Section 2.0

Introduction to 3.5L V-6 Engine

2004 VUE New Product
Participant Guide

Section Structure

2.0 Intro to 3.5L V-6 Engine

- Section Structure

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Section Structure (Cont'd)

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Section 2.1

L66 Engine
Technical Overview

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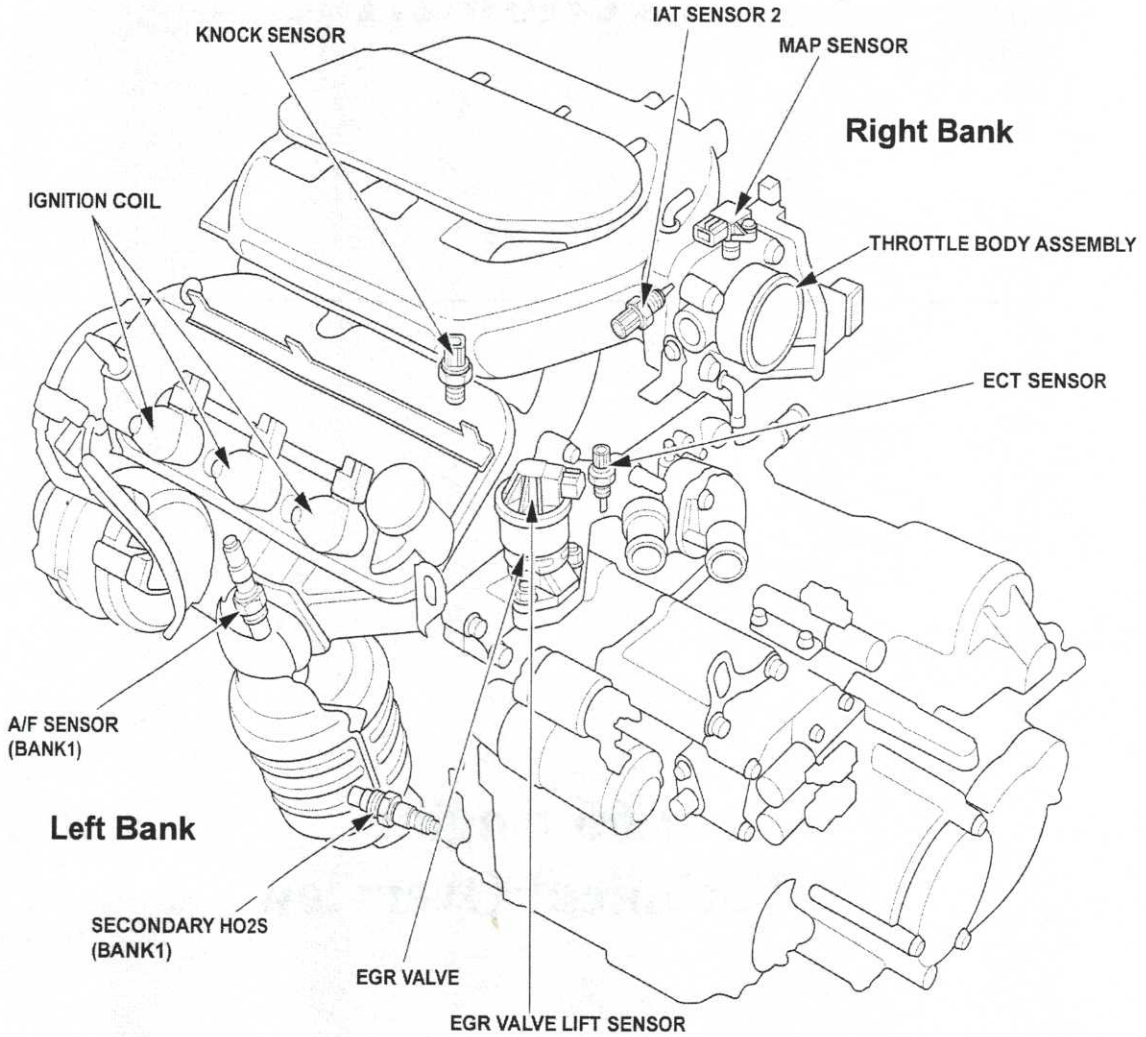
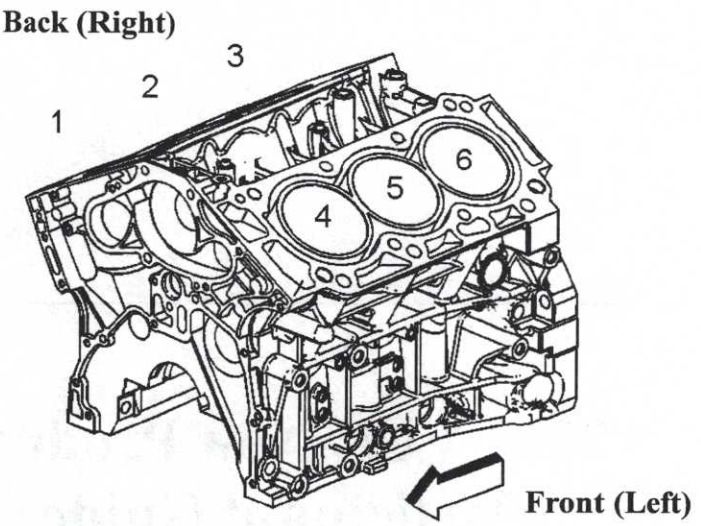
3.5 L V-6 Front & Driver Side Sensors/Components



Component Location 1



Technical Overview

L66 (V-6) Engine Specifications

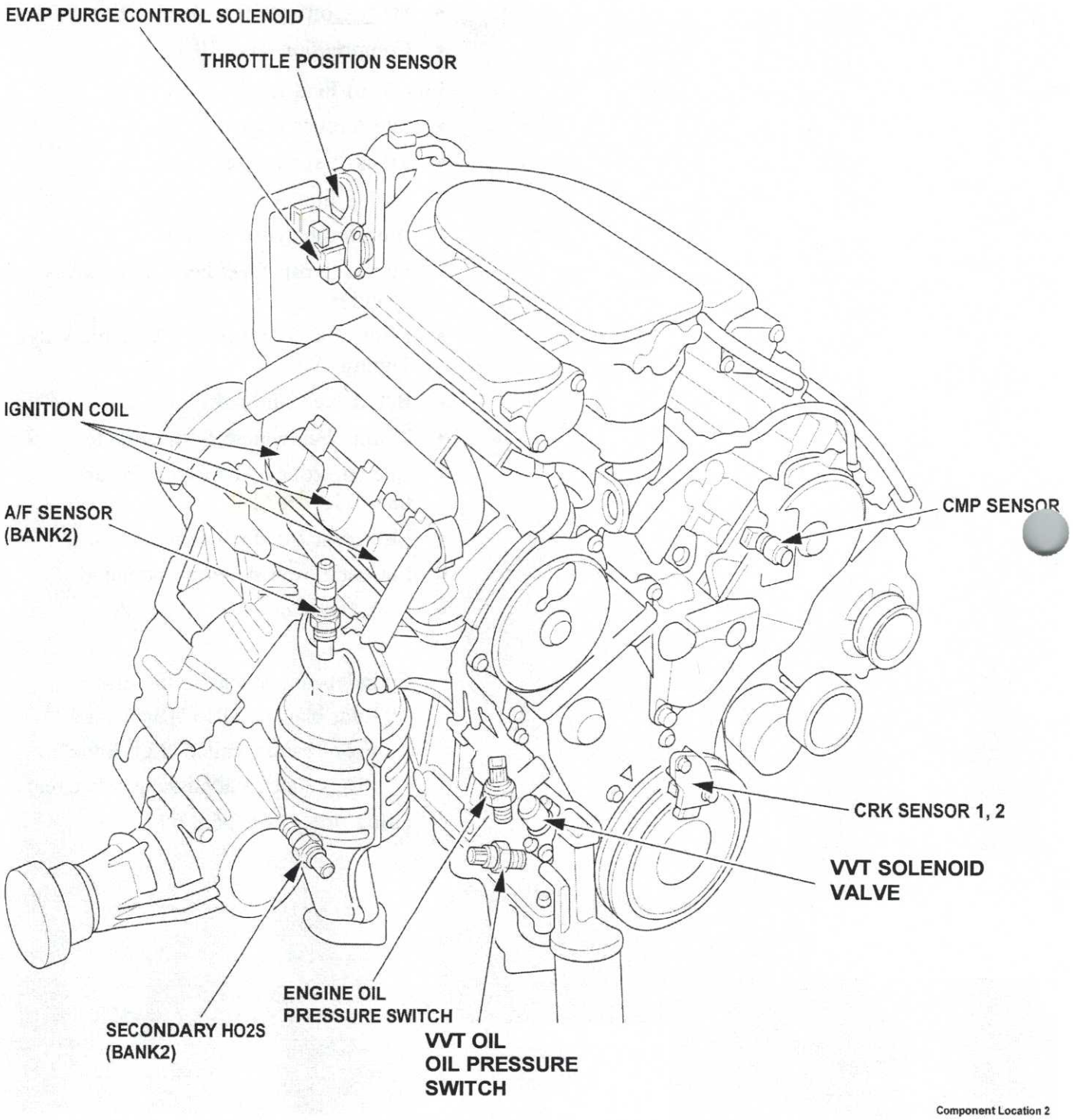
- 3.5 Liter (212 cid)
- 24-valve SOHC
- 60° V-configuration six cylinder
- Compression ratio: 10:1

L66 (V-6) Features

- Interference Engine
- Transverse mounted
- Aluminum block
- Aluminum cylinder heads
- Single camshaft per head, four valves per cylinder
- Electronically controlled Variable Valve Timing (VVT)
- Belt driven camshafts
- Timing belt with self-adjusting tensioner
- One control module for engine and transaxle - PCM
- Electronic throttle by wire
- Electric power steering - no pump
- Uses Dex-Cool.

- Cylinder numbering is different:
  - Rear bank is called "Right Bank"
  - Front bank is called "Left Bank"
  - #1 Cylinder is at passenger side rear
- Firing order: 1 4 2 5 3 6

3.5L V-6 Rear & Passenger Side Sensors/Components



Component Location 2

Section 2.2

L66 Engine
Air Induction/Fuel Injection

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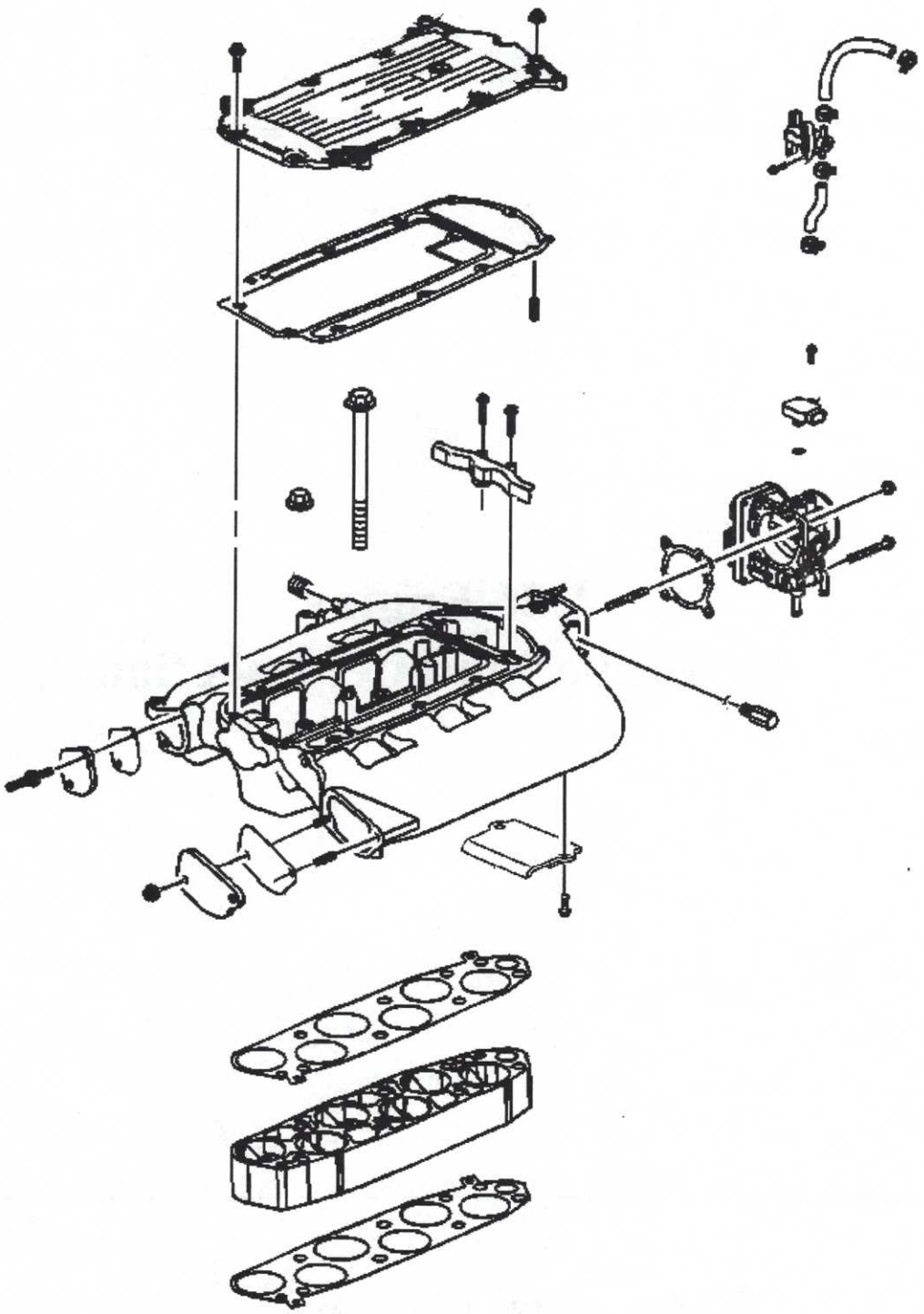
Air Induction System



Air Induction Systems

This section covers components related to the Air Induction and Fuel Injection systems of the L66 engine.

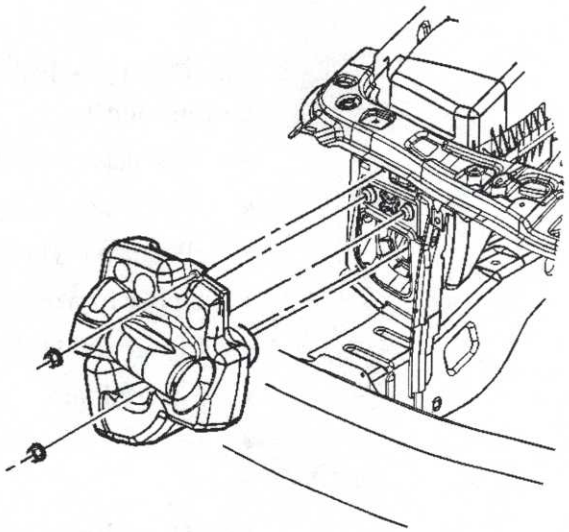
L66 (V-6) Air Induction System Components

- Resonator Inlet Duct
- Air Cleaner Assembly
- Electronic Throttle Body
- Upper Intake Manifold
- Lower Intake Manifold
- Spacer Plate
- EGR

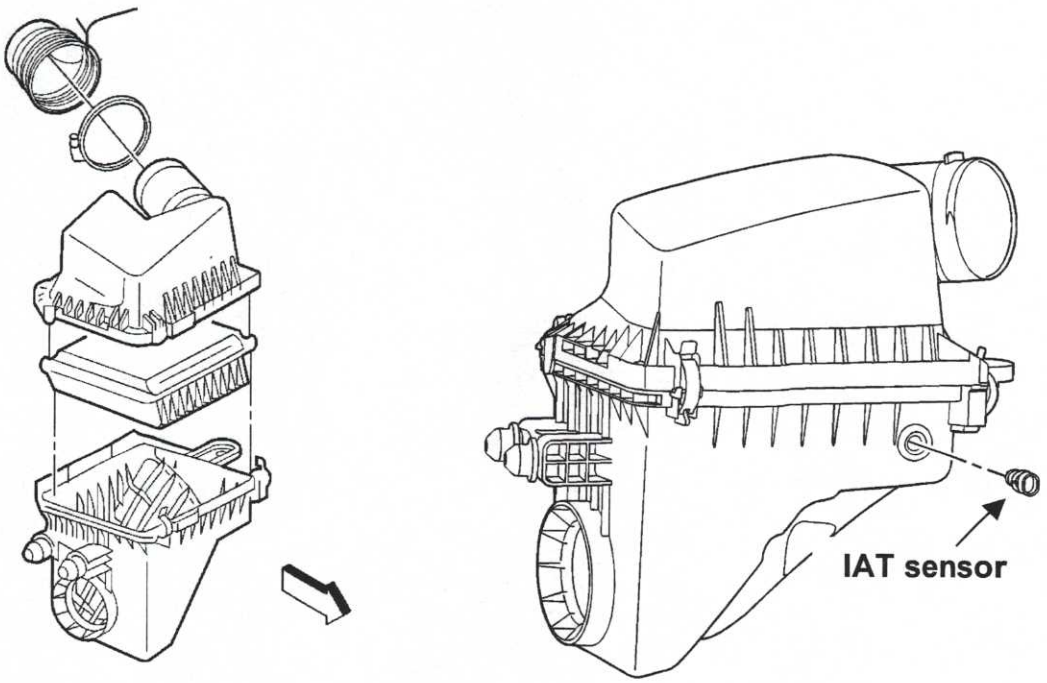
L66 (V-6) Fuel Injection System Components

- Fuel Rail
- Injectors

Air Intake Duct



Air Filter Box



Air Induction Systems (Cont'd)

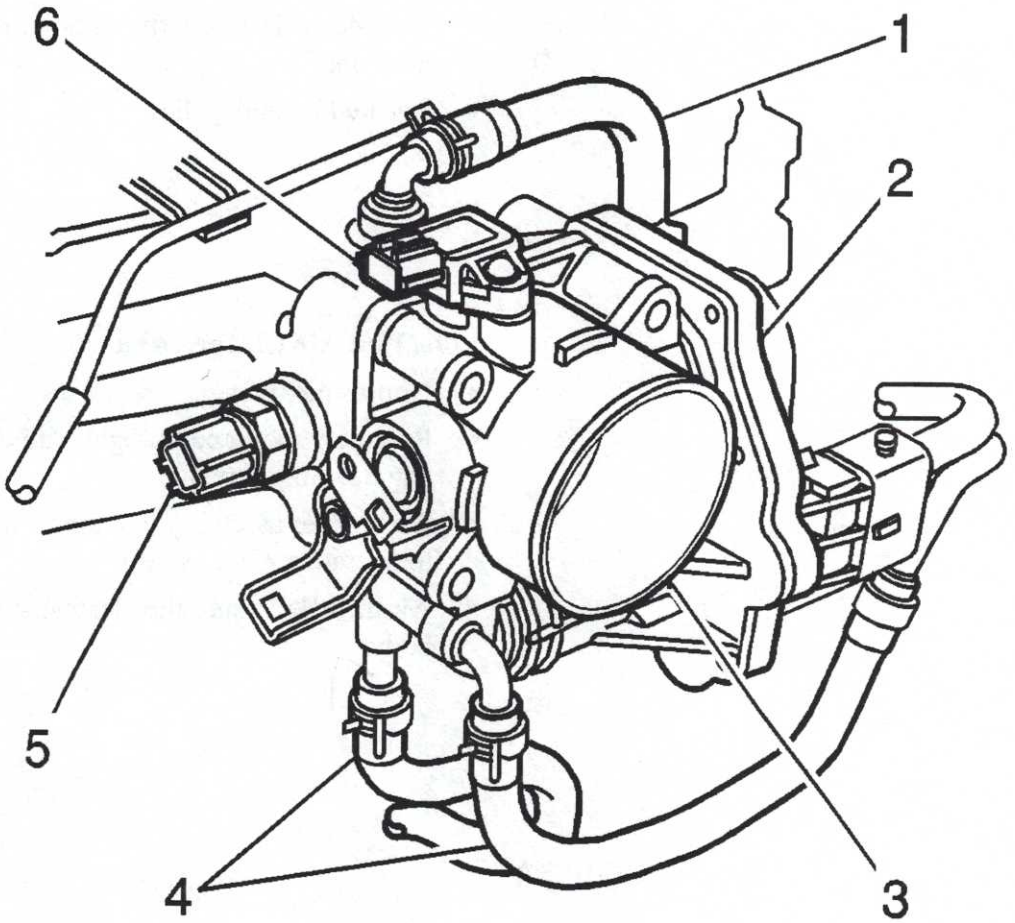
L66 (V-6) Resonator Inlet Duct

- First component of air induction system
- Outside air is drawn through the resonator inlet duct
- Located behind grille

L66 (V-6) Air Cleaner Assembly

- Houses air filter
- Remotely mounted on right side of the engine compartment
- Air cleaner assembly contains a intake air temperature (IAT) sensor
- Air then flows into the electronic throttle body

Electronic Throttle Body



1 - EVAP Line

2 - Throttle Actuator Control (TAC) Module

3 - Throttle Body

4 - Engine Coolant Hoses

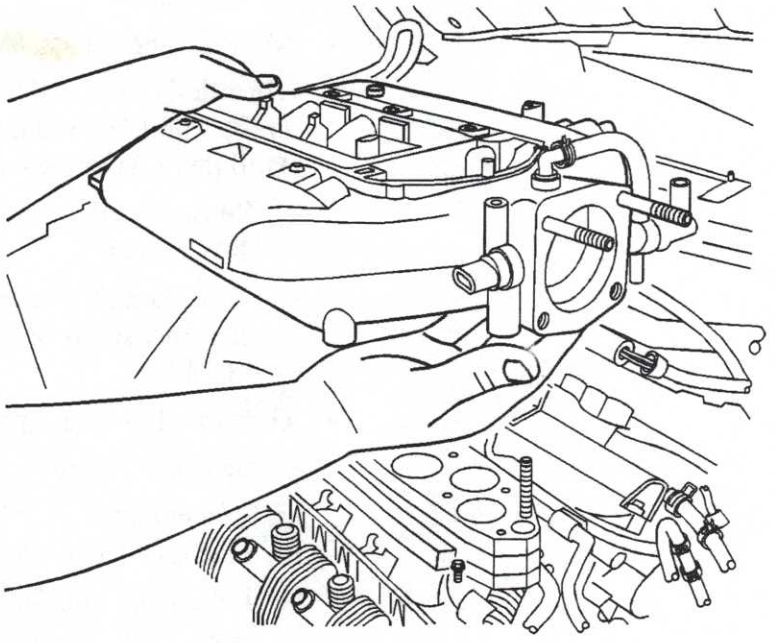
5 - IAT Sensor

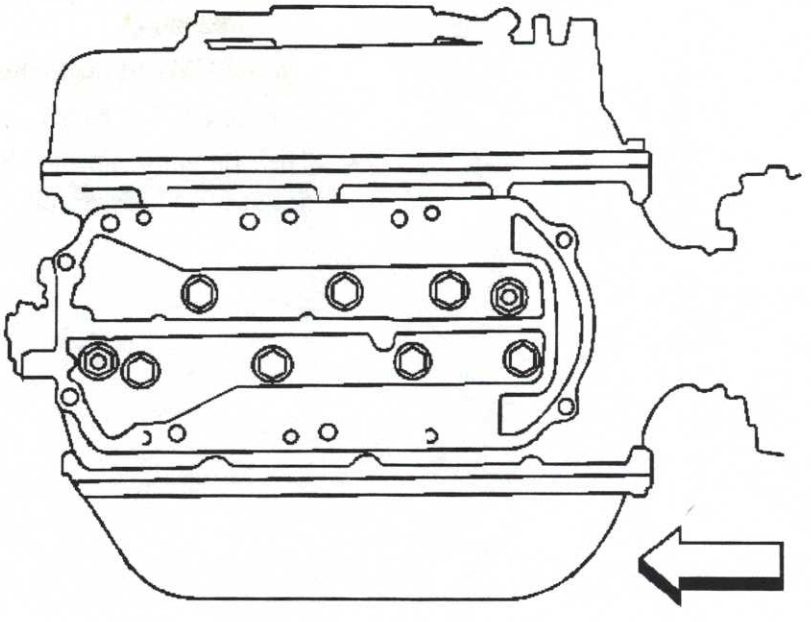
6 - MAP Sensor

Electronic Throttle Body

- The intake manifold contains another IAT sensor (5), which is attached behind the throttle body.
- MAP sensor (6), no MAF.
- Throttle Position (TP) sensors are located in the Throttle Actuator Control (TAC) Module (2) and not serviced separately.
  - Sensors send individual signals to the TAC module.
  - TAC module averages the two signals and only sends one position signal to the PCM.
- General idle relearn procedure:
  - Scan tool; engine output controls.
  - Run engine at 3,000 RPM until ECT reaches 90°C (194°F).
  - Let engine idle for 5 minutes.
  - If fan cycles during this time, do not include the time the fan runs in the "5 minutes at idle" time.
  - Procedures that require throttle body relearn:
    - Throttle body replacement or cleaning.
    - PCM replacement or reprogrammed.
- Engine coolant runs through throttle body.
- Throttle body motor is bolted in place, but not serviced separately.

Upper Intake Manifold



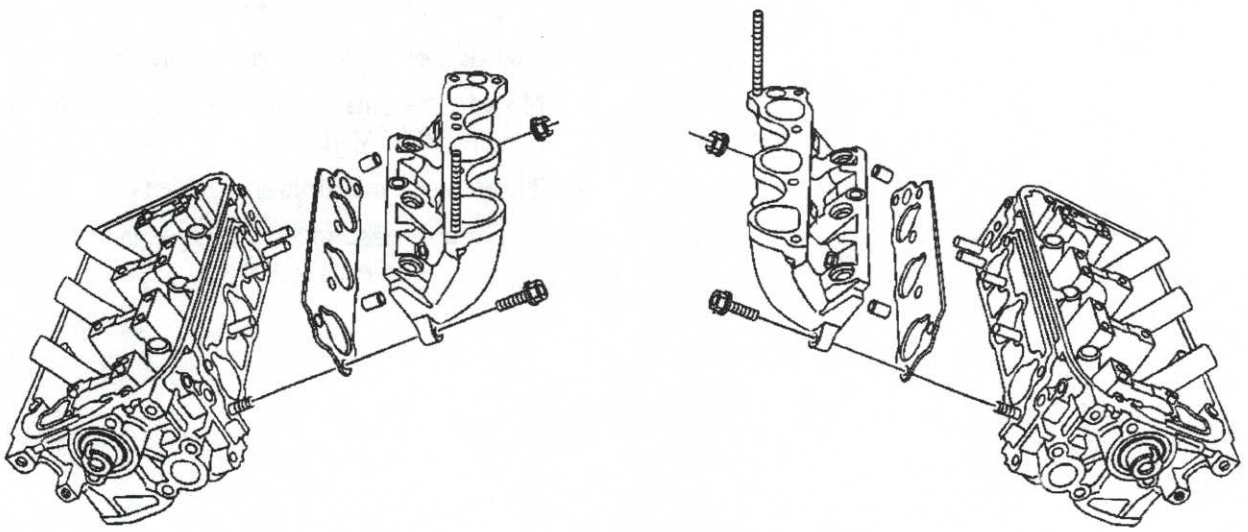


Upper Intake manifold

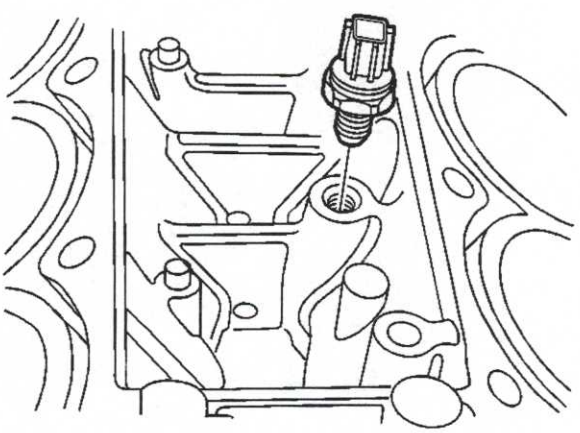
Intake manifold is made of aluminum alloy.

- If bolts strip out, cannot use heli-coil or time serts
  - If bolt holes in the intake are stripped, the intake must be replaced
- Use tightening sequence in manual
- No variable intake runners like L-series and current VUE V-6.
- Three piece metal intake gaskets
  - Do not reuse metal gaskets once they have been crushed

Lower Intake Manifold



Knock Sensor Location

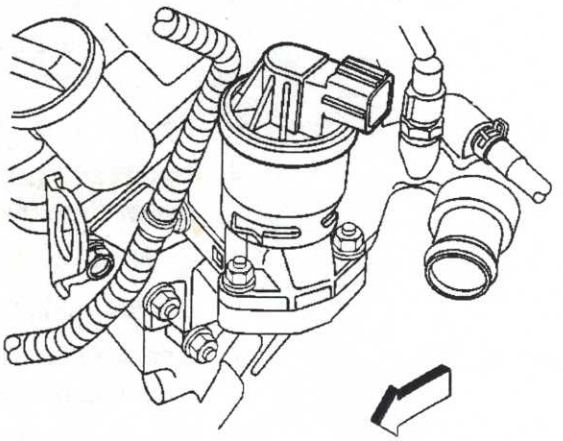


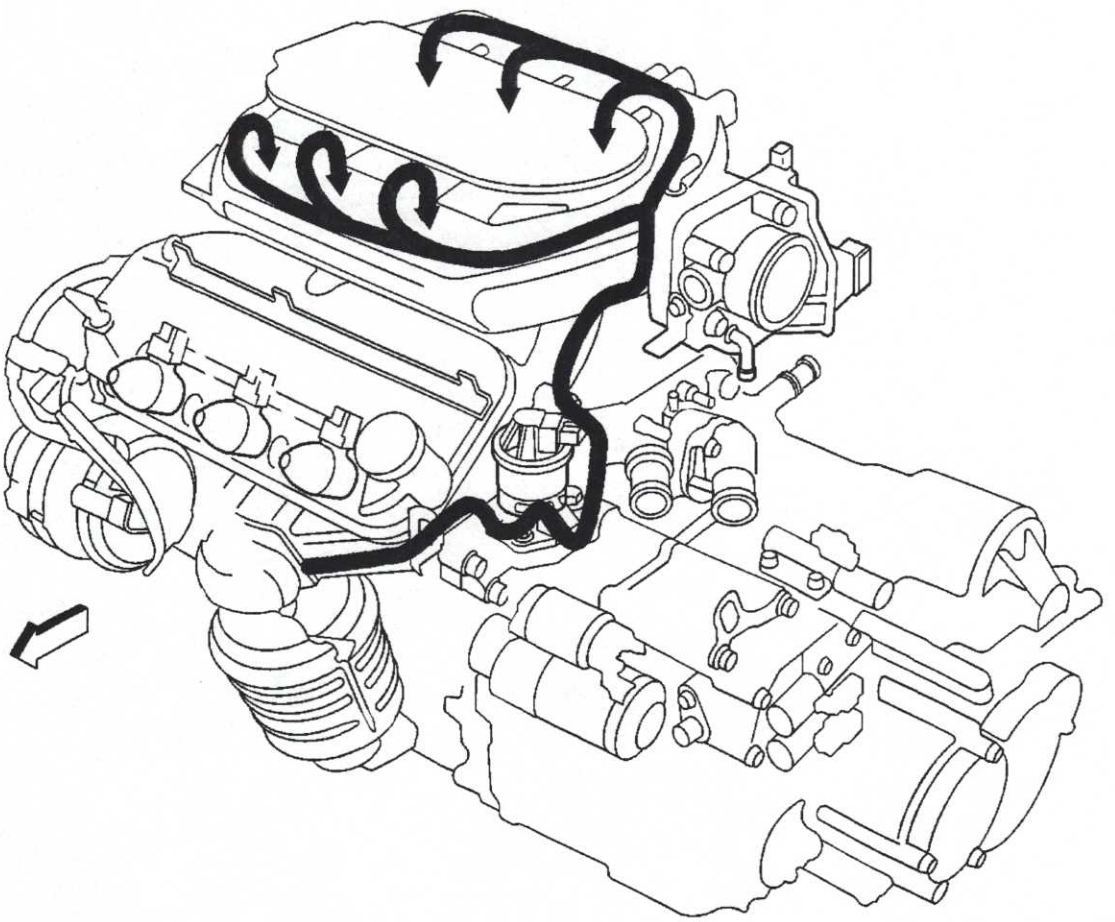
Lower Intake Manifold

Lower intake manifold has a separate runner for each bank.

- Remove bolts from both sides
  - There are two hidden nuts on the bottom of runners
- Remove one side, then other side
- Upon removal, be careful to not drop dowels into the cylinder head
  - There are four dowels
  - Dowels just sit in place
- Knock sensor in valley under the lower intake manifold
- Uses metal gaskets, which should not be re-used

EGR



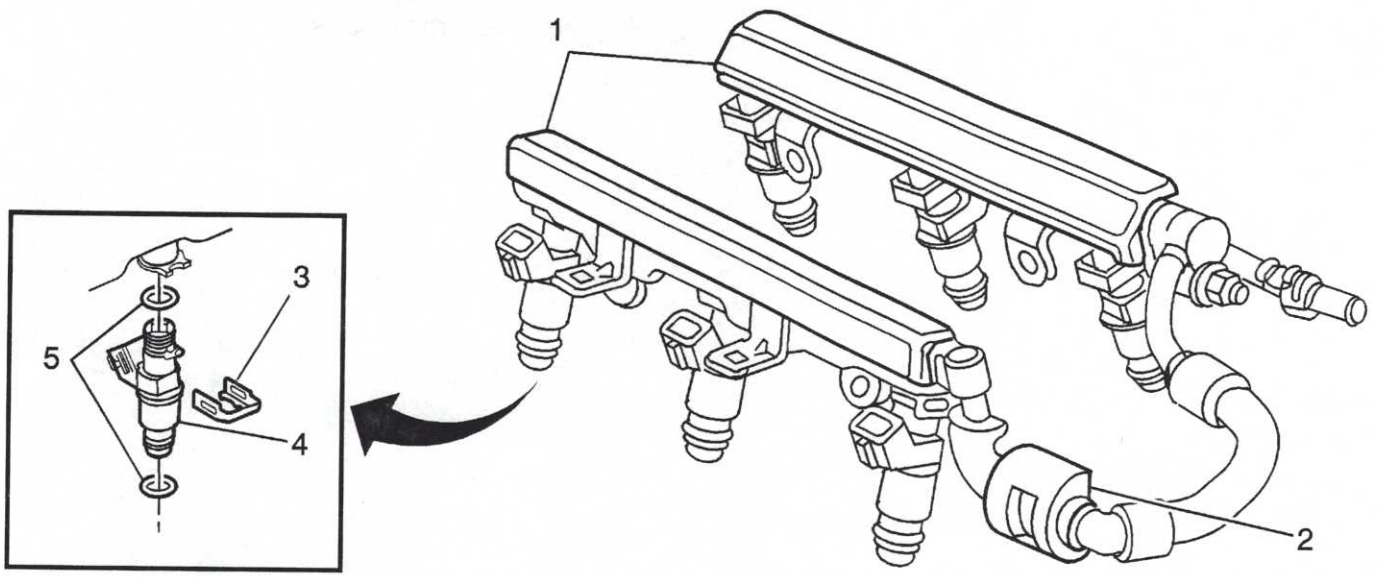


EGR

EGR path is through cylinder heads then up into intake.

- Crossover inside intake manifold
- Linear EGR system, operates similar to other Saturn vehicles

Fuel Injector Rail/Injectors



Fuel Injection

- Fuel rail service port is located near throttle body
  - Fuel pressure service port has black cap
- EVAP service port is located next to fuel rail service port
  - EVAP testing will be done using a fuel filler neck tool
  - EVAP service port has green cap
- Both sides of fuel rail system can be removed together, or removed one side at a time
- Injector rails can be removed without removing upper and lower intake manifolds
- Injector balance test is available with a Tech 2 or manually with J-39021
- Injectors are oriented specifically in the manifold
  - Spray pattern directs fuel to sides of chamber, so fuel can be directed into cylinder through both intake valve openings
  - Connector faces upward

Air Induction System

Objective: At the completion of this worksheet, the technicians will have the knowledge and hands-on experience necessary to service components of the air induction system for an L66 engine.

Reference: 2004 L66 VUE Engine Service Manuals.

Directions: Follow the service manual procedures to remove the components listed.

Components Involved in Removal

- **Throttle body**
- **Upper intake manifold**
- **Spacer plate**
- **Fuel rails and injectors**
- **Lower intake manifolds**

Questions for Review

1. Should intake manifold gaskets be reused?

   no

2. How do you remove the lower intake manifolds?

   remove bolts, one side then other

3. What happens if you strip the threads in a bolt hole of the upper intake cover?

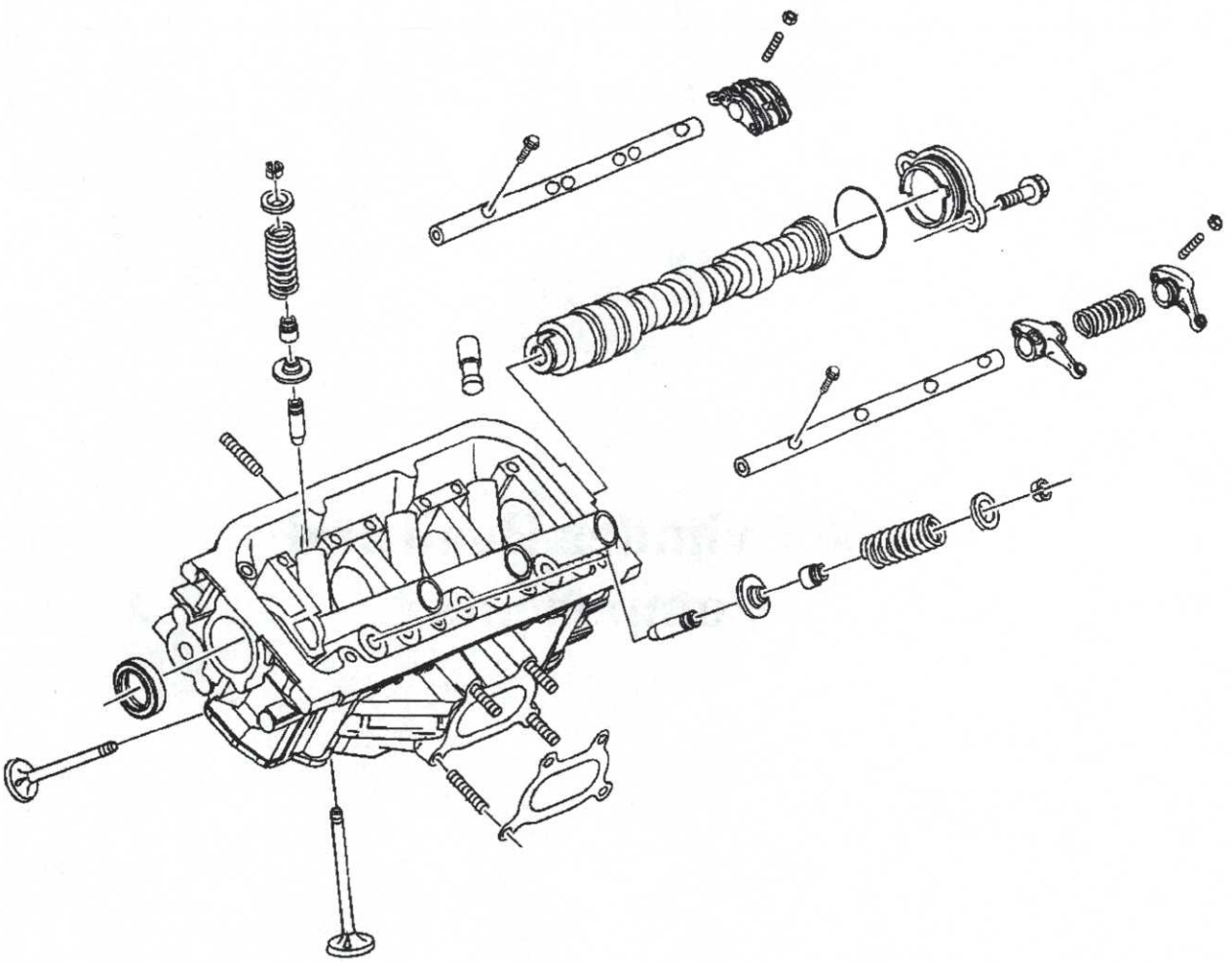
   replace

Section 2.3

L66 Cylinder Head and Components

2004 VUE New Product Participant Guide

Cylinder Head & Components

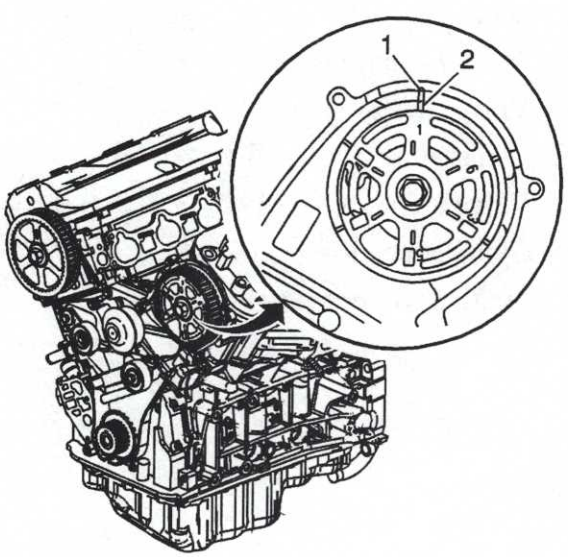


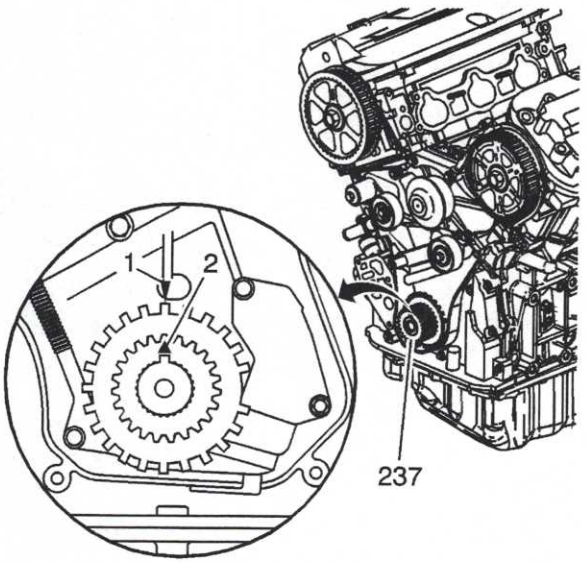
Cylinder Head and Components

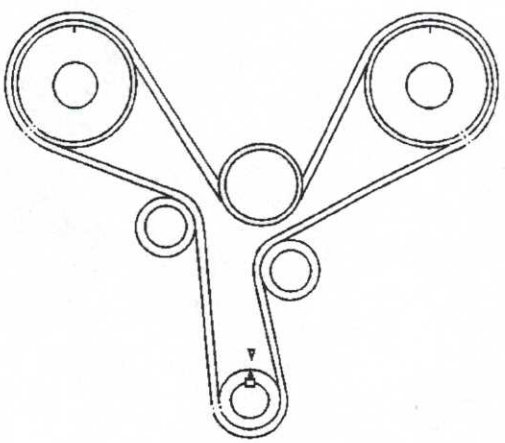
Components of the L66 (V-6) cylinder head include:

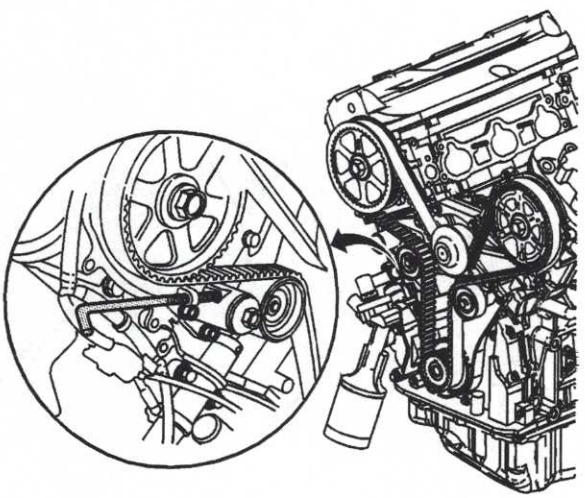
- Timing components
- Valve covers
- Camshaft
- Valve train
- Cylinder head
- Ignition components

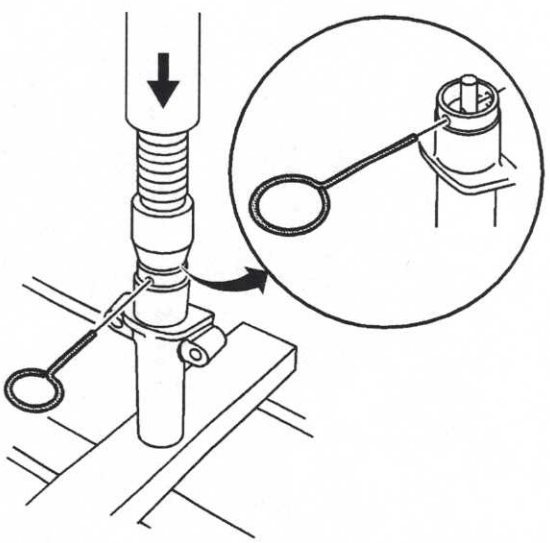
Timing Belt











Timing Components

L66 (V-6) Timing Belt

- Maintenance interval is 100,000 miles
- Timing belt direction
  - When removing and reinstalling, mark belt and reinstall the same way that it was originally installed
  - With a new belt, position the belt so the letters or numbers printed on the belt, can be read while facing the engine
- Belt does not have timing marks, can be installed in any position, as long as cam gears and crank gear are properly aligned

L66 (V-6) Timing belt idler pulley

- Loosen to remove belt
  - Ensure pulley is released from bolt during disassembly
  - If bolt is not released, timing belt will still have tension
- Upon installation, do not tighten idler pulley until belt is in place

L66 (V-6) Timing Belt Tensioner and Pulley

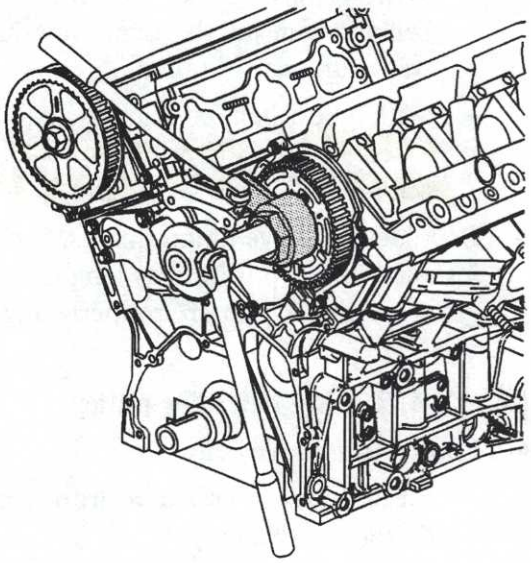
- Tensioner is spring loaded, nitrogen filled
- Use special tool EN46331 to hold tensioner and pulley in place while removing belt

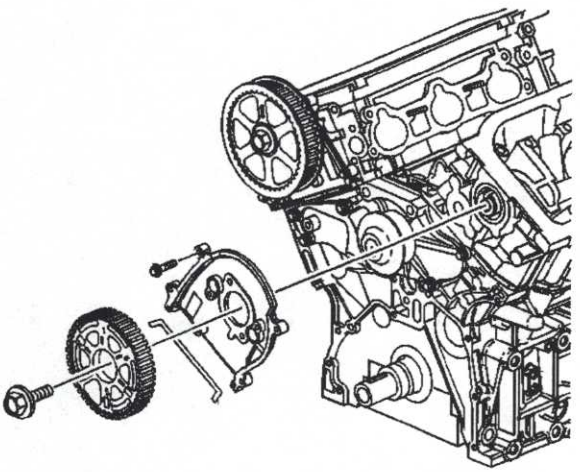
Notice: Don't use anything, except special tool EN 46331 or you might strip the threads in the timing belt's right rear cover.

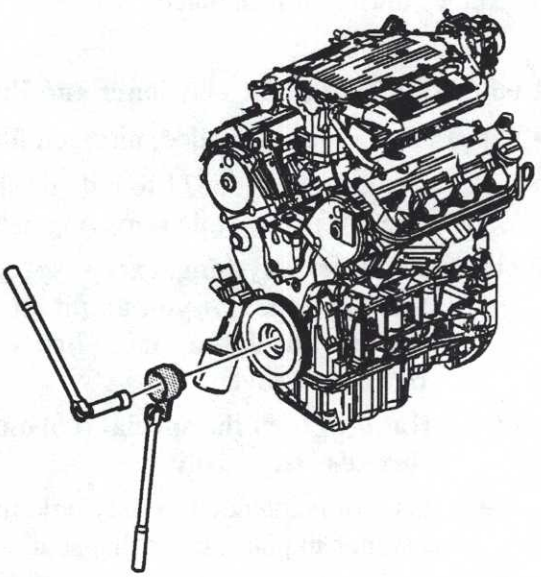
Notice: Hand tighten the special tool only, threads strip easily

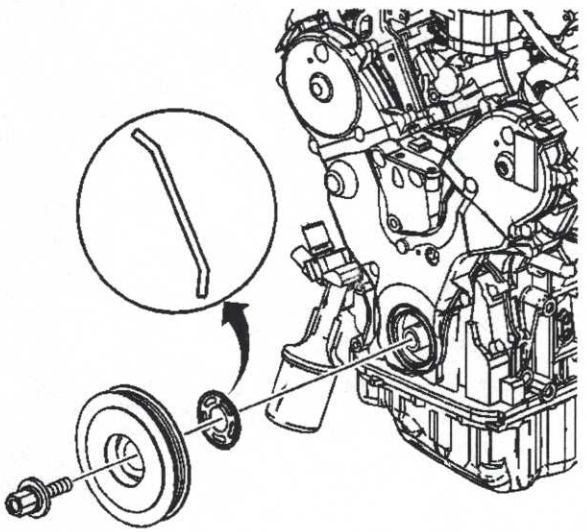
  - This tool is intended to only hold the tensioner in place, not collapse it
- Collapse tensioner in vice before installing
- Use special tool EN46330 to hold the collapsed tensioner in place when reinstalling belt

Camshaft Gears









Timing Components (Cont'd)

L66 (V-6) Camshaft Gears

- Left camshaft gear has valve timing marks and marks for timing belt installation
- Right camshaft gear only has marks for timing belt installation
- Cam gears are keyed to cam, can only be installed one way

L66 (V-6) Crankshaft Balancer

- Mounted to the crankshaft
- Rubber, not fluid filled
- Has 2 alignment mark grooves
  - White mark means either 1 or 5 cylinder is at TDC
  - Red mark is used to check ignition timing in plant

Notice: If the timing belt is to be removed, the crankshaft balancer must be rotated to position number 1 piston at Top Dead Center (TDC) of compression stroke to avoid valve to piston contact.

- Use special tool J46337 to hold balancer while removing crank bolt
  - This tool is also used for the same purpose when removing the camshaft gears

Timing Belt Drive Sprocket

- Used to drive timing belt
- Used by crankshaft potion sensor as a reluctor

Timing Belt

Objective: At the completion of this worksheet, the technicians will have the knowledge and hands-on experience necessary to remove the timing components from an L66 engine.

Reference: 2004 VUE Service Manual

Directions: Follow the "Engine Unit Repair" section of the service manual.

Components Involved in Removal:

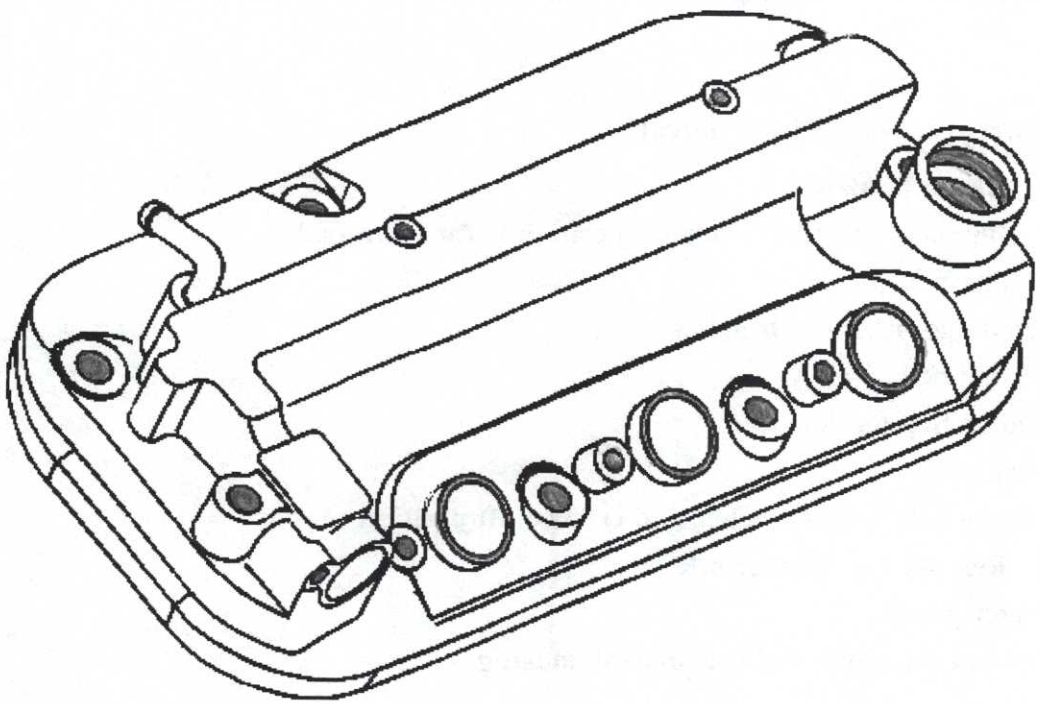
- **Crankshaft balancer**
  - **Balancer must be in proper position before removal**
- **Timing belt cover**
- **Front engine mount bracket**
- **Timing belt**
- **Timing belt tensioner**
- **Idler pulley**
- **Timing belt drive sprocket and crankshaft position sensor**
  - **Remove key from crank**
- **Water pump**
- **Coolant crossover and thermostat housing**

Question for Review

1. Which way should the timing belt be installed?

the way it come off
honda read from fast

Valve Cover

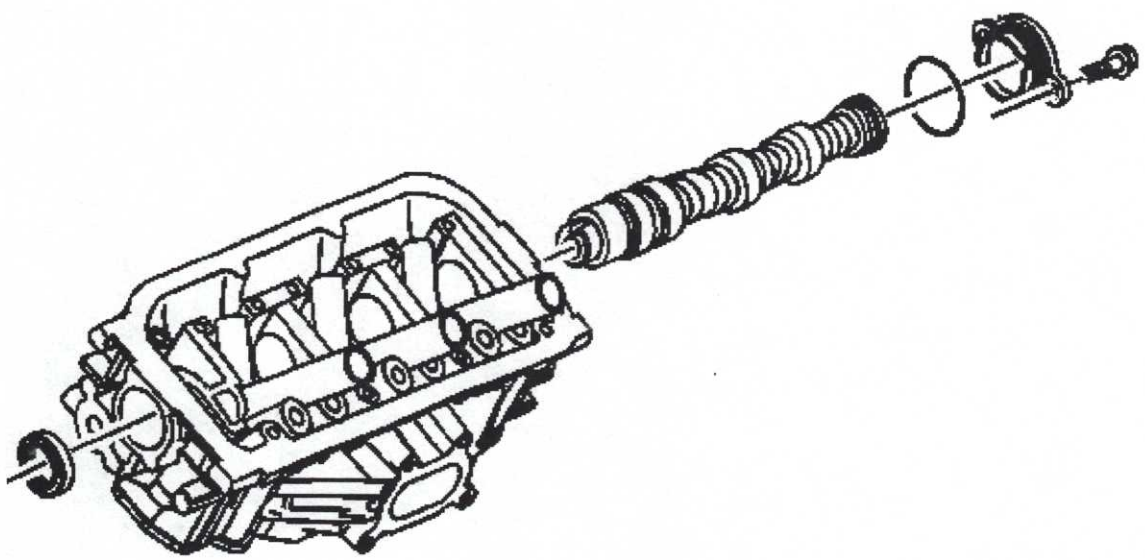


Rocker Arm Covers

L66 (V-6) Rocker Arm Covers

- Use new seals and grommets when reinstalling rocker arm covers
- Remove ignition coils before removing rocker arm cover
- Cover bolts have a specific tightening sequence
- PCV in front left rocker arm cover

Cylinder Head and Camshaft



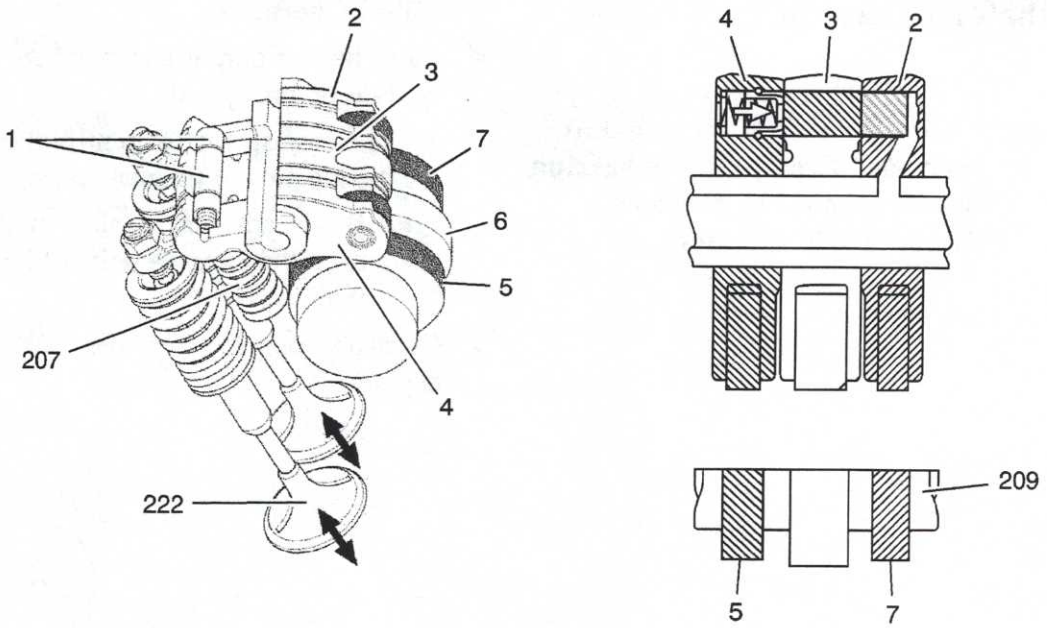
Camshaft and Bearings

LG Note: Engine does not have camshaft bearings. Head provides bearing surface, similar to previous Saturn SOHC engines.

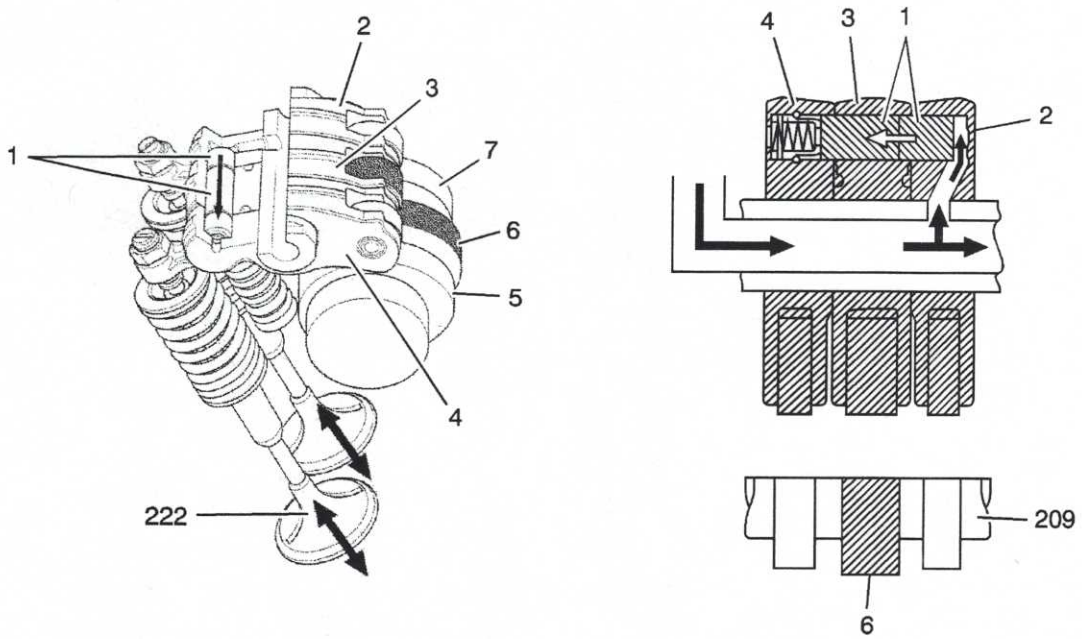
L66 (V-6) Camshaft

- Cams have different part numbers and must be used on proper side
  - The easiest way to identify them is by the location of the cam journals
    - If the cams are installed on the wrong side, the journals will not line up with the bores
- Cams are removed from the back of the engine

Variable Valve Timing - Off



Variable Valve Timing - On



1. Synchronizing Pistons
2. Secondary Rocker Arm
3. Middle Rocker Arm
4. Primary Arm
5. Camshaft Lobe
6. Center Camshaft Lobe
7. Camshaft Lobe

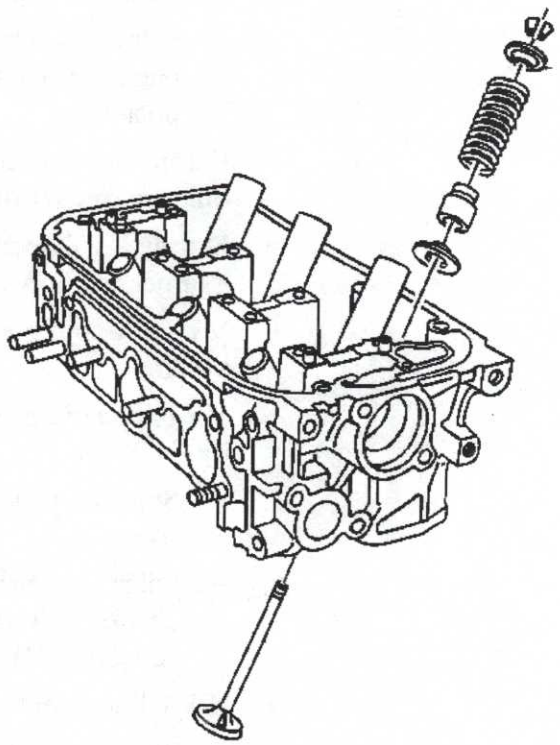
207. Valve Lash Adjuster
209. Camshaft
222. Intake Valve

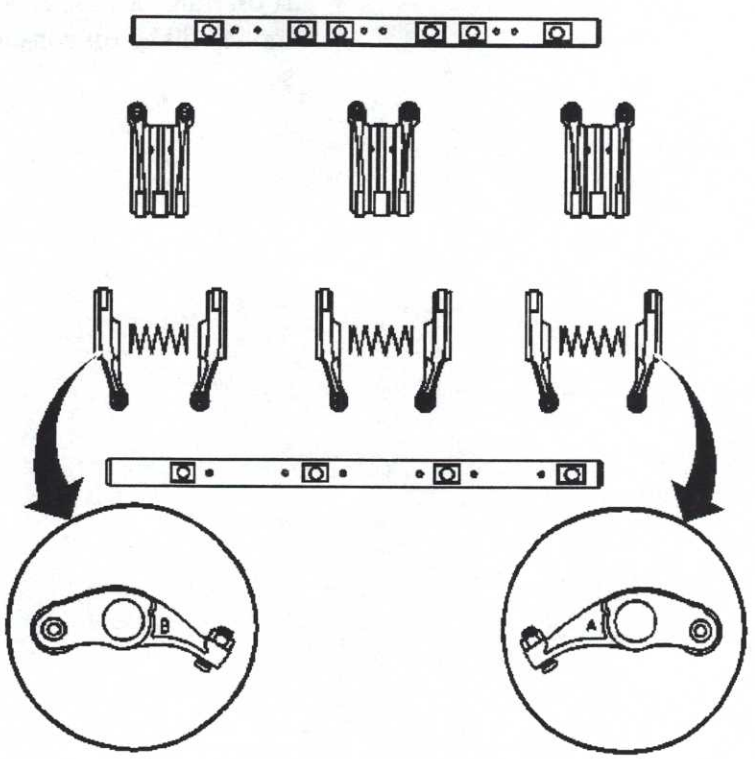
Valve Train

L66 (V-6) Variable valve timing (VVT)

- Varies intake valves only.
  - Depends on engine speed, engine load, engine coolant temp, and shift lever position
- During normal operation rocker arms ride on a smaller set of cam lobes
- During VVT operation rocker arms ride on a larger cam lobe
- VVT solenoid controls oil pressure to VVT system
- VVT solenoid is electronically controlled by the PCM
  - Solenoid is not PWM, it is an ON/OFF solenoid
  - Oil pressure switch near VVT solenoid, checks for full pressure before activating VVT
- If VVT solenoid sticks:
  - In "off" position, P2646 sets
  - In "on" position, P2647 sets
- If oil transfer tube is not in place, VVT mode will be on constantly and a DTC will set

Valves / Rockers



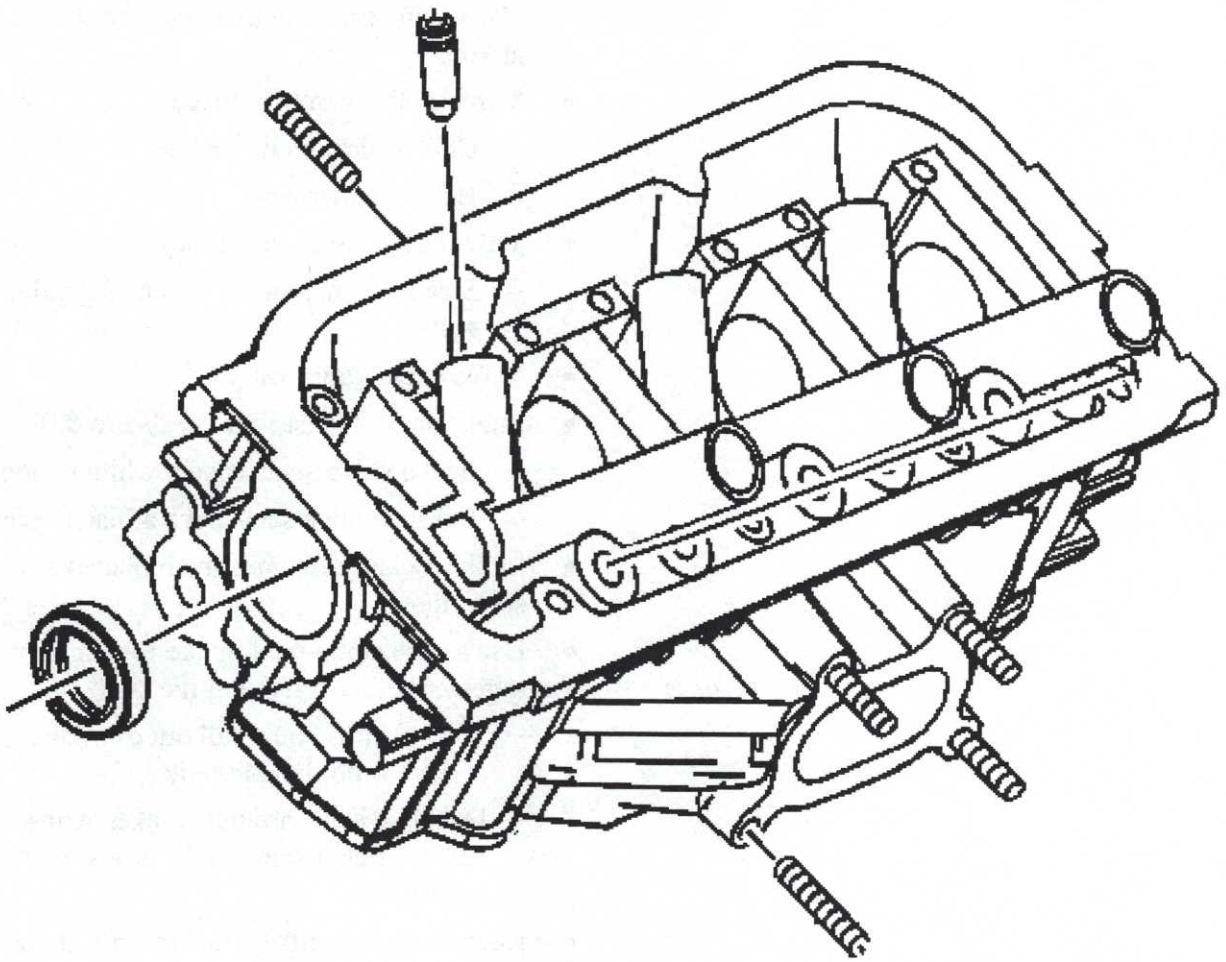


Valve Train (Cont'd)

L66 (V-6) Rockers/Valves/Seals and Guides

- Engine is not free spinning and valve damage will occur if camshaft jumps timing
- Valve adjustment in maintenance schedule at 100,000 miles
- Valve guides can be replaced
  - Chill replacement guides
  - Heat cylinder head
- Valve seats can be cut if they are not worn
  - Standard procedures for cutting valve seats
- Three angle valve seats
- Intake and Exhaust valve seals are different
  - Intake valve seals have a white spring
  - Exhaust valve seals have a black spring
- Intake rocker arms must be replaced as a set of three.
- Use a tie strap to hold intake rocker arms together before removing the shaft.
  - VVT pistons could fall out of intake rockers if not held together.
  - Install tie strap around Rocker Arms next to rocker shaft, NOT adjustment screws
- Keep bolts in shafts so rocker arms do not slide off

Cylinder Head

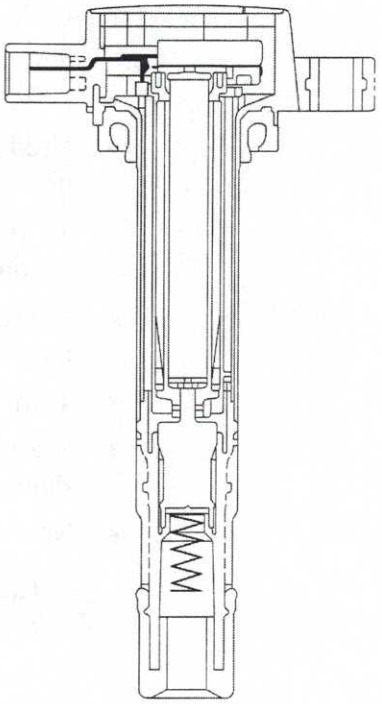


Cylinder Head

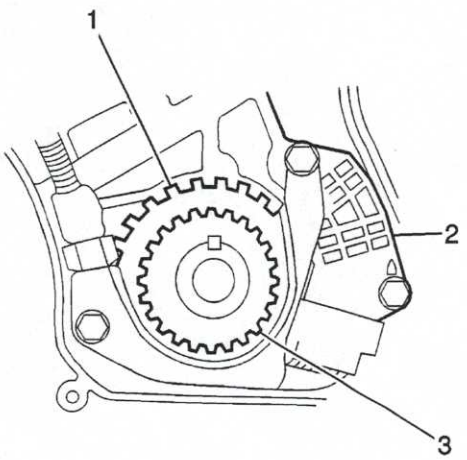
L66 (V-6) Cylinder Head

- Cylinder heads are made from aluminum alloy
- Head gaskets are steel three-layer design
- Head gaskets have dowel holes to line them up with head and block
  - If gasket is installed backward oil passages will be blocked
- Not torque to yield bolts, head bolts can be reused
- Torque sequence is same for both sides
- Spark plug tubes are **not** replaceable and should **not** be removed
- No exhaust manifold
  - Catalytic converters bolt directly to cylinder heads.

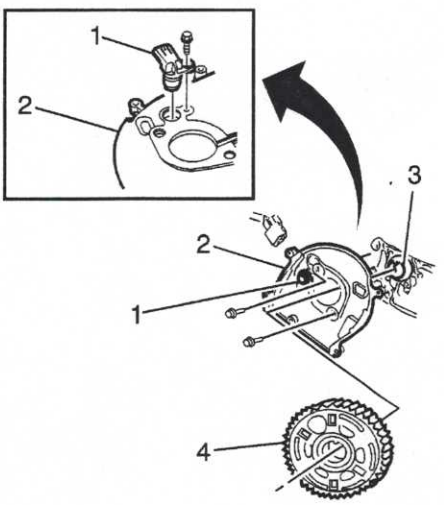
Coil



Crank Sensor



Cam Sensor



Ignition Components

Ignition System

- Individual ignition coils attached to each spark plug
- PCM controls primary voltage to ignition control module located in ignition coil
  - Secondary voltage is directly sent to individual spark plugs.
- For coil diagnosis there are no specs on coil output
  - Use misfire diagnosis and then swap with known good coil
- Dual crank sensor
  - Crankshaft position (CKP) sensor A and B are in the same unit and mounted behind crankshaft reluctor wheel.
  - Both sensors are built into one component
  - Sensors are 22.5 degrees apart
  - Reluctor wheel has 24 evenly-spaced teeth with two missing teeth
    - Produces 22 pulses per crankshaft revolution.
- Cam sensor provides PCM with a reference point
  - Located behind left cam gear
  - Must remove timing belt and cam gear to remove cam sensor
  - Camshaft gear has three unevenly-spaced protrusions, the sensor produces three pulses per camshaft rotation
- Firing order is 142536

Cylinder Head and Components

Objective: At the completion of this worksheet, the technicians will have the knowledge and hands-on experience necessary to remove the cylinder head from an L66 engine.

Reference: 2004 VUE Service Manual

Directions: Working on the right side cylinder head, follow the "Engine Disassembly" section of the service manual remove the following components:

Components Involved in Removal:

- **Right valve rocker arm cover**
- **Right rocker arm assemblies**
- **Right camshaft**
- **Right catalytic converter**
- **Right cylinder head**

Question for Review

1. What should be done to the intake rocker arms before removing them?

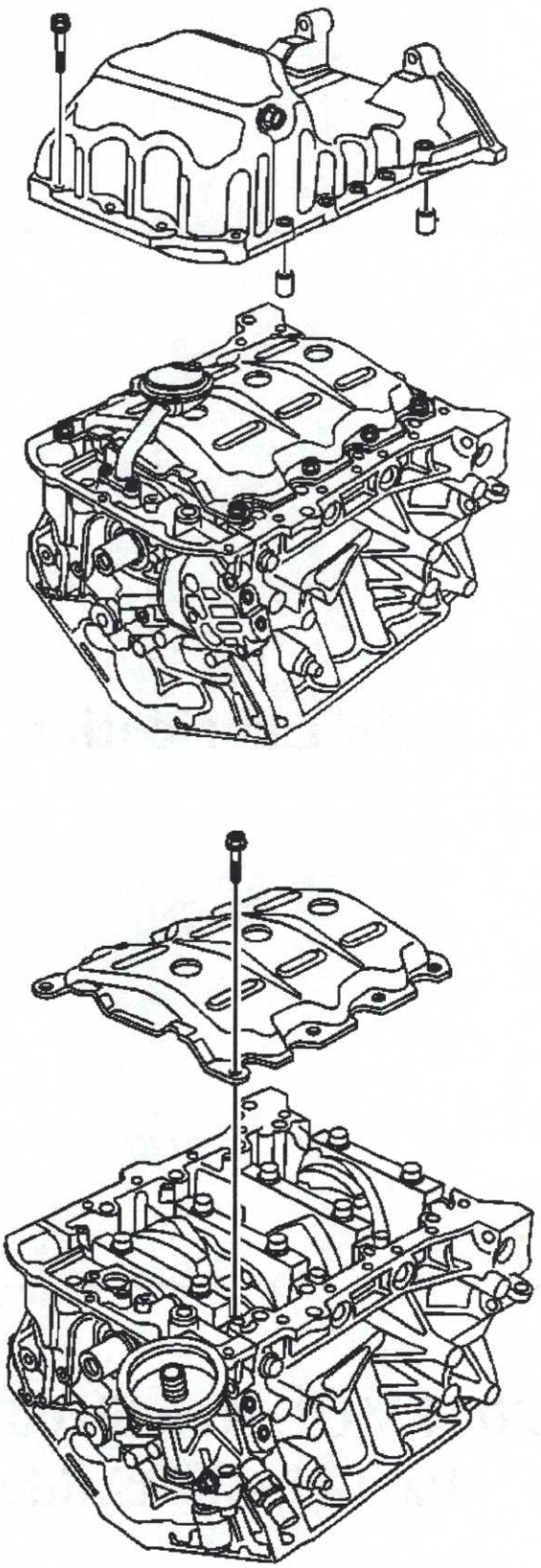
tie together

Section 2.4

L66 Lubrication

2004 VUE New Product
Participant Guide

Oil Pan and Crankshaft Oil Deflector



Lubrication System

L66 (V-6) Lubrication System Components

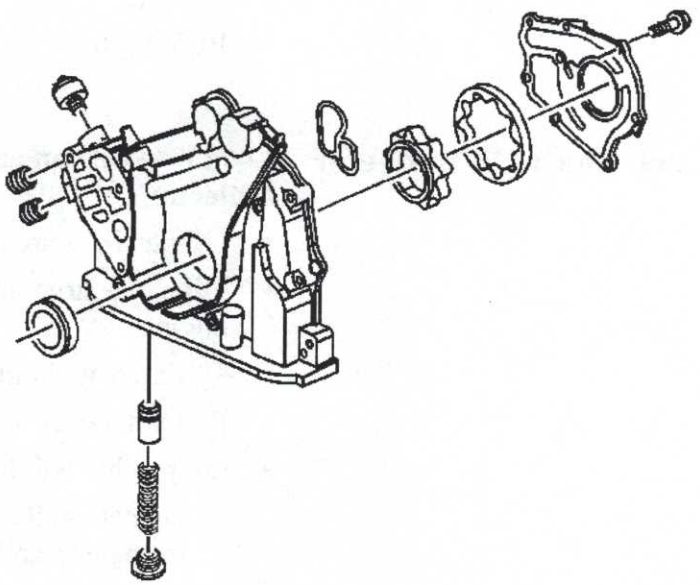
- Oil pan and crankshaft oil deflector
- Oil pump
- Oil filter
- PCV System

Oil Pan and Crankshaft Oil Deflector

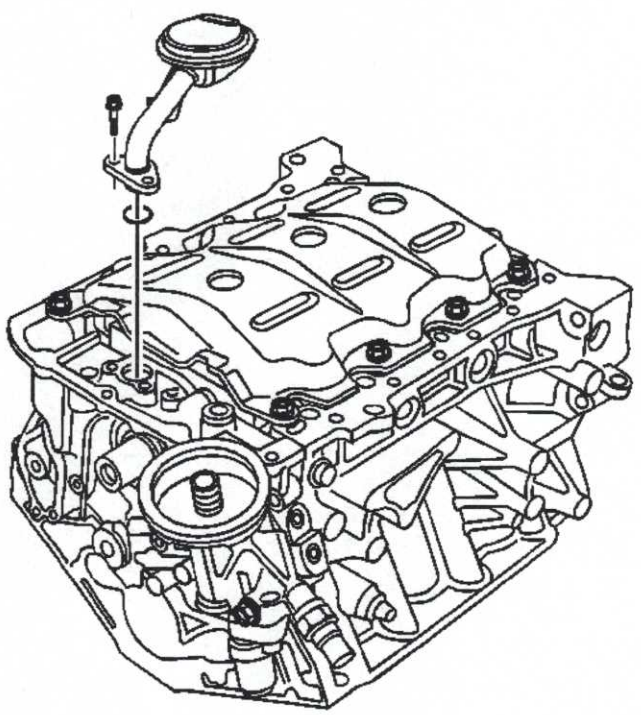
L66 (V-6) Oil pan and Crankshaft Oil Deflector

- Oil pan bolts are two different lengths
- Oil pan is structural component of the engine
  - External ribbing on pan
- Pan has dowels for alignment
- Oil pan has bolt holes for trans bell housing
  - Do not use these holes to mount engine to engine stand
- 5W-20 motor oil is recommended for this engine
- Oil pump pipe/screen has to be removed before deflector

Oil Pump



Oil Pump Pipe/Screen Assembly



Oil Pump

L66 (V-6) Oil Pump

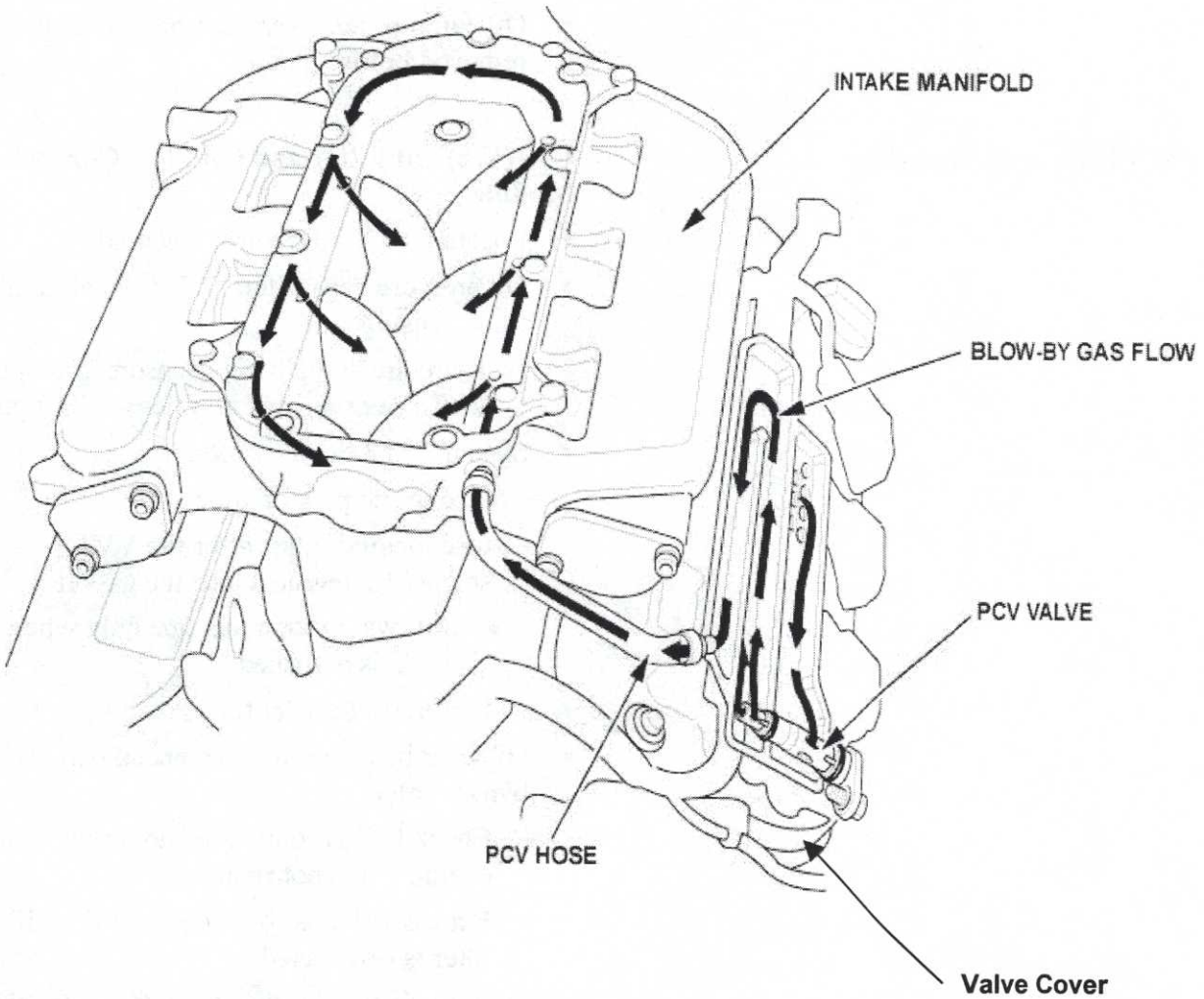
- Gerotor style pump
- Attached to front engine cover
- Inner gear is installed with shoulder down
- Use pre-luber during reassembly as needed
- Oil pump pipe/screen assembly must be removed before pump

Oil Filter and Housing

L66 (V-6) Oil Filter and Oil Flow Control Module

- Location of VVT control solenoid
- Oil pressure sensor for VVT is located in filter housing
  - There are actually two sensors, one for VVT operation and another for IP input
- System has 3 debris screens
  - One in the pick up tube
  - One located inline after the VVT solenoid integrated into the gasket
    - Oil flows through this one only when VVT is activated
  - One in oil transfer tube
- Oil filter has a drain down check ball and bypass valve
  - Check ball is so oil does not drain from engine when not running
  - Bypass valve is so oil can still flow if filter is obstructed
- Oil filter is smaller than S-series, will need smaller filter wrench

Crankcase Ventilation



PCV System

PCV System

- PCV valve is bolted to left bank valve cover
- Blow-by gas flows from holes in valve cover through PCV valve.
- Flows through PCV hoses that connect the valve cover and intake manifold to passages in intake manifold
- Blow-by gas is drawn through a hole in each intake manifold runner and into combustion chambers

Lubrication System

Objective: At the completion of this worksheet, the technicians will have the knowledge and hands-on experience necessary to service components of the lubrication system of an L66 engine.

Reference: 2004 VUE Service Manual

Directions: Follow the "Engine Unit Repair" section of the Service Manual.

Components Involved in Removal

- **Oil pan**
- **Oil pump pipe/screen assembly**
- **Crankshaft oil deflector**
- **Oil flow control module**
- **Oil pump**
- **PCV valve**

Question for Review

1. Why do we use 5W-20 oil?

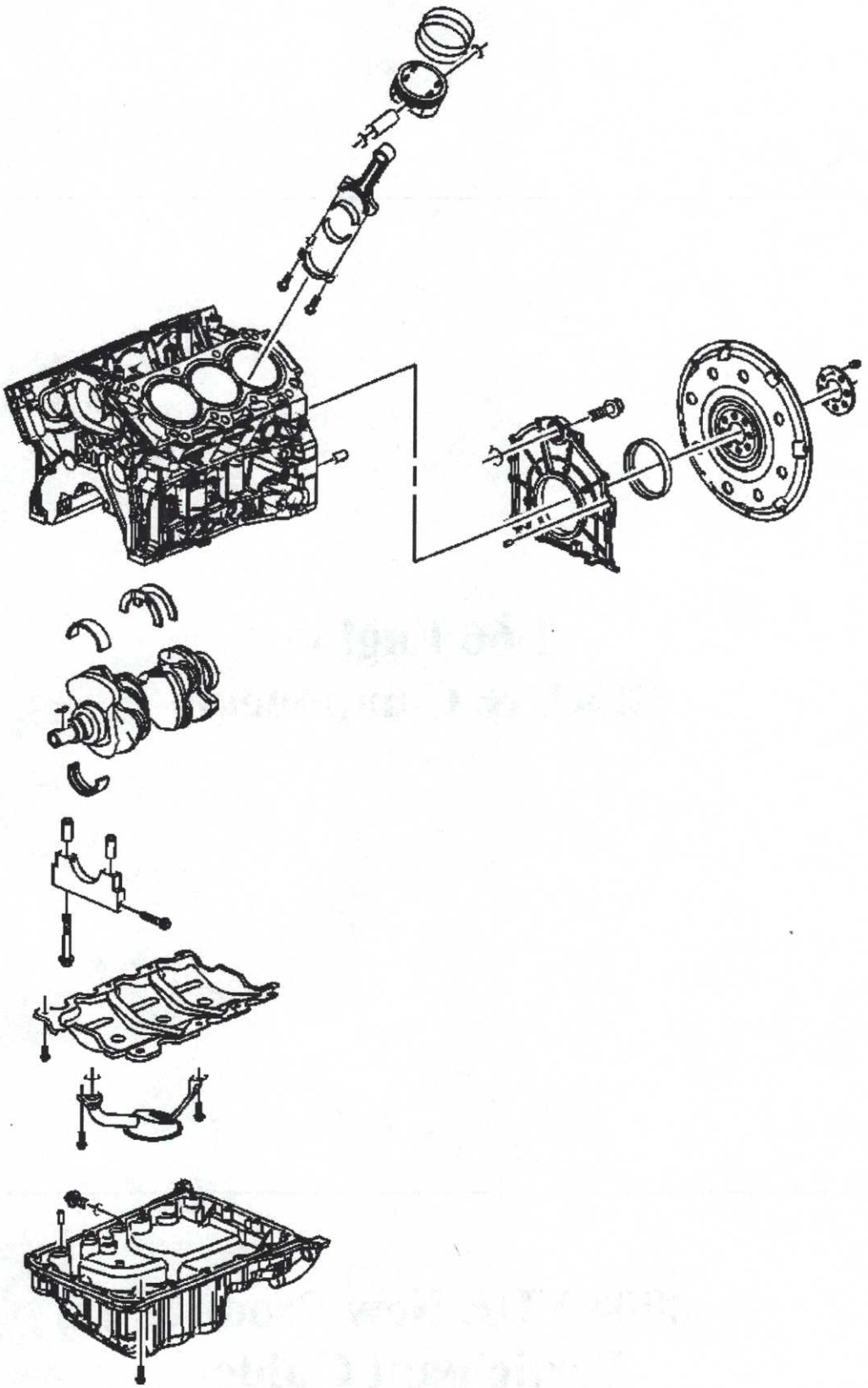
fuel economy

Section 2.5

L66 Engine
Block & Components

2004 VUE New Product
Participant Guide

Engine Block & Components



Engine Block and Components

Components of the L66 (V-6) engine block include:

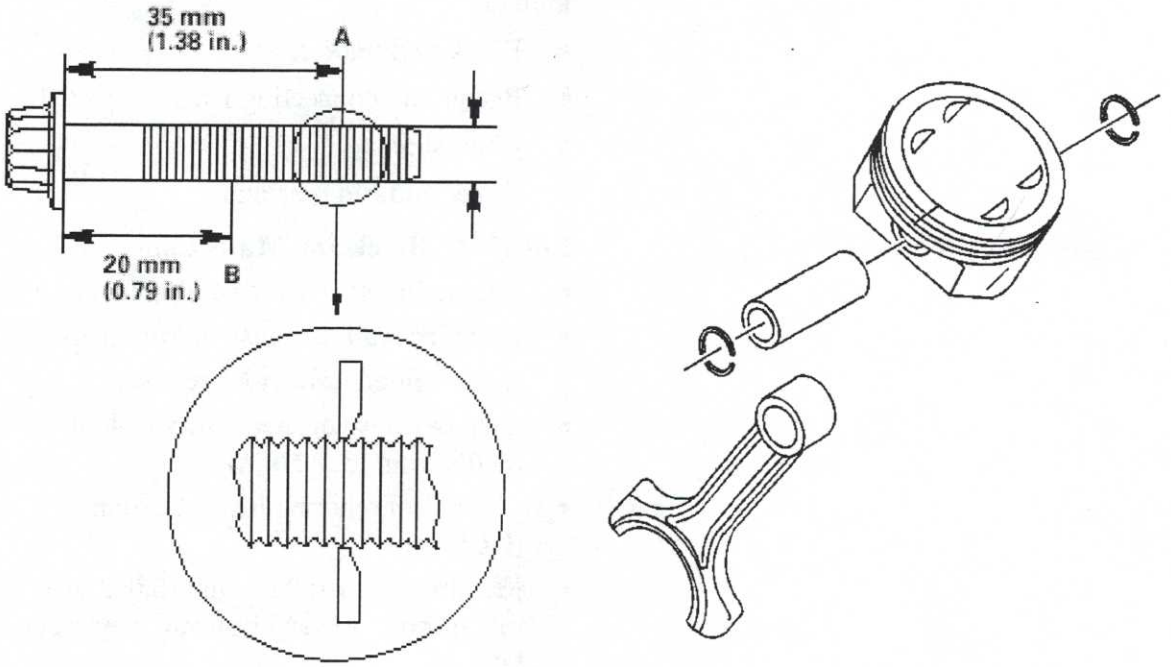
- Block and main caps
- Piston and connecting rods
- Crankshaft
- Crank and rod bearings

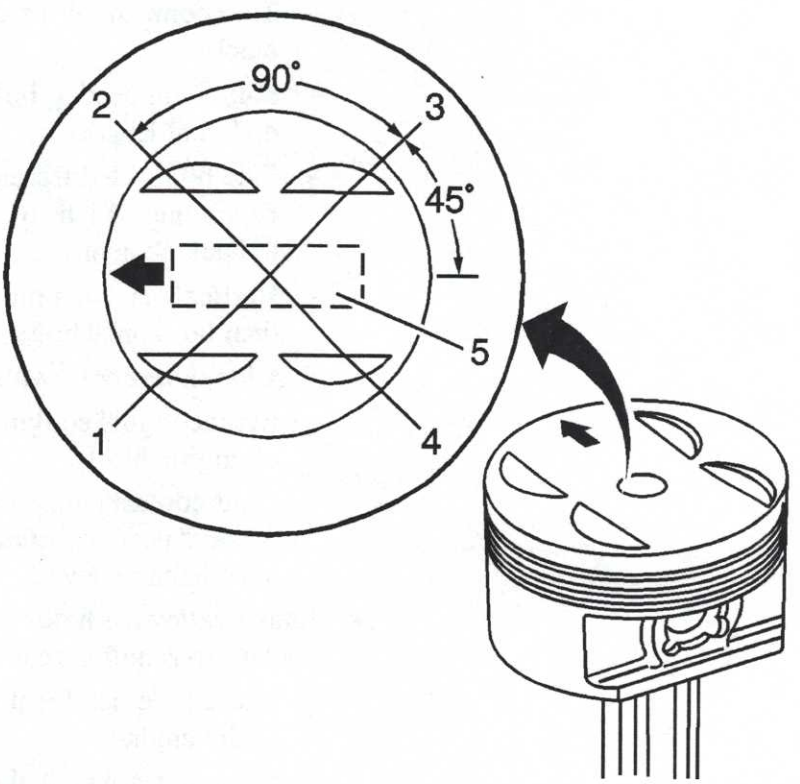
Block and Main Caps

L66 (V-6) Block and Main Caps

- Engine block is made of aluminum
- Cylinder walls are cast-in iron liners
  - Iron liners cannot be removed.
- Cylinder bore diameter service limit: 89.065 mm (3.5056 in)
- Maximum reboring limit: 0.25mm (0.010in)
- Maximum taper: 0.05 mm (0.002 in.) measured at top and bottom of cylinder bore
- Each main bearing cap has four bolts
  - Two are straight down
  - Two come in from side of the engine block
  - Side main bearing bolts are three different lengths
  - Side bolts are different lengths depending on left to right side, and front to back positions
  - Vertical cap bolts must be torqued first, then horizontal bolts
- RIA block heater is available
  - Replaces gold coolant plug on left side of engine block.
  - Gold coolant plugs have crush washers. Always need to replace these once they have been removed.
- Intake valley has holes drilled to allow coolant to runoff at rear of engine
  - These holes are located toward the rear of the engine
  - If crossover pipe leaks coolant will drain from these holes instead of sitting in the valley

Piston and Connecting Rods



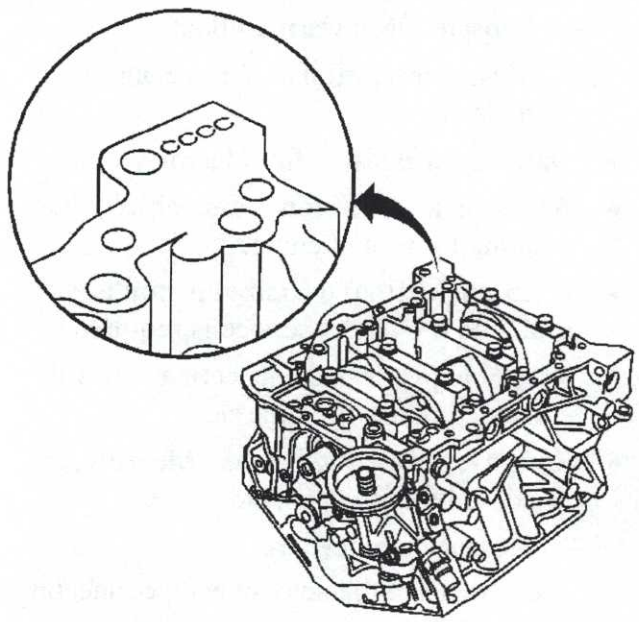


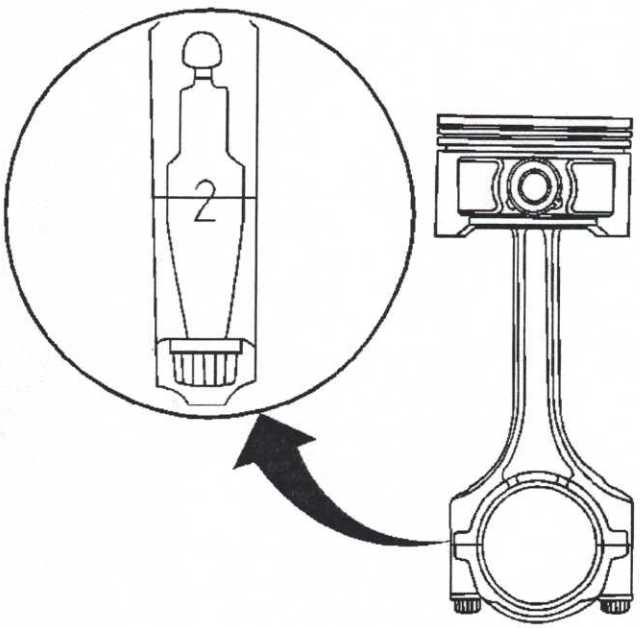
Piston and Connecting Rods

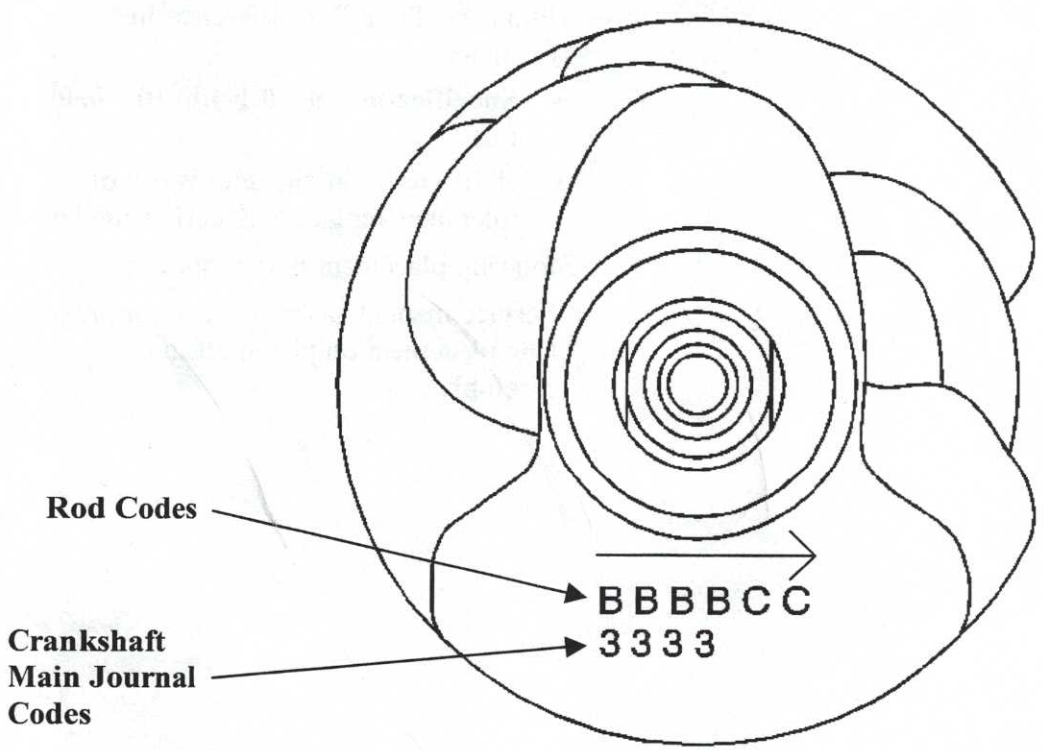
L66 (V-6) Piston and Connecting Rods

- Semi full-floating pin
  - Pin is tight in piston when cold
  - Loosens when warm to float
  - Must warm piston to remove and replace
- Only one size piston from factory
- Arrow on top of piston is assembled pointing to front of engine
- A .25mm (.010in) oversized piston is available if cylinder service is required
- Assemble piston and connecting rod with embossed marks on same side
- Rods use torque angle bolts. Measure, to decide if bolts are reusable
  - Measuring procedure:
    - Measure diameter of each connecting rod bolt at point A and point B
    - Calculate difference in diameter between point A and point B
  - Point A – Point B = difference in diameter
    - **Specification: 0 – 0.1 mm (0 – 0.004 in.)**
    - If difference in diameter is out of tolerance, replace connecting rod bolt
- Piston ring placement is very specific
  - Service manual has procedure for proper ring placement on piston during assembly

Bearing Selection Stampings







Crankshaft

L66 (V-6) Crankshaft

- Crankshaft **CANNOT** be machined
- Crank uses thrust bearing
  - No variation in size
  - Measure end play, if not in spec, replace bearing
  - They are located on the third main cap/crank journal
- Do not lubricate harmonic balancer bolt washer only lubricate bolt threads

Crank and Rod Bearings

L66 (V-6) Crank and Rod Bearings

Bearings are determined by codes stamped on the engine block, crankshaft and connecting rods

- Engine block codes are located on the oil pan sealing surface at the rear of the block
- Crankshaft codes are located on the front lobe of the crankshaft
- Connecting rod codes are located at cap/rod connecting point
- There are four possible main journal bore sizes
  - Use block and crankshaft markings to choose correct main bearing sizes
- Each connecting rod falls into 1 of 4 tolerance ranges:
  - Use connecting rod and crankshaft markings to choose correct size bearings

Rod #2

Bearing Selection

Objective: At the completion of this worksheet, the technicians will have the knowledge and hands-on experience necessary to select main and connecting rod bearings for a L66 engine.

Reference: 2004 VUE Service Manual

Directions: With cylinder #3 connecting rod cap and main cap #1 removed, note bearing codes to answer the following questions.

Question for Review

1. What code does cylinder #3 connecting rod cap have stamped on it?

   2

2. What codes are stamped into the crankshaft?

   CCBCCC
   5244

3. What codes are stamped into the engine block?

   CCCB

4. What color bearing does cylinder #3 connecting rod need?

   Yellow

5. What color bearing does crank journal #1 need?

   green brown

Section 2.6

L66 (V-6) Engine Assembly

2004 VUE New Product
Participant Guide

Engine Assembly

Objective: At the completion of this worksheet, technicians will be able to properly reassemble the L66 engine components that have been removed.

Reference: 2004 VUE Service Manual

Directions:

- Use the "Engine Assembly " service procedures in the Service Manual as a resource.
- **Notice: Not all steps will need to be completed**.

Components Involved in Installation

- Crank main bearing cap and connecting rod cap

  Note: You can reuse all the bolts; not torque to yield.

- Oil pump
- Crank sprocket and sensor

  Note: It's easier to plug the crank sensor in now before the belt is in place.

- Oil flow control module
- Crankshaft oil deflector and oil pump pipe/screen

  Note: Make sure oil pump pipe/screen o-ring is in place. Don't tighten bolt for deflector without having pump pipe/screen in place first.

- Oil pan

  Note: Two different length bolts.

- Cylinder head

  Note: There are three steps to torquing the head-to-block bolts. You don't have to torque fully in class. Line up crank before installing head. There are threaded bosses on the front of the cylinder heads that are not used; the timing belt covers cover them. Don't let these holes confuse you.

- Camshaft

  Note: Small end of cam goes towards the front of the engine. Align the cam timing marks before installing the rocker arms. When the crank timing marks are lined up, the middle right piston is at TDC. When the cam is rotated beyond "1", the intake valves hit the middle piston. When the cam is turned to "3", the exhaust valves hit the middle piston.

- Rocker arms and lifters
- Water pump/cover

  Note: Make sure it goes on before the timing belt.

- Idler pulley
- Timing belt tensioner

  Note: You can collapse it in a vise. Make sure the pin is installed to hold it.

- Engine Mount Bracket
- Timing belt

  Note: When setting the timing belt, make sure you follow the directions in the service manual. It's very important to put the belt on in the correct order to minimize the slack between the cams.

- Timing belt covers

  Note: Covers must be installed to adjust the valves. Alignment marks are on the belt covers.

- Crankshaft balancer
- Valve Lash Adjustment
- Valve cover
- Coolant crossover pipe and thermostat housing

Note: Don't forget the gold pipe.

- Lower intake manifold:

Note: Make sure that the FOUR dowels are in place.

- Injector rail

Note: If the rail is on backwards, the boltholes will not line up. The rail can be removed and reinstalled with the upper manifold in place.

- Upper intake manifold
- Throttle body

VVT Engine Output Demonstration

The purpose of the engine output control "VVT enable" is to allow the VVT to be turned on and off to check for sticking or inoperative VVT system.

The service manual procedure for DTC P2648 directs you through the process of testing operation of the VVT.

- Start engine; allow to reach normal operating temperature.
  - Greater than 185° F (85° C)
- With transmission in neutral, hold engine speed to 2,800 RPM.
  - Test will abort if RPM falls below 2,700 RPM.
- Command VVT on and off using output controls on Tech 2 while monitoring change

VVT Failure Modes

Objective: At the completion of this worksheet, the technicians will have knowledge and hands-on experience necessary to identify electrical VVT failure modes for the L66 engine.

Reference: 2004 VUE Service Manual

Directions: Instructor test-drive the vehicle with the Technicians, use the VVT gauge and switch setup and Tech 2 to answer the following questions.

VVT Forced On.

1. What code(s) set(s) when the VVT is switched on?

2. What driving symptoms occur?

3. Do the conditions clear when the Switch is turned back to normal operation? If not, what is required to resume normal function?

VVT Forced Off

4. What code(s) set(s) with the VVT switched off?

5. Do(es) the code(s) set immediately, or wait for attempted VVT activation?

6. What driving symptoms occur?

7. Can you clear the code(s) with the Tech 2 while the switch is still off?

8. Do the conditions clear by themselves when the Switch is turned back to normal operation? If not, what is required to resume normal function?

Section 2.7

L66 Engine Diagnostics

2004 VUE New Product
Participant Guide

L66 Engine Diagnostics

The purpose of this section is to review any engine control diagnostics that are new or different for the 2004 VUE.

- Differences in engine diagnostic systems from current Saturn Vehicles
- Fuel system changes

Engine Control System Differences / Similarities

This is a high-level review of what engine control systems are different or new for the 2004 VUE in comparison to current Saturn vehicles.

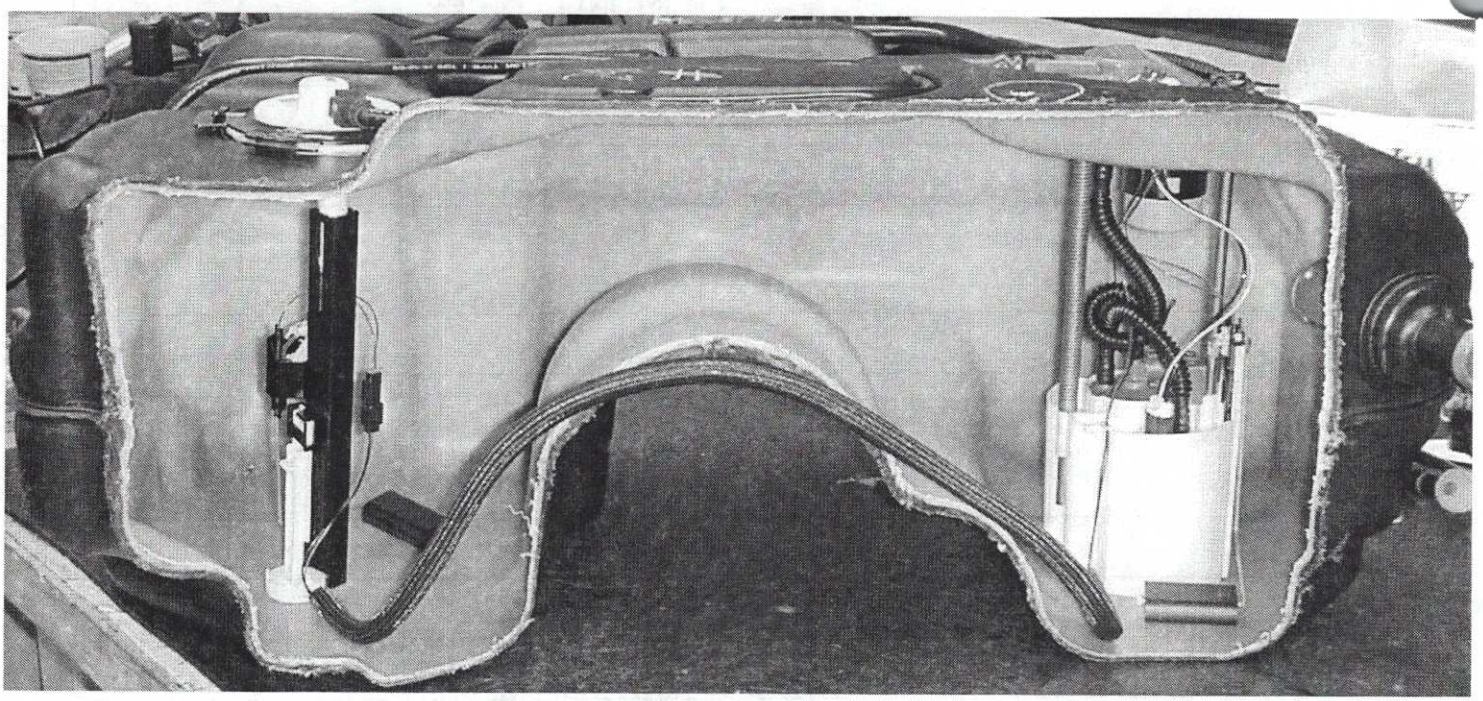
The objective is to introduce differences or similarities in the engine control system of 2004 VUE that can help you understand how they should act and what to consider while diagnosing a failure.

The Powertrain Control Module (PCM) is a "No Start" module. It must be programmed before the vehicle will run.

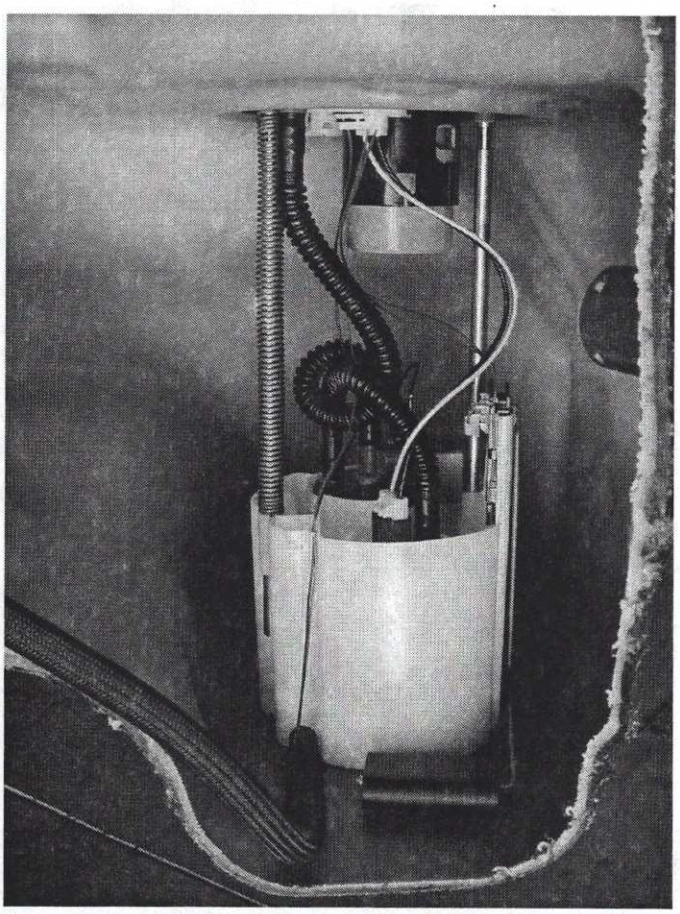
Inputs	LL0/L24	L61 (L&ION)	L61 (VUE)	L81	L66
Accelerator Pedal Position (APP)			X (2)	X (2)	X
A/C Pressure Switch	X	X	X	X	X
Brake Switch	X	X	X	X	X
Camshaft Position Signal		X	X	X	X
Cyl #4 Signal	X				
Crankshaft Position Signal	X	X	X	X	X
Cruise Brake Switch	X		X	X	X
Cruise Control On/Off	X		X	X	X
Cruise Set Coast	X		X	X	X
Cruise Engage		X			
Cruise Resume/Accelerate			X	X	X
EGR Position	X			X L Only	X
Engine Coolant Temp	X	X	X	X	X
Fuel Level	X	X	X (2)	X (2) VUE	X (2) VUE
Fuel Tank Pressure Sensor	X	X	X	X	X
Generator F Terminal		X			X
Generator L Terminal	X	X	X	X	X
Intake Air Temperature	X	X	X	X	X (2)
Knock Sensor	X	X	X	X (2)	X
MAP Sensor	X	X	X	X L Only	X
Mass Air Flow				X	
Low Coolant	X				
Oil Pressure Switch	X	X	X	X	X
Oil Life Reset	X				X
Oxygen Sensor	X (2)	X (2)	X (2)	X (4)	X (4)

	LL0/L24	L61 (L&ION)	L61 (VUE)	L81	L66
Throttle Position Sensor (TPS)	X	X	X (2)	X (2)	X
Throttle Actuator Control (TAC)					X
Right Front Wheel Speed Sensor		X		X	
Vehicle Speed Sensor	X	X ION Man	X Man Only		X
VVT Oil Pressure					X
Outputs					
A/C Relay	X	X	X	X	X
Cooling Fan	X	X	X	X	X
EVAP Purge Solenoid	X	X	X	X	X
EVAP Vent Solenoid	X	X	X	X	X
EGR Solenoid	X			X L Only	X
Fuel Injectors	X	X	X	X	X
Fuel Pump Relay	X	X	X	X	X
Generator L Terminal	X	X	X	X	
TAC Module			X	X	X
Idle Air Control	X	X			
Ignition Control	X	X	X	X	X
Main Relay Control			X	X	X
O2 Sensor Heater	X	X	X	X (4)	X (4)
Vehicle Speed		X			
Intake Manifold Runner Control				X	
Auxiliary Coolant Pump Relay				X VUE Only	
VVT Actuator Solenoid					X

Fuel Tank/Pump Assembly



Primary Pump Unit



Wet Fuel System Overview

The fuel system of the Saturn 2004 VUE operates slightly differently from previous units.

- Fuel pressure regulator is located in fuel filter.
- Gas tank is changed slightly, but the fuel delivery system remains, a dual module system
- Gas tank capacity increases from 15.7 to 16.5 gallons
- There is a primary fuel pump and a secondary unit
- Primary pump unit houses fuel pressure regulator and 2 jet pump assemblies
  - Previously the secondary unit regulated fuel pressure and housed the jet pump
- Primary pump unit contains fuel filtering system
  - Fuel filter is now internal to fuel tank
  - Previously it was an external fuel filter
- Primary pump with pressure regulator, filter assembly, pump and all attached lines is serviced as a unit
- Secondary unit assembly only serves two functions:
  - Provides a fuel pickup point for the jet pump assembly, which is now located in the primary pump
  - Reading fuel level on driver's side of tank
- Fuel level is calculated the same as for previous VUEs
  - Because both senders are in series the electrical signal is "averaged out"
  - That averaged signal is what tells the PCM the fuel level.

To service primary unit, first remove secondary unit

- Connector for secondary sending unit is inside fuel tank
- Secondary unit must be removed to disconnect the connector