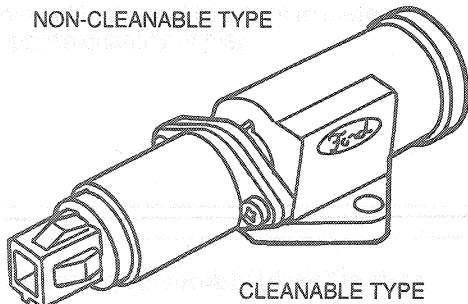
**CAUTION:** Do not clean black plastic bypass valves. Use only specified cleaner. Do not spray directly on throttle plate or use any type of scrubbing method. Do not run engines of vehicles with airflow meters during cleaning.

## Idle Air Control Valves

IDLE AIR  
CONTROL (IAC)  
VALVES 9F715



NON-CLEANABLE TYPE



CLEANABLE TYPE

V7763-A

1. Ensure bypass actuator is operating properly. Refer to Powertrain Control/Emissions Diagnosis Manual<sup>3</sup>.
2. Remove throttle inlet air tube.
3. Disconnect idle air control (IAC) valve connector.
4. Connect Rotunda Air Bypass Actuator 113-00009 and Injector Tester/Cleaner 113-00001 or equivalent.
5. Start the actuator. Do not start engines of vehicles equipped with airflow meters.
6. Spray Carburetor Tune-Up Cleaner D9AZ-19579-BA (ESR-M14P9-A) or equivalent into idle air control (IAC) valve passage for five seconds while actuator is operating.
7. Turn off the actuator. Allow solvent to soak for 15 minutes.
8. Turn on actuator.
9. Spray carburetor cleaner into idle air bypass passage for no more than six seconds.
10. Turn off actuator.
11. Install intake air tube. Start actuator and engine and run engine for one minute, to dry out solvent residue.
12. Disconnect actuator from idle air control (IAC) valve. Connect idle air control (IAC) valve signal lead electrical connector.
13. Start engine and check for normal operation.

## Alternate Cleaning Procedure

**NOTE:** This procedure should only be done when recommended tools are not available.

Remove the idle air control (IAC) valve from the throttle body assembly. Remove the electrical solenoid assembly from the mechanical portion of the air bypass valve by removing the two screws, then sliding the mechanical portion away from the solenoid.

**CAUTION:** Do not exceed three minutes soak time, and do not use choke cleaner as an internal O-ring may begin to deteriorate.

Soak the mechanical portion in Carburetor Tune-Up Cleaner D9AZ-19579BA (ESR-M14P9-A), or equivalent for two to three minutes maximum.

With the mechanical portion completely submerged, shake in all directions: up, down, right and left. Then push in on the rod that mates with the solenoid assembly, and again shake in all directions with the unit submerged and the rod held in as far as possible.

Remove the unit from the cleaning fluid and dry out thoroughly using shop air.

<sup>3</sup> Can be purchased as a separate item.



## CLEANING AND INSPECTION (Continued)

**Air Cleaner**

Refer to Section 00-03 for the recommended air cleaner assembly maintenance mileage interval.

**Cleaning the air cleaner or crankcase ventilation filter elements is not recommended.** They should be replaced at the specified mileage intervals. Clean the air cleaner body and the cover with a solvent or compressed air. Wipe the air cleaner body and cover dry if a solvent is used. Inspect the air cleaner body and cover for distortion or damage at the gasket mating surfaces. Replace cover or body if they are damaged beyond service. Hold filter in front of a light and carefully inspect it for any splits or cracks. If filter is split or cracked, replace it.

## SPECIFICATIONS

**TORQUE SPECIFICATIONS**

Description	N-m	Lb-Ft
Intake Manifold-to-Cylinder Head Bolts	15-23	11-17
Intake Manifold Support Bracket Bolts	15-23	11-17
Throttle Body-to-Intake Manifold Bolts and Nuts	16-23	12-17
Throttle Position Sensor-to-Throttle Body Screws	1.6-1.8	14-16 Lb-In
Air Control Valve-to-Intake Manifold Screws	7.1-11	63-97 Lb-In
Fuel Injection Supply Manifold-to-Cylinder Head Bolts	15-23	12-17
Fuel Injection Supply Manifold Connector Retaining Bolts	24-34	18-25
Fuel Pressure Relief Valve	5-9	44-80 Lb-In
Fuel Pressure Regulator to Fuel Injection Supply Manifold	25-34	18-25
Fuel Injection Pulse Dampener to Fuel Injection Supply Manifold	25-34	18-25

## SPECIAL SERVICE TOOLS

Tool Number	Description
D87L-9280-A	Spring Lock Coupling Disconnect Tool (3/8 inch)
D87L-9280-B	Spring Lock Coupling Disconnect Tool (1/2 inch)

**ROTUNDA EQUIPMENT**

Model	Description
113-00001	Injector Tester/Cleaner
113-00009	Air Bypass Actuator

## PARTS CROSS-REFERENCE

Base Part #	Part Name	Old Part Name
9002	Fuel Tank	
9350	Fuel Pump	
9424	Intake Manifold	
9B989	Throttle Position Sensor	Throttle Potentiometer
9C968	Fuel Pressure Regulator	
9D280	Fuel Injection Supply Manifold	
9D475	EGR Valve	
9D477	EGR Valve to Exhaust Manifold Tube	
9E926	Throttle Body	
9E936	Air Charge Control to Intake Manifold Gasket	
9F593	Fuel Injector	
9F715	Idle Air Control Valve	Throttle Air Bypass Valve
9F775	Fuel Injection Pulse Dampener	
9H321	Fuel Pressure Relief Valve	

# SECTION 03-04C Fuel Charging and Controls—3.8L

SUBJECT	PAGE	SUBJECT	PAGE
<b>CLEANING AND INSPECTION</b>		<b>REMOVAL AND INSTALLATION</b>	
Air Cleaner .....	03-04C-12	Fuel Charging Assembly .....	03-04C-6
Idle Air Control (IAC) Valve .....	03-04C-12	Fuel Injector .....	03-04C-11
<b>COMPONENTS</b>		Fuel Pressure Regulator .....	03-04C-11
Fuel Injection Supply Manifold Assembly .....	03-04C-6	Fuel Rail Assembly .....	03-04C-10
Fuel Injectors .....	03-04C-5	Idle Air Control (IAC) Valve Assembly .....	03-04C-10
Fuel Pressure Regulator .....	03-04C-5	Spring Lock Coupling .....	03-04C-7
Throttle Body Assembly .....	03-04C-5	Throttle Body .....	03-04C-9
<b>DESCRIPTION</b>		Throttle Position (TP) Sensor .....	03-04C-10
Fuel Metering Assembly Identification .....	03-04C-1	Upper Intake Manifold and Throttle Body .....	03-04C-9
<b>OPERATION</b>		<b>SPECIAL SERVICE TOOLS</b> .....	03-04C-13
Air Intake Manifold .....	03-04C-4	<b>SPECIFICATIONS</b> .....	03-04C-13
<b>PARTS CROSS-REFERENCE</b> .....	03-04C-13	<b>VEHICLE APPLICATION</b> .....	03-04C-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

The multiport fuel injection (MFI) system is classified as a multi-point, pulse time, speed density control, fuel injection system. Fuel is metered into each intake port in a sequential firing order. Injectors pulse to follow engine firing order in accordance with engine demand through fuel injectors (9F593) mounted on the cylinder heads.

**WARNING: DO NOT SMOKE, CARRY LIGHTED TOBACCO, OR OPEN FLAME OF ANY TYPE WHEN WORKING ON OR NEAR ANY FUEL-RELATED COMPONENT. HIGHLY FLAMMABLE MIXTURES ARE ALWAYS PRESENT AND MAY BE IGNITED, RESULTING IN POSSIBLE PERSONAL INJURY.**

An on-board vehicle powertrain control module (PCM) 12A650 accepts inputs from various engine sensors to compute the required fuel flow rate necessary to maintain a prescribed air/fuel ratio throughout the entire engine operational range. The PCM then outputs a command to the fuel injectors to meter the appropriate quantity of fuel.

The EEC-IV engine control system also determines and compensates for the age of the vehicle and its uniqueness. The system will automatically sense and compensate for changes in altitude (i.e. from sea level to mountains).

All engines use a closed-type positive crankcase ventilation (PCV) system and an exhaust emission system to control engine emissions within Government specifications.

To maintain the required exhaust emission levels, the fuel metering system must be kept in good operating condition and adjusted to specifications listed in the applicable Section of the Powertrain Control/Emissions Diagnosis Manual<sup>1</sup>, the applicable Section of this Group, or on the Vehicle Emission Control Information (VECI) decal.

Additional engine performance checks are required to keep the exhaust emissions at the specified minimum pollutant level. Refer to the Pre-Delivery manual, Section 00-06, for these performance checks and recommended intervals.

Always refer to the Master Parts List for parts usage and interchangeability before replacing a throttle body (9E926) or a component part of a throttle body.

### Fuel Metering Assembly Identification

The base part number of the fuel metering assembly is 9E926. The base part number on 3.8L engines is located on the boss near the throttle position sensor (9B989).

The "Unleaded Fuel Only" nomenclature must appear:

- Near the fuel filler opening.
- On the instrument cluster.

<sup>1</sup> Can be purchased as a separate item.

## OPERATION

The fuel delivery sub-system consists of a high-pressure in-tank mounted electric fuel pump and a fuel filter / reservoir.

A constant fuel pressure drop is maintained across the injector nozzles by a fuel pressure regulator (9C968). The fuel pressure regulator is connected in series with the fuel injector and is positioned downstream from them. Excess fuel supplied by the pump, but not required by the engine, passes through the fuel pressure regulator and returns to the fuel tank through a fuel return line.

Each fuel injector is energized once every other crankshaft revolution in sequence with engine firing order. The period of time that the fuel injectors are energized (injector "on time" or pulse width) is controlled by vehicle's powertrain control module (PCM). Air entering the engine is monitored by speed, pressure and temperature sensors. The outputs of these sensors are processed by the powertrain control module (PCM). The powertrain control module (PCM) determines the needed injector pulse width and outputs a command to the fuel injector to meter the exact quantity of fuel.

Component	Part Number	Quantity
Fuel Filter / Reservoir	9C968	1
Fuel Pressure Regulator	9C968	1
Fuel Injector	9C968	4

The fuel delivery sub-system also includes a fuel pressure regulator (9C968) which maintains a constant fuel pressure drop across the injector nozzles. The fuel pressure regulator is connected in series with the fuel injector and is positioned downstream from them. Excess fuel supplied by the pump, but not required by the engine, passes through the fuel pressure regulator and returns to the fuel tank through a fuel return line.

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- On the instrument cluster.
- Near the fuel filter opening.

Component	Part Number	Quantity
Fuel Filter / Reservoir	9C968	1
Fuel Pressure Regulator	9C968	1
Fuel Injector	9C968	4

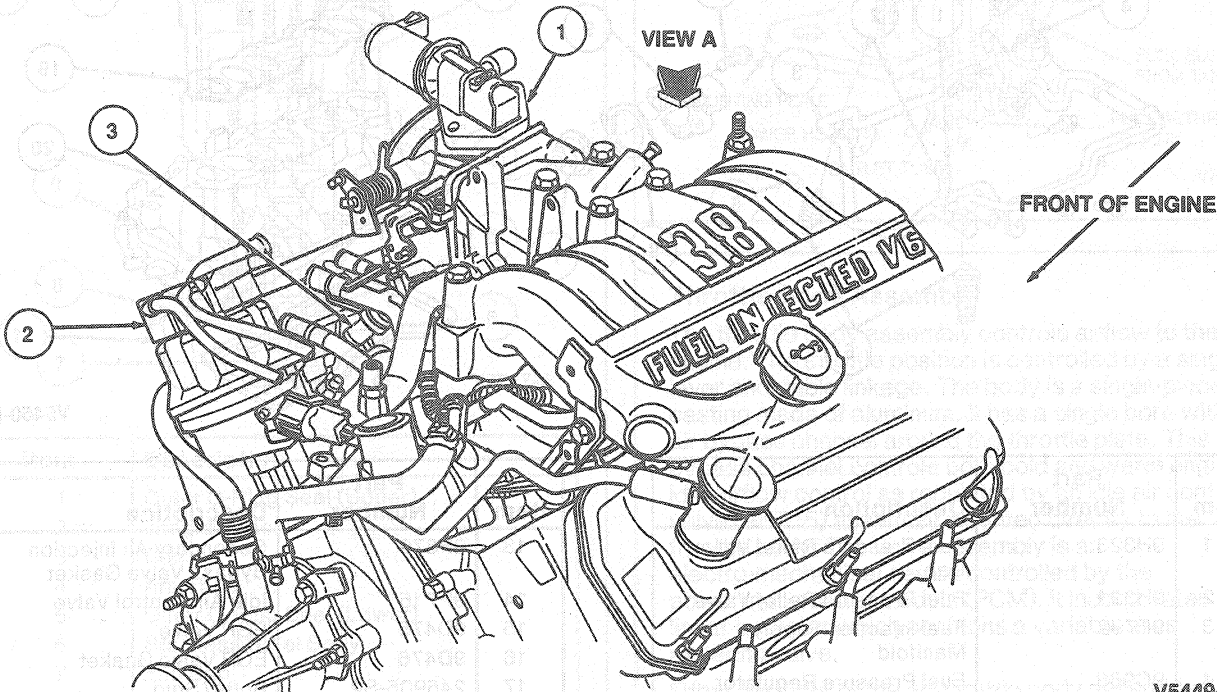
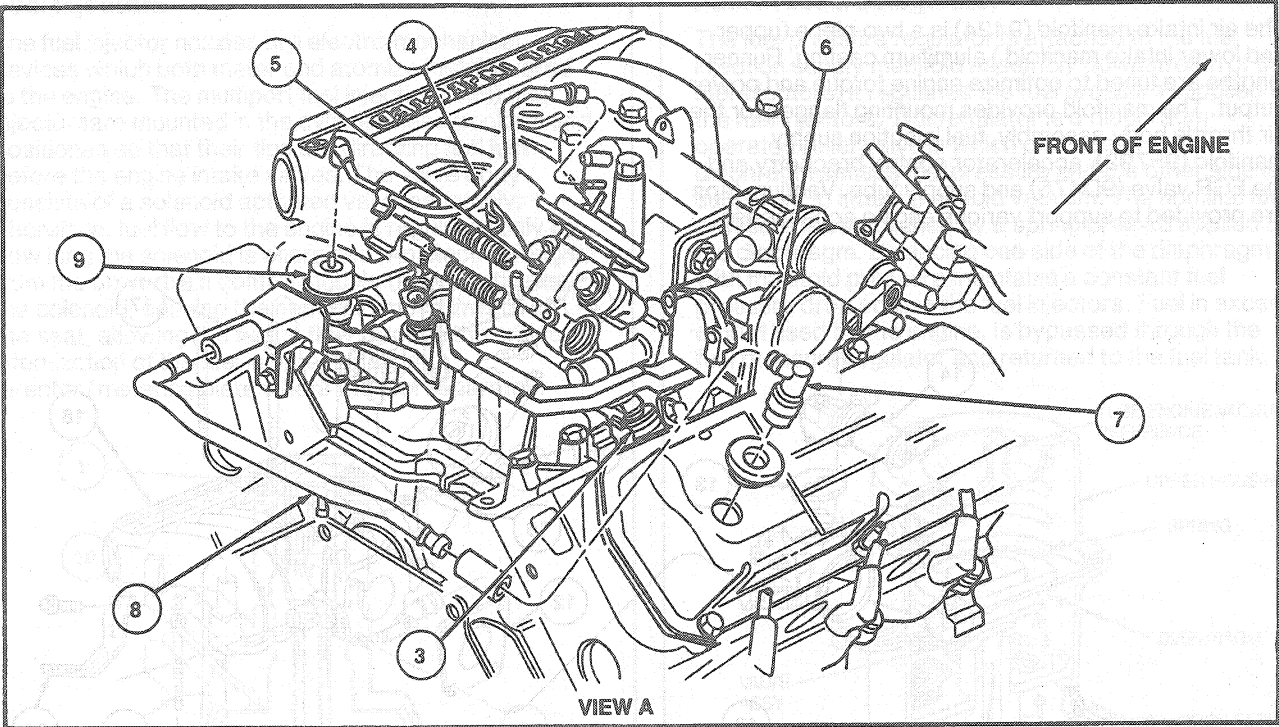
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The base part number of the fuel metering assembly is 9C968. The base part number on 3.8L engines is located on the base near the throttle position sensor (TPS).

OPERATION (Continued)



V5449-E

Item	Part Number	Description
1	9F715	Idle Air Control Valve
2	—	Distributor and Cap Assy
3	9F593	Fuel Injector
4	—	Fuel Pressure Regulator Vacuum Harness

(Continued)

Item	Part Number	Description
5	9D475	EGR Valve
6	9E926	Throttle Body
7	6B890	PCV Valve
8	—	Crankcase Vent Tube
9	9C968	Fuel Pressure Regulator

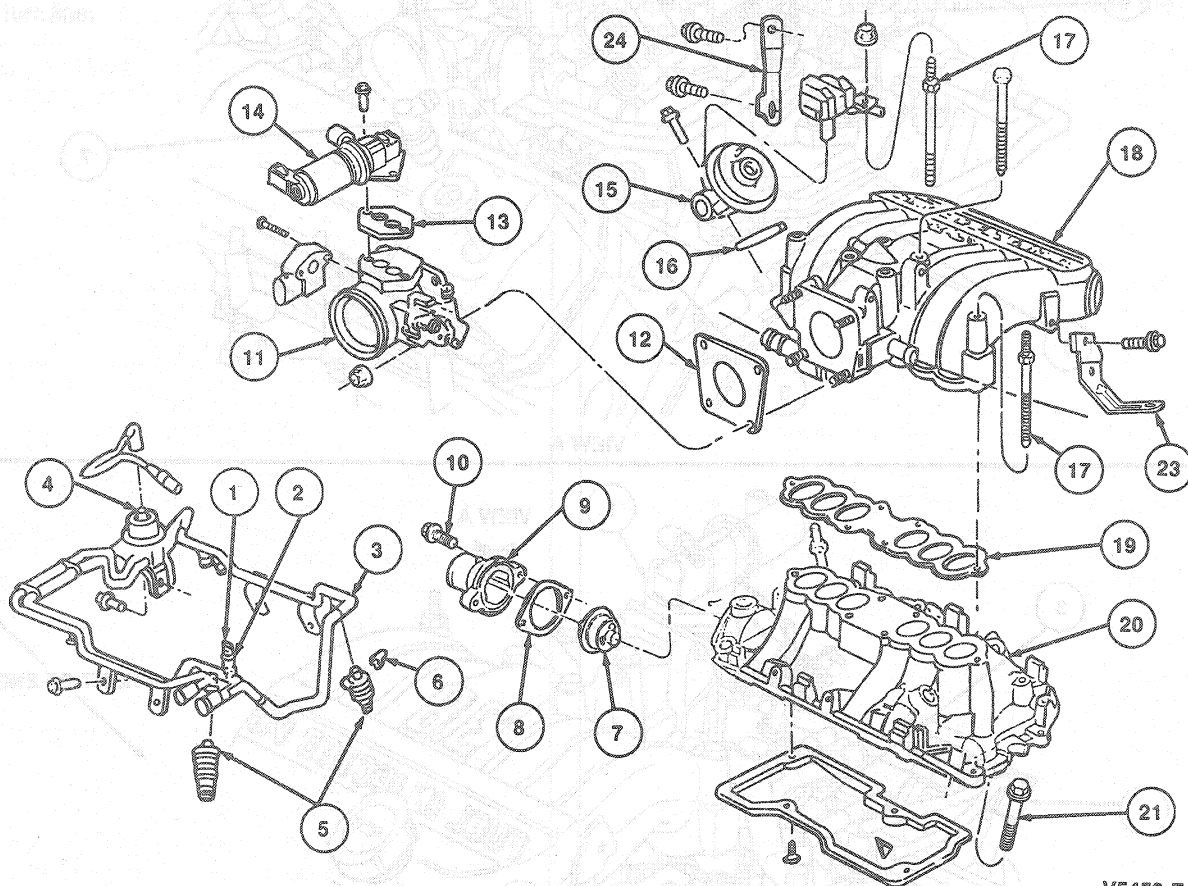
TV5449E



## OPERATION (Continued)

## Air Intake Manifold

The air intake manifold (9424) is a two-piece (upper and lower intake manifold) aluminum casting. Runner lengths are tuned to optimize engine torque and power output. The manifold provides mounting flanges for the air throttle body assembly, fuel injection supply manifold (9F792), accelerator control bracketry and the EGR valve (9D475) and supply tube. Vacuum taps are provided to support various engine accessories.



V5450-E

Item	Part Number	Description
1	9H323	Fuel Pressure Relief Valve Cap
2	9H321	Fuel Pressure Relief Valve
3	9F792	Fuel Injection Supply Manifold
4	9C968	Fuel Pressure Regulator
5	9F593	Fuel Injector
6	247111	Retainer
7	8575	Thermostat
8	8255	Gasket
9	8594	Housing
10	N605909-S8	Bolt
11	9E926	Throttle Body
12	9E936	Air Charge Control to Intake Manifold Gasket

Item	Part Number	Description
13	9F670	Secondary Air Injection Bypass Valve Gasket
14	9F715	Idle Air Control Valve
15	9D475	EGR Valve
16	9D476	EGR Valve Gasket
17	245905-S2	Bolts/Stud
18	9424	Upper Intake Manifold
19	9H486	Intake Manifold Upper Gasket
20	9424	Lower Intake Manifold
21	N803674-S2	Bolt
22	9J444	Front Intake Manifold Support
23	9J444	Rear Intake Manifold Support

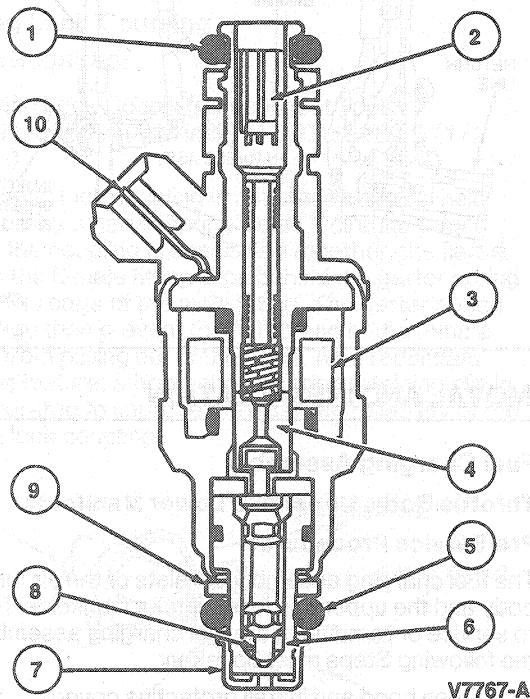
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TV5450E

## COMPONENTS

### Fuel Injectors

The fuel injector nozzles are electro-mechanical devices which both meter and atomize fuel delivered to the engine. The multiport fuel injection (MFI) fuel injectors are mounted in the cylinder head pockets and positioned so that their tips are directing fuel just before the engine intake valves. The valve body consists of a solenoid actuated valve assembly. Therefore, fuel flow to the engine is regulated only by how long the solenoid is energized. An electrical signal from the powertrain control module (PCM) activates the solenoid, causing the needle to move inward off the seat, allowing the fuel to flow through the orifice. Atomization of the fuel is obtained by a director / metering plate where the fuel separates.



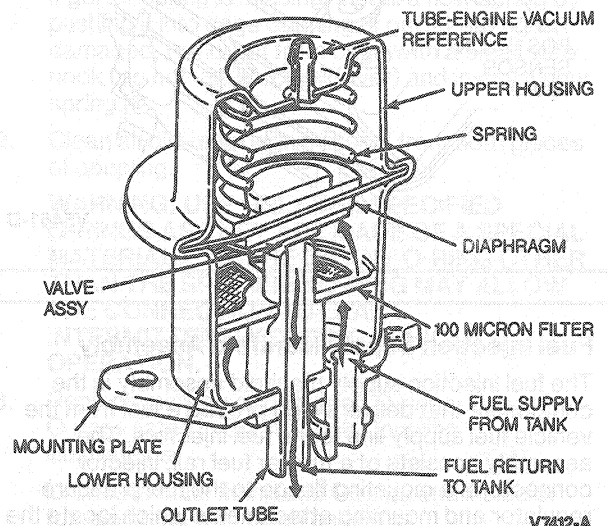
V7767-A

Item	Description
1	Outer O-Ring Seal (Upper)
2	Integral Filter
3	Coil
4	Armature
5	Outer O-Ring Seal (Lower)
6	Stainless Steel Body
7	End Cap
8	Stainless Steel Needle
9	Washer
10	Electrical Connector

TV7767A

### Fuel Pressure Regulator

The fuel pressure regulator is attached to the fuel injection supply manifold assembly downstream of the fuel injectors. It regulates the fuel pressure supplied to the fuel injectors. The regulator is a diaphragm operated relief valve in which one side of the diaphragm senses fuel pressure and the other side is subjected to intake manifold vacuum. The nominal fuel pressure is established by a spring preload applied to the diaphragm. Balancing one side of the diaphragm with manifold pressure maintains a constant fuel pressure drop across the fuel injectors. Fuel in excess of that used by the engine, is bypassed through the fuel pressure regulator and returned to the fuel tank.



V742-A

### Throttle Body Assembly

The throttle body assembly controls airflow to the engine. The throttle position is controlled by a single lever and cable linkage. The body is a single-piece die casting made of aluminum. It has a single bore with an air bypass channel around the throttle plate. This bypass channel controls both cold and warm engine idle airflow control as regulated by an idle air control valve (9F715) assembly mounted directly to the throttle body. The valve assembly is an electro-mechanical device controlled by the powertrain control module (PCM). It incorporates a linear actuator which positions a variable area metering valve.

Other features of the air throttle body assembly include:

1. A pre-set stop to locate the WOT position.

## COMPONENTS (Continued)

2. A throttle body-mounted throttle position sensor.

THROTTLE BODY  
(TB)  
9E926

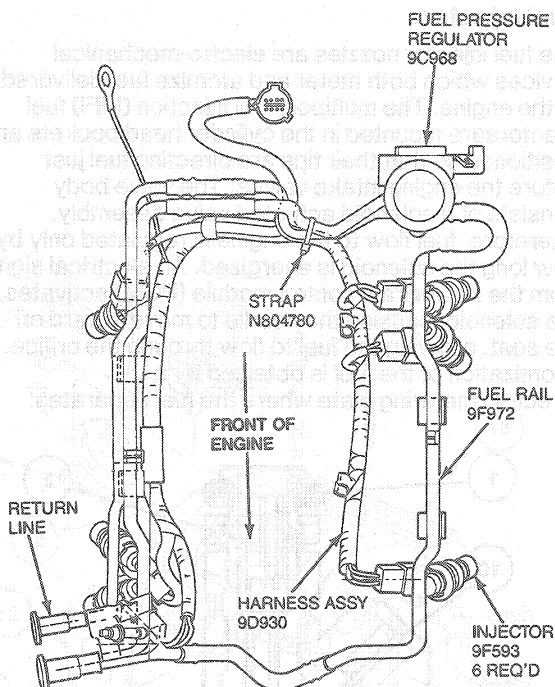
FRONT  
OF ENGINE

THROTTLE  
POSITION (TP)  
SENSOR  
9B989

V5461-D

## Fuel Injection Supply Manifold Assembly

The fuel injection supply manifold assembly is the component that delivers high-pressure fuel from the vehicle fuel supply line to the fuel injectors. The assembly consists of a tubular fuel rail, injector connectors, a mounting flange to the fuel pressure regulator and mounting attachments which locate the fuel injection supply manifold assembly and provide fuel injector retention. The fuel inlet and outlet connections have push-connect (CCD) fittings.



V7418-A

## REMOVAL AND INSTALLATION

## Fuel Charging Assembly

## Throttle Body, Upper and Lower Manifolds

## Pre-Service Procedures

The fuel charging assembly consists of the air throttle body and the upper and lower intake manifolds. Prior to service or removal of the fuel charging assembly, the following Steps must be taken:

1. Open hood and install protective covers.
2. Disconnect battery ground cable and secure it out of the way.
3. Remove fuel cap and release tank pressure.

**CAUTION: The fuel system is normally pressurized to 276 kPa (40 psi).**

4. Release pressure from fuel system. Refer to Section 10-01 for fuel system pressure relief procedures. A fuel pressure relief valve (9H321) on the fuel injection supply manifold assembly is provided for this procedure.

## Post-Service Procedures

After the service is complete and the fuel charging assembly is installed onto engine, the following Steps must be taken:

1. Install fuel cap at tank.
2. Connect battery ground cable.
3. Add engine coolant, if necessary.

## REMOVAL AND INSTALLATION (Continued)

4. Turn ignition switch from ON/OFF several times without starting engine to check for fuel leaks.

**CAUTION: The fuel system is normally pressurized to 276 kPa (40 psi).**

**NOTE:** Check all connections at fuel injection supply manifold, push-connect fittings, etc.

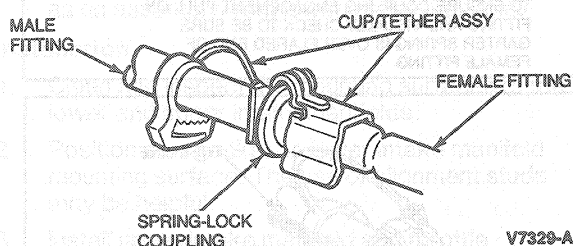
5. Start engine and warm to operating temperature. Check for coolant leak if coolant was removed.
6. Perform powertrain control module (PCM) Self-Test to check systems function. Refer to the Powertrain Control/Emissions Diagnosis Manual<sup>2</sup>.

## Spring Lock Coupling

## Tools Required:

- Spring Lock Coupling Disconnect Tool D87L-9280-A (3/8 inch) or D87L-9280-B (1/2 inch)

The spring lock coupling is a fuel line coupling held together by a garter spring inside a circular cage. When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting. The garter spring and cage then prevent the flared end of the female fitting from pulling out of the cage. As a redundant locking feature, a horseshoe-shaped retaining clip is incorporated to improve the retaining reliability of the spring lock coupling.



## Removal

1. Release fuel system pressure. Refer to Section 10-01 for fuel system pressure relief procedures. A fuel pressure relief valve on the fuel injection supply manifold assembly is provided for this procedure.
2. Remove retaining clip from spring lock coupling by hand only. Do not use any sharp tool or screwdriver as it may damage the spring lock coupling.

3. Twist fitting to free it from any adhesion at the O-ring seals.
4. Fit Spring Lock Coupling Disconnect Tool D87L-9280-A (3/8 inch) or D87L-9280-B (1/2 inch) or equivalent to coupling.
5. Close tool and push into open side of the cage to expand garter spring and release female fitting.
6. After garter spring has expanded, pull fittings apart.
7. Remove tool from disconnected coupling.

## Installation

1. Ensure that garter spring is in cage of male fitting. If garter spring is missing, install a new spring by pushing it into cage opening. If garter spring is damaged, remove it from cage with a small wire hook (do not use a screwdriver) and install a new spring.
2. Clean all dirt or foreign material from both pieces of coupling.

**WARNING: USE ONLY THE SPECIFIED O-RINGS AS THEY ARE MADE OF A SPECIAL MATERIAL. THE USE OF ANY O-RING OTHER THAN THE SPECIFIED O-RING MAY ALLOW THE CONNECTION TO LEAK INTERMITTENTLY DURING VEHICLE OPERATION.**

3. Replace missing or damaged O-rings. Use only O-rings listed in Spring Lock Coupling illustrations.

Lubricate male fitting and O-rings and inside of female fitting with clean engine oil XO-10W30-QSP (ESE-M2C153-E) or equivalent.

4. Fit female fitting to male fitting and push until garter spring snaps over flared end of female fitting.
5. Ensure coupling engagement by pulling on fitting and visually checking to ensure garter spring is over flared end of female fitting.

**NOTE:** All vehicles require the large black clip to be installed on the supply side fuel line and the small gray clip to be installed on the return side fuel line.

6. Position retaining clip over metal portion of spring lock coupling. Firmly push retaining clip onto spring lock coupling. Ensure that horseshoe portion of clip is over the coupling. Do not install retaining clip over rubber fuel line.

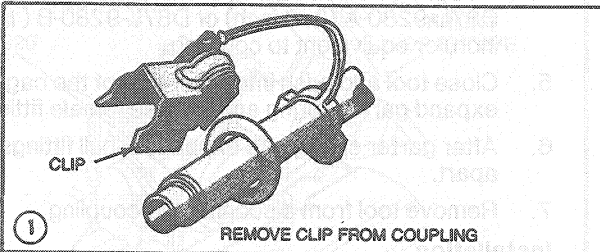
<sup>2</sup> Can be purchased as a separate item.



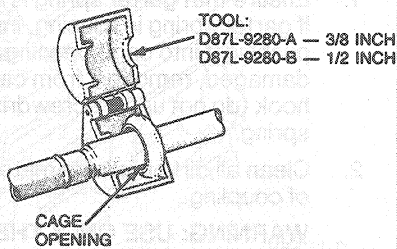
## REMOVAL AND INSTALLATION (Continued)

**TO DISCONNECT COUPLING**

**CAUTION — RELIEVE FUEL PRESSURE BEFORE DISCONNECTING COUPLING**

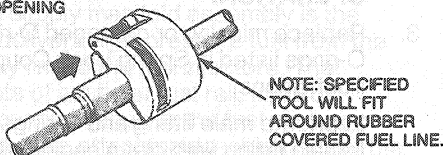


USE SPECIFIED TOOL OR EQUIVALENT

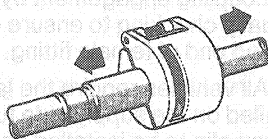


2 FIT TOOL TO COUPLING SO THAT TOOL CAN ENTER CAGE OPENING TO RELEASE THE GARTER SPRING.

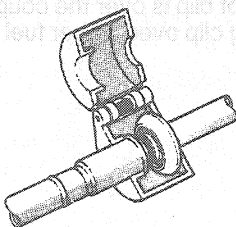
PUSH TOOL INTO CAGE OPENING



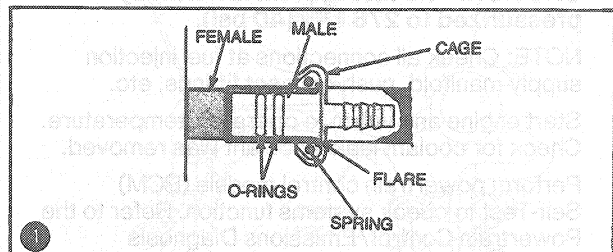
3 PUSH THE TOOL INTO THE CAGE OPENING TO RELEASE THE FEMALE FITTING FROM THE GARTER SPRING



4 PULL THE COUPLING MALE AND FEMALE FITTINGS APART



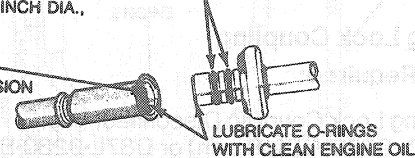
5 REMOVE THE TOOL FROM THE DISCONNECTED SPRING LOCK COUPLING

**TO CONNECT COUPLING**

REPLACEMENT O-RINGS  
390846-S96 (3/8 INCH DIA.,  
2 PER FITTING)  
390847-S96 (1/2 INCH DIA.,  
2 PER FITTING)

USE ONLY SPECIFIED FUEL RESISTANT O-RINGS (COLOR: BROWN)

CHECK FOR CORROSION

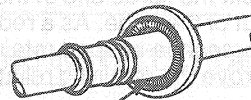


CLEAN FITTINGS WITH SOLVENT. CHECK FOR MISSING OR DAMAGED O-RINGS. REPLACE MISSING O-RINGS. IF EITHER O-RING IS DAMAGED, REPLACE BOTH O-RINGS.

REPLACEMENT GARTER SPRINGS:

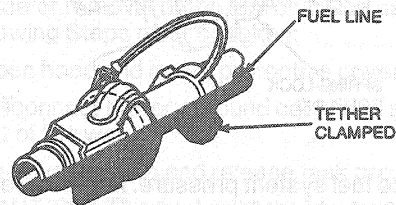
3/8-INCH — E1ZZ-19E576-A  
1/2-INCH — E1ZZ-19E576-B

2



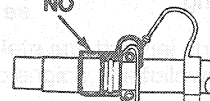
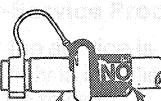
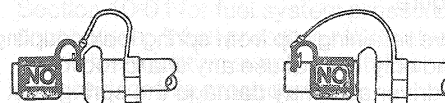
TO ENSURE COUPLING ENGAGEMENT, PULL ON FITTING AND VISUALLY CHECK TO BE SURE GARTER SPRING IS OVER FLARED END OF FEMALE FITTING

3



4

YES



WRONG — WHEN FLARE OR O-RINGS ARE SHOWING

5

V7332-A

## REMOVAL AND INSTALLATION (Continued)

## Upper Intake Manifold and Throttle Body

## Removal

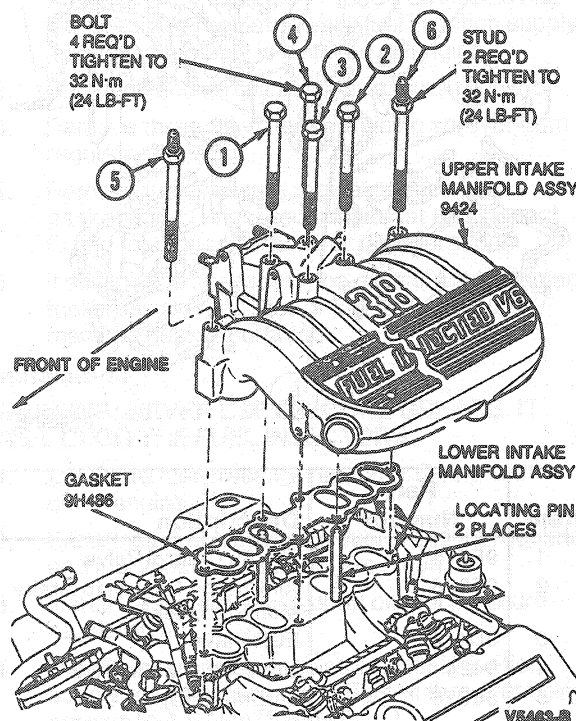
1. Disconnect electrical connectors at idle air control (IAC) valve, throttle position sensor and EGR pressure valve sensor (9J460).
2. Disconnect throttle linkage at throttle ball and transmission linkage from throttle body. Remove two bolts securing bracket to intake manifold and position bracket with cables out of way.
3. Disconnect upper intake manifold vacuum fitting connections by disconnecting all vacuum lines to vacuum tree, vacuum lines to EGR valve and vacuum line to fuel pressure regulator.
4. Disconnect PCV system by disconnecting hose from fitting on rear of upper intake manifold.
5. Remove nut retaining EGR transducer to upper intake manifold.
6. Loosen EGR tube at exhaust manifold and disconnect at EGR valve.
7. Remove two bolts retaining EGR valve to upper intake manifold and remove EGR valve and EGR transducer as an assembly.
8. Remove six upper intake manifold retaining bolts.
9. Remove two retaining bolts on front and rear edges of upper intake manifold where intake manifold supports (9J444) are located.
10. Remove nut retaining generator bracket to upper intake manifold and two bolts retaining generator bracket to water pump and generator.
11. Remove upper intake manifold and throttle body as an assembly from lower intake manifold.

## Installation

1. Clean and inspect the mounting surfaces of the lower and upper intake manifolds.
2. Position new gasket on lower intake manifold mounting surface. The use of alignment studs may be helpful.
3. Install upper intake manifold and throttle body assembly to lower intake manifold. Ensure gasket remains in place (if alignment studs are not used).
4. Install four center retaining bolts and two studs to upper intake manifold and tighten to 10 N·m (8 lb-ft). Repeat sequence in two steps: 20 N·m (15 lb-ft) and 32 N·m (24 lb-ft).
5. Install two bolts retaining intake manifold supports to upper intake manifold and tighten to 25 N·m (19 lb-ft).
6. Position generator bracket and install two retaining bolts to water pump and generator. Install generator bracket to upper intake manifold retaining nut. Tighten to 25 N·m (19 lb-ft).
7. Connect EGR valve to EGR tube making sure tube is properly seated in EGR valve. Connect EGR valve to upper intake manifold and tighten to 25 N·m (19 lb-ft).

8. Connect PCV hose to rear of upper intake manifold.
9. Connect vacuum lines to vacuum tree, EGR valve and fuel pressure regulator.
10. Position throttle linkage bracket with cables to upper intake manifold. Install two retaining bolts and tighten to 17 N·m (13 lb-ft). Connect throttle cable and AXOD-E transaxle cable to throttle body.
11. Connect electrical connectors at idle air control (IAC) valve, throttle position sensor and EGR pressure valve sensor.

NOTE: If lower intake manifold was removed, fill and bleed cooling system. Refer to Section 03-03.



## Throttle Body

## Removal

1. Disconnect throttle position sensor and idle air control (IAC) valve connectors.
2. Remove four throttle body retaining nuts.
3. Remove and discard air charge control to intake manifold gasket (9E936) between throttle body and upper intake manifold.

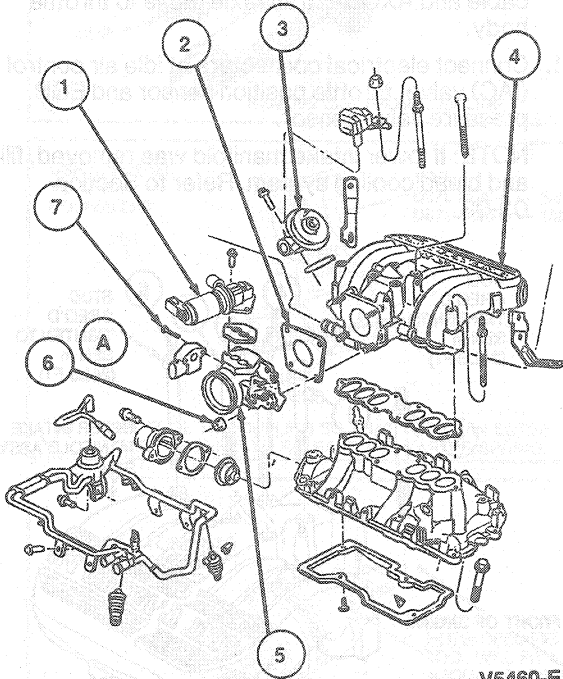
## Installation

NOTE: If scraping is necessary, be careful not to damage gasket surfaces or allow material to drop into intake manifold.

1. Clean gasket mating surfaces.

## REMOVAL AND INSTALLATION (Continued)

2. Install throttle body with new air charge control to intake manifold gasket on the four studs of the upper intake manifold. Tighten retaining nuts to 25 N·m (19 lb-ft).
3. Connect throttle position sensor and idle air control (IAC) valve.



V5460-E

Item	Part Number	Description
1	9F715	Idle Air Control Valve
2	9E936	Air Charge Control to Intake Manifold Gasket
3	9D475	EGR Valve
4	9424	Upper Intake Manifold
5	9E926	Throttle Body
6A	—	Nut
7	N603257-S 100	Screw
A		Tighten to 25 N·m (19 Lb-Ft)

TV5460E

## Throttle Position (TP) Sensor

## Removal

1. Disconnect throttle position sensor from wiring harness.
2. Scribe a reference mark across the edge of the sensor and to the throttle body to ensure correct position during installation.
3. Remove two throttle position sensor retaining screws.
4. Remove throttle position sensor.

3 Can be purchased as a separate item.

## Installation

1. To install throttle position sensor, reverse Removal procedure.
2. Tighten retaining screws to 2.4-3.8 N·m (21-34 lb-in).
3. If required, adjust throttle position sensor, refer to the Powertrain Control/Emissions Diagnosis Manual<sup>3</sup>.

SCREW  
TIGHTEN TO  
9.5 N·m  
(7 LB-FT)

IDLE AIR CONTROL  
(IAC) VALVE 9F715

THROTTLE POSITION (TP)  
SENSOR 9B989

SCREW  
TIGHTEN TO  
2.4-3.8 N·m  
(21-34 LB-IN)

V8551-A

## Idle Air Control (IAC) Valve Assembly

## Removal

1. Disconnect the idle air control valve assembly connector from the wiring harness.
2. Remove the two idle air control (IAC) valve retaining screws.
3. Remove the idle air control (IAC) valve and gasket.

## Installation

1. Clean gasket mating surfaces.

NOTE: If scraping is necessary, be careful not to damage idle air control (IAC) valve or throttle body gasket surfaces, or drop material into throttle body.

2. To install valve, reverse Removal procedure.
3. Tighten retaining screws to 9.5 N·m (7 lb-ft).

## Fuel Rail Assembly

## Tools Required:

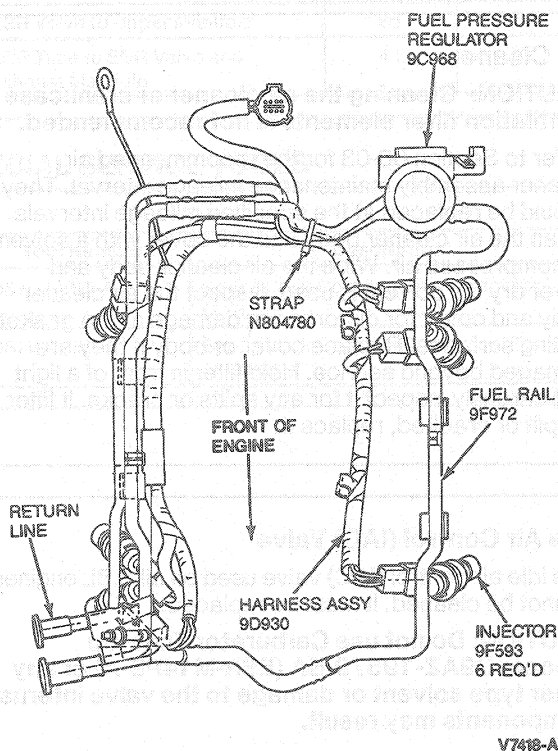
- Spring Lock Coupling Disconnect Tool D87L-9280-A (3/8 inch) or D87L-9280-B (1/2 inch)

## Removal

1. Perform Steps 1 through 4 under Fuel Charging Assembly, Pre-Service Procedures.

## REMOVAL AND INSTALLATION (Continued)

2. Remove upper intake manifold assembly as outlined.
  3. Remove spring lock coupling retaining clips from fuel inlet and return fittings.
  4. Using Spring Lock Coupling Disconnect Tool D87L-9280-A, D87L-9280-B or equivalent disconnect the inlet and outlet fuel lines from the fuel rail assembly.
  5. Remove four fuel injection supply manifold assembly retaining bolts (two on each side).
- NOTE: It may be easier to remove fuel injectors with the fuel injection supply manifold as an assembly.
6. Carefully disengage fuel injection supply manifold from fuel injectors and remove fuel injection supply manifold.
  7. Use a rocking, side-to-side motion while lifting to remove fuel injectors from cylinder head pockets.



## Installation

**CAUTION:** When installing fuel injection supply manifold assemblies with new or used fuel injectors, particular attention should be paid to proper O-ring seating to ensure that no fuel leaks exist.

1. Push fuel injection supply manifold down to ensure all injector O-rings are fully seated in the fuel rail cups and cylinder head pockets.
2. Install retaining bolts while holding fuel injection supply manifold down. Tighten bolts to 10 N·m (8 lb-ft).

3. Install spring lock coupling as outlined.
4. With fuel injector wiring disconnected, turn ignition to the RUN position to allow the fuel tank sending unit and pump (9H307) to pressurize the system.
5. Using a clean towel, check for fuel leaks.
6. Connect fuel injector wiring harness. Run vehicle at idle for two minutes.
7. Turn engine OFF and inspect for leaks.

## Fuel Pressure Regulator

## Removal

1. Perform Steps 1 through 4 under Fuel Charging Assembly, Pre-Service Procedures if removing fuel pressure regulator while fuel injection supply manifold assembly is installed on engine.
2. Remove vacuum line at fuel pressure regulator.
3. Remove three Allen head retaining screws from regulator housing.
4. Remove fuel pressure regulator assembly, gasket and O-ring. Discard gasket and inspect O-ring for signs of cracks or deterioration.
5. If scraping is necessary, be careful not to damage fuel pressure regulator or fuel injection supply manifold gasket surfaces.

## Installation

**WARNING: NEVER USE SILICONE GREASE. IT WILL CLOG THE FUEL INJECTORS.**

1. Lubricate fuel pressure regulator O-ring with clean engine oil.
2. Ensure gasket surfaces of fuel pressure regulator and fuel injector assembly are clean.
3. Install O-ring and new gasket on fuel pressure regulator.
4. Install fuel pressure regulator on fuel injection supply manifold assembly. Tighten three retaining screws to 4.0 N·m (34 lb-in).
5. Install vacuum line to fuel pressure regulator.
6. Perform Steps 1 through 6 under Fuel Charging Assembly, Post-Service Procedure.

## Fuel Injector

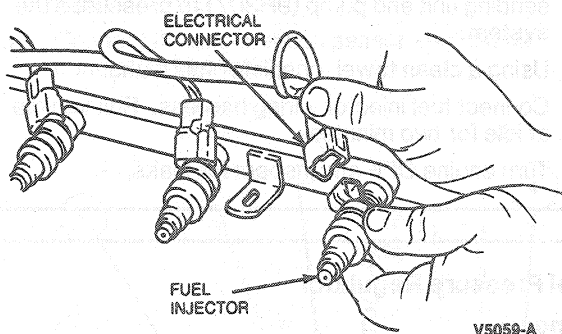
## Removal

1. Perform Steps 1 through 4 under Fuel Charging Assembly, Pre-Service Procedures.
2. Remove upper intake manifold as outlined.
3. Remove fuel injection supply manifold assembly as outlined.
4. Remove fuel injector retaining clips as required.

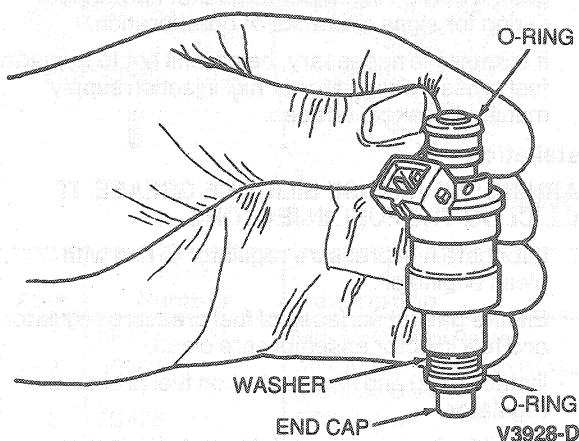


## REMOVAL AND INSTALLATION (Continued)

5. Carefully remove electrical harness connectors from individual fuel injectors as required.



6. Grasping injector body, pull up while gently rocking fuel injector from side-to-side.
7. Inspect fuel injector O-rings (two per injector) for signs of deterioration. Replace as required.
8. Inspect fuel injector body, end cap and washer for signs of dirt and deterioration.



## Installation

**NOTE:** Never use silicone grease. It will clog the fuel injectors.

1. Lubricate O-rings with light grade oil XO-10W30-QSP (ESE-M2C153-E) or equivalent.

2. Install fuel injectors. Use a light, twisting, pushing motion to install them.
3. Reconnect fuel injector retaining clips as required.
4. Install fuel injection supply manifold assembly as outlined.
5. Install electrical harness connectors to fuel injectors.
6. Install upper intake manifold as outlined. Perform Steps 1 through 6 of Fuel Charging Assembly, Post-Service Procedures.

## CLEANING AND INSPECTION

**NOTE:** The throttle body for this vehicle is a sludge resistant design and should not be cleaned.

## Air Cleaner

**CAUTION:** Cleaning the air cleaner or crankcase ventilation filter elements is not recommended.

Refer to Section 00-03 for the recommended air cleaner assembly maintenance mileage interval. They should be replaced at the specified mileage intervals. Clean the air cleaner body and the cover with a solvent or compressed air. Wipe the air cleaner body and cover dry if a solvent is used. Inspect the air cleaner body and cover for distortion or damage at the gasket mating surfaces. Replace cover or body if they are damaged beyond service. Hold filter in front of a light and carefully inspect it for any splits or cracks. If filter is split or cracked, replace it.

## Idle Air Control (IAC) Valve

The idle air control (IAC) valve used on all 3.8L engines cannot be cleaned. It must be replaced.

**CAUTION:** Do not use Carburetor Tune-Up Cleaner D9AZ-19579-BA (ESR-M14P9-A) or any other type solvent or damage to the valve internal components may result.

## SPECIFICATIONS

Description	N-m	Lb-Ft
Lower Intake Manifold to Head	32	23
Upper Intake Manifold to Lower Intake Manifold Bolts	—	4
Throttle Body to Upper Intake Manifold	25	19
Air Control Valve to Throttle Body	9.5	7
Throttle Position Sensor to Throttle Body	2.4-3.8	21-34 Lb-in
Fuel Pressure Regulator to Fuel Rail Assembly	4	34 Lb-in
Fuel Rail Assembly to Intake Manifold	10	8
Throttle Cable Bracket to Manifold	17	13
Manifold Support Bracket	25	19
Generator Brace to Generator	51	37
Generator Brace to Water Pump and Upper Manifold	25	19
EGR Valve to Upper Manifold	25	19
EGR Tube to EGR Valve and Exhaust Manifold	41	30

## SPECIAL SERVICE TOOLS

Tool Number	Description
D87L-9280-A	Spring Lock Coupling Disconnect Tool (3/8 inch)
D87L-9280-B	Spring Lock Coupling Disconnect Tool (1/2 inch)

## ROTUNDA EQUIPMENT

Model	Description
113-00001	Injector Tester / Cleaner

## PARTS CROSS-REFERENCE

Base Part #	Part Name	Old Part Name
9424	Intake Manifold	
9B989	Throttle Position Sensor	Throttle Potentiometer
9C968	Fuel Pressure Regulator	
9D475	EGR Valve	
9E926	Throttle Body	
9E936	Air Charge Control to Intake Manifold Gasket	
9F593	Fuel Injector	
9F715	Idle Air Control Valve	Throttle Air Bypass Valve
9F792	Fuel Injection Supply Manifold	
9H307	Fuel Tank Sending Unit and Pump	
9H321	Fuel Pressure Relief Valve	
9J444	Intake Manifold Support	
9J460	EGR Pressure Valve Sensor	

4 Tighten bolts and studs in three steps: 10 N-m (8 Lb-Ft) 20 N-m (15 Lb-Ft) 32 N-m (24 Lb-Ft)