

**2009 ENGINE PERFORMANCE****Emissions Control - Journey****DESCRIPTION****VEHICLE EMISSION CONTROL INFORMATION LABEL**

All vehicles have a Vehicle Emission Control Information (VECI) Label. Chrysler permanently attaches the label in the engine compartment. It cannot be removed without defacing information and destroying the label.

The label contains the vehicle's emission specifications and vacuum hose routings. All hoses must be connected and routed according to the label.

**TRIP DEFINITION**

A "Trip" means vehicle operation (following an engine-off period) of duration and driving mode such that all components and systems are monitored at least once by the diagnostic system. The monitors must successfully pass before the PCM can verify that a previously malfunctioning component is meeting the normal operating conditions of that component. For misfire or fuel system malfunction, the MIL may be extinguished if the fault does not recur when monitored during three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first determined.

Anytime the MIL is illuminated, a DTC is stored. The DTC can self erase only after the MIL has been extinguished. Once the MIL is extinguished, the PCM must pass the diagnostic test for the most recent DTC for 40 warm-up cycles (80 warm-up cycles for the Fuel System Monitor and the Misfire Monitor). A warm-up cycle can best be described by the following:

- The engine must be running
- A rise of 40° F (4.5° C) in engine temperature must occur from the time when the engine was started
- Engine coolant temperature must crossover 160° F (71° C)
- A "driving cycle" that consists of engine start up and engine shut off.

Once the above conditions occur, the PCM is considered to have passed a warm-up cycle. Due to the conditions required to extinguish the MIL and erase the DTC, it is most important that after a repair has been made, all DTC's be erased and the repair verified by running 1 good trip.

**DESCRIPTION - MONITORED COMPONENT**

There are several components that will affect vehicle emissions if they malfunction. If one of these components malfunctions the Malfunction Indicator Lamp (Check Engine) will illuminate.

Some of the component monitors are checking for proper operation of the part. Electrically operated components now have input (rationality) and output (functionality) checks as well as continuity tests (opens/shorts). Previously, a component like the Throttle Position sensor (TPS) was checked by the PCM for an open or shorted circuit. If one of these conditions occurred, a DTC was set. Now there is a check to ensure that

the component is working. This is done by watching for a TPS indication of a greater or lesser throttle opening than MAP and engine RPM indicate. In the case of the TPS, if engine vacuum is high and engine RPM is 1600 or greater and the TPS indicates a large throttle opening, a DTC will be set. The same applies to low vacuum and 1600 RPM.

Any component that has an associated limp in will set a fault after 1 trip with the malfunction present.

Refer to the **DTC INDEX** for diagnostic procedures.

The following is a list of the monitored components:

- Catalyst Monitor
- Comprehensive Components
- EGR (if equipped)
- Fuel Control (rich/lean)
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Purge
- Misfire
- ESIM (Evaporative System Integrity Monitor)

#### COMPREHENSIVE COMPONENTS

Along with the major monitors, OBD II requires that the diagnostic system monitor any component that could affect emissions levels. In many cases, these components were being tested under OBD I. The OBD I requirements focused mainly on testing emissions-related components for electrical opens and shorts.

However, OBD II also requires that inputs from powertrain components to the PCM be tested for rationality, and that outputs to powertrain components from the PCM be tested for functionality. Methods for monitoring the various Comprehensive Components include:

1. Circuit Continuity
  - Open
  - Shorted high
  - Shorted to ground
2. Rationality or Proper Functioning

**NOTE:**        **Comprehensive component monitors are continuous. Therefore, enabling conditions do not apply. All will set a DTC and illuminate the MIL in 1- trip.**

- Inputs tested for rationality
- Outputs tested for functionality

**Input Rationality-** While input signals to the PCM are constantly being monitored for electrical opens and shorts, they are also tested for rationality. This means that the input signal is compared against other inputs and information to see if it makes sense under the current conditions.

PCM sensor inputs that are checked for rationality include:

- Manifold Absolute Pressure (MAP) Sensor
- Oxygen Sensor (O2S) (slow response)
- Engine Coolant Temperature (ECT) Sensor
- Camshaft Position (CMP) Sensor
- Vehicle Speed Sensor
- Crankshaft Position (CKP) Sensor
- Inlet Air Temperature (IAT) Sensor
- Power Steering Switch
- Oxygen Sensor Heater
- Engine Controller
- Brake Switch
- ESIM (Evaporative System Integrity Monitor)
- P/N Switch
- Trans Controls

**Output Functionality-** PCM outputs are tested for functionality in addition to testing for opens and shorts. When the PCM provides a voltage to an output component, it can verify that the command was carried out by monitoring specific input signals for expected changes. For example, when the PCM commands the Idle Air Control (IAC) Motor to a specific position under certain operating conditions, it expects to see a specific (target) idle speed (RPM). If it does not, it stores a DTC.

PCM outputs monitored for functionality include:

- Fuel Injectors
- Ignition Coils
- Torque Converter Clutch Solenoid
- Purge Solenoid
- EGR Solenoid
- Radiator Fan Control
- Trans Controls

#### **OXYGEN SENSOR (O2S) MONITOR**

**DESCRIPTION-** Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572° to 662°F), the sensor generates a voltage that is inversely

proportional to the amount of oxygen in the exhaust. When there is a large amount of oxygen in the exhaust caused by a lean condition, misfire or exhaust leak, the sensor produces a low voltage, below 450 mV. When the oxygen content is lower, caused by a rich condition, the sensor produces a higher voltage, above 450mV.

The information obtained by the sensor is used to calculate the fuel injector pulse width. The PCM is programmed to maintain the optimum air/fuel ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrous oxide (NOx) from the exhaust.

The O2S is also the main sensing element for the EGR, Catalyst and Fuel Monitors, and purge.

The O2S may fail in any or all of the following manners:

- Slow response rate (Big Slope)
- Reduced output voltage (Half Cycle)
- Heater Performance

**Slow Response Rate (Big Slope)-** Response rate is the time required for the sensor to switch from lean to rich signal output once it is exposed to a richer than optimum A/F mixture or vice versa. As the PCM adjusts the air/fuel ratio, the sensor must be able to rapidly detect the change. As the sensor ages, it could take longer to detect the changes in the oxygen content of the exhaust gas. The rate of change that an oxygen sensor experiences is called 'Big Slope'. The PCM checks the oxygen sensor voltage in increments of a few milliseconds.

**Reduced Output Voltage (Half Cycle)-** The output voltage of the O2S ranges from 0 to 1 volt. A good sensor can easily generate any output voltage in this range as it is exposed to different concentrations of oxygen. To detect a shift in the A/F mixture (lean or rich), the output voltage has to change beyond a threshold value. A malfunctioning sensor could have difficulty changing beyond the threshold value. Many times the condition is only temporary and the sensor will recover. Under normal conditions the voltage signal surpasses the threshold, and a counter is incremented by one. This is called the Half Cycle Counter.

**Heater Performance-** The heater is tested by a separate monitor. Refer to **OXYGEN SENSOR HEATER MONITOR (NGC)**.

**OPERATION-** As the Oxygen Sensor signal switches, the PCM monitors the half cycle and big slope signals from the oxygen sensor. If during the test neither counter reaches a predetermined value, a malfunction is entered and a Freeze Frame is stored. Only one counter reaching its predetermined value is needed for the monitor to pass.

The Oxygen Sensor Signal Monitor is a two trip monitor that is tested only once per trip. When the Oxygen Sensor fails the test in two consecutive trips, the MIL is illuminated and a DTC is set. The MIL is extinguished when the Oxygen Sensor monitor passes in three consecutive trips. The DTC is erased from memory after 40 consecutive warm-up cycles without test failure.

**Enabling Conditions-** The following conditions must typically be met for the PCM to run the oxygen sensor monitor:

- Battery voltage

- Engine temperature
- Engine run time
- Engine run time at a predetermined speed
- Engine run time at a predetermined speed and throttle opening
- Transmission in gear (automatic only)
- Fuel system in Closed Loop
- Long Term Adaptive (within parameters)
- Power Steering Switch in low PSI (no load)
- Engine at idle
- Fuel level above 15%
- Ambient air temperature
- Barometric pressure
- Engine RPM within acceptable range of desired idle
- Closed throttle speed

**Pending Conditions-** The Task Manager typically does not run the Oxygen Sensor Signal Monitor if overlapping monitors are running or the MIL is illuminated for any of the following:

- Misfire Monitor
- Front Oxygen Sensor and Heater Monitor
- MAP Sensor
- Vehicle Speed Sensor
- Engine Coolant Temperature Sensor
- Engine Controller Self Test Faults
- Cam or Crank Sensor
- Injector and Coil
- EVAP Electrical
- EGR Solenoid Electrical
- Inlet Air Temperature
- 5 Volt Feed

**Conflict-** The Task Manager does not run the Oxygen Sensor Monitor if any of the following conditions are present:

- A/C ON (A/C clutch cycling temporarily suspends monitor)
- Purge flow in progress

**Suspend-** The Task Manager suspends maturing a fault for the Oxygen Sensor Monitor if any of the following are present:

- Oxygen Sensor Heater Monitor, Priority 1
- Misfire Monitor, Priority 2

**OXYGEN SENSOR HEATER MONITOR (NGC)**

**DESCRIPTION-** If the Oxygen sensor (O2S) DTC as well as a O2S heater DTC is present, the O2S Heater DTC MUST be repaired first. After the O2S Heater is repaired, verify that the sensor circuit is operating correctly.

The voltage reading taken from the O2S are very temperature sensitive. The readings taken from the O2S are not accurate below 300 degrees C. Heating the O2S is done to allow the engine controller to shift to closed loop control as soon as possible. The heating element used to heat the O2S must be tested to ensure that it is heating the sensor properly. Starting with the introduction on the NGC module the strategy for checking the heater circuit has changed. The heater resistance is checked by the NGC almost immediately after the engine is started. The same O2S heater return pin used to read the heater resistance is capable of detecting an open circuit, a shorted high or shorted low condition.

**CATALYST MONITOR**

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide.

Normal vehicle miles or engine misfire can cause a catalyst to decay. A meltdown of the ceramic core can cause a reduction of the exhaust passage. This can increase vehicle emissions and deteriorate engine performance, driveability and fuel economy.

The catalyst monitor uses dual oxygen sensors (O2S's) to monitor the efficiency of the converter. The dual O2S strategy is based on the fact that as a catalyst deteriorates, its oxygen storage capacity and its efficiency are both reduced. By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream O2S is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. The PCM calculates the A/F mixture from the output of the O2S. A low voltage indicates high oxygen content (lean mixture). A high voltage indicates a low content of oxygen (rich mixture).

When the upstream O2S detects a high oxygen condition, there is an abundance of oxygen in the exhaust gas. A functioning converter would store this oxygen so it can use it for the oxidation of HC and CO. As the converter absorbs the oxygen, there will be a lack of oxygen downstream of the converter. The output of the downstream O2S will indicate limited activity in this condition.

As the converter loses the ability to store oxygen, the condition can be detected from the behavior of the downstream O2S. When the efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same downstream as upstream. The output voltage of the downstream O2S copies the voltage of the upstream sensor. The only difference is a time lag (seen by the PCM) between the switching of the O2S's.

To monitor the system, the number of lean-to-rich switches of upstream and downstream O2S's is counted. The ratio of downstream switches to upstream switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer downstream switches than it has upstream switches i.e., a ratio

closer to zero. For a totally ineffective catalyst, this ratio will be one-to-one, indicating that no oxidation occurs in the device.

The system must be monitored so that when catalyst efficiency deteriorates and exhaust emissions increase to over the legal limit, the MIL (check engine lamp) will be illuminated.

**Monitor Operation-** To monitor catalyst efficiency, the PCM expands the rich and lean switch points of the heated oxygen sensor. With extended switch points, the air/fuel mixture runs richer and leaner to overburden the catalytic converter. Once the test is started, the air/fuel mixture runs rich and lean and the O<sub>2</sub> switches are counted. A switch is counted when an oxygen sensor signal goes from below the lean threshold to above the rich threshold. The number of Rear O<sub>2</sub> sensor switches is divided by the number of Front O<sub>2</sub> sensor switches to determine the switching ratio.

The test runs for 20 seconds. As catalyst efficiency deteriorated over the life of the vehicle, the switch rate at the downstream sensor approaches that of the upstream sensor. If at any point during the test period the switch ratio reaches a predetermined value, a counter is increments by one. The monitor is enabled to run another test during that trip. When the test fails three times, the counter increments to three, a malfunction is entered, and a Freeze Frame is stored. When the counter increments to three during the next trip, the code is matured and the MIL is illuminated. If the test passes the first, no further testing is conducted during that trip.

The MIL is extinguished after three consecutive good trips. The good trip criteria for the catalyst monitor is more stringent than the failure criteria. In order to pass the test and increment one good trip, the downstream sensor switch rate must be less than 80% of the upstream rate (60% for manual transmissions). The failure percentages are 90% and 70% respectively.

**Enabling Conditions-** The following conditions must typically be met before the PCM runs the catalyst monitor. Specific times for each parameter may be different from engine to engine.

- Accumulated drive time
- Enable time
- Ambient air temperature
- Barometric pressure
- Catalyst warm-up counter
- Engine coolant temperature
- Accumulated throttle position sensor
- Vehicle speed
- MAP
- RPM
- Engine in closed loop
- Fuel level

**Pending Conditions-**

- Misfire DTC

- Front Oxygen Sensor Response
- Front Oxygen Sensor Heater Monitor
- Front Oxygen Sensor Electrical
- Rear Oxygen Sensor Rationality (middle check)
- Rear Oxygen Sensor Heater Monitor
- Rear Oxygen Sensor Electrical
- Fuel System Monitor
- All MAP faults
- All ECT sensor faults
- Purge flow solenoid functionality
- Purge flow solenoid electrical
- All PCM self test faults
- All CMP and CKP sensor faults
- All injector and ignition electrical faults
- Vehicle Speed Sensor
- Brake switch
- Inlet air temperature

**Conflict-** The catalyst monitor does not run if any of the following are conditions are present:

- EGR Monitor in progress
- Fuel system rich intrusive test in progress
- EVAP Monitor in progress
- Time since start is less than 60 seconds
- Low fuel level
- Low ambient air temperature

**Suspend-** The Task Manager does not mature a catalyst fault if any of the following are present:

- Oxygen Sensor Monitor, Priority 1
- Upstream Oxygen Sensor Heater, Priority 1
- EGR Monitor, Priority 1
- EVAP Monitor, Priority 1
- Fuel System Monitor, Priority 2
- Misfire Monitor, Priority 2

## **NON-MONITORED CIRCUITS**

The PCM does not monitor all circuits, systems and conditions that could have malfunctions causing driveability problems. However, problems with these systems may cause the PCM to store diagnostic trouble

codes for other systems or components. For example, a fuel pressure problem will not register a fault directly, but could cause a rich/lean condition or misfire. This could cause the PCM to store an oxygen sensor or misfire diagnostic trouble code.

The major non-monitored circuits are listed below along with examples of failures modes that do not directly cause the PCM to set a DTC, but for a system that is monitored.

#### **FUEL PRESSURE**

The fuel pressure regulator controls fuel system pressure. The PCM cannot detect a clogged fuel pump inlet filter, clogged inline fuel filter, or a pinched fuel supply or return line. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor, fuel system, or misfire diagnostic trouble code.

#### **SECONDARY IGNITION CIRCUIT**

The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables. The misfire will however, increase the oxygen content in the exhaust, deceiving the PCM in to thinking the fuel system is too lean. Also see misfire detection. There are DTC's that can detect misfire and Ionization shorts in the secondary ignition circuit, refer to **POWERTRAIN CONTROL MODULE (PCM) - ELECTRICAL DIAGNOSTICS - 545RE** for more information.

#### **CYLINDER COMPRESSION**

The PCM cannot detect uneven, low, or high engine cylinder compression. Low compression lowers O2 content in the exhaust. Leading to fuel system, oxygen sensor, or misfire detection fault.

#### **EXHAUST SYSTEM**

The PCM cannot detect a plugged, restricted or leaking exhaust system. It may set a EGR (if equipped) or Fuel system or O2S fault.

#### **FUEL INJECTOR MECHANICAL MALFUNCTIONS**

The PCM cannot determine if a fuel injector is clogged, the needle is sticking or if the wrong injector is installed. However, these could result in a rich or lean condition causing the PCM to store a diagnostic trouble code for either misfire, an oxygen sensor, or the fuel system.

#### **EXCESSIVE OIL CONSUMPTION**

Although the PCM monitors engine exhaust oxygen content when the system is in closed loop, it cannot determine excessive oil consumption.

#### **THROTTLE BODY AIR FLOW**

The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.

#### **VACUUM ASSIST**

The PCM cannot detect leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices. However, these could cause the PCM to store a MAP sensor diagnostic trouble code and cause a high idle condition.

#### **PCM SYSTEM GROUND**

The PCM cannot determine a poor system ground. However, one or more diagnostic trouble codes may be generated as a result of this condition. The module should be mounted to the body at all times, including when diagnostics are performed.

#### **PCM CONNECTOR ENGAGEMENT**

The PCM may not be able to determine spread or damaged connector pins. However, it might store diagnostic trouble codes as a result of spread connector pins.

#### **DESCRIPTION - MONITORED SYSTEMS**

There are new electronic circuit monitors that check fuel, emission, engine and ignition performance. These monitors use information from various sensor circuits to indicate the overall operation of the fuel, engine, ignition and emission systems and thus the emissions performance of the vehicle.

The fuel, engine, ignition and emission systems monitors do not indicate a specific component problem. They do indicate that there is an implied problem within one of the systems and that a specific problem must be diagnosed.

If any of these monitors detect a problem affecting vehicle emissions, the Malfunction Indicator (Check Engine) Lamp will be illuminated. These monitors generate Diagnostic Trouble Codes that can be displayed with the a scan tool.

The following is a list of the system monitors:

- EGR Monitor (if equipped)
- Misfire Monitor
- Fuel System Monitor
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Catalyst Monitor
- Evaporative System Leak Detection Monitor (if equipped)

Following is a description of each system monitor, and its DTC.

**Refer to POWERTRAIN CONTROL MODULE (PCM) - ELECTRICAL DIAGNOSTICS - 545RE for diagnostic procedures.**

#### **OXYGEN SENSOR (O2S) MONITOR**

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperatures of 300° to 350°C (572° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. The PCM is programmed to maintain the optimum air/fuel ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrous oxide (NOx) from the exhaust.

The O2S is also the main sensing element for the EGR (if equipped), Catalyst and Fuel Monitors.

The O2S may fail in any or all of the following manners:

- Slow response rate
- Reduced output voltage
- Dynamic shift
- Shorted or open circuits

Response rate is the time required for the sensor to switch from lean to rich once it is exposed to a richer than optimum A/F mixture or vice versa. As the sensor starts malfunctioning, it could take longer to detect the changes in the oxygen content of the exhaust gas.

The output voltage of the O2S ranges from 0 to 1 volt (voltages are offset by 2.5 volts on NGC vehicles). A good sensor can easily generate any output voltage in this range as it is exposed to different concentrations of oxygen. To detect a shift in the A/F mixture (lean or rich), the output voltage has to change beyond a threshold value. A malfunctioning sensor could have difficulty changing beyond the threshold value.

#### **OXYGEN SENSOR HEATER MONITOR**

If there is an oxygen sensor (O2S) DTC as well as a O2S heater DTC, the O2S heater fault **MUST** be repaired first. After the O2S fault is repaired, verify that the heater circuit is operating correctly.

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperatures of 300° to 350°C (572 ° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The voltage readings taken from the O2S are very temperature sensitive. The readings are not accurate below 300°C. Heating of the O2S is done to allow the engine controller to shift to closed loop control as soon as possible. The heating element used to heat the O2S must be tested to ensure that it is heating the sensor properly.

The O2S circuit is monitored for a drop in voltage. The sensor output is used to test the heater by isolating the effect of the heater element on the O2S output voltage from the other effects.

#### **EGR MONITOR (if equipped)**

The Powertrain Control Module (PCM) performs an on-board diagnostic check of the EGR system.

The EGR monitor is used to test whether the EGR system is operating within specifications. The diagnostic check activates only during selected engine/driving conditions. When the conditions are met, the EGR is turned off (solenoid energized) and the O<sub>2</sub>S compensation control is monitored. Turning off the EGR shifts the air fuel (A/F) ratio in the lean direction. The O<sub>2</sub>S data should indicate an increase in the O<sub>2</sub> concentration in the combustion chamber when the exhaust gases are no longer recirculated. While this test does not directly measure the operation of the EGR system, it can be inferred from the shift in the O<sub>2</sub>S data whether the EGR system is operating correctly. Because the O<sub>2</sub>S is being used, the O<sub>2</sub>S test must pass its test before the EGR test. Also looks at EGR linear potentiometer for feedback.

### **MISFIRE MONITOR**

Excessive engine misfire results in increased catalyst temperature and causes an increase in HC emissions. Severe misfires could cause catalyst damage. To prevent catalytic converter damage, the PCM monitors engine misfire.

The Powertrain Control Module (PCM) monitors for misfire during most engine operating conditions (positive torque) by looking at changes in the crankshaft speed. If a misfire occurs the speed of the crankshaft will vary more than normal.

The PCM can detect and compensate for variances in the engine and its components. To learn these variations, the PCM uses the input of the actual crankshaft rotation pattern and ideal crankshaft rotation pattern that has been calibrated into the PCM. The PCM then compares the two patterns. The variation between the two values is the Adaptive Numerator. If the Adaptive Numerator is not learned by the PCM, the misfire monitor will not run and the Multi-Cylinder Displacement System (MDS) will not operate. Without MDS operation, the customer will experience decreased fuel economy. If the customer experiences decrease fuel economy, use the scan tool to ensure that the Adaptive Numerator is learned.

### **FUEL SYSTEM MONITOR**

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide. The catalyst works best when the air fuel (A/F) ratio is at or near the optimum of 14.7 to 1.

The PCM is programmed to maintain the optimum air/fuel ratio. This is done by making short term corrections in the fuel injector pulse width based on the O<sub>2</sub>S output. The programmed memory acts as a self calibration tool that the engine controller uses to compensate for variations in engine specifications, sensor tolerances and engine fatigue over the life span of the engine. By monitoring the actual air-fuel ratio with the O<sub>2</sub>S (short term) and multiplying that with the program long-term (adaptive) memory and comparing that to the limit, it can be determined whether it will pass an emissions test. If a malfunction occurs such that the PCM cannot maintain the optimum A/F ratio, then the MIL will be illuminated.

### **CATALYST MONITOR**

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide.

Normal vehicle miles or engine misfire can cause a catalyst to decay. A meltdown of the ceramic core can cause a reduction of the exhaust passage. This can increase vehicle emissions and deteriorate engine performance, driveability and fuel economy.

The catalyst monitor uses dual oxygen sensors (O2S's) to monitor the efficiency of the converter. The dual O2S's strategy is based on the fact that as a catalyst deteriorates, its oxygen storage capacity and its efficiency are both reduced. By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream O2S is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. The PCM calculates the A/F mixture from the output of the O2S. A low voltage indicates high oxygen content (lean mixture). A high voltage indicates a low content of oxygen (rich mixture).

When the upstream O2S detects a lean condition, there is an abundance of oxygen in the exhaust gas. A functioning converter would store this oxygen so it can use it for the oxidation of HC and CO. As the converter absorbs the oxygen, there will be a lack of oxygen downstream of the converter. The output of the downstream O2S will indicate limited activity in this condition.

As the converter loses the ability to store oxygen, the condition can be detected from the behavior of the downstream O2S. When the efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same downstream as upstream. The output voltage of the downstream O2S copies the voltage of the upstream sensor. The only difference is a time lag (seen by the PCM) between the switching of the O2S's.

To monitor the system, the number of lean-to-rich switches of upstream and downstream O2S's is counted. The ratio of downstream switches to upstream switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer downstream switches than it has upstream switches i.e., a ratio closer to zero. For a totally ineffective catalyst, this ratio will be one-to-one, indicating that no oxidation occurs in the device.

The system must be monitored so that when catalyst efficiency deteriorates and exhaust emissions increase to over the legal limit, the MIL (Check Engine lamp) will be illuminated.

#### **EVAPORATIVE SYSTEM LEAK DETECTION MONITOR (if equipped)**

The ESIM (Evaporative System Integrity Monitor) is the next generation evaporative leak detection system that is used on vehicles equipped with either the Next Generation Controller (NGC) or Global Powertrain Engine Controller (GPEC). The operation of this monitor is similar to the Natural Vacuum Leak Detection (NVLD) system it replaces. A leak detection pump is no longer required and the system is able to detect a leak equivalent to a 0.020" (0.5 mm) hole.

The basic leak detection theory employed with ESIM is the "Gas Law". This is to say that the pressure in a sealed vessel will change if the temperature of the gas in the vessel changes. The vessel will only see this effect if it is indeed sealed. Even small leaks will allow the pressure in the vessel to come to equilibrium with the ambient pressure. In addition to the detection of very small leaks, this system has the capability of detecting medium as well as large evaporative system leaks.

The ESIM seals the canister vent during engine off conditions. If the EVAP system has a leak of less than the failure threshold, the evaporative system will be pulled into a vacuum, either due to the cool down from

operating temperature or diurnal ambient temperature cycling. The diurnal effect is considered one of the primary contributors to the leak determination by this diagnostic. When the vacuum in the system exceeds about 1" H<sub>2</sub>O (0.25 KPA), a vacuum switch closes. The switch closure sends a signal to the powertrain module. The module, via appropriate logic strategies, utilizes the switch signal, or lack thereof, to make a determination of whether a leak is present.

## HIGH AND LOW LIMITS

The PCM compares input signal voltages from each input device with established high and low limits for the device. If the input voltage is not within limits and other criteria are met, the PCM stores a diagnostic trouble code in memory. Other diagnostic trouble code criteria might include engine RPM limits or input voltages from other sensors or switches that must be present before verifying a diagnostic trouble code condition.

## OPERATION

### SYSTEM

The Powertrain Control Module (PCM) monitors many different circuits in the fuel injection, ignition, emission and engine systems. If the PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a Diagnostic Trouble Code (DTC) in the PCM's memory. If the code applies to a non-emissions related component or system, and the problem is repaired or ceases to exist, the PCM cancels the code after 40 warm-up cycles. Diagnostic trouble codes that affect vehicle emissions illuminate the Malfunction Indicator Lamp (MIL). Refer to **DESCRIPTION - MONITORED COMPONENT**.

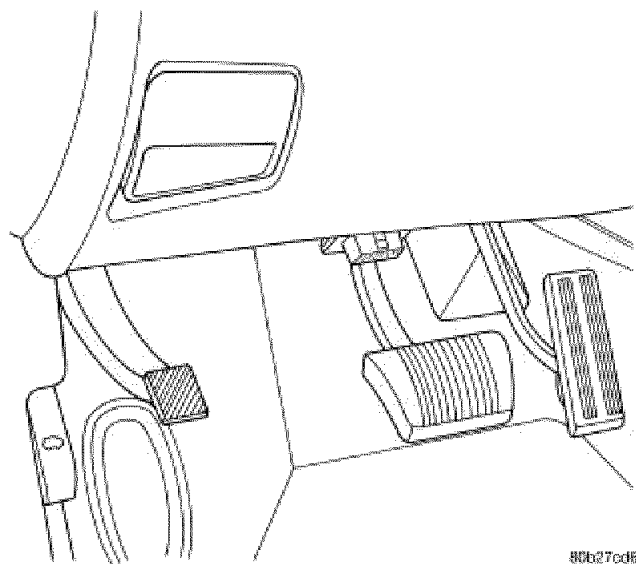
Certain criteria must be met before the PCM stores a DTC in memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

The PCM might not store a DTC for a monitored circuit even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. **For example**, assume the diagnostic trouble code criteria requires the PCM to monitor the circuit only when the engine operates between 750 and 2000 RPM. Suppose the sensor's output circuit shorts to ground when engine operates above 2400 RPM (resulting in 0 volt input to the PCM). Because the condition happens at an engine speed above the maximum threshold (2000 RPM), the PCM will not store a DTC.

There are several operating conditions for which the PCM monitors and sets DTC's. Refer to **DESCRIPTION - MONITORED SYSTEMS**.

**NOTE:** Various diagnostic procedures may actually cause a diagnostic monitor to set a DTC. For instance, pulling a spark plug wire to perform a spark test may set the misfire code. When a repair is completed and verified, use the scan tool to erase all DTC's and extinguish the MIL.

Technicians can display stored DTC's. For obtaining the DTC information, use the Data Link Connector with the scan tool .



**Fig. 1: Data Link Connector**  
Courtesy of CHRYSLER LLC

## STATE DISPLAY TEST MODE

### OPERATION

The switch inputs to the Powertrain Control Module (PCM) have two recognized states; HIGH and LOW. For this reason, the PCM cannot recognize the difference between a selected switch position versus an open circuit, a short circuit, or a defective switch. If the State Display screen shows the change from HIGH to LOW or LOW to HIGH, assume the entire switch circuit to the PCM functions properly. From the state display screen, access either State Display Inputs and Outputs or State Display Sensors.

## AIR INJECTION

### PUMP, AIR

#### Description

#### DESCRIPTION

The air injection pump is located on the left side of the engine compartment. The pump is operated by an internal electrical motor and is mounted to a bracket by rubber isolators. An inlet and outlet air hoses are attached to the air pump. A heat shield is attached at the air pump mounting bracket to ensure that the air pump is not damaged by heat coming off the exhaust system.

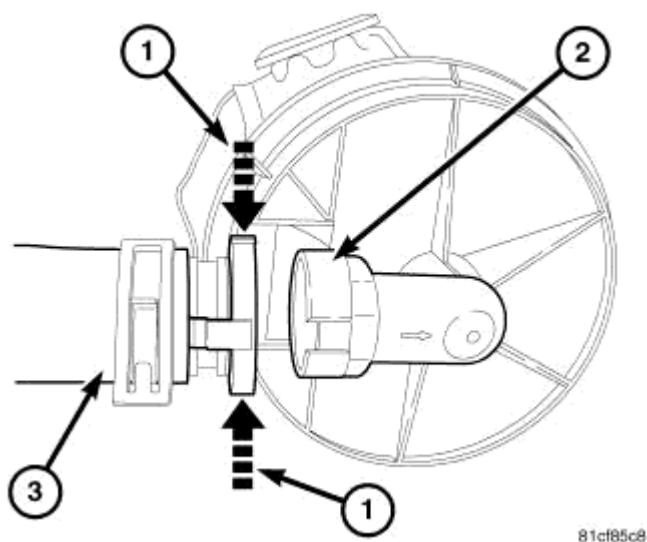
#### Operation

#### OPERATION

The electric air pump only functions during cold starts. The PCM will not command the electric air pump to run if the engine coolant temperature is 10° Celsius (18° Fahrenheit) above ambient temperature or if the engine coolant temperature is above 37° Celsius (98.6° Fahrenheit). The air pump will not run more than 20 seconds during this cold start condition. The air inlet tube to the electric air pump is equipped with a mass air flow (MAF) sensor. This MAF sensor monitors air flow to the exhaust system and is used to diagnose the system by making sure the correct amount of air, not too much or too little, reaches the exhaust system. Each component of the secondary air system is diagnosed assuming the other part is functioning correctly. The diagnostic tool can command the air pump ON with the key ON and engine OFF (KOEO).

## Removal

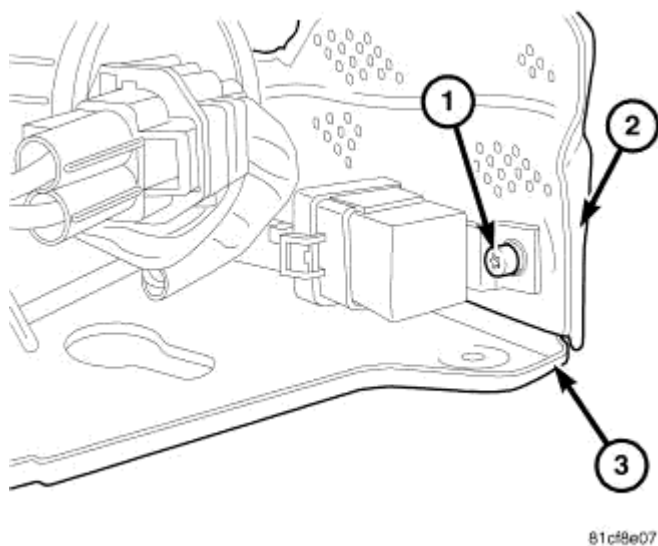
### REMOVAL



**Fig. 2: AIR INLET TUBE AT AIR PUMP**

Courtesy of CHRYSLER LLC

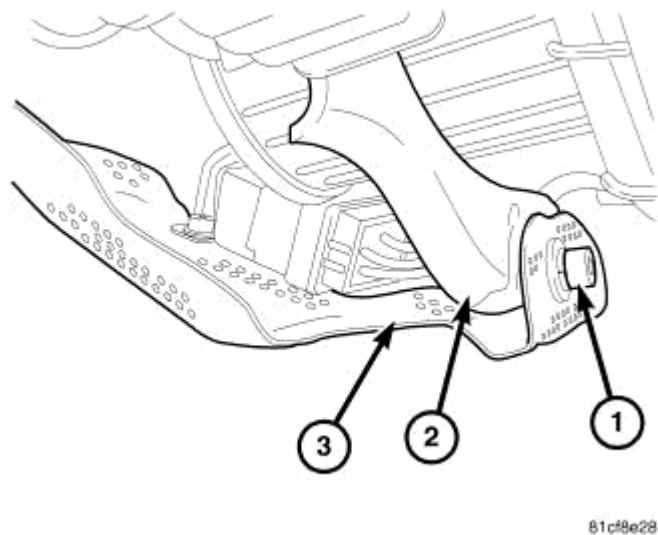
1. Disconnect and isolate negative battery.
2. Remove engine cover.
3. Remove air inlet tube (3) by pushing the ends (1) together while pulling the air inlet tube (3) away from air pump housing connection (2).
4. Remove air outlet tube by pushing the coupling ends together while pulling the air outlet tube away from the air pump.



**Fig. 3: RELAY**

Courtesy of CHRYSLER LLC

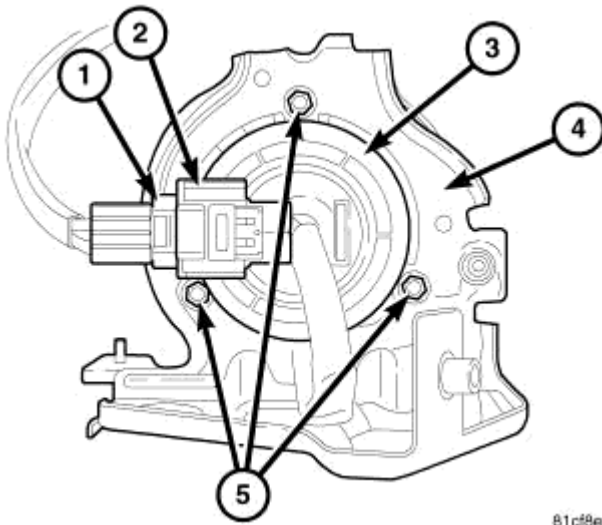
5. Remove bolt (1) from heat shield (2) and air pump bracket (3).



**Fig. 4: HEAT SHIELD**

Courtesy of CHRYSLER LLC

6. Remove heat shield bolt (1) and heat shield (3) from air pump bracket (2).



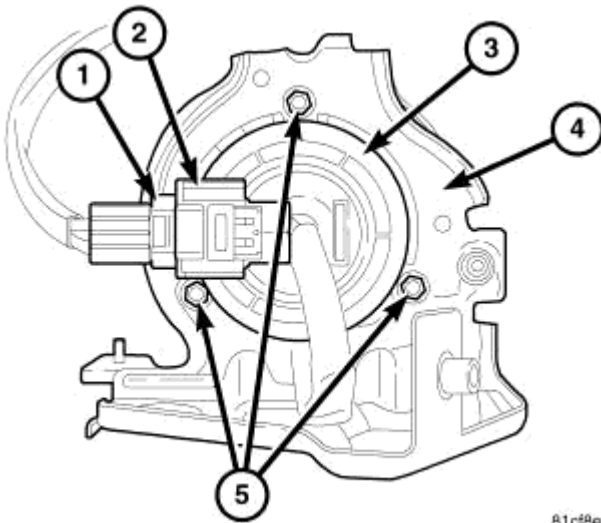
81c8e33

**Fig. 5: PUMP TO BRACKET**  
Courtesy of CHRYSLER LLC

7. Disconnect electrical harness connector (1) from the air pump electrical connector (2).
8. Remove air pump and bracket assembly from vehicle.
9. Remove air pump mounting nuts (5) from bracket (4).
10. Remove air pump (3) from bracket (4).

### Installation

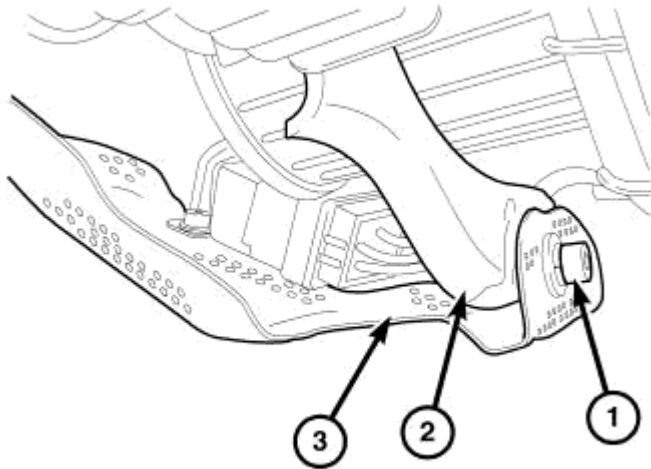
#### INSTALLATION



81c8e33

**Fig. 6: PUMP TO BRACKET**  
Courtesy of CHRYSLER LLC

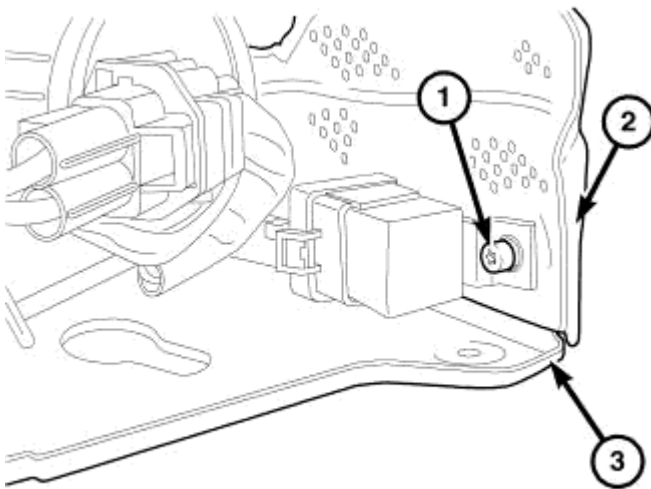
1. Install air pump (3) to bracket (4).
2. Install air pump mounting nuts (5) to bracket (4). Tighten the nuts to 8 N.m (71 in. lbs.).
3. Position air pump and bracket assembly in vehicle.
4. Connect electrical harness connector (1) to the air pump electrical connector (2).



81c98e28

**Fig. 7: HEAT SHIELD**  
Courtesy of CHRYSLER LLC

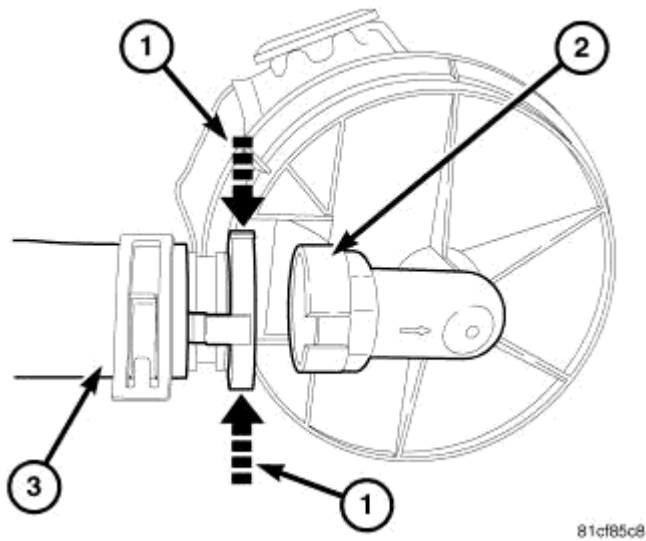
5. Install heat shield (3) and bolt (1) to air pump bracket (2). Tighten the bolt to 8 N.m (71 in. lbs.).



81c98e07

**Fig. 8: RELAY**  
Courtesy of CHRYSLER LLC

6. Install relay, heat shield (2) and bolt (1) to air pump bracket (3). Tighten the bolt to 8 N.m (71 in. lbs.).



**Fig. 9: AIR INLET TUBE AT AIR PUMP**

Courtesy of CHRYSLER LLC

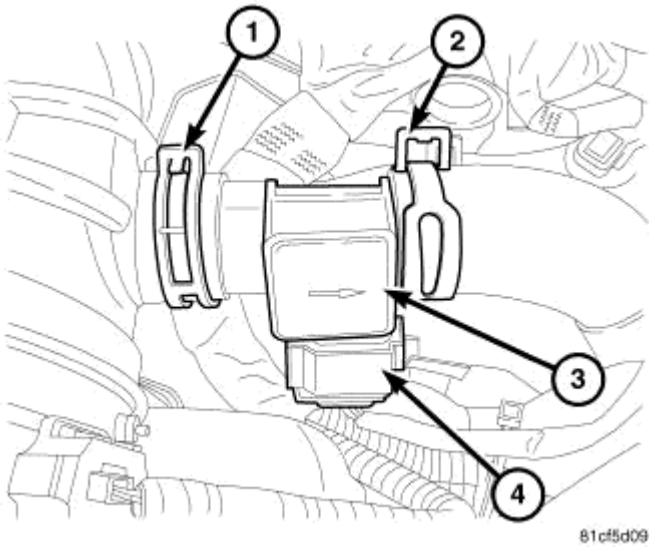
**NOTE:** The quick connect fitting on the air inlet tube is slotted to fit the air pump housing fitting. Line the slot up when making the connection.

7. Install air inlet tube (3) to air pump housing connection (2). A click noise will indicate a good connection.
8. Install air outlet tube to air pump housing. A click noise will indicate a good connection.
9. Connect the negative battery cable, tighten the nut to 5 N.m (45 in. lbs.).
10. Install engine cover.

## SENSOR, MASS AIR FLOW (MAF)

### Removal

### REMOVAL

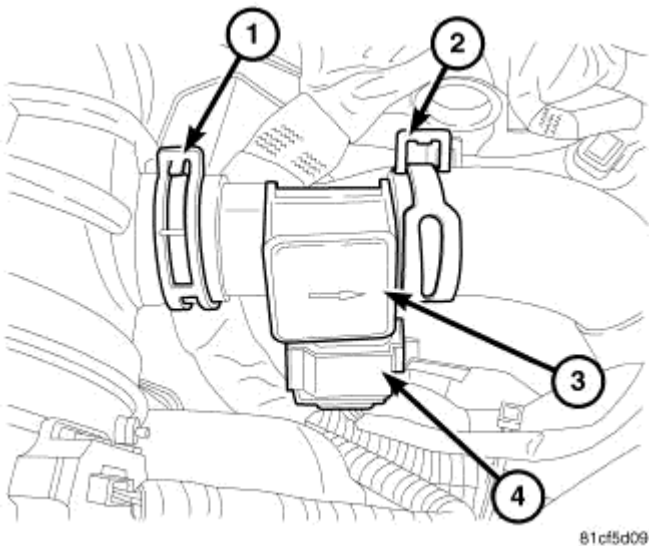


**Fig. 10: MASS AIR FLOW SENSOR**  
Courtesy of CHRYSLER LLC

1. Disconnect air flow sensor electrical connector (4).
2. Remove constant tension clamps (1), (2) securing the air flow sensor (3).
3. Remove air flow sensor (3) from hoses.

#### Installation

#### INSTALLATION



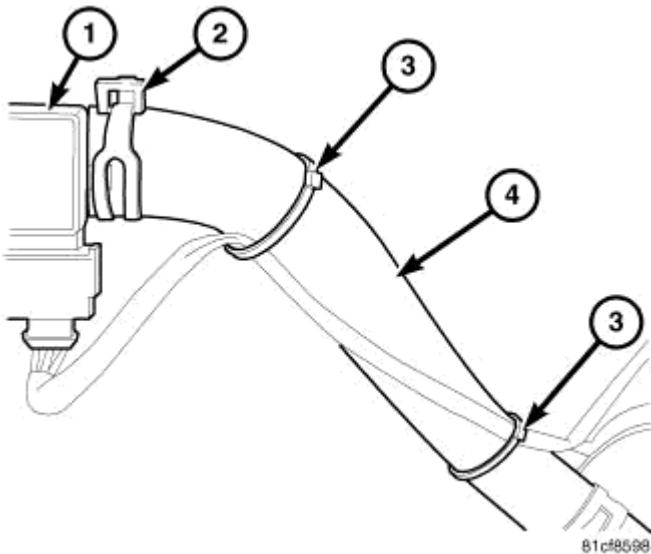
**Fig. 11: MASS AIR FLOW SENSOR**  
Courtesy of CHRYSLER LLC

1. Note the arrow direction on the sensor and correctly position the air flow sensor (3) to hoses.

2. Install constant tension clamps (1), (2) to secure air flow sensor (3) to hoses.
3. Connect air flow sensor electrical connector (4).

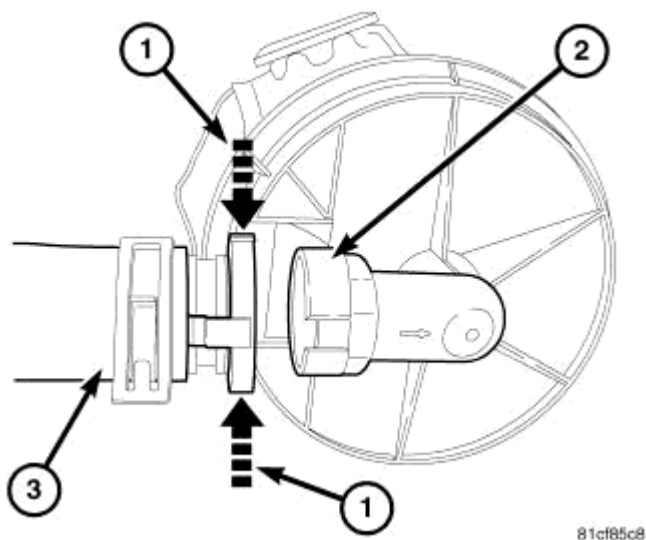
**TUBE, AIR PUMP, INLET****Description****DESCRIPTION**

The air pump inlet tube is located on the left side of the engine compartment. The tube attaches to the air injection pump using a quick connect style fitting. The other end of the tube connects to the mass air flow sensor using a constant tension clamp.

**Removal****REMOVAL**

**Fig. 12: Air Inlet Tube At Mass Air Flow**  
**Courtesy of CHRYSLER LLC**

1. Cut the tie straps (3) being careful not to damage the air inlet tube (4).
2. Remove the constant tension clamp (2) and remove the mass air flow (MAF) sensor (1) from the air inlet tube (4). Position MAF sensor (1) and wiring aside.



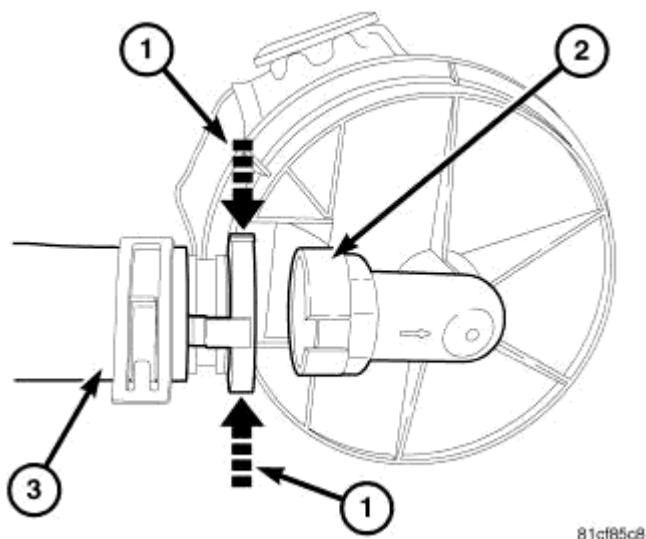
**Fig. 13: AIR INLET TUBE AT AIR PUMP**

Courtesy of CHRYSLER LLC

3. Remove air inlet tube (3) by pushing the ends (1) together, while pulling the air inlet tube (3) away from air pump housing connection (2).

#### Installation

#### INSTALLATION

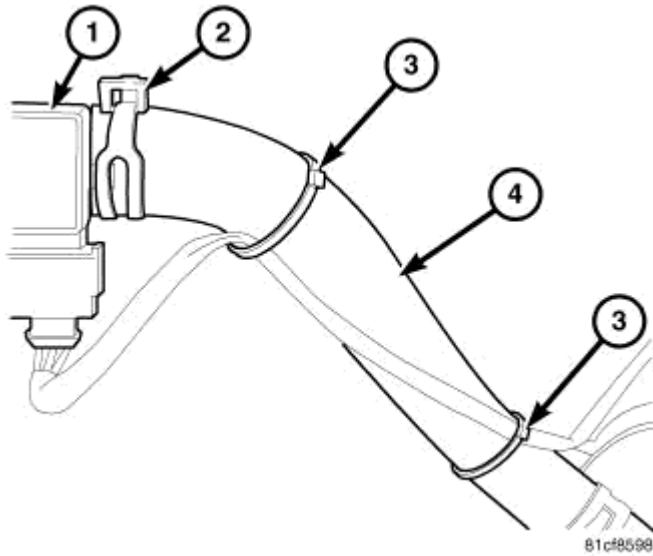


**Fig. 14: AIR INLET TUBE AT AIR PUMP**

Courtesy of CHRYSLER LLC

**NOTE:** The quick connect fitting on the air inlet tube is slotted to fit the air pump housing fitting. Line the slot up when making the connection.

1. Install air inlet tube (3) to air pump housing connection (2). A click noise will indicate a good connection.



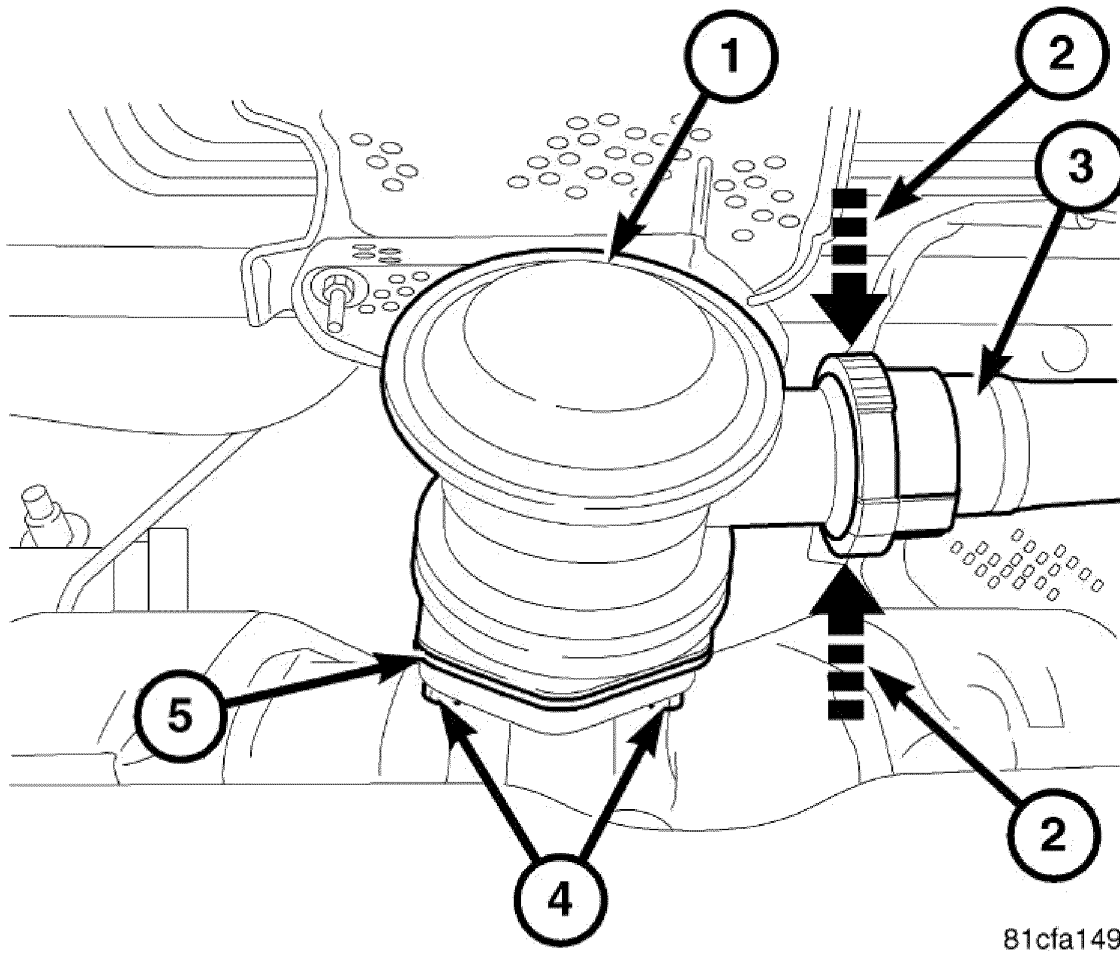
**Fig. 15: Air Inlet Tube At Mass Air Flow**  
Courtesy of CHRYSLER LLC

2. Install mass air flow (MAF) sensor (1) and constant tension clamp (2) to air inlet tube (4).
3. Position MAF sensor wiring to air inlet tube (4). Install new tie straps (3) securing the MAF sensor wiring to air inlet tube (4).

## VALVE, ONE WAY CHECK

### Description

### DESCRIPTION



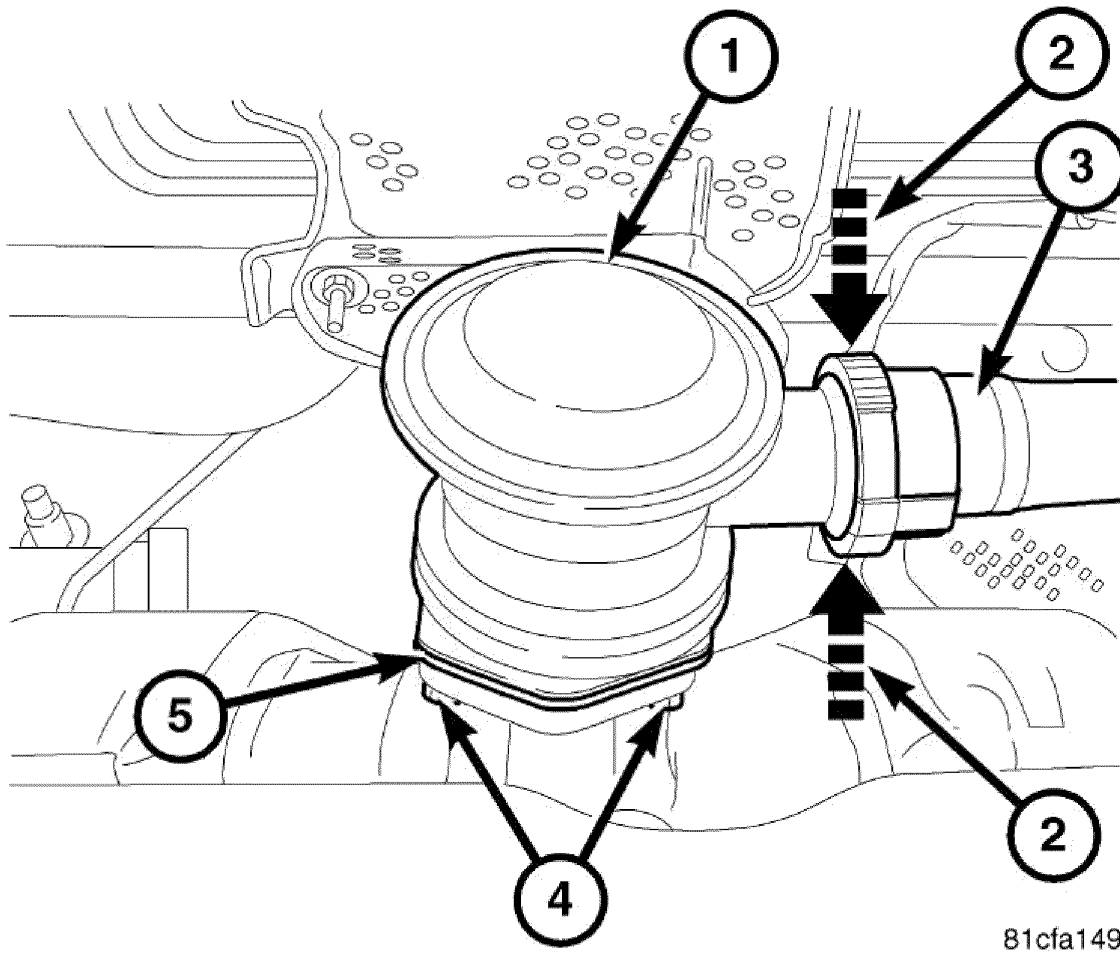
**Fig. 16: AIR INJECTION CHECK VALVE**

Courtesy of CHRYSLER LLC

The air injection check valve (1) is a one-valve check valve that allows air to flow in one direction only. The valve is located at exhaust side of the engine at the top of the exhaust manifold.

#### Operation

#### OPERATION



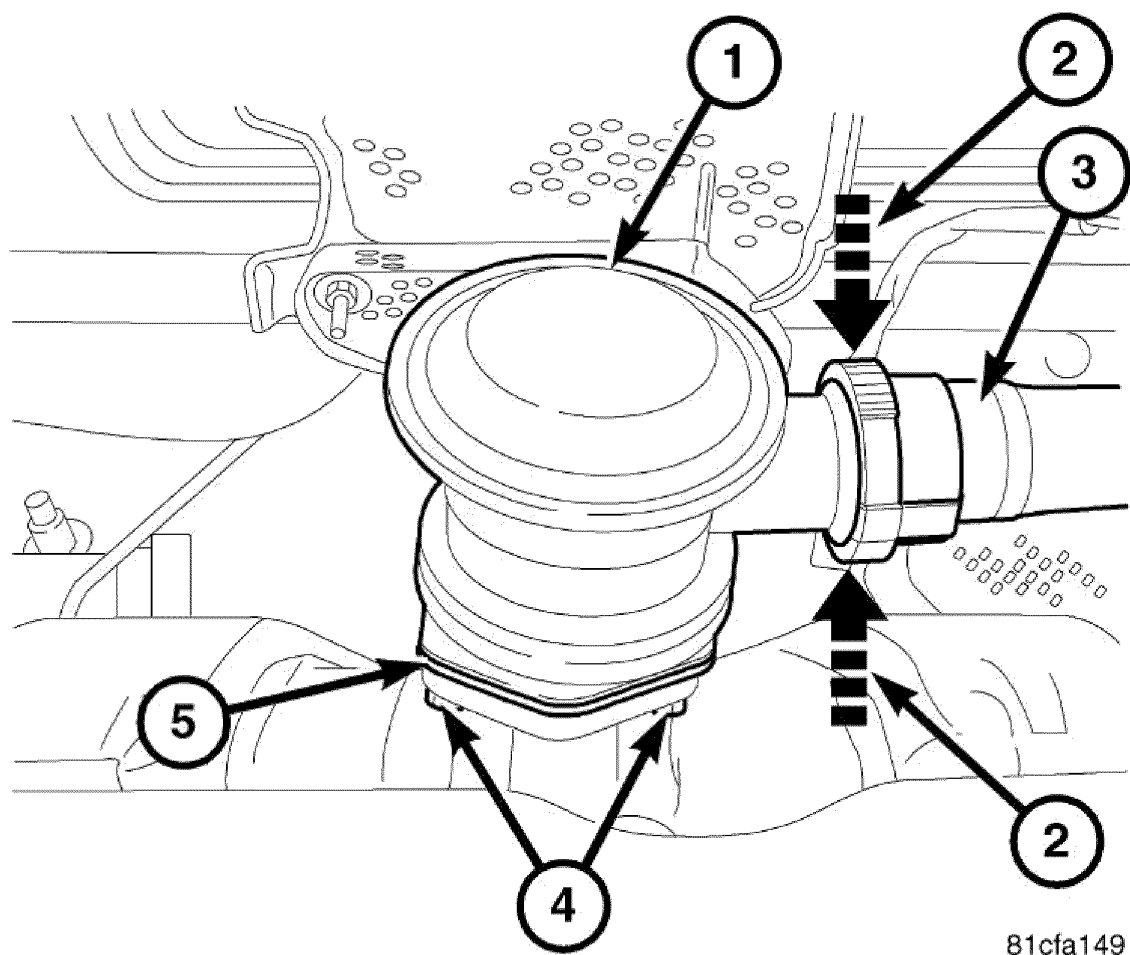
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**Fig. 17: AIR INJECTION CHECK VALVE**

Courtesy of CHRYSLER LLC

The air injection check valve (1) allows air pumped from the air injection pump to enter the exhaust manifold during cold engine starts only. Air pressure from the air injection pump causes the spring inside the air injection check valve to open allowing air to flow into the exhaust system.

**Removal****REMOVAL**



81cfa149

**Fig. 18: AIR INJECTION CHECK VALVE**

Courtesy of CHRYSLER LLC

**WARNING:** THE EXHAUST MANIFOLD, AIR INJECTION PIPES, EXHAUST PIPES AND CATALYTIC CONVERTER(S) BECOME VERY HOT DURING ENGINE OPERATION. ALLOW ENGINE TO COOL BEFORE REMOVING AIR INJECTION CHECK VALVE. FAILURE TO ALLOW ENGINE TO COOL BEFORE REMOVAL MAY RESULT IN PERSONAL INJURY CAUSED BY BURNS.

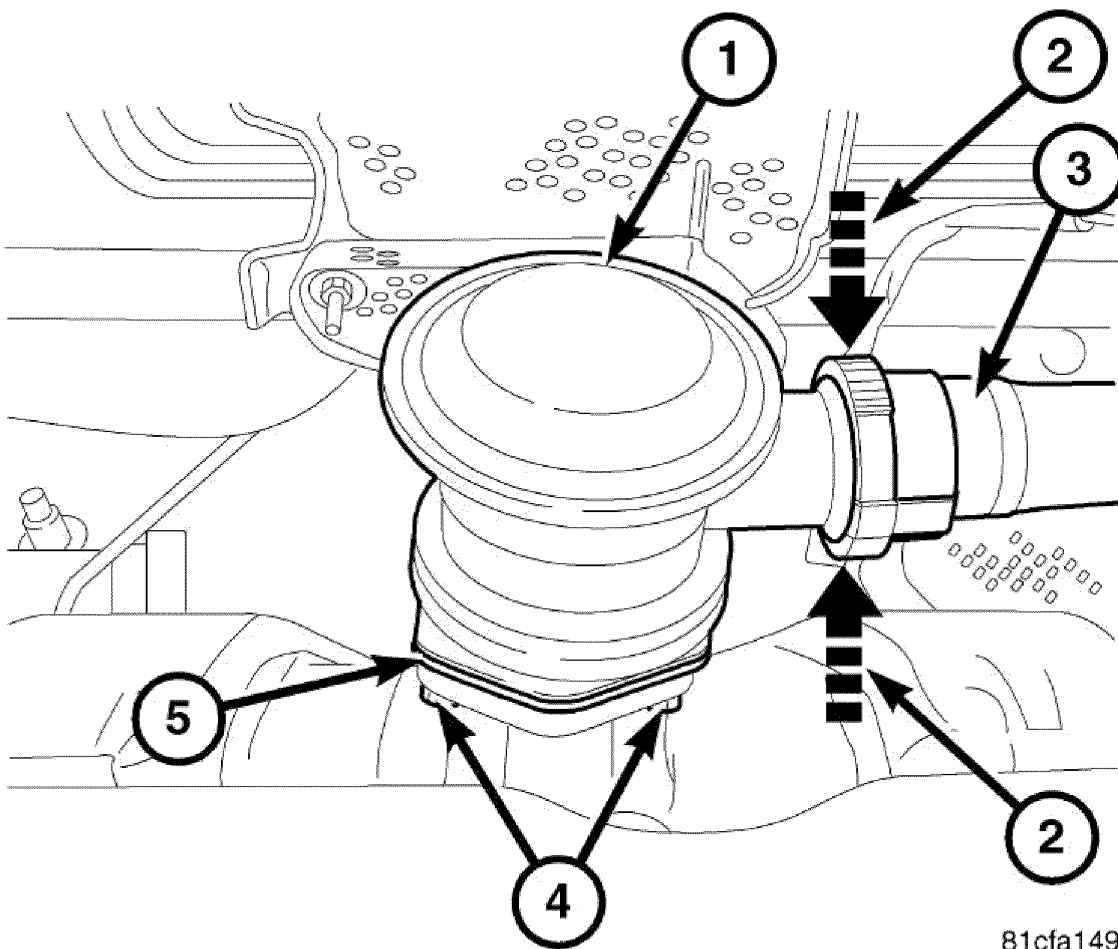
1. Remove engine cover.
2. Remove air outlet tube (3) by pushing the ends (2) together, while pulling the air inlet/outlet tube (3).

away from air injection check valve (1).

3. Remove air injection check valve mounting bolts (4).
4. Remove air injection check valve (1) and gasket (5) from pipe. Clean old gasket material from air injection pipe.

### Installation

#### INSTALLATION



**Fig. 19: AIR INJECTION CHECK VALVE**  
Courtesy of CHRYSLER LLC

**NOTE:** Make sure the old gasket material is completely removed from air injection pipe.

1. Install new gasket (5) and air injection check valve (1) to pipe.
2. Install air injection check valve mounting bolts (4).

**NOTE:** The quick connect fitting on the air outlet tube is slotted to fit the air injection check valve fitting. Line the slot up when making the connection.

3. Install air pump outlet tube (3) to air injection check valve (1) connection. A click noise will indicate a good connection.
4. Install engine cover.

## EVAPORATIVE EMISSIONS

### CANISTER, VAPOR

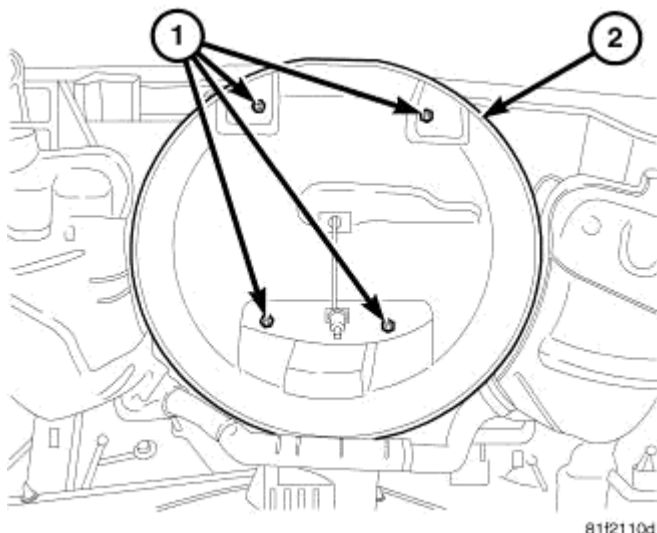
#### Operation

#### OPERATION

All gasoline fueled vehicles use a maintenance free, evaporative (EVAP) canister. Fuel tank vapors vent into the canister. The canister temporarily holds the fuel vapors until intake manifold vacuum draws them into the combustion chamber. The Powertrain Control Module (PCM) purges the canister through the proportional purge solenoid. The PCM purges the canister at predetermined intervals and engine conditions. The proportional purge solenoid controls the purge rate of fuel vapors from the vapor canister and fuel tank to the engine intake manifold.

#### Removal

#### REMOVAL



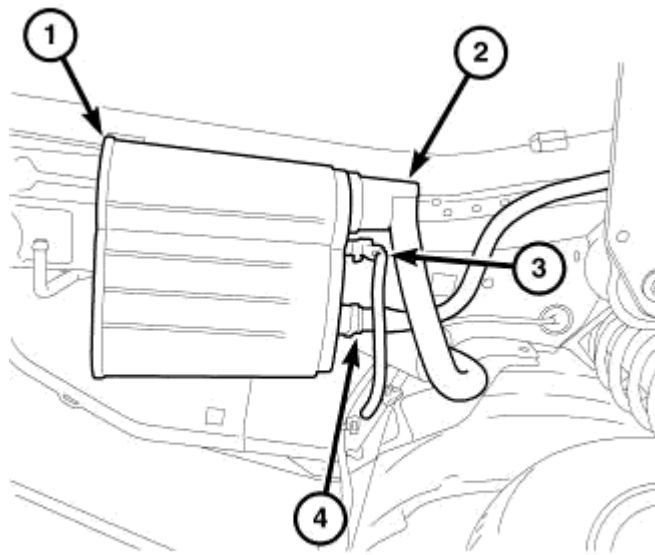
**Fig. 20: Spare Tire Well**

Courtesy of CHRYSLER LLC

1 - Nuts

2 - Spare Tire Well

1. Disconnect and isolate negative battery cable.
2. Remove the spare tire.
3. Raise and support vehicle.
4. Remove the 4 nuts (1) and the spare tire well (2).

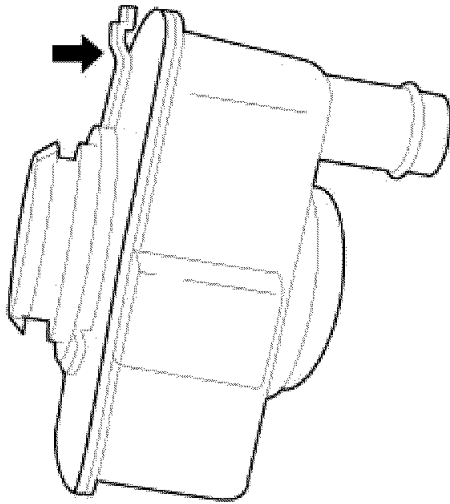


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**Fig. 21: Canister Mounting Evaporative System Integrity Monitor**

Courtesy of CHRYSLER LLC

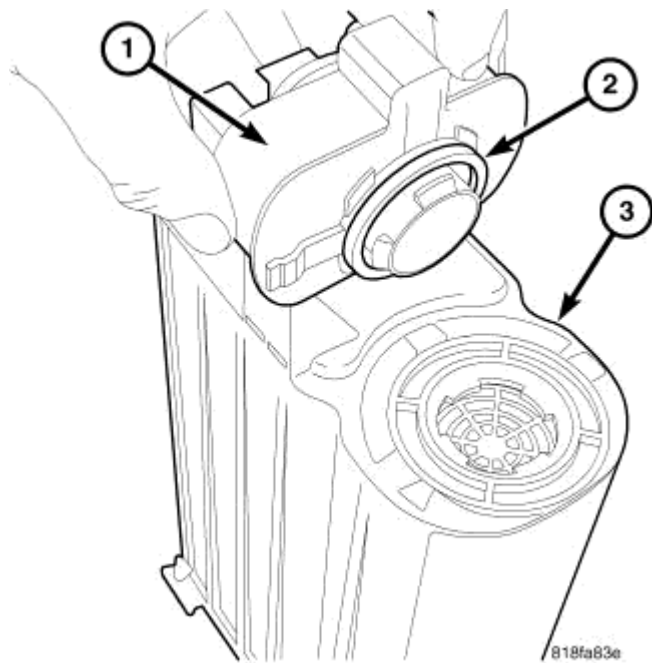
5. Remove 2 nuts from EVAP canister mounting brackets and reposition EVAP canister assembly.
6. Disconnect purge line (4) from EVAP canister (1). Refer to **Fuel System/Fuel Delivery/FITTING, Quick Connect - Standard Procedure**.
7. Remove fresh air hose (2) and electrical connector (3) from the ESIM.
8. Remove EVAP canister assembly from vehicle.



8176a3b0

**Fig. 22: Natural Vacuum Leak Detection Locking Tab**  
Courtesy of CHRYSLER LLC

9. A lock tab (see arrow) is used on the back of the switch. Push lock tab towards switch while rotating switch counterclockwise 1/4 turn for removal.



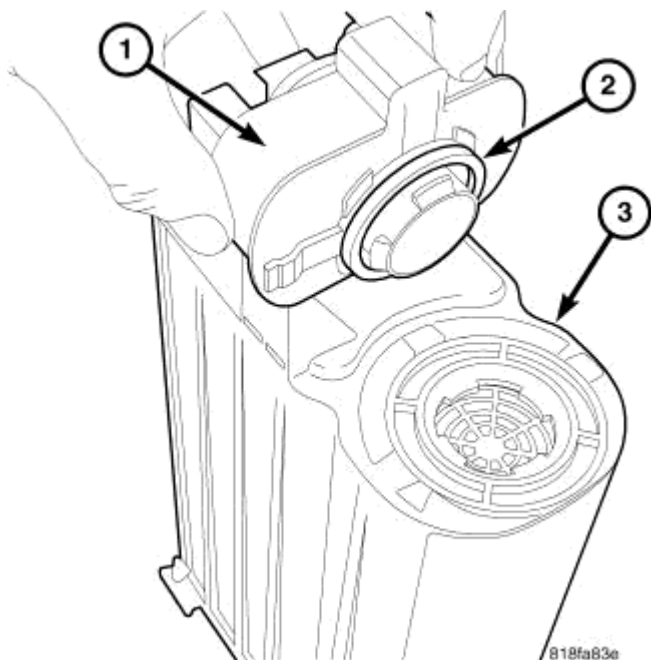
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**Fig. 23: Evaporative System Integrity Monitor Switch Removed**  
Courtesy of CHRYSLER LLC

10. Remove ESIM (1) from the EVAP canister (3).
11. Remove mounting brackets from EVAP canister.

## Installation

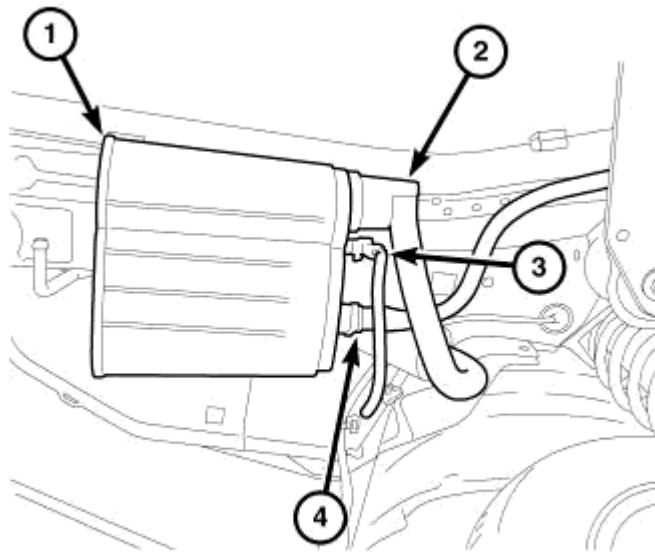
## INSTALLATION



**Fig. 24: Evaporative System Integrity Monitor Switch Removed**  
Courtesy of CHRYSLER LLC

The picture displays a typical EVAP Canister and a typical ESIM switch. After installing any ESIM switch, the electrical connector on the switch must be in the 3 O'clock position. This step must be done for proper ESIM switch operation.

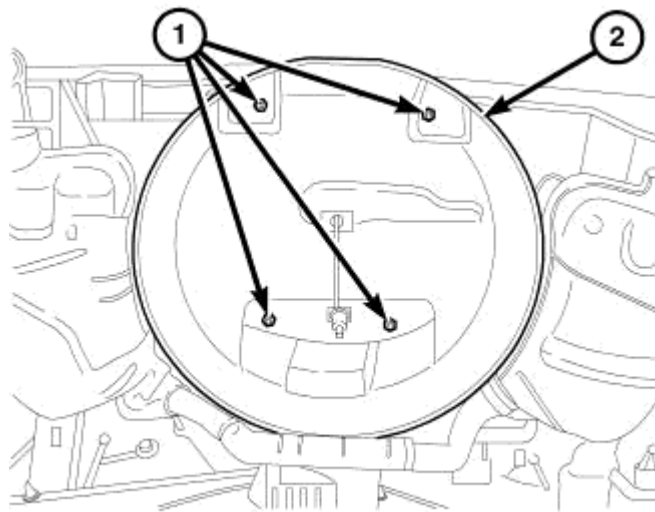
1. The fresh air hose that attaches to the ESIM must have a clear opening to the atmosphere. Check the fresh air hose, including the fresh air filter, for obstructions or restrictions at the ESIM. If a restriction is present, the system will not allow free flow passage of clean air, and an early shut off of the fuel fill nozzle may occur during fuel fill.
2. Be sure O-ring (2) and EVAP canister opening are clean.
3. Install ESIM (1) to the EVAP canister (3).
4. Instal mounting brackets to EVAP canister assembly.



8192ad73

**Fig. 25: Canister Mounting Evaporative System Integrity Monitor**  
Courtesy of CHRYSLER LLC

5. Install EVAP canister assembly to vehicle.
6. Install purge line (4) to EVAP canister (1). Refer to **Fuel System/Fuel Delivery/FITTING, Quick Connect - Standard Procedure** .
7. Install fresh air hose (2) and electrical connector (3) to the ESIM.



8112110d

**Fig. 26: Spare Tire Well**  
Courtesy of CHRYSLER LLC

1 - Nuts

**2 - Spare Tire Well**

8. Install the spare tire well (2) with 4 nuts (1).
9. Lower vehicle.
10. Install the spare tire.
11. Connect negative battery cable, tighten nut to 5 N.m (45 in. lbs.).

**CAP, FUEL FILLER****Description****DESCRIPTION**

The plastic fuel fill cap is a threaded/quarter turn onto the end of the fuel filler tube. Its purpose is to retain vapors and fuel in the fuel tank.

**Operation****OPERATION**

The loss of any fuel vapor out of fuel filler tube is prevented by the use of pressure-vacuum fuel fill cap. Relief valves inside the cap will release fuel tank pressure at predetermined pressures. Fuel tank vacuum will also be released at predetermined values. This cap must be replaced by a similar unit if replacement is necessary. This is in order for the system to remain effective.

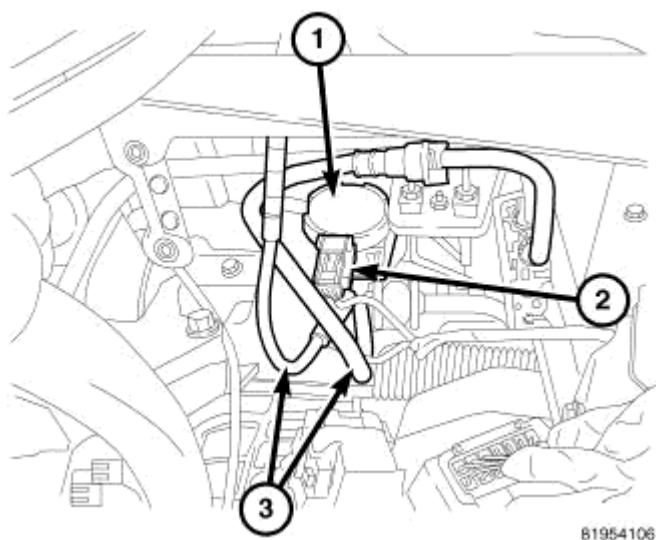
**CAUTION: Remove fill cap before servicing any fuel system component to relieve tank pressure. If the cap is left loose, a Diagnostic Trouble Code (DTC) may be set.**

**SOLENOID, EVAPORATIVE EMISSIONS PURGE****Operation****OPERATION**

During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged.

The proportional purge solenoid operates at a frequency of 200 hz and is controlled by an engine controller circuit that senses the current being applied to the proportional purge solenoid and then adjusts that current to achieve the desired purge flow. The proportional purge solenoid controls the purge rate of fuel vapors from the vapor canister and fuel tank to the engine intake manifold.

**Removal****REMOVAL**



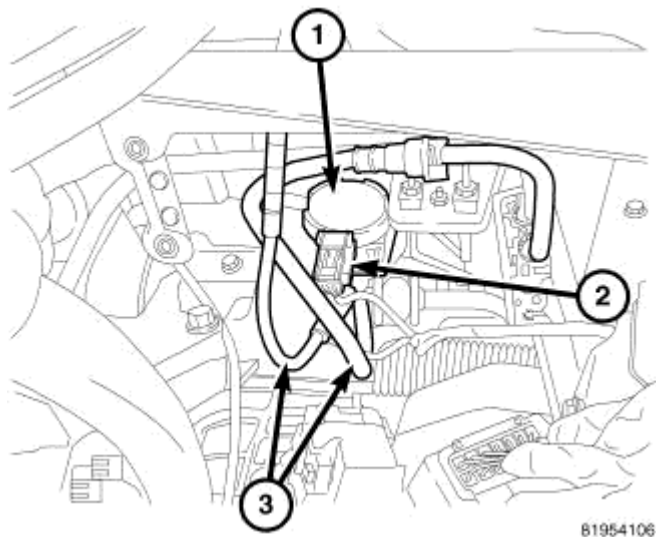
**Fig. 27: PURGE SOLENOID CONNECTIONS**

Courtesy of CHRYSLER LLC

1. Disconnect and isolate negative battery cable at battery.
2. If equipped with 2.7L or 3.5L engine, remove the PCM. Refer to **Electrical - Electronic Control Modules/Electronic Control Modules/MODULE, Powertrain Control - Removal** .
3. Disconnect electrical connector (2) from evaporator purge solenoid (1).
4. Remove purge hose and quick connect fuel tank hose (3) from evaporator purge solenoid (1). Refer to **Fuel System/Fuel Delivery/FITTING, Quick Connect - Standard Procedure** .
5. Release tab to remove evaporator purge solenoid (1) from bracket.

## Installation

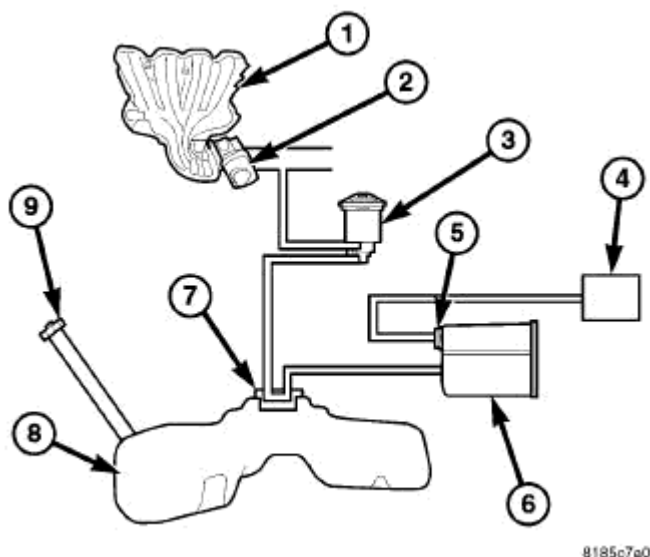
### INSTALLATION



**Fig. 28: PURGE SOLENOID CONNECTIONS**

Courtesy of CHRYSLER LLC

1. Install evaporator purge solenoid (1) to bracket. Make sure the tab secures the solenoid to the bracket.
2. Install quick connect fuel tank hose and purge hose (3) to evaporator purge solenoid (1). Refer to **Fuel System/Fuel Delivery/FITTING, Quick Connect - Standard Procedure**.
3. Connect electrical connector (2) to evaporator purge solenoid (1).
4. If equipped with 2.7L or 3.5L engine, install the PCM. Refer to **Electrical - Electronic Control Modules/Electronic Control Modules/MODULE, Powertrain Control - Installation**.
5. Connect negative battery cable, tighten nut to 5 N.m (45 in. lbs.).

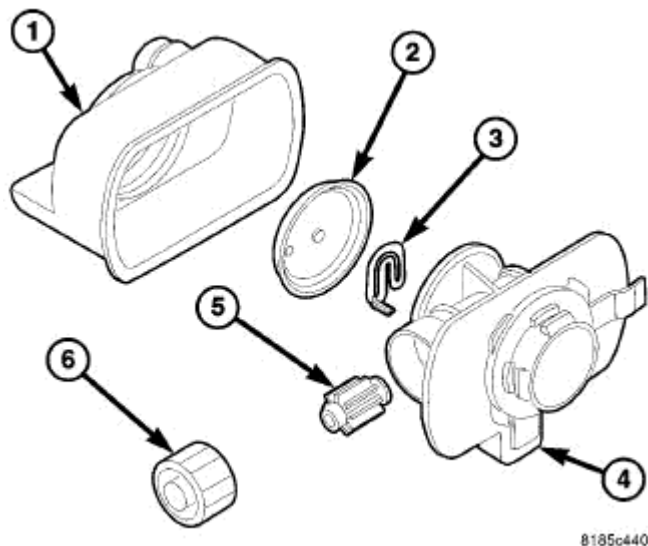
**SWITCH, EVAPORATIVE EMISSIONS SYSTEM MONITOR****Operation****OPERATION****Fig. 29: Evaporative Emissions System Monitor Switch**

Courtesy of CHRYSLER LLC

- 1 - Intake Manifold
- 2 - Throttle Body
- 3 - Purge Solenoid
- 4 - Filter
- 5 - ESIM
- 6 - Vapor Canister
- 7 - Control Valve
- 8 - Fuel Tank

## 9 - Gas Cap

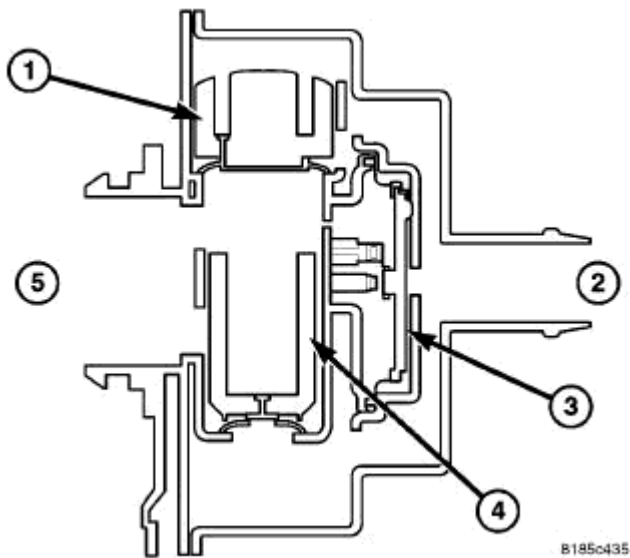
The ESIM (Evaporative System Integrity Monitor) is very similar to the NVLD. However, the design of the ESIM has been simplified and unlike the NVLD the ESIM does not require a solenoid. The ESIM mounts directly to the canister, eliminating the need for a mounting bracket. It is critical that the ESIM is mounted vertically. On vehicles where the canister is mounted on an angle, the ESIM requires an adaptor to maintain a vertical position. When the ESIM is installed vertically, the electrical connector is in the 3 o'clock position.



**Fig. 30: EXPLODED VIEW**  
Courtesy of CHRYSLER LLC

- 1 - ESIM Housing
- 2 - Diaphragm
- 3 - Switch
- 4 - Cover
- 5 - Small Check Valve
- 6 - Large Check Valve

The ESIM assembly consists of a housing, a small weight and a large weight that serve as check valves, a diaphragm, a switch and a cover. There is one large weight and one small weight check valve in the ESIM assembly. A seal is attached at the end of each weighted check valve. The large weight check valve seals for pressure. The small weight check valve seals for vacuum. The weighted check valves are contained within the ESIM housing.



**Fig. 31: CUT AWAY OF MODULE**  
Courtesy of CHRYSLER LLC

- 1 - Large Check Valve
- 2 - Fresh Air Inlet
- 3 - Diaphragm
- 4 - Small Check Valve
- 5 - Vapor Canister

The ESIM (Evaporative System Integrity Monitor), while physically different than the NVLD system, performs the same basic function as the NVLD does - controlling evaporative emissions. The ESIM has been simplified because the solenoid used on the NVLD is not used on the ESIM.

The ESIM consists of housing, two check valves (sometimes referred to as weights), a diaphragm, a switch and a cover. The larger check valve seals for pressure and the smaller one seals for vacuum.

During refueling, pressure is built up in the evaporative system. When pressure reaches approximately .5 inches of water, the large check valve unseats and pressure vents to the fresh air filter.

Conversely, when the system cools and the resulting vacuum lifts the small check valve from its seat and allows fresh air to enter the system and relieve the vacuum condition. When a calibrated amount of vacuum is achieved in the evaporative system, the diaphragm is pulled inward, pushing on the spring and closing the contacts.

The ESIM conducts test on the evaporative system as follows: An engine off, non-intrusive test for small leaks and an engine running, intrusive test for medium/large leaks.

The ESIM weights seal the EVAP system during engine off conditions. If the EVAP system is sealed, it will be pulled into a vacuum, either due to the cool down from operating temperature or diurnal ambient temperature cycling. When the vacuum in the system exceeds about 1" H2O, the vacuum switch closes. The switch closure

sends a signal to the powertrain control module (PCM). In order to pass the non-intrusive small leak test, the ESIM switch must close within a calculated amount of time and within a specified amount of key-off events.

If the ESIM switch does not close as specified, the test is considered inconclusive and the intrusive engine running test will be run during the next key-on cycle. This intrusive test will run on the next cold engine running condition.

Conditions for running the intrusive test are:

- After the vehicle is started, the engine coolant temperature must be within 10° C (50°F) of ambient to indicate a cold start.
- The fuel level must be between 12% and 88%.
- The engine must be in closed loop.
- Manifold vacuum must be greater than a minimum specified value.
- Ambient temperature must be between 4° C and 37° C (39° F and 98° F) and the elevation level must be below 8500 feet.

The test is accomplished by the PCM activating the purge solenoid to create a vacuum in the evaporative system. The PCM then measures the amount of time it takes for the vacuum to dissipate. This is known as the vacuum decay method. If the switch opens quickly a large leak is recorded. If the switch opens after a predetermined amount of time, then the small leak matures. If the switch does not close, then a general evaporative failure is recorded.

Even when all of the thresholds are met, a small leak won't be recorded until after the medium/large leak monitor has been run. If the medium/large leak test runs and the ESIM switch doesn't close, a general evaporative test is run. The purge solenoid is activated for approximately 10 seconds, increasing the amount of vacuum in the system. If the ESIM switch closes after the extended purge activation, a large leak fault is generated. If the switch doesn't close, a general evaporative system fault is generated.

The purge monitor tests the integrity of the hose attached between the purge valve and throttle body/intake. The purge monitor is a two stage test and it runs only after the evaporative system passes the small leak test.

Stage one of the purge monitor is non-intrusive. The PCM monitors the purge vapor ratio. If the ratio is above a calibrated specification, the monitor passes. Stage two is an intrusive test and it runs only if stage one fails. During the stage two test, the PCM commands the purge solenoid to flow at a specified rate to force the purge vapor ratio to update. The vapor ratio is compared to a calibrated specification and if it is less than specified, a one-trip failure is recorded.

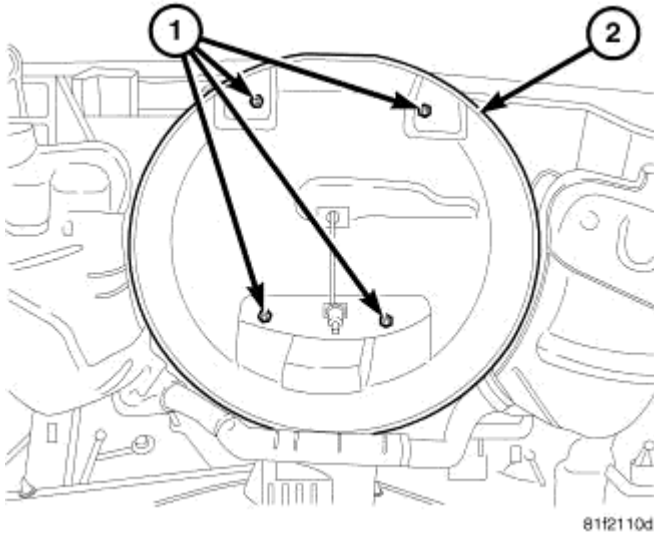
The ESIM switch stuck closed monitor checks to see if the switch is stuck closed. This is a power down test that runs at key-off; when the PCM sees 0 rpm's, the purge solenoid is energized for a maximum of 30 seconds, venting any vacuum trapped in the evaporative system. If the switch opens or was open before the test began, the monitor passes. If the switch doesn't open, the monitor fails. This is a two-trip MIL. The star scan tool can be used to force the ESIM switch stuck closed monitor to run.

The PCM also uses the ESIM to detect a loose or missing gas cap. The PCM looks for a change in the fuel level (25% minimum). If a medium/large leak is then detected, a loose gas cap light illuminates and a pending one-

trip fault code is set. This is a three-trip fault before the code matures.

### Removal

#### REMOVAL



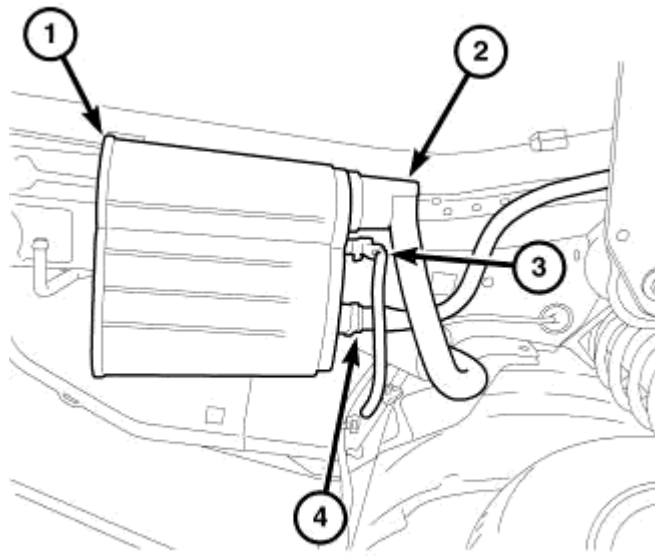
**Fig. 32: Spare Tire Well**

Courtesy of CHRYSLER LLC

1 - Nuts

2 - Spare Tire Well

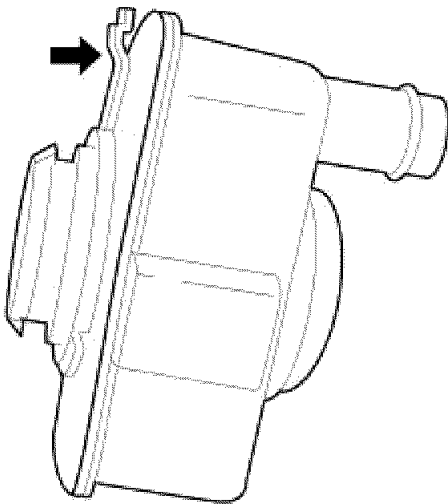
1. Disconnect and isolate negative battery cable.
2. Remove the spare tire.
3. Raise and support vehicle.
4. Remove the 4 nuts (1) and the spare tire well (2).



8192ad73

**Fig. 33: Canister Mounting Evaporative System Integrity Monitor**  
Courtesy of CHRYSLER LLC

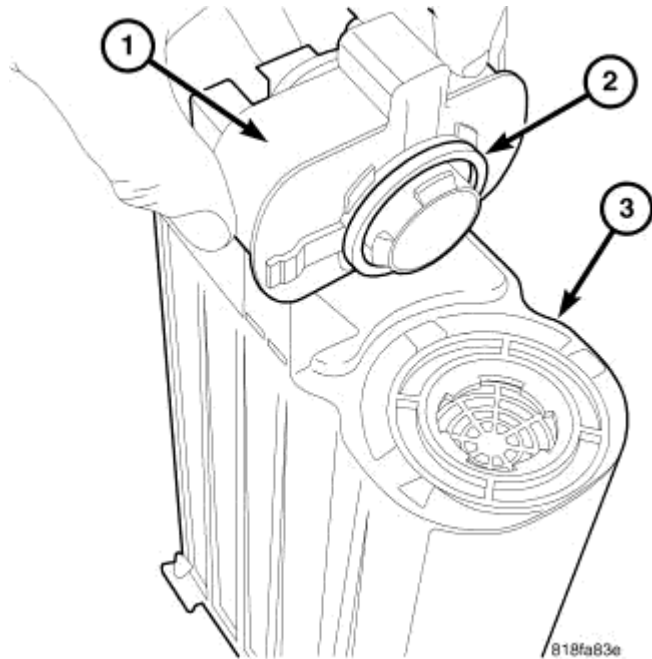
5. Remove fresh air hose (2) and electrical connector (3) from the ESIM.



8176a3b0

**Fig. 34: Natural Vacuum Leak Detection Locking Tab**  
Courtesy of CHRYSLER LLC

6. A lock tab (see arrow) is used on the back of the switch. Push lock tab towards switch while rotating switch counterclockwise 1/4 turn for removal.

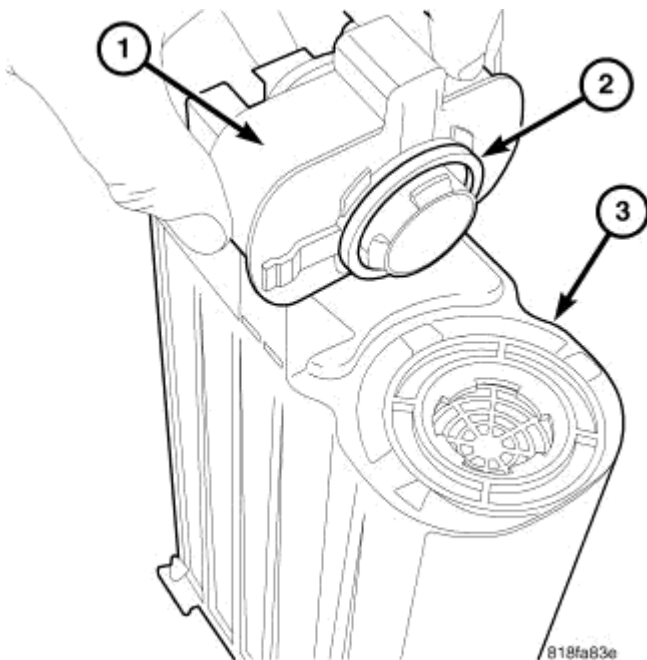


**Fig. 35: Evaporative System Integrity Monitor Switch Removed**  
Courtesy of CHRYSLER LLC

7. Remove ESIM (1) from the EVAP canister (3).

#### Installation

#### INSTALLATION

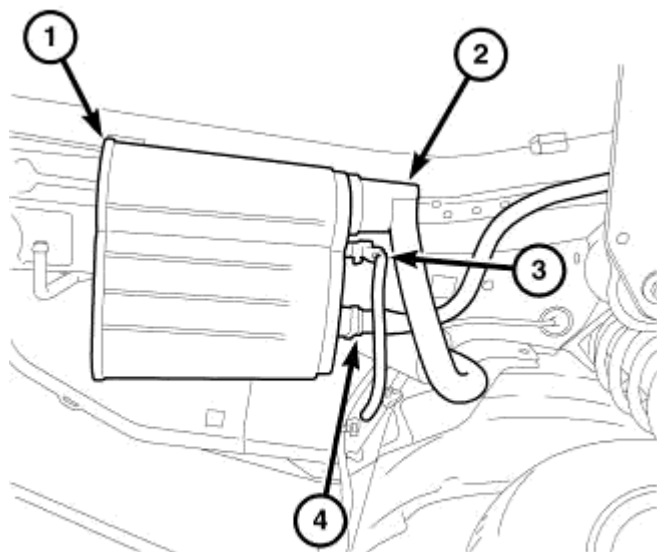


**Fig. 36: Evaporative System Integrity Monitor Switch Removed**

Courtesy of CHRYSLER LLC

The picture displays a typical EVAP Canister and a typical ESIM switch. After installing any ESIM switch, the electrical connector on the switch must be in the 3 O'clock position. This step must be done for proper ESIM switch operation.

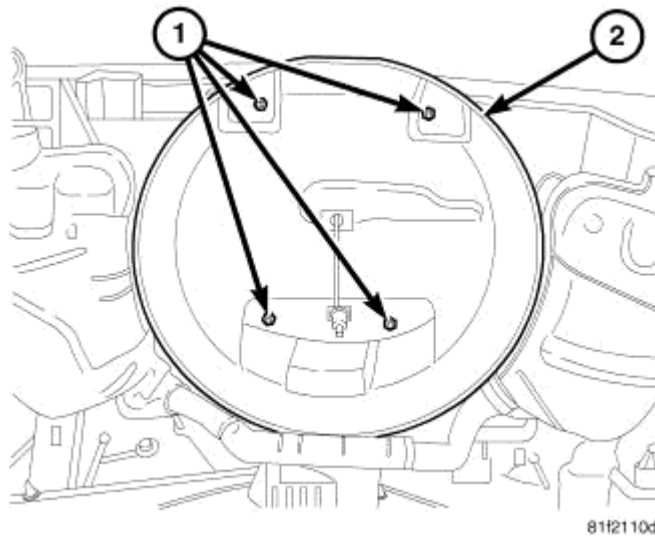
1. The fresh air hose that attaches to the ESIM must have a clear opening to the atmosphere. Check the fresh air hose, including the fresh air filter, for obstructions or restrictions at the ESIM. If a restriction is present, the system will not allow free flow passage of clean air, and an early shut off of the fuel fill nozzle may occur during fuel fill.
2. Be sure O-ring (2) and EVAP canister opening are clean.
3. Install ESIM (1) to the EVAP canister (3).



8192ad73

**Fig. 37: Canister Mounting Evaporative System Integrity Monitor**  
Courtesy of CHRYSLER LLC

4. Install fresh air hose (2) and electrical connector (3) to the ESIM.



**Fig. 38: Spare Tire Well**  
Courtesy of CHRYSLER LLC

- |                     |
|---------------------|
| 1 - Nuts            |
| 2 - Spare Tire Well |

5. Install the spare tire well (2) with 4 nuts (1).
6. Lower vehicle.
7. Install the spare tire.
8. Connect negative battery cable, tighten nut to 5 N.m (45 in. lbs.).

## VALVE, POSITIVE CRANKCASE VENTILATION (PCV)

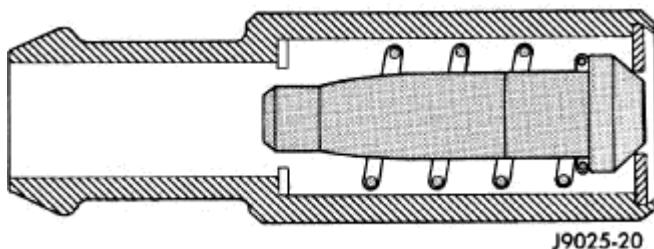
### Description

#### DESCRIPTION

The PCV valve contains a spring loaded plunger. The plunger meters the amount of crankcase vapors routed into the combustion chamber based on intake manifold vacuum.

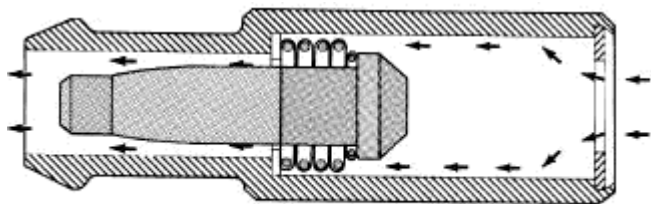
### Operation

#### OPERATION



**Fig. 39: Engine Off or Engine Backfire No Vapor Flow**  
 Courtesy of CHRYSLER LLC

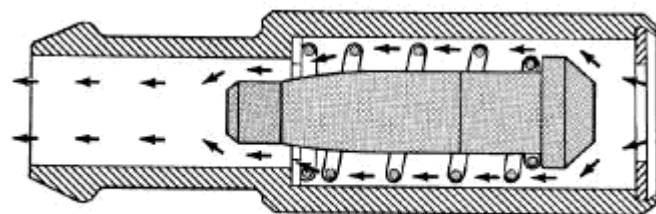
When the engine is not operating or during an engine backfire, the spring forces the plunger back against the seat. This prevents vapors from flowing through the valve.



J8925-14

**Fig. 40: High Intake Manifold Vacuum Minimal Vapor Flow**  
 Courtesy of CHRYSLER LLC

When the engine is at idle or cruising, high manifold vacuum is present. At these times manifold vacuum is able to completely compress the spring and pull the plunger to the top of the valve. In this position there is minimal vapor flow through the valve.



J8925-15

**Fig. 41: Moderate Intake Manifold Vacuum Maximum Vapor Flow**  
 Courtesy of CHRYSLER LLC

During periods of moderate intake manifold vacuum the plunger is only pulled part way back from the inlet. This results in maximum vapor flow through the valve.

## Diagnosis and Testing

### PCV SYSTEM

**WARNING:** apply parking brake and/or block wheels before performing any test or adjustment with the engine operating.

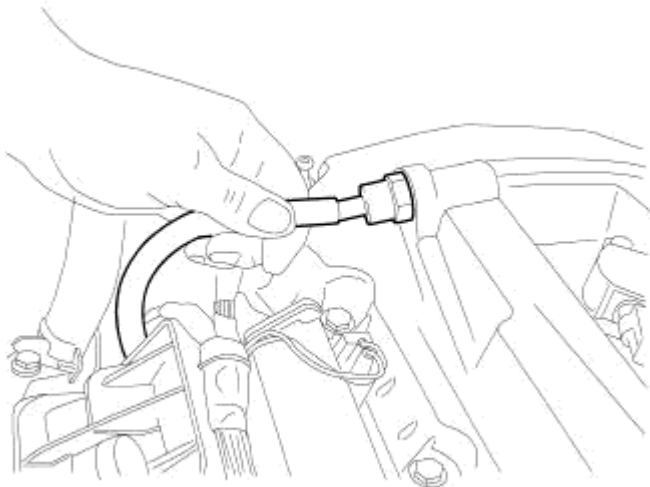
1. With engine idling, remove the hose from the PCV valve. If the valve is not plugged, a hissing noise will be heard as air passes through the valve. A strong vacuum should also be felt when a finger is placed over the valve inlet.
2. Install hose on PCV valve. Remove the make-up air hose from the air plenum at the rear of the engine. Hold a piece of stiff paper (parts tag) loosely over the end of the make-up air hose.
3. After allowing approximately one minute for crankcase pressure to reduce, the paper should draw up

against the hose with noticeable force. If the engine does not draw the paper against the grommet after installing a new valve, replace the PCV valve hose.

4. Turn the engine off. Remove the PCV valve from intake manifold. The valve should rattle when shaken.
5. Replace the PCV valve and retest the system if it does not operate as described in the preceding tests. **Do not attempt to clean the old PCV valve.**

## Removal

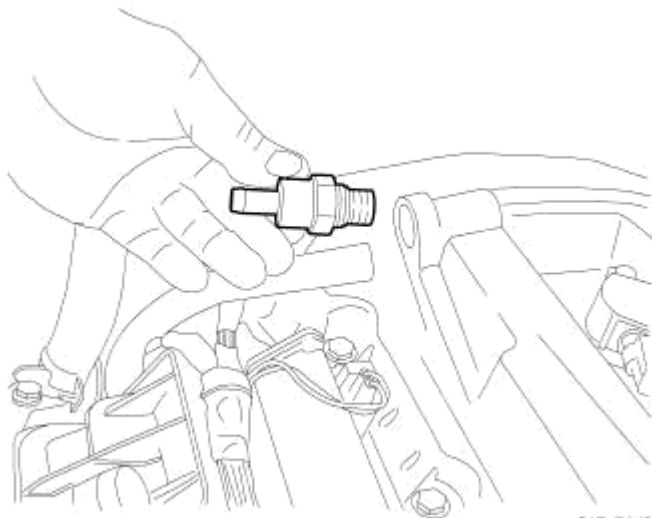
### 2.4L



817e71d5,

**Fig. 42: Positive Crankcase Ventilation Hose Removed**  
Courtesy of CHRYSLER LLC

1. Remove the engine cover.
2. Remove the hose from the PCV valve.

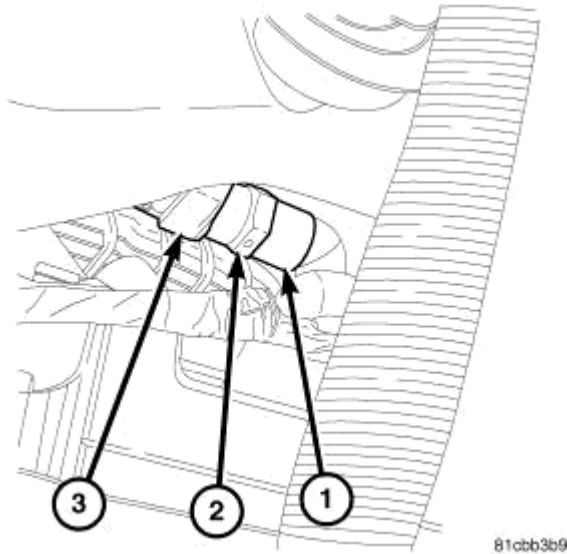


R17e71d9

**Fig. 43: Positive Crankcase Ventilation Removed**  
Courtesy of CHRYSLER LLC

3. Unscrew the PCV valve.

2.7L

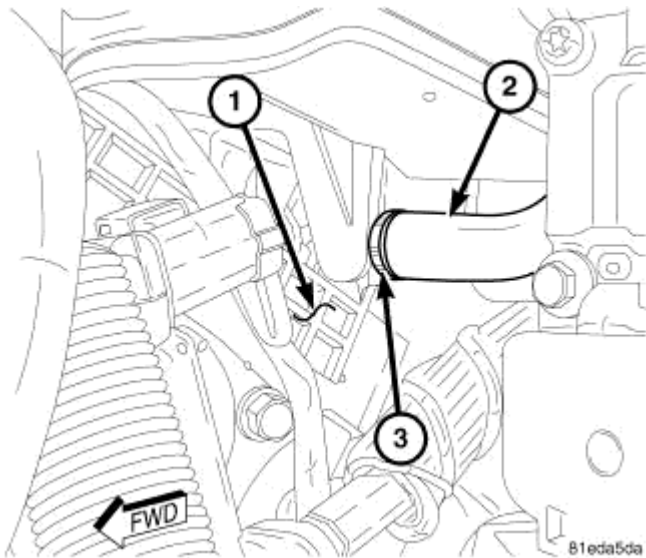


**Fig. 44: Positive Crankcase Ventilation Valve - 2.7L**  
Courtesy of CHRYSLER LLC

The Positive Crankcase Ventilation (PCV) valve is located under the intake manifold on the right rear bank of the engine.

1. Remove positive crankcase ventilation (PCV) hose (3) from PCV valve (2).
2. Unscrew PCV valve (2) from valve cover (1).

3.5L



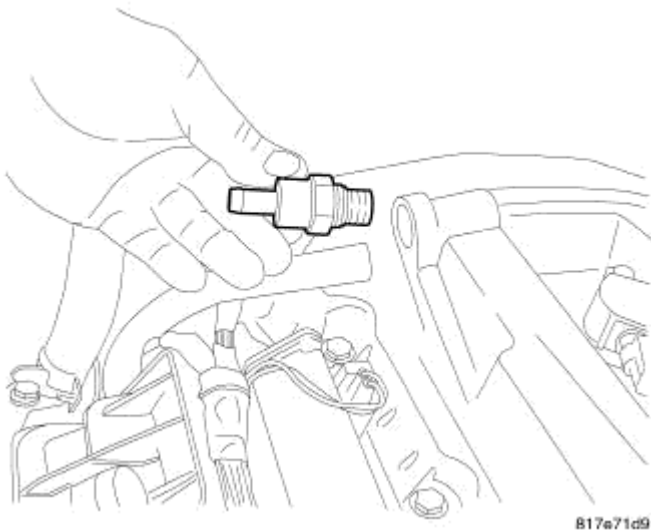
**Fig. 45: Positive Crankcase Ventilation Valve - 3.5L**  
Courtesy of CHRYSLER LLC

The Positive Crankcase Ventilation (PCV) valve is located on the end of the rear valve cover.

1. Remove positive crankcase ventilation (PCV) hose (2) from PCV valve (3).
2. Unscrew PCV valve (3) from valve cover (1).

#### Installation

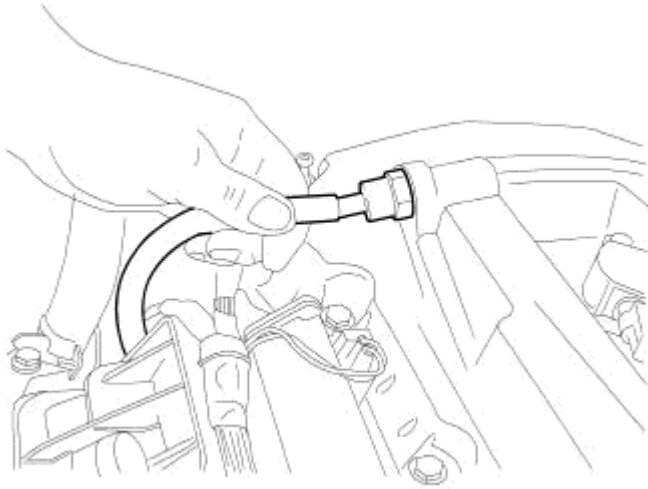
##### 2.4L



**Fig. 46: Positive Crankcase Ventilation Removed**  
Courtesy of CHRYSLER LLC

1. Lubricate the O-ring on the valve.

2. Install the PCV valve and tighten the valve to 8.1 N.m (72 in. lbs.).

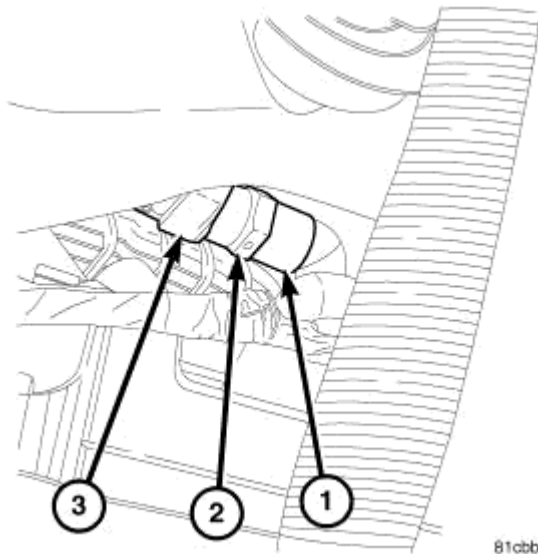


817e71d5,

**Fig. 47: Positive Crankcase Ventilation Hose Removed**  
Courtesy of CHRYSLER LLC

3. Install the hose.
4. Install engine cover.

2.7L

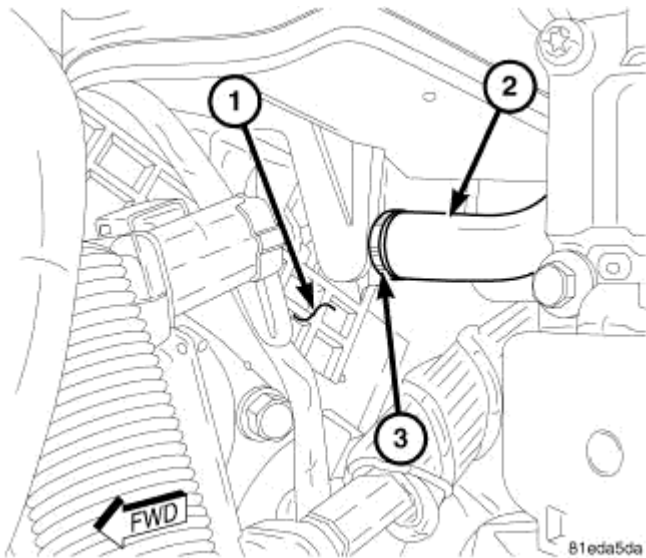


81cbb3b9

**Fig. 48: Positive Crankcase Ventilation Valve - 2.7L**  
Courtesy of CHRYSLER LLC

1. Install positive crankcase ventilation (PCV) valve (2) to valve cover (1) and tighten to 4 N.m (35 in. lbs.).
2. Install positive crankcase ventilation (PCV) hose (3) to PCV valve (2).

3.5L



**Fig. 49: Positive Crankcase Ventilation Valve - 3.5L**  
Courtesy of CHRYSLER LLC

1. Install positive crankcase ventilation (PCV) valve (3) to valve cover (1) and tighten to 4 N.m (35 in. lbs.).
2. Install positive crankcase ventilation (PCV) hose (2) to PCV valve (3).

## EXHAUST GAS RECIRCULATION

### SPECIFICATIONS

#### TORQUE

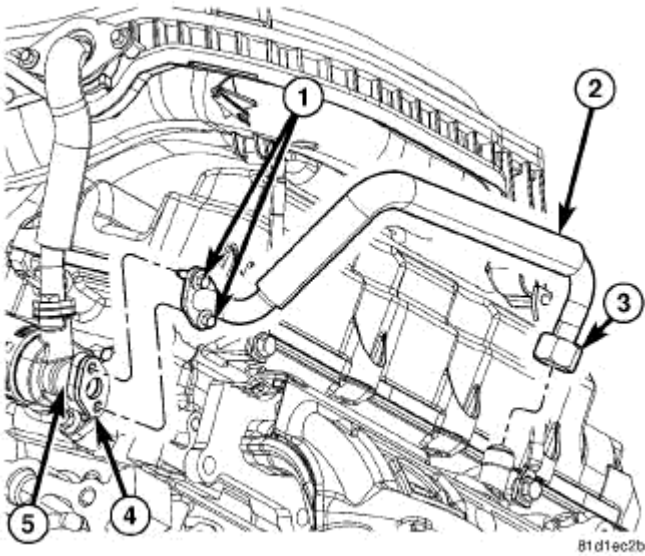
#### TORQUE

| DESCRIPTION                    | N.m | Ft. Lbs. | In. Lbs. |
|--------------------------------|-----|----------|----------|
| Tube to Exhaust Manifold Bolts | 31  | 23       | 275      |
| Tube to EGR valve Bolts        | 11  | -        | 95       |
| EGR Valve to Cyl. Head Bolts   | 31  | 23       | 275      |

### TUBE, EXHAUST GAS RECIRCULATION (EGR)

#### Removal

#### 2.7L - LOWER TUBE

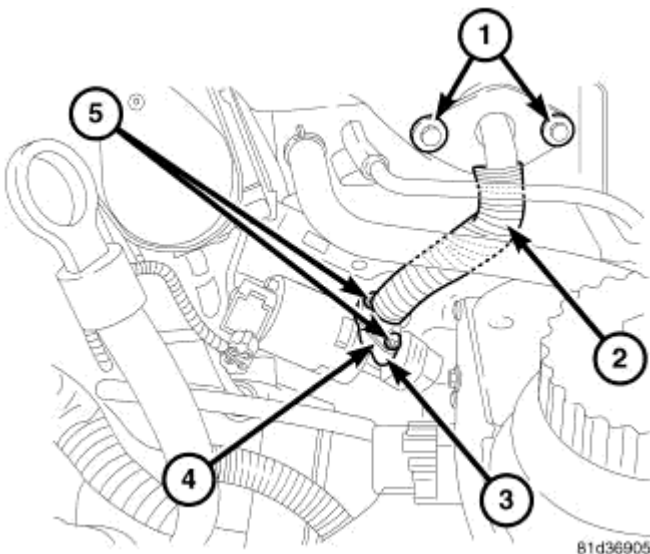


**Fig. 50: Lower Exhaust Gas Recirculation Tube - 2.7L**  
Courtesy of CHRYSLER LLC

**WARNING:** The normal operating temperature of the exhaust gas recirculate (EGR) valve and tube is very high. Therefore, never work around or attempt to service any engine component until it is completely cooled.

1. Remove lower EGR tube nut (3) from exhaust manifold.
2. Remove lower EGR tube bolts (1) from EGR valve (5).
3. Remove gasket (4) from EGR valve (5). Clean gasket surfaces on EGR valve.
4. Remove lower EGR tube (2) from vehicle.

#### 2.7L - UPPER TUBE



**Fig. 51: Upper Tube**

Courtesy of CHRYSLER LLC

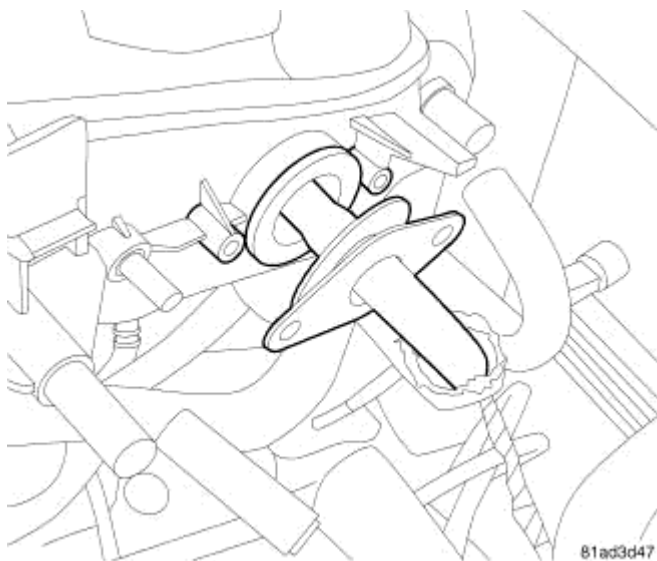
**WARNING:** The normal operating temperature of the exhaust gas recirculate (EGR) valve and tube is very high. Therefore, never work around or attempt to service any engine component until it is completely cooled.

1. Disconnect negative battery cable.
2. Remove upper bolts (1) from intake manifold. Inspect gasket, replace if necessary.
3. Remove bolts (5) attaching upper tube (2) to EGR valve (3).
4. Remove the gasket (4) between upper tube (2) and EGR valve (3).

**CAUTION:** Clean mounting surface of EGR valve. Do not use sharp metal scraping tools. Damage may occur to the sealing surfaces of the EGR valve causing a leak.

5. Clean mounting surface of EGR valve.

3.5L

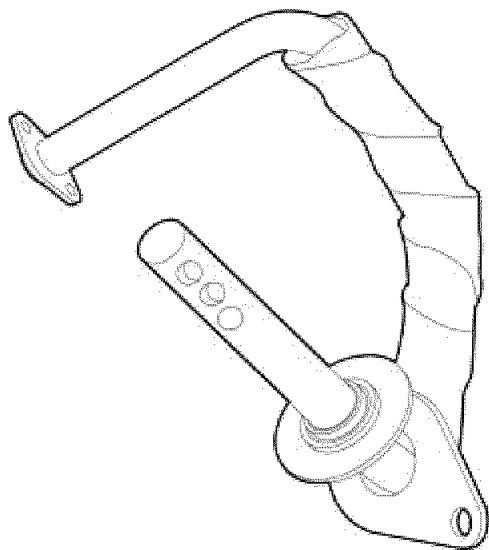
**Fig. 52: UPPER MOUNTING**

Courtesy of CHRYSLER LLC

**WARNING:** The normal operating temperature of the exhaust gas recirculate (EGR) valve and tube is very high. Therefore, never work around or attempt to service any engine component until it is completely cooled.

1. Remove two upper tube mounting bolts.
2. When removing EGR tube assembly be careful not to drop the silicone rubber seals into the intake

manifold. Clean gasket surfaces on the EGR valve. Note that any loose dirt can lodge between the pintle and the seat and cause valve leakage that will give a rough idle and depressed manifold vacuum.



61ad3d2d

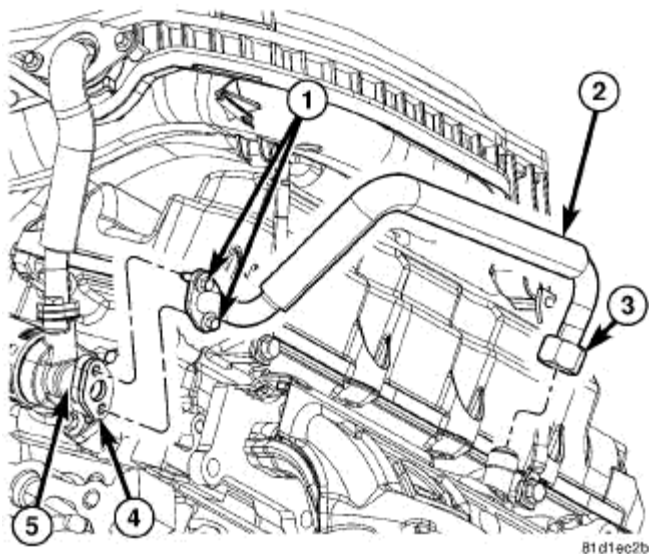
**Fig. 53: UPPER TUBE**

Courtesy of CHRYSLER LLC

3. Remove two lower tube mounting bolts.
4. Remove tube assembly from vehicle.

#### Installation

#### 2.7L - LOWER TUBE



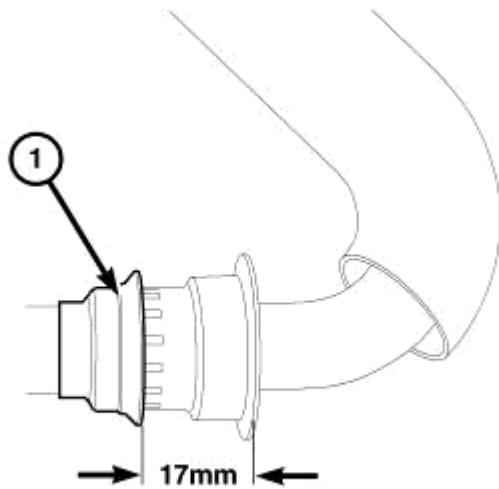
81d1ec2b

**Fig. 54: Lower Exhaust Gas Recirculation Tube - 2.7L**

Courtesy of CHRYSLER LLC

1. Install gasket (4) to EGR valve (5).
2. Install lower EGR tube (2) to vehicle.
3. Install lower EGR tube bolts (1) to EGR valve (5). Tighten bolts to 12 N.m (106 in. lbs.).
4. Install lower EGR tube nut (3) to exhaust manifold. Tighten nut to 70 N.m (51.5 ft. lbs.).

#### 2.7L - UPPER TUBE



81ce4322

**Fig. 55: Identifying Inner Exhaust Gas Recirculation Tube Seal**  
Courtesy of CHRYSLER LLC

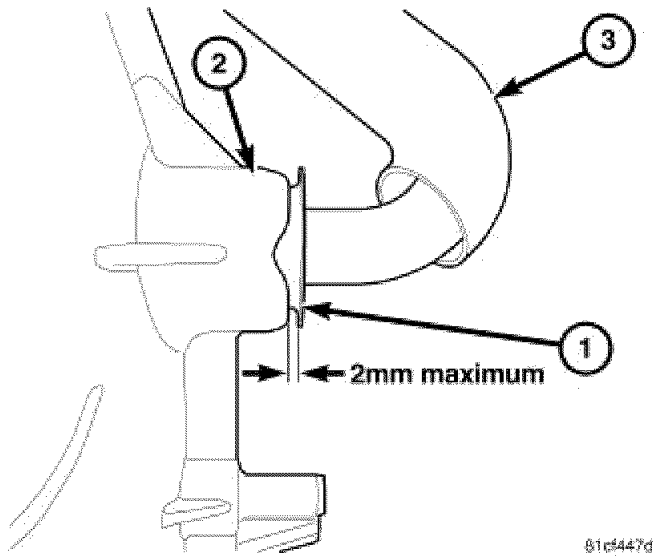
**CAUTION:** Do Not use metal scrapers when cleaning the mounting surface of the EGR valve. Damage from scratching the surface may cause an improper seal.

**CAUTION:** Do not allow debris to enter the EGR valve when cleaning the mounting surface. Debris can lodge between the pintle and the seat causing valve leakage that results in rough idle and depressed manifold vacuum.

1. Clean and inspect gasket sealing surfaces.

**NOTE:** Install new rubber silicone seals on intake manifold end of EGR tube any time it is removed from the intake manifold.

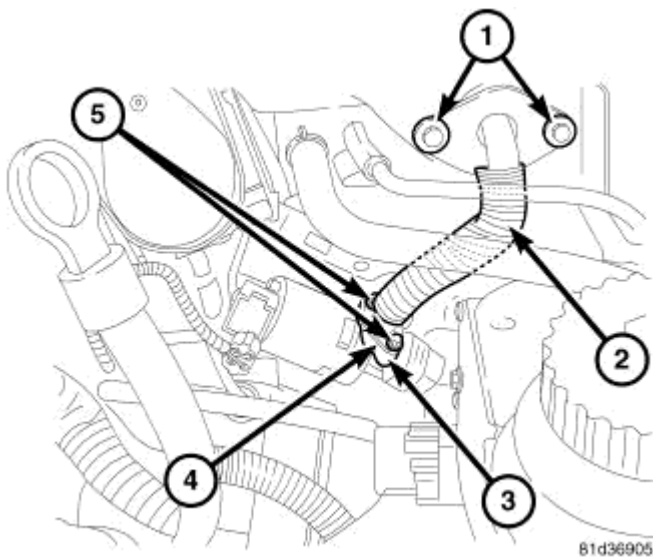
2. Install new silicone rubber seal (1) on the intake manifold end of the EGR tube. Position seal 17 mm (0.67 in.) from the tube flange.



**Fig. 56: Identifying Exhaust Gas Recirculation Flange, Tube & Intake Manifold**  
Courtesy of CHRYSLER LLC

1 - EGR tube flange  
2 - intake manifold

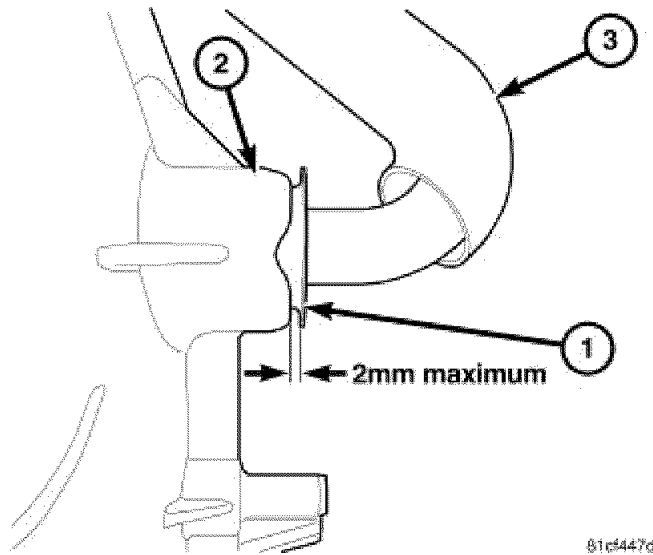
3. Lubricate the EGR mounting tube hole in the intake manifold with Mopar® Rubber Bushing Installation Lube. Do not lubricate the EGR tube or seal.
4. Install the EGR tube (3) into the intake manifold (2) being careful not to damage the silicone rubber seals, and verify that the seals are correctly positioned in the intake manifold.



**Fig. 57: Upper Tube**  
Courtesy of CHRYSLER LLC

5. Install new gasket (4) between the EGR valve (3) and tube (2) and install bolts (5). Tighten bolts to 12

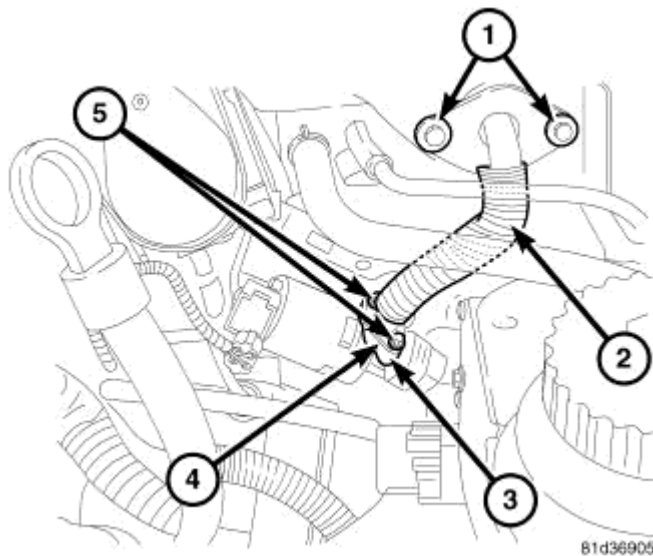
N.m (106 in. lbs.).



**Fig. 58: Identifying Exhaust Gas Recirculation Flange, Tube & Intake Manifold**  
 Courtesy of CHRYSLER LLC

- |                     |
|---------------------|
| 1 - EGR tube flange |
| 2 - intake manifold |

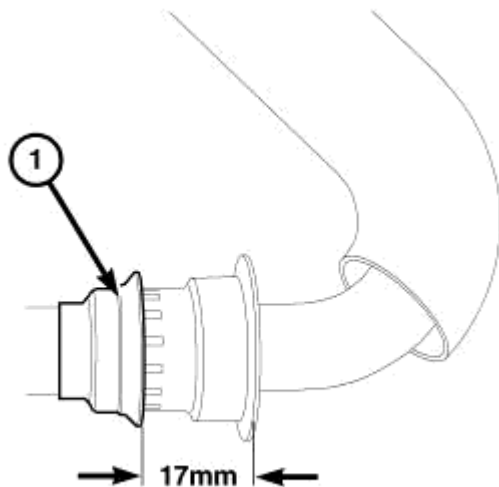
**NOTE:** The EGR tube flange (1) does not need to be flush with the intake manifold (2) to be sealed. The EGR tube flange can be up to 2 mm (0.08 in.) from intake manifold and still be sealed. This design allows the EGR tube position to vary with the tolerance stack up and remain properly sealed.



**Fig. 59: Upper Tube**  
 Courtesy of CHRYSLER LLC

6. Tighten the EGR tube to intake manifold bolts (1) to 6 N.m (53 in. lbs.).
7. Connect negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

3.5L



81ce4322

**Fig. 60: Identifying Inner Exhaust Gas Recirculation Tube Seal**  
Courtesy of CHRYSLER LLC

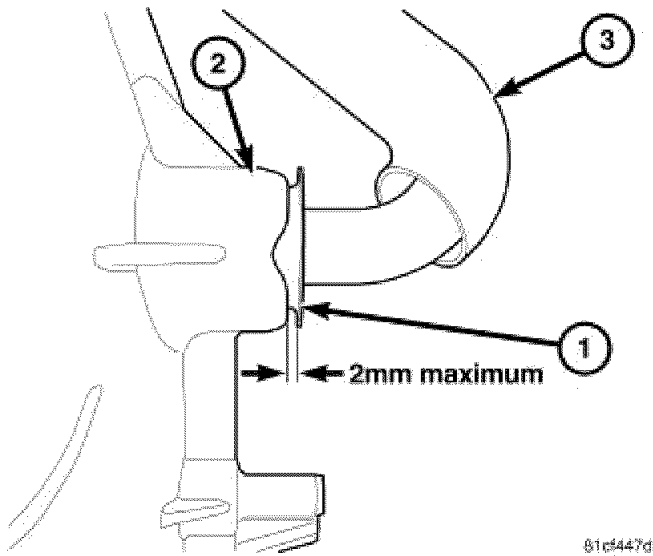
**CAUTION:** Do Not use metal scrapers when cleaning the mounting surface of the EGR valve. Damage from scratching the surface may cause an improper seal.

**CAUTION:** Do not allow debris to enter the EGR valve when cleaning the mounting surface. Debris can lodge between the pintle and the seat causing valve leakage that results in rough idle and depressed manifold vacuum.

1. Clean and inspect gasket sealing surfaces.

**NOTE:** Install new rubber silicone seals on intake manifold end of EGR tube any time it is removed from the intake manifold.

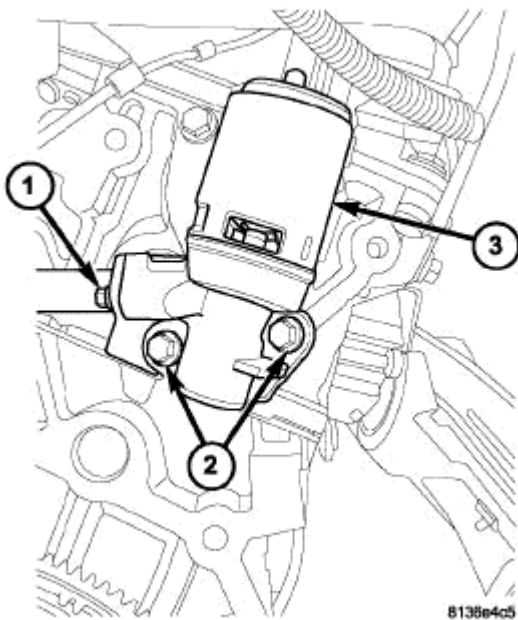
2. Install new silicone rubber seal (1) on the intake manifold end of the EGR tube. Position seal 17 mm (0.67 in.) from the tube flange.



**Fig. 61: Identifying Exhaust Gas Recirculation Flange, Tube & Intake Manifold**  
 Courtesy of CHRYSLER LLC

1 - EGR tube flange  
 2 - intake manifold

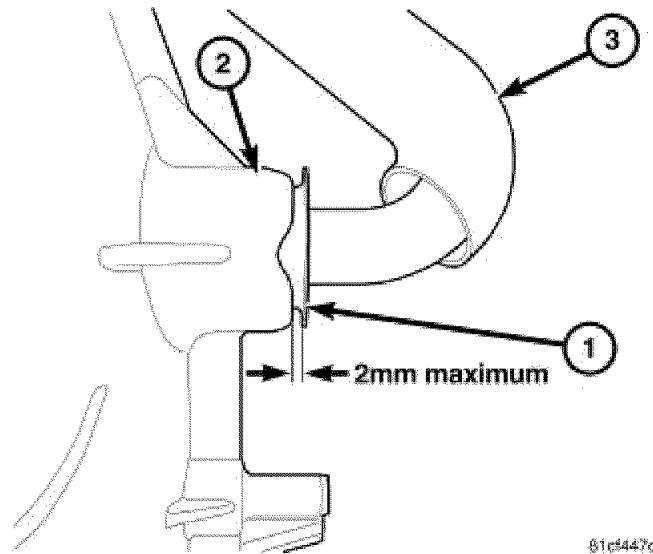
3. Lubricate the EGR mounting tube hole in the intake manifold with Mopar® Rubber Bushing Installation Lube. Do not lubricate the EGR tube or seal.
4. Install the EGR tube (3) into the intake manifold (2) being careful not to damage the silicone rubber seals, and verify that the seals are correctly positioned in the intake manifold.



**Fig. 62: Exhaust Gas Recirculation Valve Mounting Bolts 3.5**

Courtesy of CHRYSLER LLC

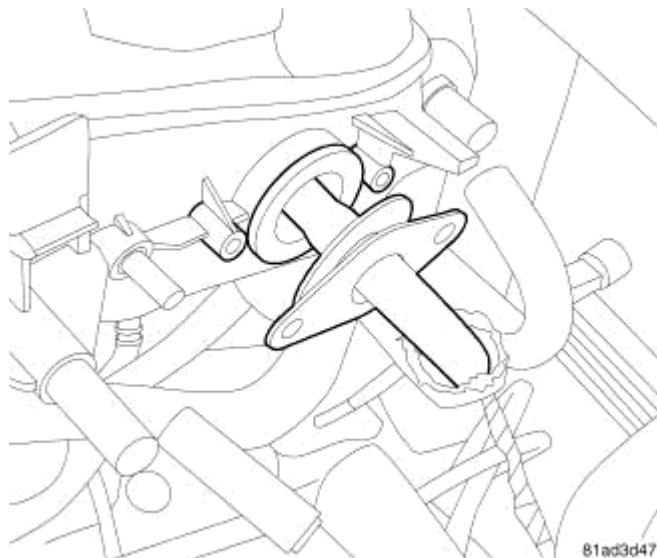
5. Install new gasket between the EGR valve and tube and install bolts (1). Tighten bolts to 15 N.m (11 ft. lbs.).

**Fig. 63: Identifying Exhaust Gas Recirculation Flange, Tube & Intake Manifold**

Courtesy of CHRYSLER LLC

- |                     |
|---------------------|
| 1 - EGR tube flange |
| 2 - intake manifold |

**NOTE:** The EGR tube flange (1) does not need to be flush with the intake manifold (2) to be sealed. The EGR tube flange can be up to 2 mm (0.08 in.) from intake manifold and still be sealed. This design allows the EGR tube position to vary with the tolerance stack up and remain properly sealed.



**Fig. 64: UPPER MOUNTING**  
Courtesy of CHRYSLER LLC

**CAUTION: DO NOT use air tools to install bolts to intake manifold. Install bolts using hand tools only. Torque all fasteners to specification. The use of air tools can cause the threads of the intake manifold to become stripped.**

6. Install the EGR tube flange mounting bolts to intake manifold. Tighten bolts to 12 N.m (106 in. lbs.).

## VALVE, EXHAUST GAS RECIRCULATION (EGR)

### Description

#### DESCRIPTION

The EGR valve consists of three major components. First there is the pintle, valve seat, and housing which contains and regulates the gas flow. Second there is the armature, return spring, and solenoid coil to provide the operating force to regulate the flow by changing the pintle position. The solenoid coil assembly is in parallel with a diode and connects to the two connectors in the connector assembly. The third major component which senses pintle position and is connected to the three connectors in the electrical connector.

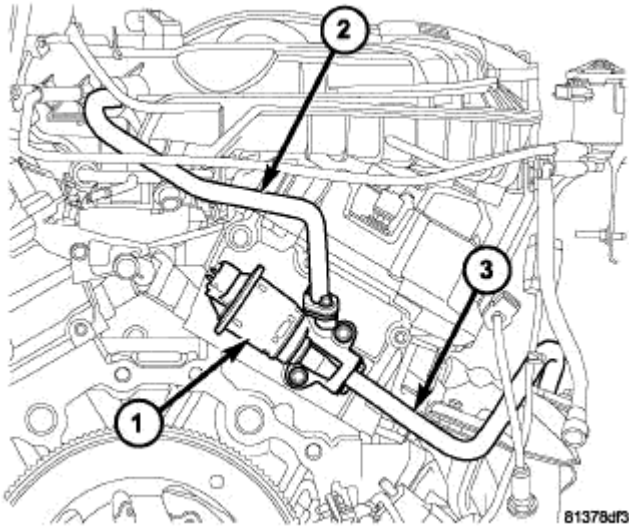
### Operation

#### OPERATION

The exhaust gas recirculation flow is determined by the engine controller. For a given set of conditions, the engine controller knows the ideal exhaust gas recirculation flow to optimize NOx and fuel economy as a function of the pintle position. Pintle position is obtained from the position sensor. The engine controller adjusts the duty cycle of 128 Hz power supplied to the solenoid coil to obtain the correct position.

### Removal

2.7L

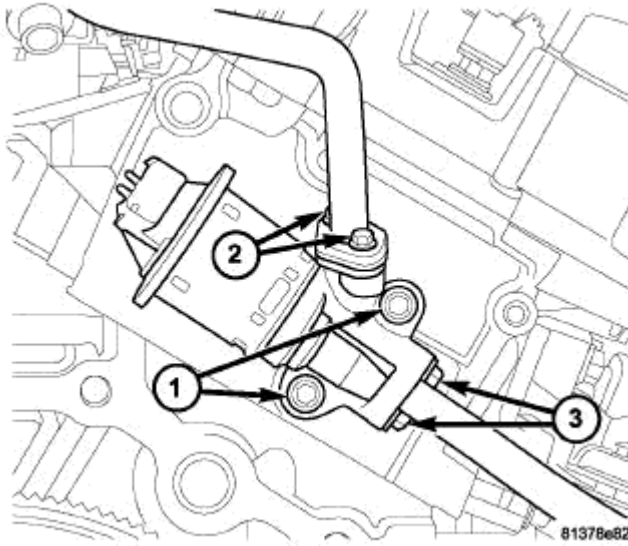


**Fig. 65: Exhaust Gas Recirculation System**  
Courtesy of CHRYSLER LLC

**WARNING:** The normal operating temperature of the exhaust gas recirculate (EGR) valve and tube is very high. Therefore, never work around or attempt to service any engine component until it is completely cooled.

**NOTE:** It is very important to disconnect the battery due to the addresses (cells) within the engine controller that store learned values related to powertrain operation. A malfunctioning EGR system can cause bad values to be stored in these cells that can cause an erroneous fault to occur after the system is repaired. Disconnecting the battery for at least two minutes will remove all power from the controller and reset these cells to normal default values.

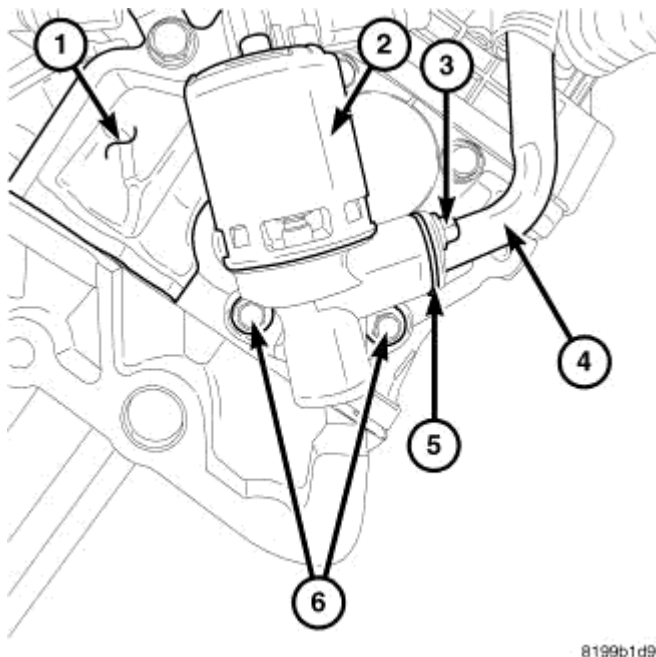
1. EGR system components and location. Upper tube (2), EGR valve (1), and Lower tube (3).
2. Disconnect negative battery cable.
3. Unlock and disconnect the electrical connector from EGR valve.



**Fig. 66: Exhaust Gas Recirculation Valve**  
**Courtesy of CHRYSLER LLC**

4. Remove the bolts from the EGR tube to exhaust manifold.
5. Remove the lower tube bolts to EGR valve and remove tube (3).
6. Remove upper tube bolts to EGR valve (2).
7. Remove the EGR valve mounting bolts (1).
8. Remove valve from vehicle.
9. Clean mounting surface.

3.5L



**Fig. 67: Exhaust Gas Recirculation Valve/Solenoid Removal - 4.0L**  
Courtesy of CHRYSLER LLC

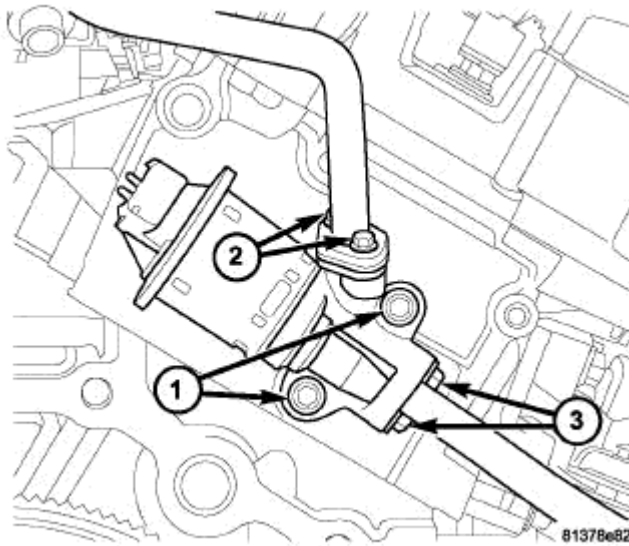
**WARNING:** The normal operating temperature of the exhaust gas recirculate (EGR) valve and tube is very high. Therefore, never work around or attempt to service any engine component until it is completely cooled.

**NOTE:** It is very important to disconnect the battery due to the addresses (cells) within the engine controller that store learned values related to powertrain operation. A malfunctioning EGR system can cause bad values to be stored in these cells that can cause an erroneous fault to occur after the system is repaired. Disconnecting the battery for at least two minutes will remove all power from the controller and reset these cells to normal default values.

1. Disconnect and isolate negative battery cable at battery.
2. Remove EGR tube bolts (3) at exhaust gas recirculate (EGR) valve (2).
3. Remove EGR tube (4) from EGR valve (2).
4. Remove and discard gasket (5) located between EGR valve (2) and EGR tube (4).
5. Disconnect electrical connector at EGR valve (2).
6. Remove EGR valve mounting bolts (6).
7. Remove EGR valve (2) from cylinder head (1).
8. Remove and discard gasket located between EGR valve (2) and cylinder head (1).

#### Installation

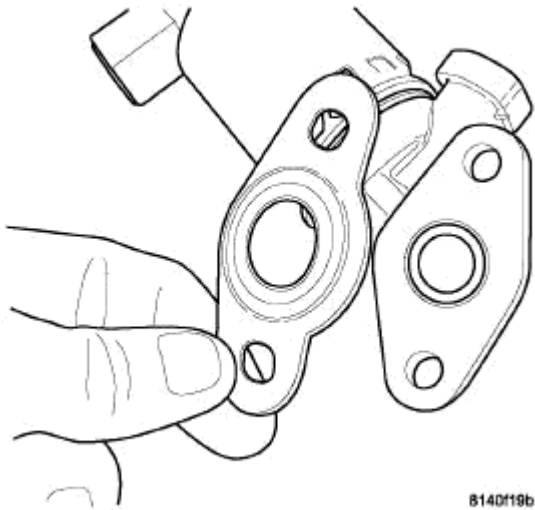
2.7L



**Fig. 68: Exhaust Gas Recirculation Valve**  
**Courtesy of CHRYSLER LLC**

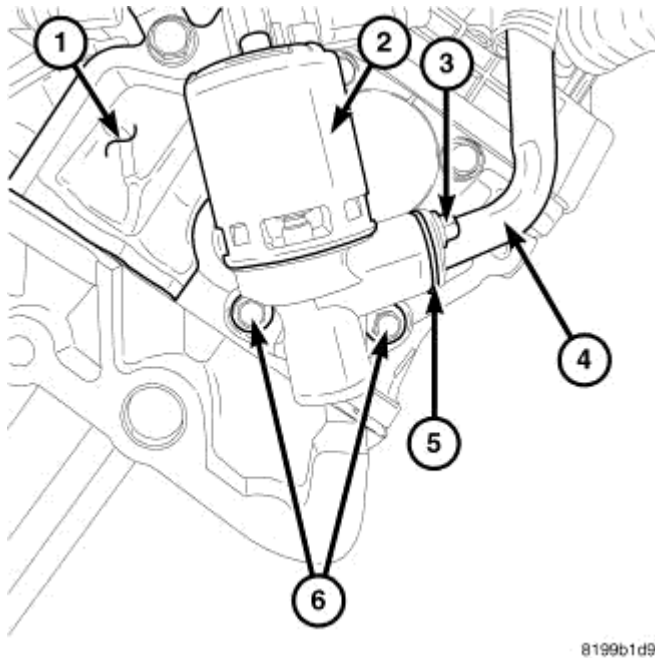
1. Clean mounting surface.
2. Install EGR valve.
3. Install the EGR valve mounting bolts (1).
4. Install new gasket between the EGR valve and upper tube and install bolts (2).
5. Install the lower tube to exhaust manifold.
6. Install new gasket between the EGR valve and lower tube and install bolts (3).
7. Tighten the lower tube to EGR valve bolts (3) to 12 N.m (106 in. lbs.).
8. Tighten the lower tube to exhaust manifold nuts to 70 N.m (51.5 ft. lbs.).
9. Tighten the upper tube to EGR valve bolts (2) to 12 N.m (106 in. lbs.).
10. Tighten EGR valve to cylinder head bolts (1) to 31 N.m (275 in. lbs.).
11. Tighten the upper tube to intake manifold bolts to 5 N.m (45 in. lbs.).
12. Connect the electrical connector to EGR valve and lock.
13. Connect negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

**3.5L**



**Fig. 69: Exhaust Gas Recirculation Valve Gasket**  
Courtesy of CHRYSLER LLC

1. Install new exhaust gas recirculate (EGR) valve gasket to EGR valve.



**Fig. 70: Exhaust Gas Recirculation Valve/Solenoid Removal - 4.0L**  
Courtesy of CHRYSLER LLC

2. Install EGR valve (2), gasket and bolts (6) to cylinder head (1). Tighten to 31 N.m (23 ft. lbs.).
3. Install new gasket (5), EGR tube (4) and bolts (3) to EGR valve (2). Tighten to 12 N.m (106 in. lbs.).
4. Tighten the EGR tube to intake manifold bolts to 5 N.m (45 in. lbs.).

## 2009 Dodge Journey R/T

### 2009 ENGINE PERFORMANCE Emissions Control - Journey

5. Connect electrical connector to EGR valve (2).
6. Connect negative battery cable, tighten nut to 5 N.m (45 in. lbs.).

## ON-BOARD DIAGNOSTICS

### DESCRIPTION

### DESCRIPTION

| ACRONYM | DEFINITION                           |
|---------|--------------------------------------|
| APPS    | Accelerator Pedal Position Sensor    |
| AAT     | Ambient Air Temperature              |
| ABS     | Anti-Lock Brake System               |
| ASD     | Auto Shut Down                       |
| AWD     | All Wheel Drive                      |
| BARO    | Barometric                           |
| CGW     | Central Gateway                      |
| CKP     | Crankshaft Position Sensor           |
| CMP     | Camshaft Position Sensor             |
| CMTC    | Compass/Mini-Trip Computer           |
| DCHA    | Diesel Cabin Heater Assist           |
| DLC     | Data Link Connector                  |
| DTC     | Diagnostic Trouble Code              |
| EATX    | Electronic Automatic Transaxle       |
| ECT     | Engine Coolant Temperature           |
| ECM     | Engine Control Module                |
| EGR     | Exhaust Gas Recirculation            |
| ESIM    | Evaporative System Integrity Monitor |
| ETC     | Electronic Throttle Control          |
| GEN     | Generator                            |
| GPEC    | Global Powertrain Engine Controller  |
| FCM     | Front Control Module                 |
| FDCM    | Final Drive Control Module           |
| FFV     | Flex Fuel Vehicle                    |
| IAT     | Intake/Inlet Air Temperature         |
| IAC     | Idle Air Control                     |
| IOD     | Ignition Off-Draw                    |
| IPM     | Integrated Power Module              |
| JTEC    | Jeep Truck Engine Controller         |
| KS      | Knock Sensor                         |
| LDP     | Leak Detection Pump                  |

## 2009 Dodge Journey R/T

### 2009 ENGINE PERFORMANCE Emissions Control - Journey

|      |                                      |
|------|--------------------------------------|
| MAP  | Manifold Air Pressure                |
| MDS  | Multi Displacement System            |
| MIC  | Mechanical Instrument Cluster        |
| MIL  | Malfunction Indicator Lamp           |
| MTV  | Manifold Tuning Valve                |
| NGC  | Next Generation Controller           |
| NVLD | Natural Vacuum Leak Detection        |
| O2S  | Oxygen Sensor                        |
| OBD  | On Board Diagnostic                  |
| PDC  | Power Distribution Center            |
| PCI  | Programmable Communication Interface |
| PCM  | Powertrain Control Module            |
| PCV  | Positive Crankcase Ventilation       |
| PEP  | Peripheral Expansion Port            |
| SBEC | Single Board Engine Controller       |
| SCM  | Steering Control Module              |
| S/C  | Speed Control                        |
| SKIS | Sentry Key Immobilizer System        |
| SOL  | Solenoid                             |
| SRV  | Short Runner Valve                   |
| TCM  | Transmission Control Module          |
| TCC  | Torque Converter Clutch              |
| TIP  | Throttle Inlet Pressure              |
| TIPM | Totally Integrated Power Module      |
| TP   | Throttle Position                    |
| TPS  | Throttle Position Sensor             |
| TPMS | Tire Pressure Monitor System         |
| TRS  | Transmission Range Sensor            |
| VSS  | Vehicle Speed Sensor/Signal          |
| WIN  | Wireless Ignition Node               |

## OPERATION

### OPERATION

The following procedure has been established to assist technicians in the field with enabling and running OBD II Monitors. The order listed in the following procedure is intended to allow the technician to effectively complete each monitor and to set the CARB Readiness Status in the least time possible.

**NOTE:** Once the monitor run process has begun, do not turn off the ignition. By turning the ignition key off, monitor enabling conditions will be lost. EVAP Monitor runs after key off. By performing a Battery Disconnect, or Selecting

**Erase DTCs, the CARB Readiness and all additional OBD II information will be cleared.**

**Monitor Preliminary Checks:**

1. Plug a scan tool into the vehicle's Data Link Connector (DLC).
2. Turn the ignition, KEY ON - ENGINE OFF. Watch for the MIL lamp illumination during the bulb check. MIL lamp must illuminate, if not, repair MIL lamp.
3. Using a scan tool check for Powertrain related DTCs.

**NOTE:** Only the monitors, which are not YES in the CARB Readiness Status, need to be completed. Specific criteria need to be met for each monitor. The most efficient order to run the monitors has been outlined below, including suggestions to aid the process.

- Verify that No Emissions Related DTCs are Present. If an Emissions DTC is Present, the OBD II Monitors may not run and the CARB Readiness will not update.
- The Emissions related DTC, will need to be repaired, then cleared. By clearing DTCs, the OBD Monitors will need to be run and completed to set the CARB Readiness Status.

Using the scan tool check the CARB Readiness Status.

Do all the CARB Readiness Status Locations read YES?

- YES - all monitors have been completed and this vehicle is ready to be I/M or Emission Tested.
- NO - then the following procedure needs to be followed to run/complete all available monitors.

**Evaporative Emission System Leak Detection with Purge Monitor**

This monitor requires a cool down cycle, usually an overnight soak for at least 8 hours without the engine running. The ambient temperature must decrease overnight - parking the vehicle outside is advised. To run this test the fuel level must be between 15-85% full. Criteria for EVAP monitor:

- Engine off time greater than one hour.
- Fuel Level between 15% and 85%.
- Start Up ECT and IAT within 10°C (18°F).
- Vehicle started and run until Purge Monitor reports a result.

**NOTE:** If the vehicle does not report a result and the conditions where correct. It may take up to two weeks to fail the small leak monitor. DO NOT use this test to attempt to determine a fault. Use the appropriate service information procedure for finding a small leak. If there are no faults and the conditions are correct this test will run and report a pass. Note the Small leak test can find leaks less than 10 thousands of an inch. If a small leak is present it takes approximately one

**week of normal driving to report a failure.****Catalyst / O2 Monitor**

The Catalyst and O2 Monitor information are acquired and processed at the same time. Most vehicles will need to be driven at highway speed (less than 50 mph) (73km/h) for a few minutes. Some vehicles run the monitor at idle in drive. If the vehicle is equipped with a manual transmission, using 4th gear may assist in meeting the monitor running criteria.

- Engine RPM between 1200 to 3000.
- Engine temperature greater than 70°C (158°F)
- Engine run time greater than 92 seconds
- MAP between 10 - 20 kPa (7.5 - 15 Hg)
- Vehicle speed between 20 - 70 mph (29-103 km/h)

**EGR Monitor**

After the vehicle has reached the below conditions and during a throttle decel the EGR monitor will run.

- Engine RPM between 1375 - 2500
- Engine temperature greater than 70°C (158°F)
- Engine run time greater than 125 seconds
- Vehicle speed between 25 - 70 mph (37-103 km/h)

**O2 Sensor Heater Monitor**

This monitor is now continuously running once the heaters are energized. Pass information will be processed at power down.

**Mis-Fire Monitor**

The Misfire Monitor is a continuous two-trip monitor. The monitor uses two different tests/counters:

**NOTE:**        **The Adaptive Numerator must be learned before the PCM will run the Mis-Fire Monitor. The PCM updates the Adaptive Numerator at every key-ON, and is relearned after battery disconnect. The Misfire Monitor will not run until the Adaptive Numerator has updated since the last battery disconnect. If the Adaptive Numerator is equal to the default value then the PCM knows that the Adaptive Numerator has not been learned and does not permit the Misfire Monitor to run. If the Adaptive Numerator exceeds a calibrated percentage, the PCM sets a DTC for CKP NOT LEARNED and illuminates the MIL.**

- 200 Revolution Counter - Looks for misfire that can cause immediate catalyst damage.
- 1000 Revolution Counter - Looks for misfire that can cause emissions to increase 1.5 times the Federal Test Procedure (FTP) standards. This test must also identify misfire percentages that might cause a

"durability demonstration vehicle" to fail an Inspection and Maintenance Program tailpipe emissions test.

## **TASK MANAGER**

### **Description**

#### **DESCRIPTION**

The PCM is responsible for efficiently coordinating the operation of all the emissions-related components. The PCM is also responsible for determining if the diagnostic systems are operating properly. The software designed to carry out these responsibilities is called the "Task Manager".

### **Operation**

#### **OPERATION**

The Task Manager determines when tests happen and when functions occur. Many of the diagnostic steps required by OBD II must be performed under specific operating conditions. The Task Manager software organizes and prioritizes the diagnostic procedures. The job of the Task Manager is to determine if conditions are appropriate for tests to be run, monitor the parameters for a trip for each test, and record the results of the test. Following are the responsibilities of the Task Manager software:

- Test Sequence
- MIL Illumination
- Diagnostic Trouble Codes (DTCs)
- Trip Indicator
- Freeze Frame Data Storage
- Similar Conditions Window

#### **Test Sequence**

In many instances, emissions systems must fail diagnostic tests more than once before the PCM illuminates the MIL. These tests are known as 'two trip monitors.' Other tests that turn the MIL lamp on after a single failure are known as 'one trip monitors.' A trip is defined as 'start the vehicle and operate it to meet the criteria necessary to run the given monitor.'

Many of the diagnostic tests must be performed under certain operating conditions. However, there are times when tests cannot be run because another test is in progress (conflict), another test has failed (pending) or the Task Manager has set a fault that may cause a failure of the test (suspend).

#### **Pending**

Under some situations the Task Manager will not run a monitor if the MIL is illuminated and a fault is stored from another monitor. In these situations, the Task Manager postpones monitors pending resolution of the original fault. The Task Manager does not run the test until the problem is remedied.

For example, when the MIL is illuminated for an Oxygen Sensor fault, the Task Manager does not run the

Catalyst Monitor until the Oxygen Sensor fault is remedied. Since the Catalyst Monitor is based on signals from the Oxygen Sensor, running the test would produce inaccurate results.

**Conflict**

There are situations when the Task Manager does not run a test if another monitor is in progress. In these situations, the effects of another monitor running could result in an erroneous failure. If this conflict is present, the monitor is not run until the conflicting condition passes. Most likely the monitor will run later after the conflicting monitor has passed.

For example, if the Fuel System Monitor is in progress, the Task Manager does not run the catalyst Monitor. Since both tests monitor changes in air/fuel ratio and adaptive fuel compensation, the monitors will conflict with each other.

**Suspend**

Occasionally the Task Manager may not allow a two trip fault to mature. The Task Manager will suspend the maturing of a fault if a condition exists that may induce an erroneous failure. This prevents illuminating the MIL for the wrong fault and allows more precise diagnosis.

For example, if the PCM is storing a one trip fault for the Oxygen Sensor and the catalyst monitor, the Task Manager may still run the catalyst Monitor but will suspend the results until the Oxygen Sensor Monitor either passes or fails. At that point the Task Manager can determine if the catalyst system is actually failing or if an Oxygen Sensor is failing.

**MIL Illumination**

The PCM Task Manager carries out the illumination of the MIL. The Task Manager triggers MIL illumination upon test failure, depending on monitor failure criteria.

The Task Manager Screen shows both a Requested MIL state and an Actual MIL state. When the MIL is illuminated upon completion of a test for a good trip, the Requested MIL state changes to OFF. However, the MIL remains illuminated until the next key cycle. (On some vehicles, the MIL will actually turn OFF during the third good trip) During the key cycle for the third good trip, the Requested MIL state is OFF, while the Actual MIL state is ON. After the next key cycle, the MIL is not illuminated and both MIL states read OFF.

**Diagnostic Trouble Codes (DTCs)**

With OBD II, different DTC faults have different priorities according to regulations. As a result, the priorities determine MIL illumination and DTC erasure. DTCs are entered according to individual priority. DTCs with a higher priority overwrite lower priority DTCs.

**Priorities**

- Priority 1 One-Trip Failure of Non-Fuel or Non-Mis-Fire Fault (e.g., Cat Mon Failure)
- Priority 3 Matured Fault (either One-Trip or Two-Trip) Non-Fuel AND Non-Mis-Fire
- Priority 4 One-Trip Failure of Fuel System or Mis-Fire Fault

- Priority 6 Matured Fault for Fuel System or Mis-Fire (either One-Trip or Two-Trip)

Non-emissions related failures have no priority. One trip failures of two trip faults have low priority. Two trip failures or matured faults have higher priority. One and two trip failures of fuel system and misfire monitor take precedence over non-fuel system and non-misfire failures.

#### **DTC Self Erasure**

With one trip components or systems, the MIL is illuminated upon test failure and DTCs are stored.

Two trip monitors are components requiring failure in two consecutive trips for MIL illumination. Upon failure of the first test, the Task Manager enters a maturing code. If the component fails the test for a second time the code matures and a DTC is set.

After three good trips the MIL is extinguished and the Task Manager automatically switches the trip counter to a warm-up cycle counter. DTCs are automatically erased following 40 warm-up cycles if the component does not fail again.

For misfire and fuel system monitors, the component must pass the test under a Similar Conditions Window in order to record a good trip. A Similar Conditions Window is when engine RPM is within  $\pm 375$  RPM and load is within  $\pm 20\%$  of when the fault occurred.

**NOTE:** It is important to understand that a component does not have to fail under a similar window of operation to mature. It must pass the test under a Similar Conditions Window when it failed to record a Good Trip for DTC erasure for misfire and fuel system monitors.

DTCs can be erased anytime with a scan tool. Erasing the DTC with the scan tool erases all OBD II information. The scan tool automatically displays a warning that erasing the DTC will also erase all OBD II monitor data. This includes all counter information for warm-up cycles, trips and Freeze Frame.

#### **Trip Indicator**

The Trip is essential for running monitors and extinguishing the MIL. In OBD II terms, a trip is a set of vehicle operating conditions that must be met for a specific monitor to run. All trips begin with a key cycle.

#### **Good Trip**

The Good Trip counters are as follows:

- Global Good Trip
- Fuel System Good Trip
- Misfire Good Trip
- Alternate Good Trip (appears as a Global Good Trip on scan tool)
  - a. Comprehensive Components

## b. Major Monitor

- Warm-Up Cycles

**Global Good Trip**

To increment a Global Good Trip, the Oxygen sensor and Catalyst efficiency monitors must have run and passed, and 2 minutes of engine run time.

**Fuel System Good Trip**

To count a good trip (three required) and turn off the MIL, the following conditions must occur:

- Engine in closed loop
- Operating in Similar Conditions Window
- Short Term multiplied by Long Term less than threshold
- Less than threshold for a predetermined time

If all of the previous criteria are met, the PCM will count a good trip (three required) and turn off the MIL.

**Misfire Good Trip**

If the following conditions are met the PCM will count one good trip (three required) in order to turn off the MIL:

- Operating in Similar Condition Window
- 1000 engine revolutions with no misfire

**Alternate Good Trip**

Alternate Good Trips are used in place of Global Good Trips for Comprehensive Components and Major Monitors. If the Task Manager cannot run a Global Good Trip because a component fault is stopping the monitor from running, it will attempt to count an Alternate Good Trip.

The Task Manager counts an Alternate Good Trip for Comprehensive components when the following conditions are met:

- Two minutes of engine run time, idle or driving
- No other faults occur

The Task Manager counts an Alternate Good Trip for a Major Monitor when the monitor runs and passes. Only the Major Monitor that failed needs to pass to count an Alternate Good Trip.

**Warm-Up Cycles**

Once the MIL has been extinguished by the Good Trip Counter, the PCM automatically switches to a Warm-Up

Cycle Counter that can be viewed on the scan tool. Warm-Up Cycles are used to erase DTCs and Freeze Frames. Forty Warm-Up cycles must occur in order for the PCM to self-erase a DTC and Freeze Frame. A Warm-Up Cycle is defined as follows:

- Engine coolant temperature must start below and rise above 160° F (71° C)
- Engine coolant temperature must rise by 40° F (4.5° C)
- No further faults occur

#### Freeze Frame Data Storage

Once a failure occurs, the Task Manager records several engine operating conditions and stores it in a Freeze Frame. The Freeze Frame is considered one frame of information taken by an on-board data recorder. When a fault occurs, the PCM stores the input data from various sensors so that technicians can determine under what vehicle operating conditions the failure occurred.

The data stored in Freeze Frame is usually recorded when a system fails the first time for two trip faults. Freeze Frame data will only be overwritten by a different fault with a higher priority.

**CAUTION: Erasing DTCs, either with the scan tool, or by disconnecting the battery, also clears all Freeze Frame data.**

#### Similar Conditions Window

The Similar Conditions Window displays information about engine operation during a monitor. Absolute MAP (engine load) and Engine RPM are stored in this window when a failure occurs. There are two different Similar conditions Windows: Fuel System and Misfire.

#### FUEL SYSTEM

- **Fuel System Similar Conditions Window** - An indicator that 'Absolute MAP When Fuel Sys Fail' and 'RPM When Fuel Sys Failed' are all in the same range when the failure occurred. Indicated by switching from 'NO' to 'YES'.
- **Absolute MAP When Fuel Sys Fail** - The stored MAP reading at the time of failure. Informs the user at what engine load the failure occurred.
- **Absolute MAP** - A live reading of engine load to aid the user in accessing the Similar Conditions Window.
- **RPM When Fuel Sys Fail** - The stored RPM reading at the time of failure. Informs the user at what engine RPM the failure occurred.
- **Engine RPM** - A live reading of engine RPM to aid the user in accessing the Similar Conditions Window.
- **Adaptive Memory Factor** - The PCM utilizes both Short Term Compensation and Long Term Adaptive to calculate the Adaptive Memory Factor for total fuel correction.
- **Upstream O2S Volts** - A live reading of the Oxygen Sensor to indicate its performance. For example, stuck lean, stuck rich, etc.

- **SCW Time in Window (Similar Conditions Window Time in Window)** - A timer used by the PCM that indicates that, after all Similar Conditions have been met, if there has been enough good engine running time in the SCW without failure detected. This timer is used to increment a Good Trip.
- **Fuel System Good Trip Counter** - A Trip Counter used to turn OFF the MIL for Fuel System DTCs. To increment a Fuel System Good Trip, the engine must be in the Similar Conditions Window, Adaptive Memory Factor must be less than calibrated threshold and the Adaptive Memory Factor must stay below that threshold for a calibrated amount of time.
- **Test Done This Trip** - Indicates that the monitor has already been run and completed during the current trip.

## MISFIRE

- **Same Misfire Warm-Up State** - Indicates if the misfire occurred when the engine was warmed up (above 160° F).
- **In Similar Misfire Window** - An indicator that 'Absolute MAP When Misfire Occurred' and 'RPM When Misfire Occurred' are all in the same range when the failure occurred. Indicated by switching from 'NO' to 'YES'.
- **Absolute MAP When Misfire Occurred** - The stored MAP reading at the time of failure. Informs the user at what engine load the failure occurred.
- **Absolute MAP** - A live reading of engine load to aid the user in accessing the Similar Conditions Window.
- **RPM When Misfire Occurred** - The stored RPM reading at the time of failure. Informs the user at what engine RPM the failure occurred.
- **Engine RPM** - A live reading of engine RPM to aid the user in accessing the Similar Conditions Window.
- **Adaptive Memory Factor** - The PCM utilizes both Short Term Compensation and Long Term Adaptive to calculate the Adaptive Memory Factor for total fuel correction.
- **200 Rev Counter** - Counts 0-100 720 degree cycles.
- **SCW Cat 200 Rev Counter** - Counts when in similar conditions.
- **SCW FTP 1000 Rev Counter** - Counts 0-4 when in similar conditions.
- **Misfire Good Trip Counter** - Counts up to three to turn OFF the MIL.

## EXHAUST GAS RECIRCULATION

### DESCRIPTION

### DESCRIPTION

The EGR system reduces oxides of nitrogen (NOx) in the engine exhaust. This is accomplished by allowing a predetermined amount of hot exhaust gas to recirculate and dilute the incoming fuel/air mixture.

A malfunctioning EGR system can cause engine stumble, sags, or hesitation, rough idle, engine stalling and poor driveability.

**OPERATION****OPERATION**

The system consists of:

- An EGR valve assembly, located toward the rear of the engine.
- An EGR solenoid, located in the left rear of engine compartment near EGR valve. The EGR solenoid controls the "on time" of the EGR valve.
- The ECM operates the EGR solenoid. The ECM is located under the hood next to the air cleaner housing.
- The tandem pump supplies vacuum for the EGR solenoid and the EGR valve. This pump also supplies vacuum for operation of the power brake booster and the heating and air conditioning system. The pump is located in the rear of the cylinder head and is driven by the exhaust camshaft.
- Vacuum lines and hoses connect the various components.

When the ECM supplies a variable ground signal to the EGR solenoid, EGR system operation begins. The ECM will monitor and determine when to supply and remove this variable ground signal. This will depend on inputs from the engine coolant temperature, throttle position and engine speed sensors.

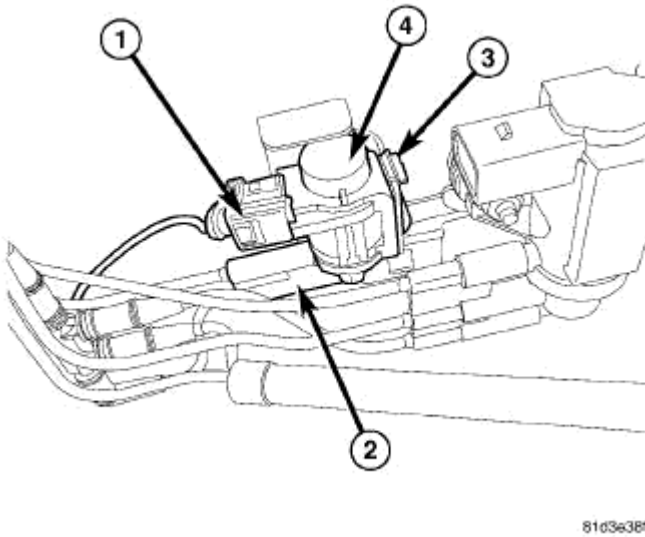
When the variable ground signal is supplied to the EGR solenoid, vacuum from the tandem pump will be allowed to pass through the EGR solenoid and on to the EGR valve with a connecting hose.

Exhaust gas recirculation will begin in this order when:

- The ECM determines that EGR system operation is necessary.
- The engine is running to operate the vacuum pump.
- A variable ground signal is supplied to the EGR solenoid.
- Variable vacuum passes through the EGR solenoid to the EGR valve.
- The inlet seat (poppet valve) at the bottom of the EGR valve opens to dilute and recirculate exhaust gas back into the mixing chamber.

The EGR system will be shut down by the ECM after 60 seconds of continuous engine idling to improve idle quality.

**SOLENOID, EXHAUST GAS RECIRCULATION (EGR), 2.0L DIESEL****Description****DESCRIPTION**



**Fig. 71: Exhaust Gas Recirculation (EGR) Solenoid - 2.0L Diesel**  
Courtesy of CHRYSLER LLC

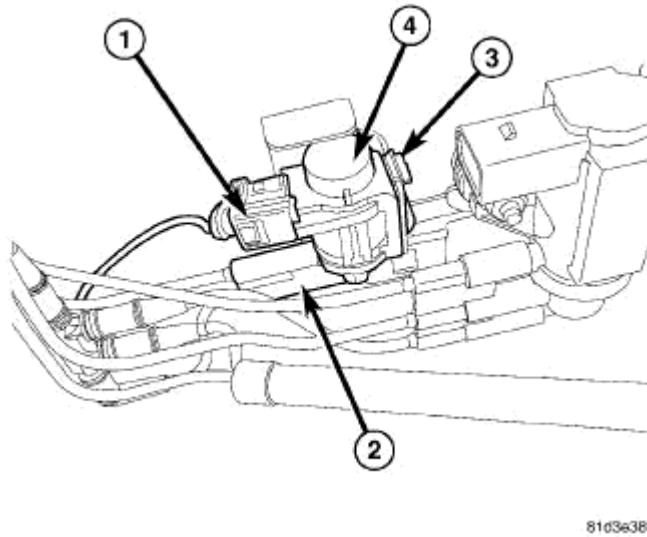
- |                                                                 |
|-----------------------------------------------------------------|
| 1 - EGR solenoid electrical connector<br>2 - EGR vacuum harness |
|-----------------------------------------------------------------|

The EGR solenoid (4) is mounted to a bracket attached to the battery tray in the engine compartment. The EGR solenoid serves two different functions. One is to control vacuum bleed-off of the EGR valve. The other is to control the "on time" of the EGR valve.

#### **Removal**

#### **REMOVAL**

1. Disconnect negative battery cable.



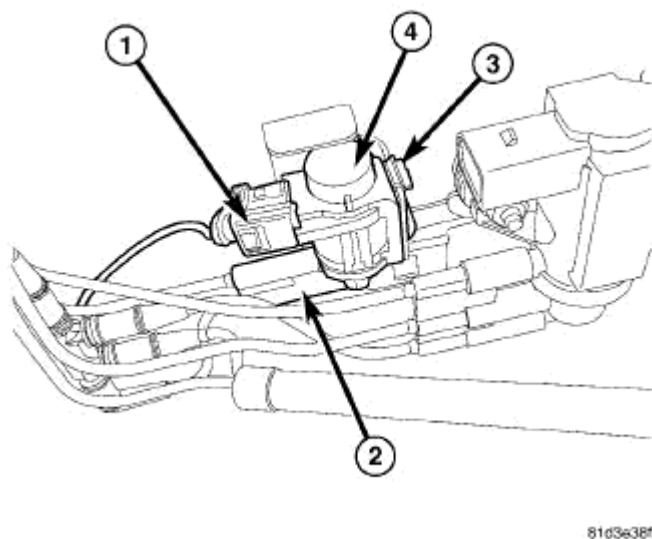
**Fig. 72: Exhaust Gas Recirculation (EGR) Solenoid - 2.0L Diesel**  
Courtesy of CHRYSLER LLC

- |                                                                 |
|-----------------------------------------------------------------|
| 1 - EGR solenoid electrical connector<br>2 - EGR vacuum harness |
|-----------------------------------------------------------------|

2. Disconnect the EGR solenoid electrical connector (1).
3. Disconnect the EGR vacuum harness (2) from the EGR solenoid (4) valve block.
4. Release EGR solenoid retainer clip (3) and push down to remove the EGR solenoid valve (4) from the bracket.

### Installation

### INSTALLATION



**Fig. 73: Exhaust Gas Recirculation (EGR) Solenoid - 2.0L Diesel**  
 Courtesy of CHRYSLER LLC

- |                                                                       |
|-----------------------------------------------------------------------|
| 1 - EGR solenoid valve electrical connector<br>2 - EGR vacuum harness |
|-----------------------------------------------------------------------|

1. Position and install EGR solenoid valve (4) onto bracket.
2. Connect EGR vacuum harness (2) to the EGR solenoid valve (4).
3. Connect EGR solenoid valve electrical connector (1).
4. Connect negative battery cable.

## VALVE, EXHAUST GAS RECIRCULATION (EGR), 2.0L DIESEL

### Description

#### DESCRIPTION

The EGR valve is mounted to the intake manifold.

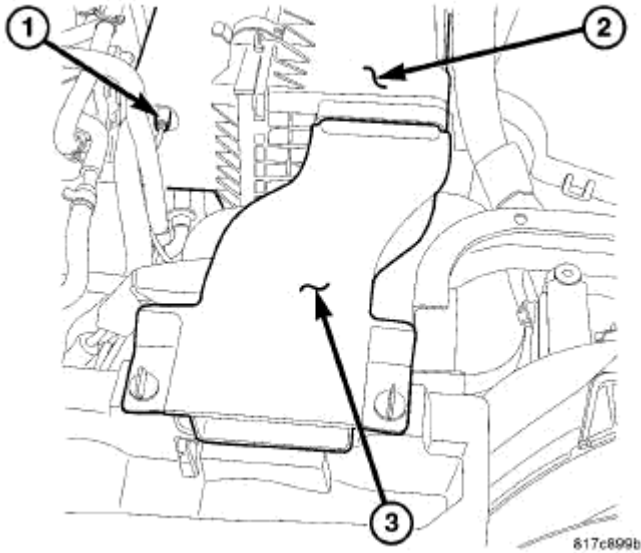
### Operation

#### OPERATION

The engines use Exhaust Gas Recirculation (EGR) systems. The EGR system reduces oxides of nitrogen (NOx) in engine exhaust and helps prevent detonation (engine knock). Under normal operating conditions, engine cylinder temperature can reach more than 1649°C (3000°F). Formation of NOx increases proportionally with combustion temperature. To reduce the emission of these oxides, the cylinder temperature must be lowered. The system allows a predetermined amount of hot exhaust gas to recirculate and dilute the incoming air/fuel mixture. The diluted air/fuel mixture reduces peak flame temperature during combustion.

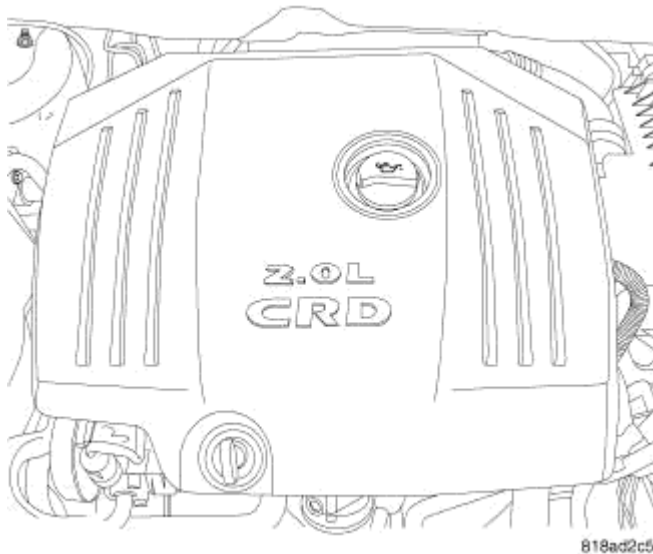
## Removal

### REMOVAL



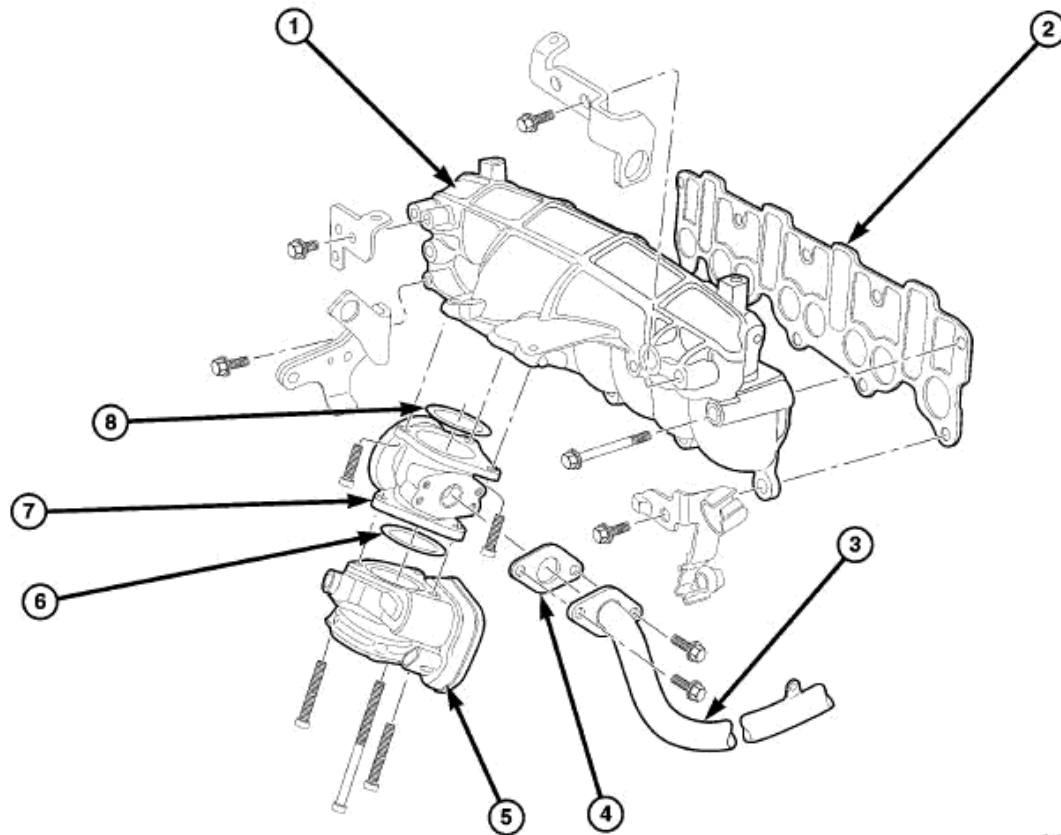
**Fig. 74: Air Inlet Duct**  
Courtesy of CHRYSLER LLC

1. Remove air inlet duct (3).
2. Disconnect negative battery cable.



**Fig. 75: ENGINE COVER-REMOVAL**  
Courtesy of CHRYSLER LLC

3. Remove engine cover. Refer to **Engine - Removal** .



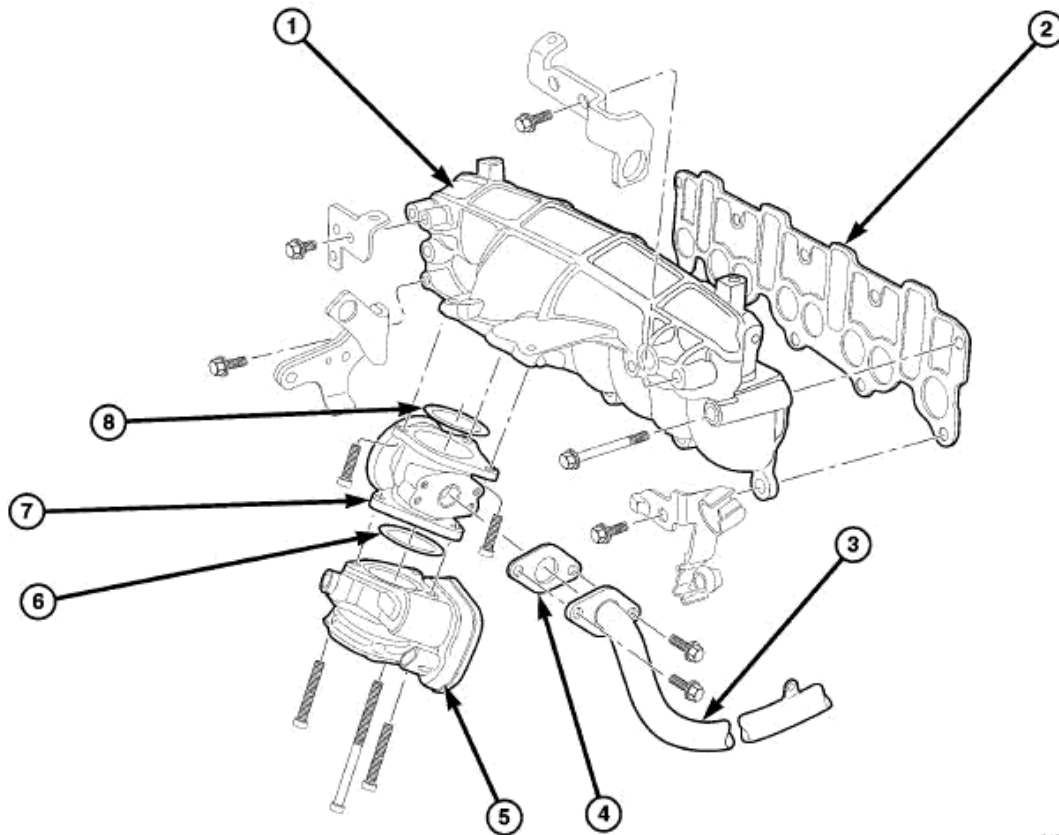
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**Fig. 76: Intake Manifold**  
Courtesy of CHRYSLER LLC

4. Disconnect EGR valve vacuum line.
5. Disconnect EGR pipe (3) at EGR valve.
6. Remove air inlet tube from intake manifold flap motor (5).
7. Remove intake manifold flap motor (5).
8. Remove EGR valve retaining bolts and remove EGR valve (7).

### Installation

### INSTALLATION

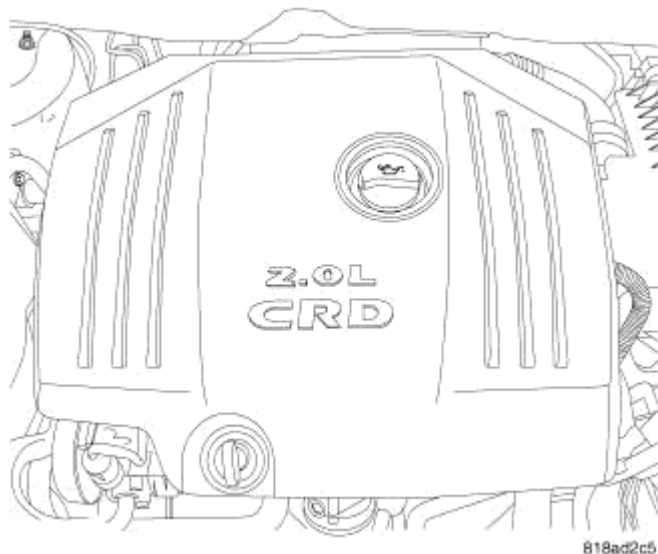


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**Fig. 77: Intake Manifold**

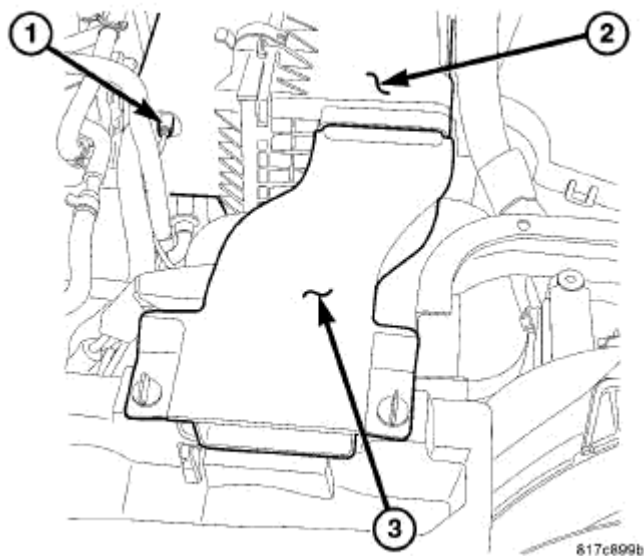
Courtesy of CHRYSLER LLC

1. Inspect EGR and intake manifold flap motor o-rings (6,8) for damage. Replace as necessary.
2. Install EGR valve (7) to intake manifold. Torque retaining bolts to 10.m (88 lbs.in.).
3. Install intake manifold flap motor (5) to EGR valve (7). Torque retaining bolts to 10 N.m (88 lbs.in.).
4. Inspect EGR pipe gasket (4)for damage, replace as necessary.
5. Connect EGR pipe (3) to EGR valve. Torque retaining bolts to 20N.m (177 lbs.in.).
6. Connect EGR valve vacuum line.



**Fig. 78: Engine Cover**  
Courtesy of CHRYSLER LLC

7. Install engine cover. Refer to **Engine - Installation** .



**Fig. 79: Air Inlet Duct**  
Courtesy of CHRYSLER LLC

8. Connect negative battery cable.
9. Install air inlet duct (3).