

# VIPER

## POWERTRAIN



**STUDENT WORKBOOK**

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# SAFETY NOTICE

This publication's purpose is to provide Technical training information to individuals in the automotive trade. All test and repair procedures must be performed in accordance with manufacturers service and diagnostic manuals. All **warnings**, **cautions**, and **notes** must be observed for safety reasons. The following is a list of general guidelines:

- Proper service and repair is critical to the safe, reliable operation of all motor vehicles.
- The information in this publication has been developed for service personnel, and can help when diagnosing and performing vehicle repairs.
- Some service procedures require the use of special tools. These special tools must be used as recommended throughout this Technical Training Publication, the diagnostic Manual, and the Service Manual.
- Special attention should be exercised when working with spring-or tension-loaded fasteners and devices such as E-Clips, Cir-clips, Snap rings, etc., careless removal may cause personal injury.
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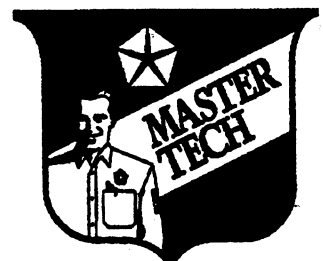
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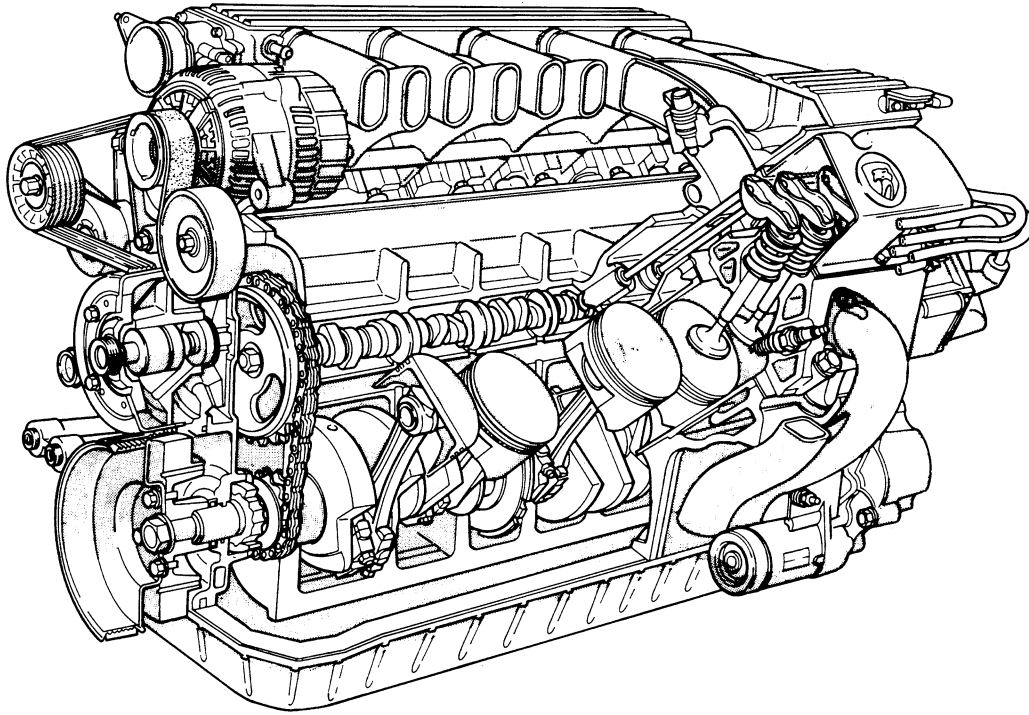
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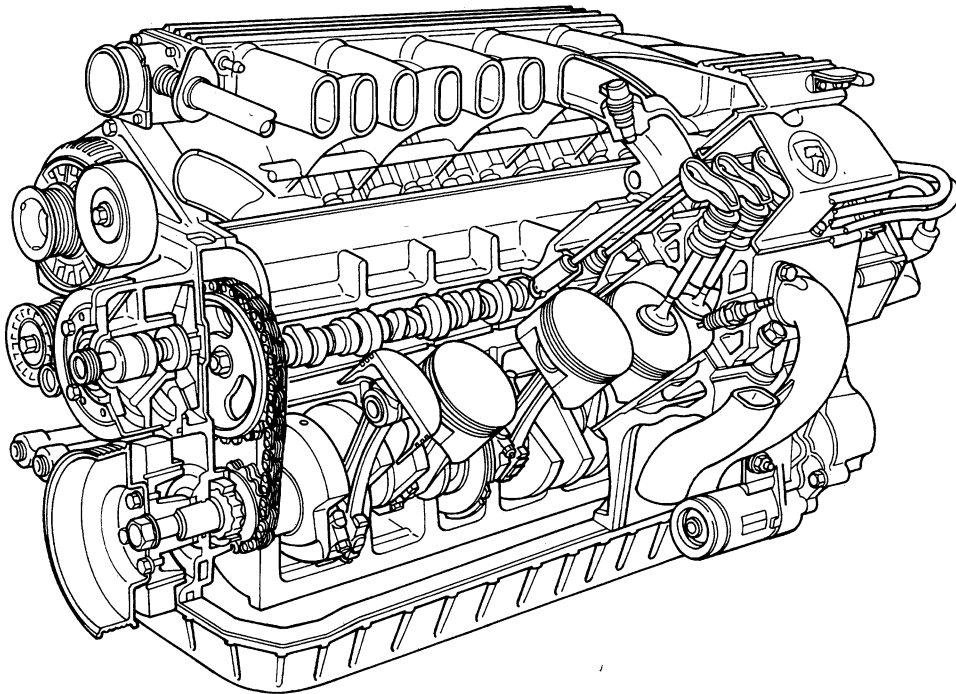
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**1996 ROADSTER**

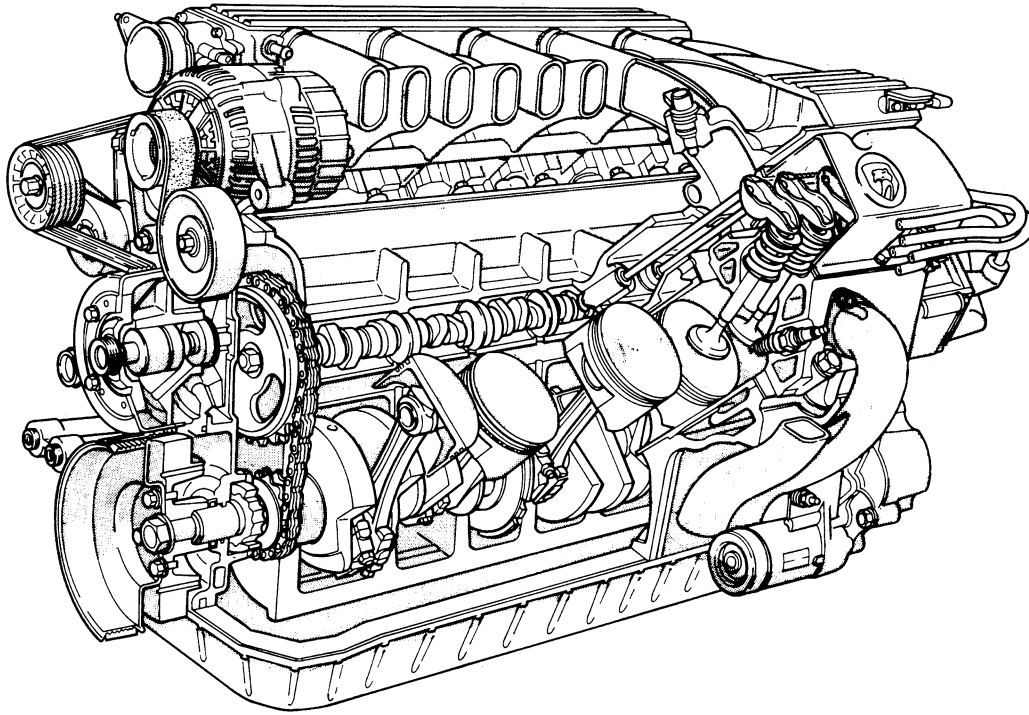


**1996 COUPE**

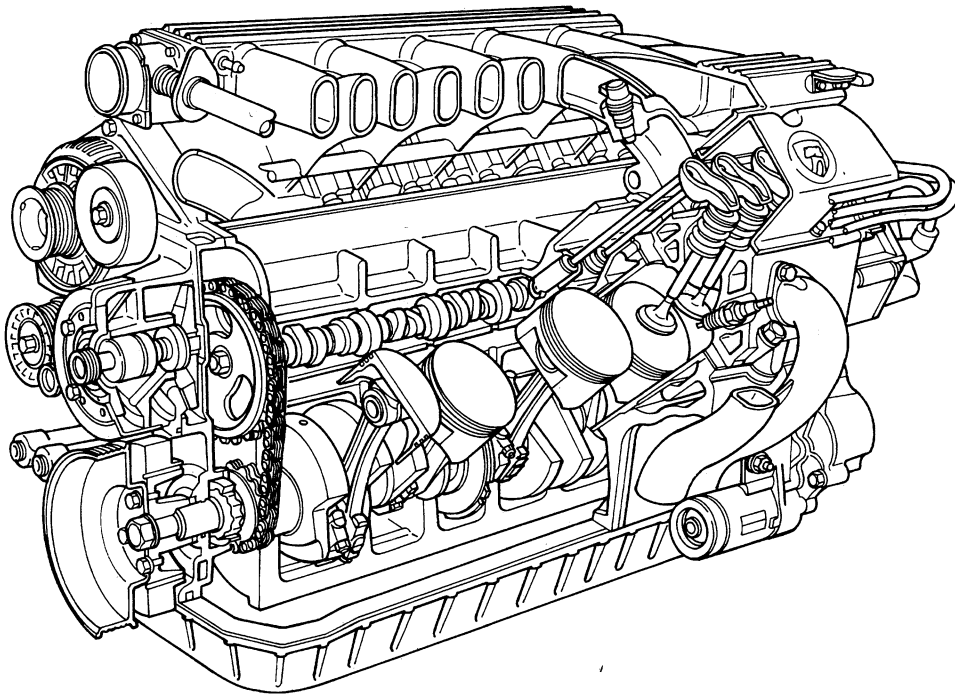
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**1996 ROADSTER**



**1996 COUPE**

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## ACRONYMS

ASD	Automatic Shutdown
CARB	California Air Resources Board
CCD	Chrysler Collision Detection
CKP	Crankshaft Position Sensor
CMP	Camshaft Position Sensor
dB	Decibel
DLC	Data Link Connector
DRB	Diagnostic Read-out Box
DTC	Diagnostic Trouble Code
ECT	Engine Coolant Temperature
IAC	Idle Air Control
IAT	Intake Air Temperature
ISO	International Standards Organization
MAP	Manifold Absolute Pressure
MIL	Malfunction Indicator Lamp
OBD II	On-Board Diagnostics Generation Two
PCM	Powertrain Control Module
RPM	Revolutions Per Minute
SAE	Society of Automotive Engineers
TPS	Throttle Position Sensor
VSS	Vehicle Speed Sensor

# ***Powertrain***

## **INTRODUCTION AND OBJECTIVES**

The 1996 Viper Powertrain Book contains information about engine components and systems that are new and/or different for 1996. The book is divided into two sections. The 1996 Viper Roadster V-10 engine is covered first. The 1996 Viper Coupe V-10 engine is covered in the second section of the book. You will see that the V-10 engine used on the Roadster and Coupe represents significant events in the history of the Viper's classic V-10 design.

Upon completion of this book, you should be able to perform the following tasks:

- Identify the differences between the 1996 Viper, Roadster V-10 and the 1996 Coupe V-10
- Perform crankshaft removal and installation procedures
- Identify and repair the cooling and lubrication systems

The information provided will assist in preparing you to service the increasing variety of Viper V-10s on the road beginning in 1996.

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## 1996 ROADSTER V-10 ENGINE

The Viper Roadster V-10 engine is very similar to previous year's V-10 engines. In fact, it would be difficult to immediately identify any differences between the pre-1996 V-10 and the engine for the 1996 Roadster.

Increased power (see Table 1) is mainly due to a major redesign in the exhaust system. A change from the previous side exhaust to a rear exit was required to accommodate the downstream O<sub>2</sub> sensor for OBD II. This allowed a 30 percent reduction in exhaust back-pressure and elimination of the air cleaner resonator while still meeting noise pass-by standards.

*Note: It also makes it sound better.*

Table 1 Roadster V-10 Engine Horsepower and Torque Ratings

1992-1995	1996
400 HP @ 5,200 RPM	415 HP @ 5,200 RPM
465 Lb. Ft. torque @ 3,600 RPM	480 Lb. Ft. @ 3,600 RPM

**Note:** Torque and horsepower ratings are approximate. The final compression ratio remains at 9.1:1.

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## DRIVELINE IMPROVEMENTS

Driveline improvements for the 1996 Viper Roadster have been made to the following components:

- Clutch
- Transmission crossmember
- Half-shafts
- Differential and mount

The torque capacity for the hydraulic assisted clutch and pressure plate has been increased. An idle stage dampener has been added to the clutch disc. This change reduces gear rattle at idle.

The revised transmission crossmember is constructed of lightweight aluminum.

The torque capacity of the half-shafts has been increased. The helix angle on the spline shaft has been revised and the diameter of the spline is increased.

A Dana Super 44 differential is used on the new Roadster. This type of differential is a 216 RIA:

216 = Diameter of the ring gear measured in millimeters

R = Rear

I = Independent

A = Aluminum construction

Externally, the differential looks the same as the previous year's (fig. 1). Internally, this differential contains a larger ring and pinion gear than before. The final drive ratio remains 3.07:1.

The ladder beam (or ladder bar) has been deleted for 1996. The differential is retained at the pinion nose by an aluminum crossmember which is bolted to the frame directly above the differential.

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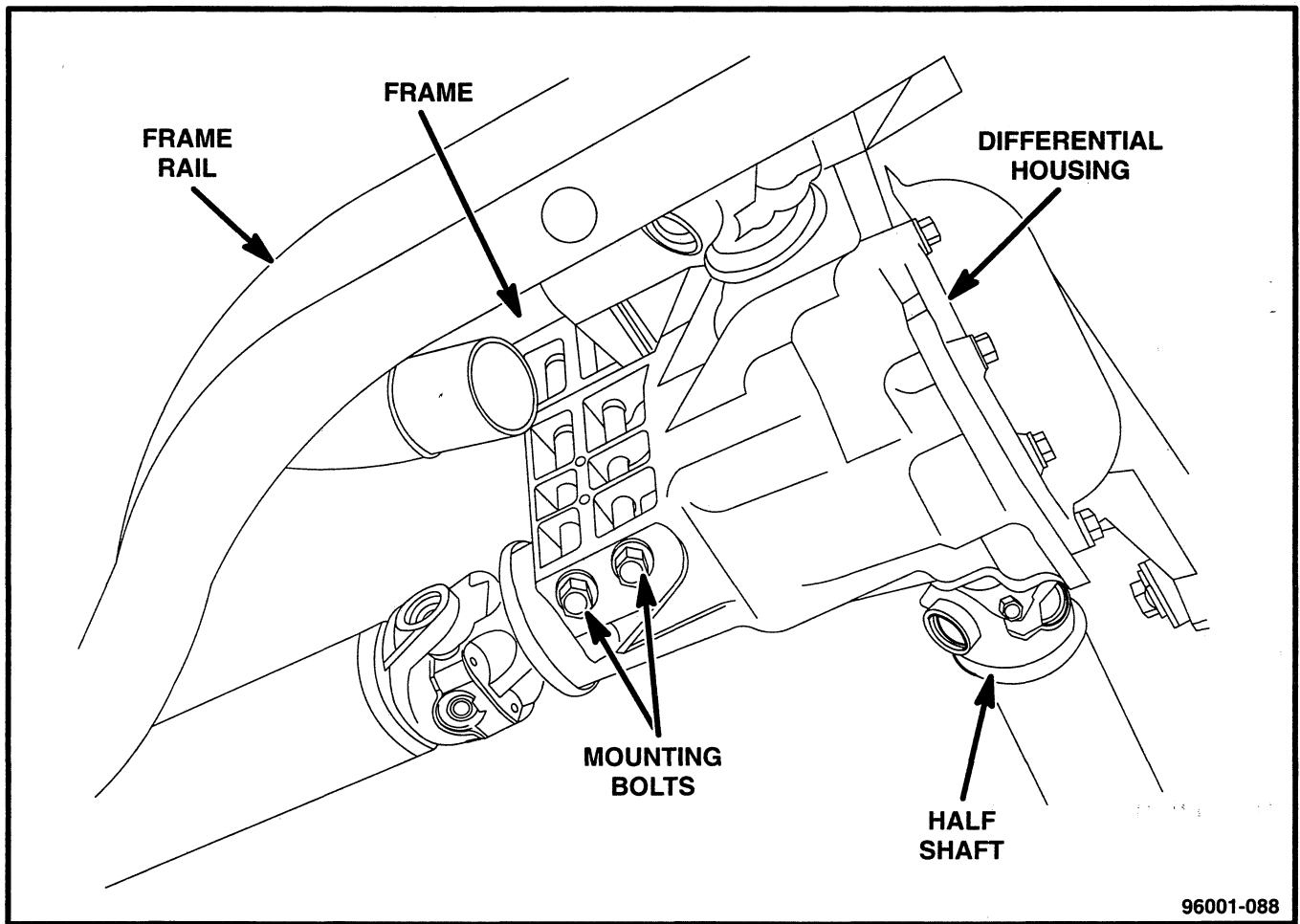


Figure 1 Differential and Mount

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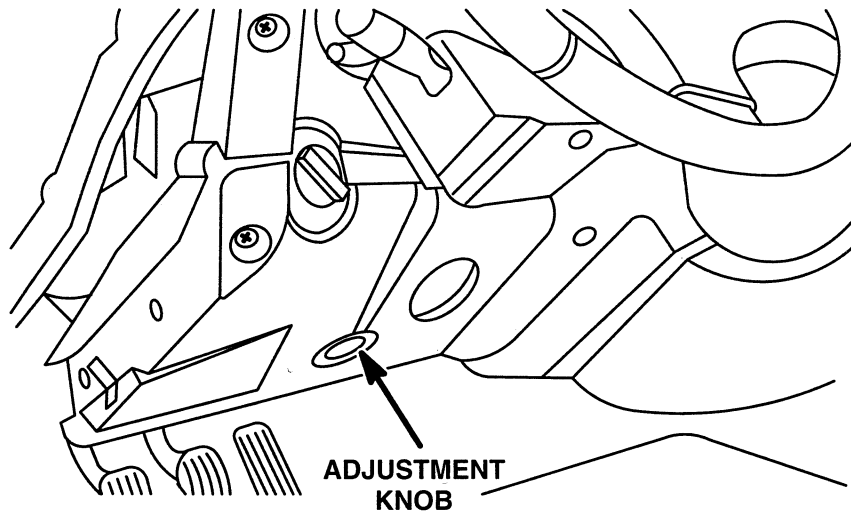
The Coupe is equipped with an adjustable pedal system that allows about 4 inches of fore and aft pedal adjustment. The pedals are adjusted using a knob recessed into the knee bolster beneath the steering column (fig. 2).

To adjust the pedals:

- Adjust the seat to a comfortable driving position
- Adjust the pedals to a position that allows full pedal travel

It may be necessary to make further small adjustments to find the best seat/pedal position.

Do not adjust the pedals while the vehicle is moving. Always adjust the pedals while the vehicle is parked.



96001-175

Figure 2 Pedal Adjustment Knob



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## 1996 COUPE V-10 ENGINE

The V-10 engine for the Coupe has significant differences compared to its 1996 Roadster counterpart. The engine is slightly smaller and leaner in size. The overall weight of the engine is reduced by approximately 80 pounds. Again, more power is achieved in the Coupe's V-10 engine as illustrated in Table Two.

Table 2 Roadster vs. Coupe V-10 Engine Horsepower and Torque Ratings

1996 ROADSTER	1996 COUPE
415 HP @ 5,200 RPM	450 HP @ 5,200 RPM
480 Lb. Ft. torque @ 3,600 RPM	490 Lb. Ft. @ 3,700 RPM
9.1:1 Compression ratio	9.6:1 Compression ratio

*Note: Torque and horsepower ratings are approximate.*

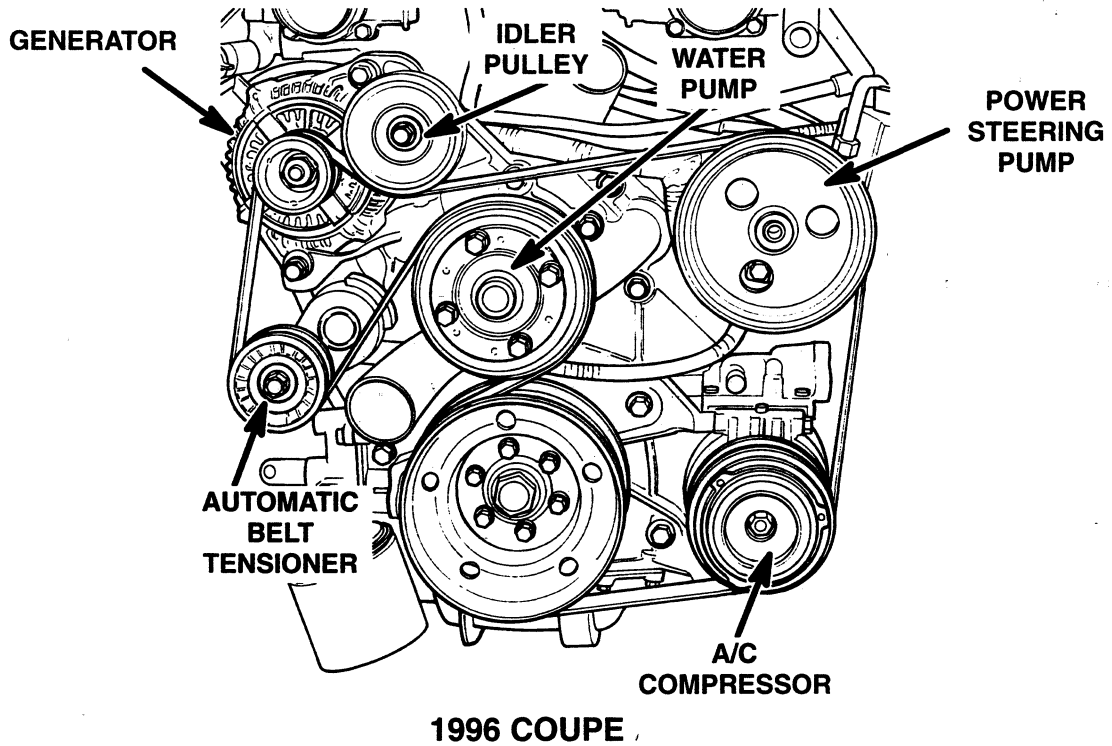
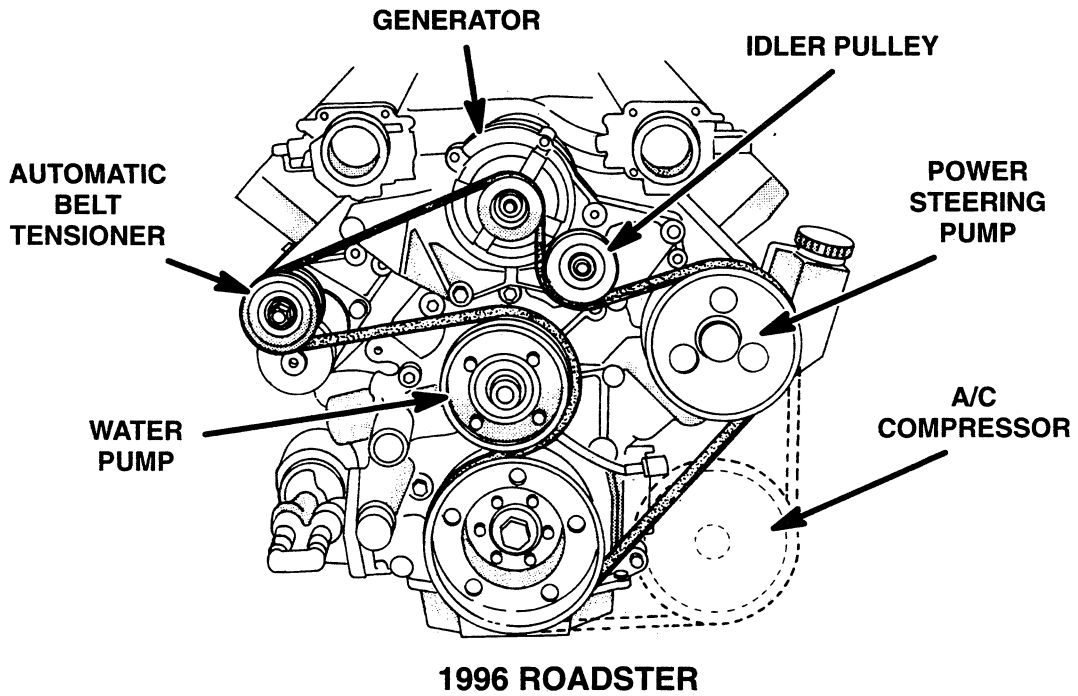
A visual comparison of the Roadster's engine to the Coupe's engine reveals some obvious physical differences between the two (fig. 3). The Automatic Belt Tensioner is located lower and closer inboard to the engine. The Generator and the idler pulley are relocated also. The Generator was relocated to provide a space increase at the front of the engine. The additional space is used to accommodate a revised cooling system design which is discussed in more detail later in this section. This also makes room for the Throttle Synchronization Shaft which is covered later in this section also.

*Note: A/C is standard on all 1996 Coupes. It will be optional in 1997.*

Another significant difference exists with the cylinder liners. On the Roadster V-10 engine, the cylinder liners are slip fit into the block. They are also serviceable as a complete cylinder liner assembly. The cylinder block for the Coupe is sand cast aluminum alloy (same as Roadster) with **pressed-in** dry, cast liners. These liners are pressed in place during block machining and **are not** serviceable items. More information on the engine block is covered later in this section.



# Powertrain



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Figure 3 Roadster and Coupe V-10 Engine Comparison

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## ENGINE BLOCK

The engine block is manufactured using a new, refined casting process. The new casting has resulted in a substantial reduction in weight. Also contributing to the weight savings is the elimination of the oil pump pick-up tube. The oil pump pick-up is now cast into the aluminum oil pan (fig. 4).

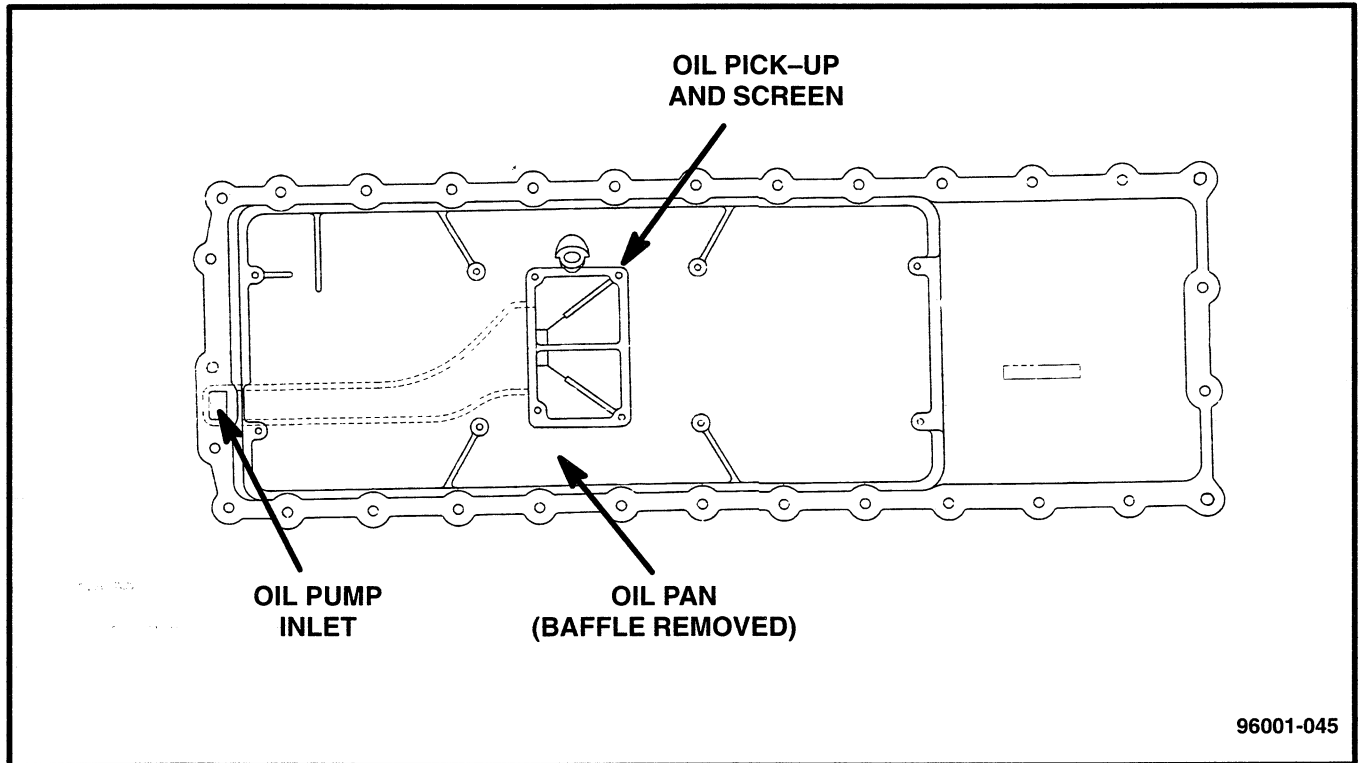


Figure 4 Oil Pan

# Powertrain

The main bearing caps are now cross-bolted (fig. 5). This helps make the bottom end of the engine more rigid.

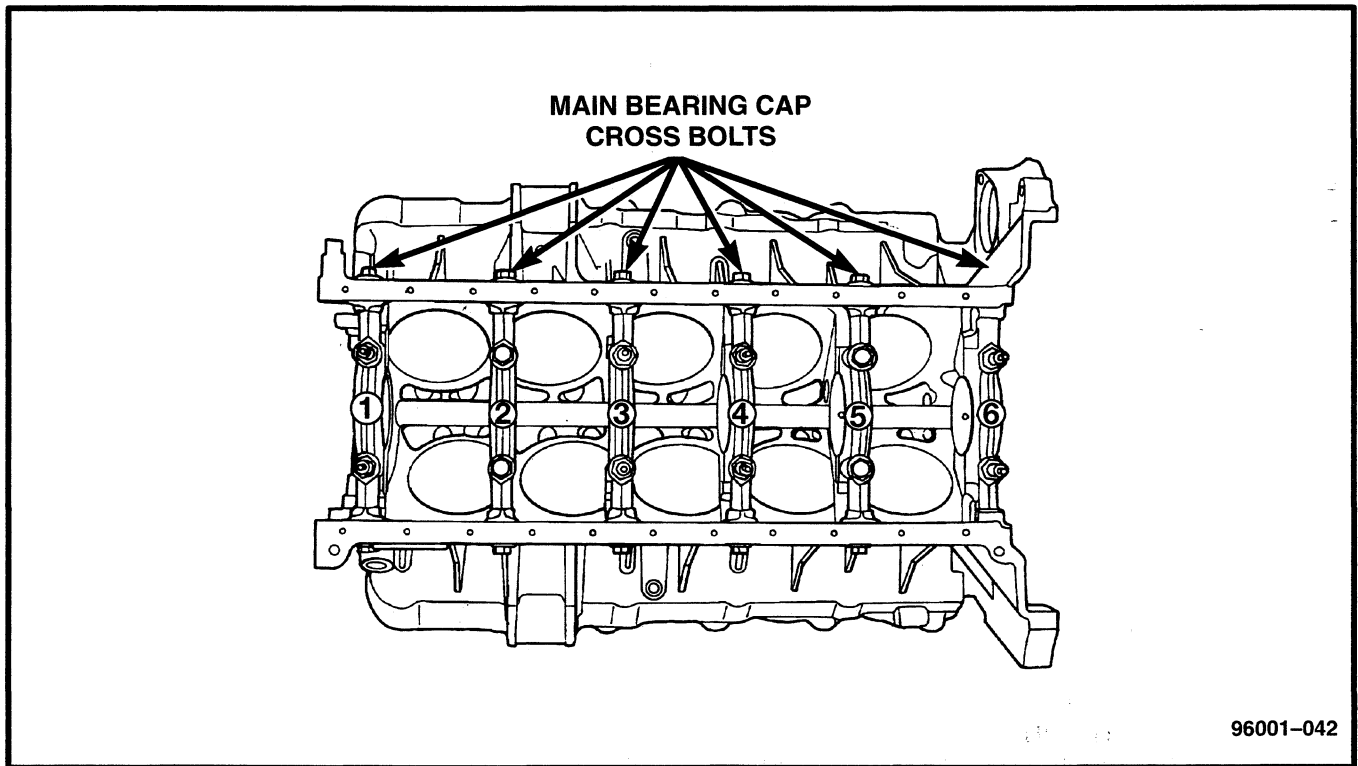


Figure 5 Main Bearing Caps

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The torque sequence and torque values are different for the Coupe (fig. 6). First, tighten all the 9/16" bolts to 45 ft./lbs., in sequence, and then to 85 ft./lbs. After that, all 7/16" bolts are tightened to 40 ft./lbs.

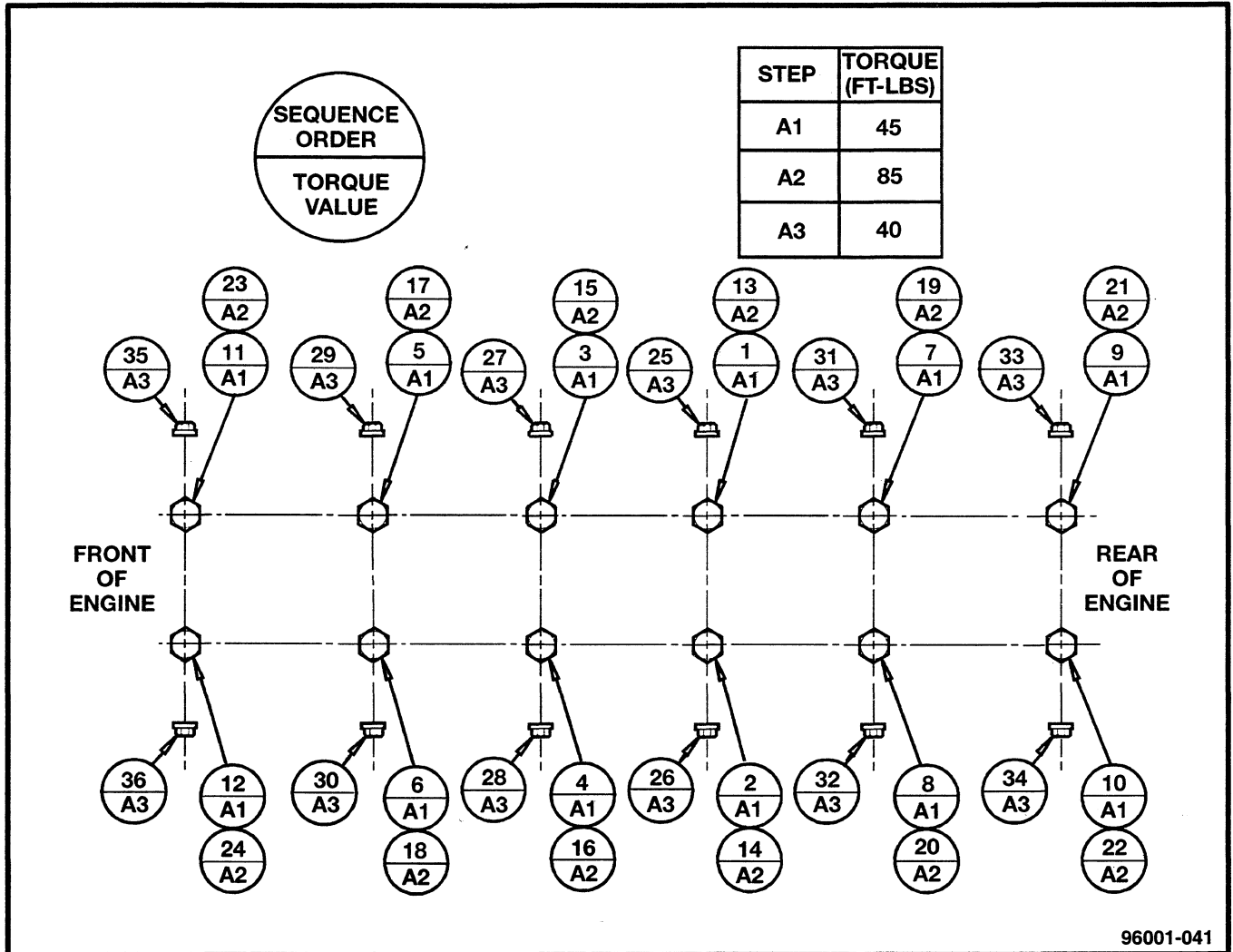


Figure 6 Main Bearing Cap Torque Sequence

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## ENGINE SYSTEMS

This section describes the components found in the engine systems of the Coupe's V-10 engine that are different from the engine found on the Viper Roadster. It is important that you remember that although there are many similarities, even as far as service procedures go, you must make sure to reference the appropriate Service Manual when performing **any** service procedure. There are some subtle, yet important differences between the two. It is important that you keep this in mind when servicing the Viper V-10 engine.

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## ENGINE COOLING SYSTEM

The cylinder head has two additional passages cast through the extreme ends of the cylinder head (fig. 7). The cylinder head is approximately seven pounds lighter as a result of a refined casting process. This has resulted in the relocation of the thermostat and ECT Sensor. Engine coolant temperature is controlled more efficiently in this design (fig. 8). The distance that the coolant must flow is reduced. With the thermostat and bypass tube located closer to the water pump and radiator, fluid flow is acted upon more quickly by the position of the thermostat. With the relocation of the thermostat, the upper radiator tube has been eliminated.

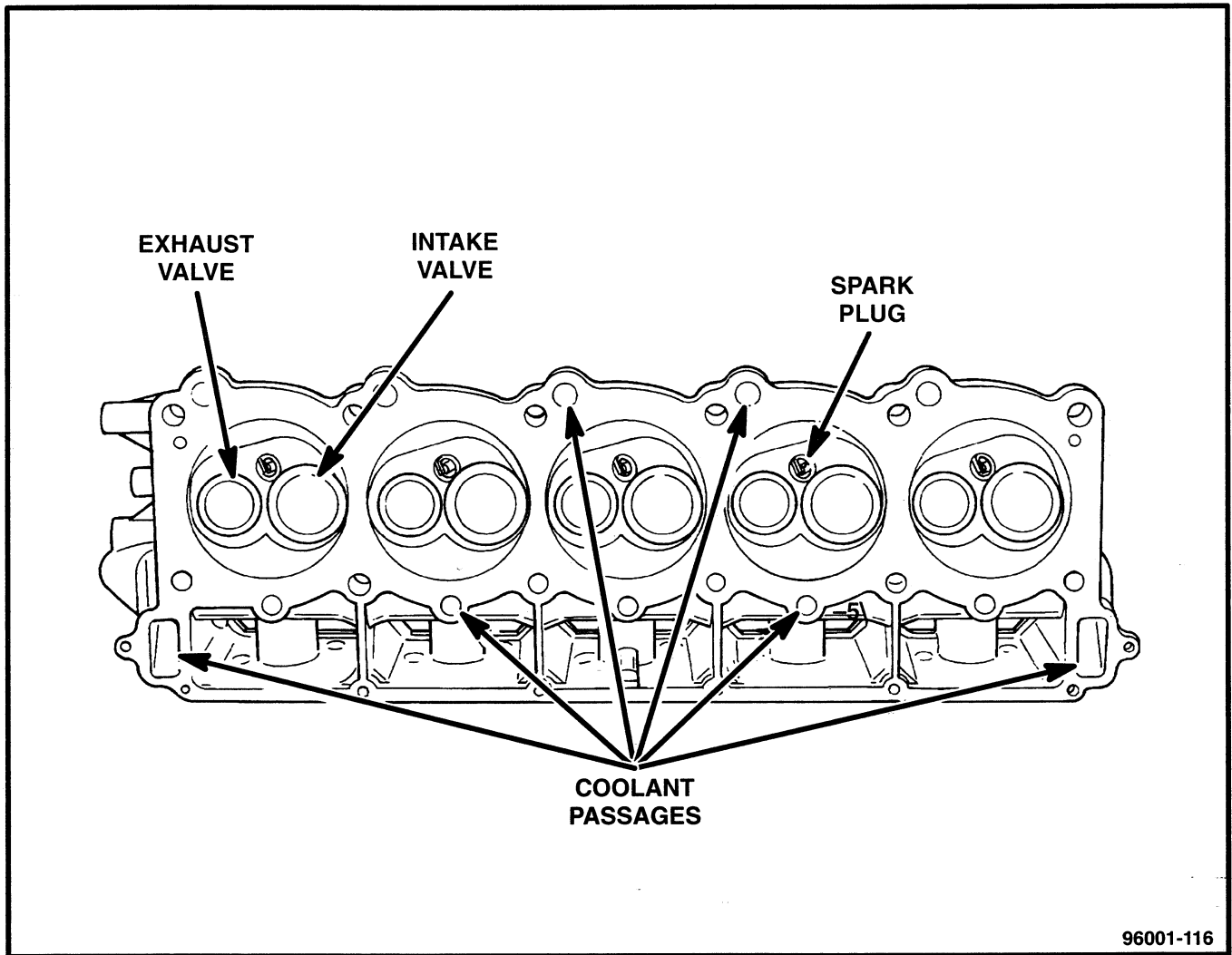
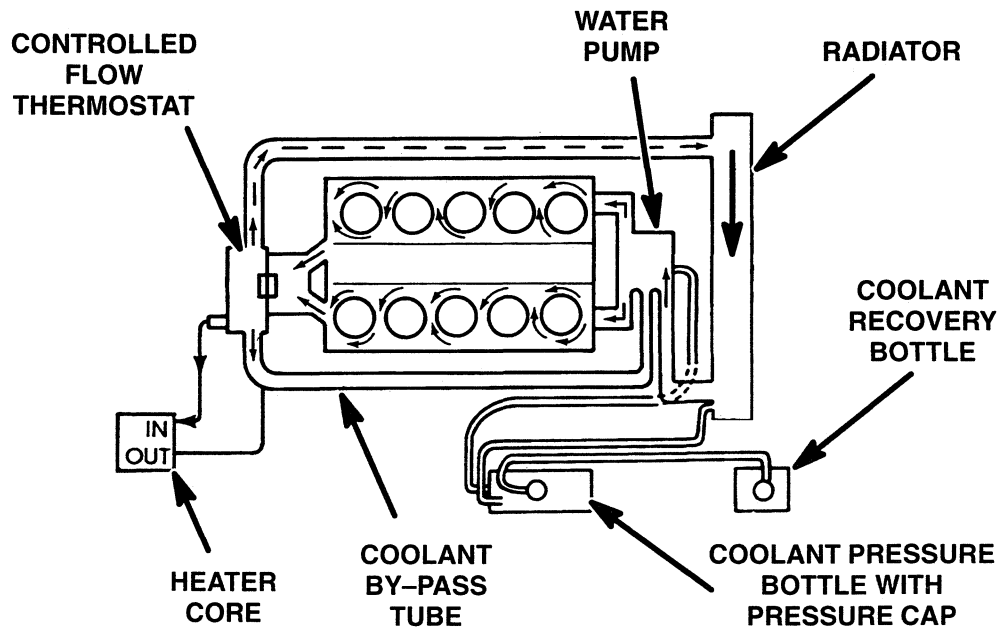
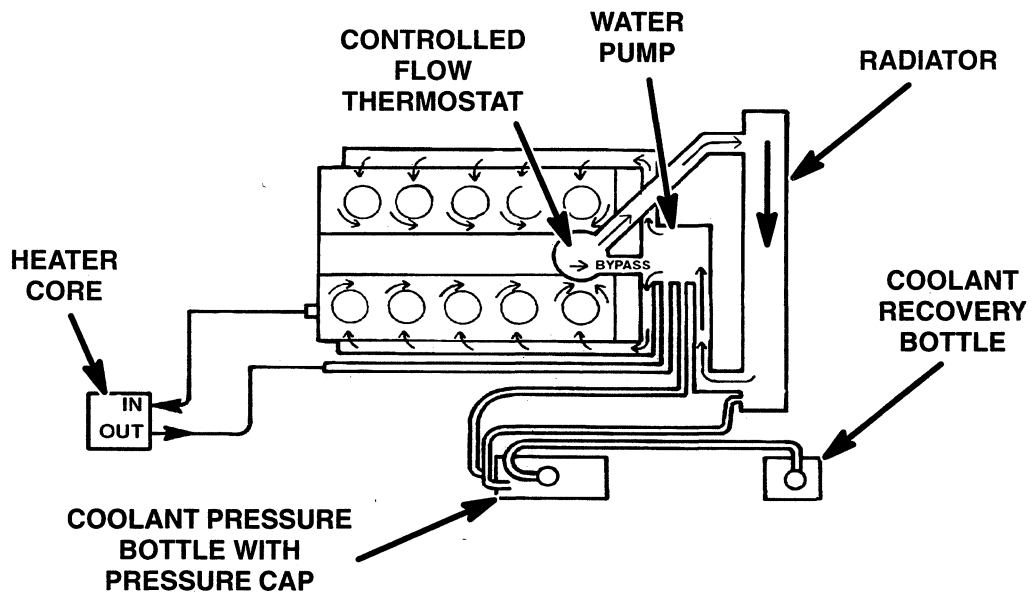


Figure 7 Cylinder Head Coolant Passages

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1996 ROADSTER



1996 COUPE

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Figure 8 Coolant Flow Comparison

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## Thermostat

The Thermostat has been relocated from the rear of the engine to the front of the engine, below the Intake Manifold (fig. 9). This move was made possible by relocating the Generator and integrating the Generator mounting bracket into the new chain case cover.

The thermostat is similar in basic function and operation to previous designs.

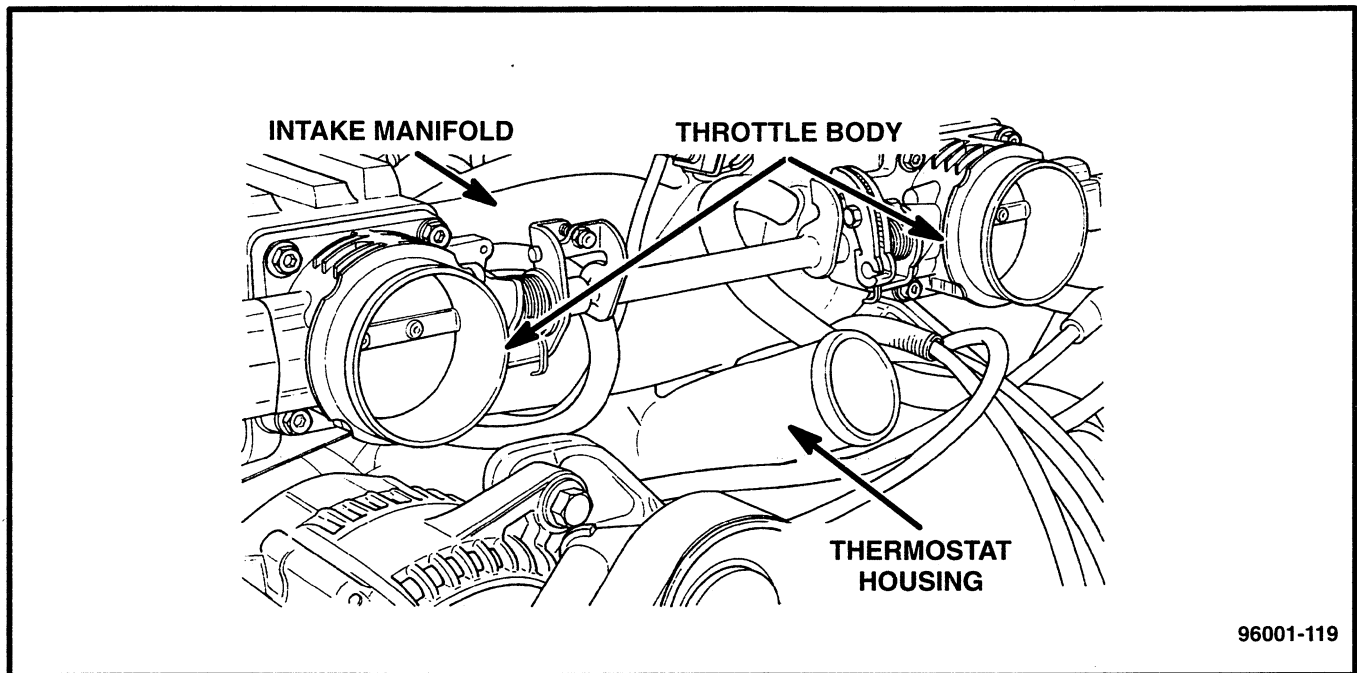


Figure 9 Thermostat Location





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## ENGINE LUBRICATION SYSTEM

The capacity and requirement for engine oil is reduced because of the overall reduction in size of the engine. The engine oil capacity of the Roadster V-10 engine is 9.5 quarts with the filter, and 9.0 quarts without the filter. On the Coupe, the engine oil capacity is 7.5 quarts with the filter and 7.0 quarts without the oil filter. Obviously, not being aware of this could result in engine performance degradation and possible long-term damage.

## Oil Filter Adapter Modification

The engine oil filter adapter has had a slight design modification. The adapter has been constructed in such a way so that the oil filter protrudes downwards (figs. 10 & 11).

*Anytime the Oil Filter Adapter gasket is removed, it must be replaced.*

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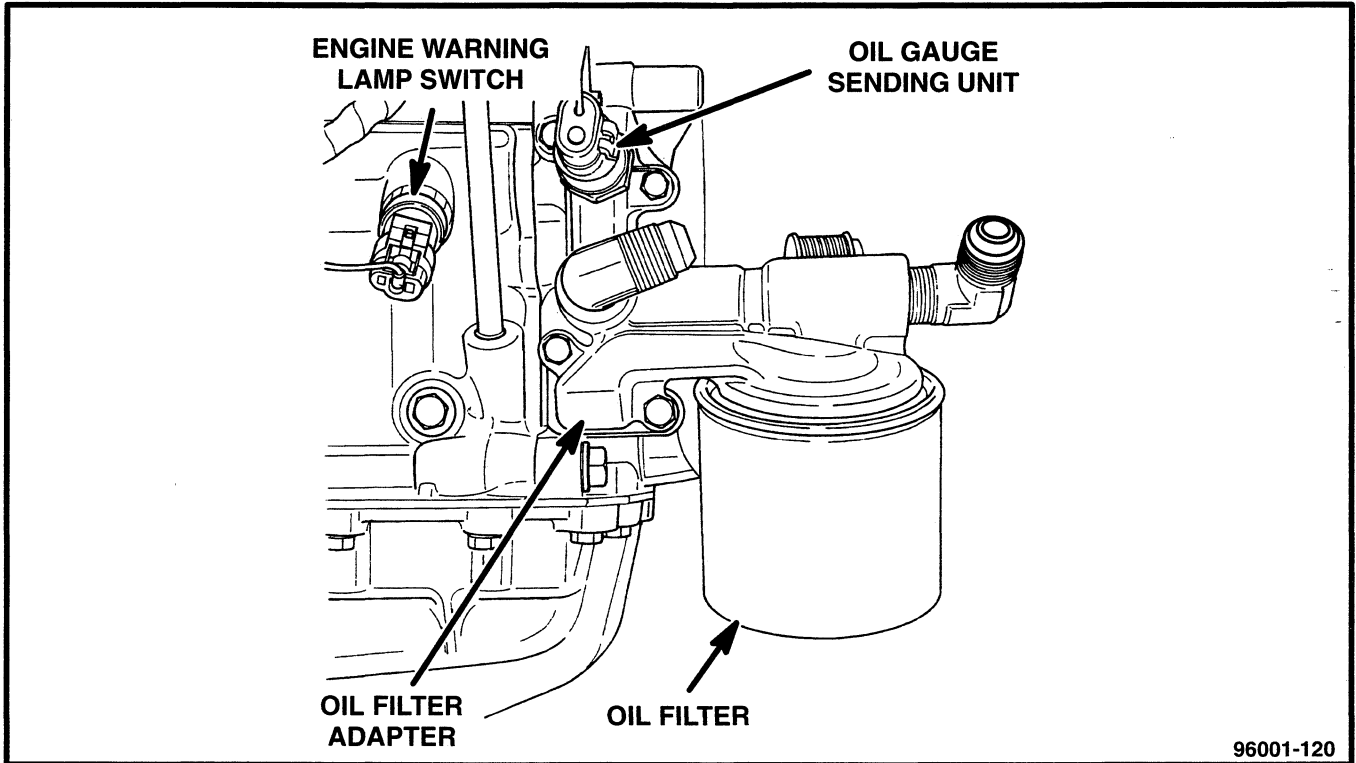


Figure 10 Engine Oil Filter Assembly

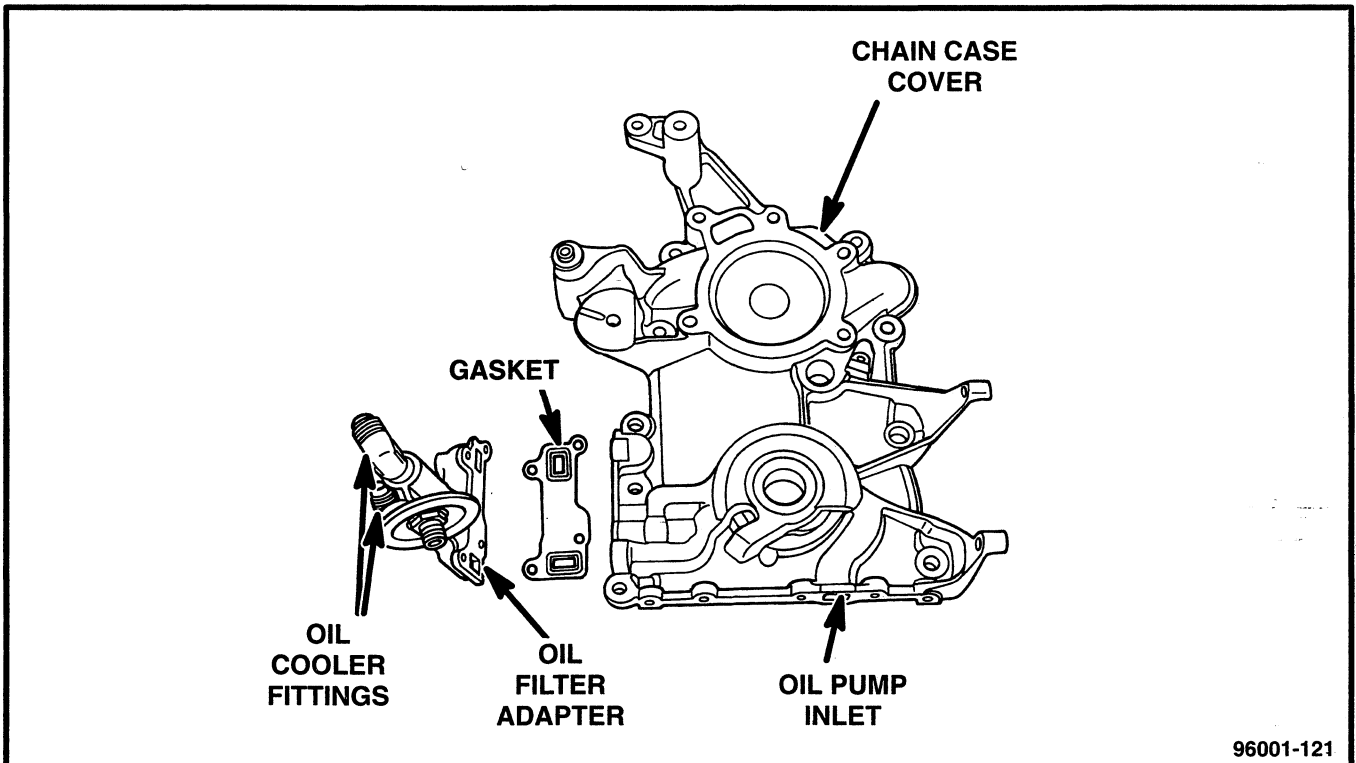


Figure 11 Engine Oil Filter Adapter

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## Engine Oil Cooler

Previously it was mentioned that there are some changes on the Coupe's engine that may not be so apparent upon visual inspection. Though the Engine Oil Cooler is virtually unchanged on the Coupe, there is one important fact to be aware of when servicing this assembly. The torque specification for the Oil Filter Adapter-to-Oil Cooler Line fitting is reduced from 35 ft. lbs. on the Roadster to 25 ft. lbs. on the Coupe.

## Checking Engine Oil Level

A new engine oil level dipstick is used on the Coupe. This dipstick has three markings - MIN, 2 qts., and MAX (fig. 12).

The dipstick is calibrated for 2 quarts between the MIN and MAX marks. This can provide you with a more precise indication of the oil level. Before checking the oil level of a customer's vehicle, ensure that the engine has been OFF for at least five minutes and that the vehicle is on a flat surface.

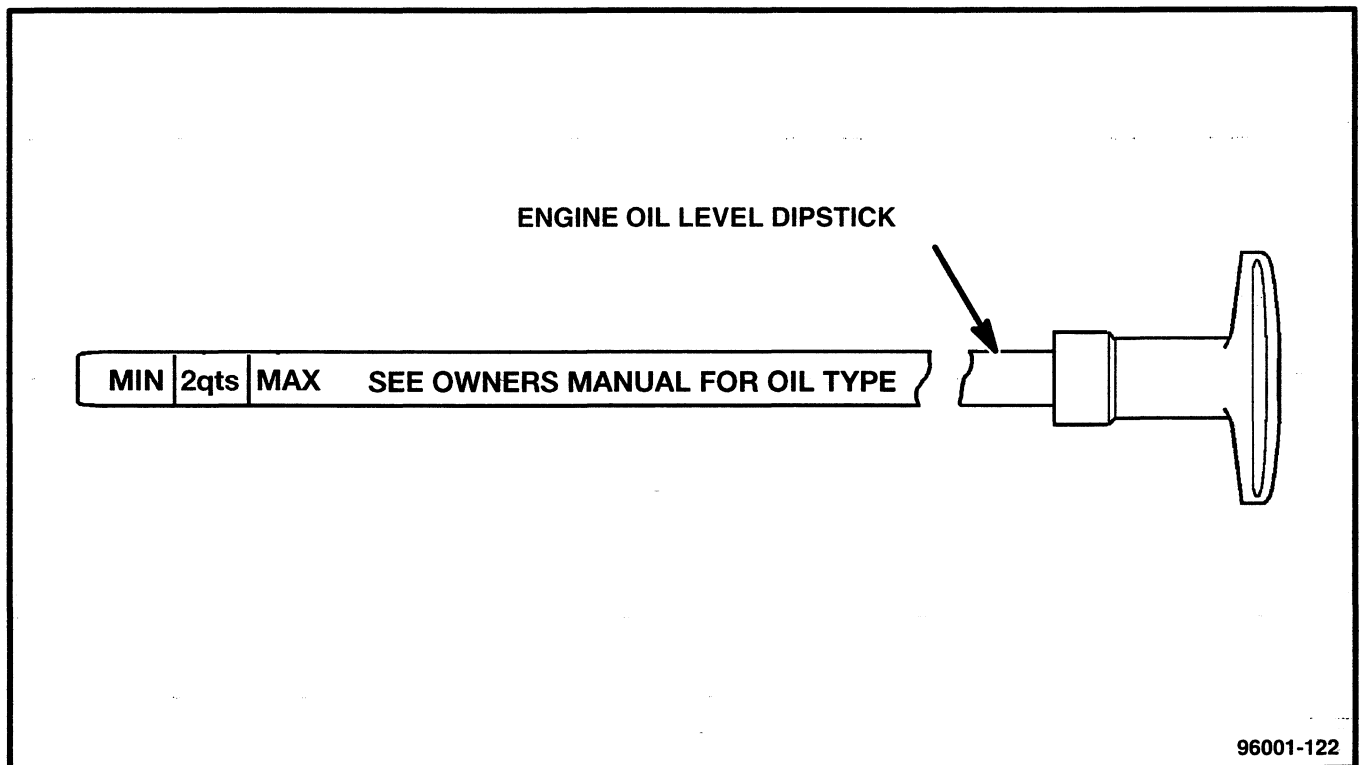


Figure 12 Engine Oil Dipstick



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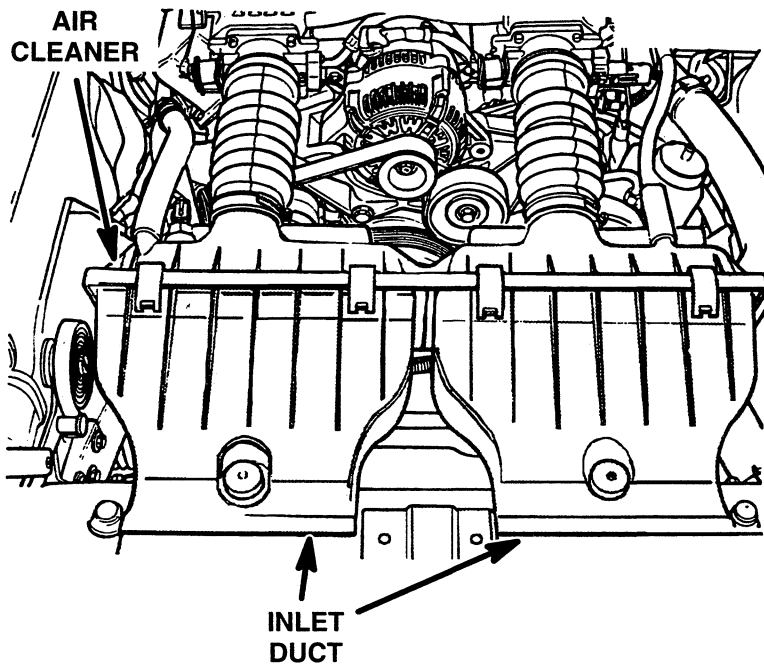
## FUEL CONTROL COMPONENTS

This section of the book focuses on the physical changes to engine components that are used for fuel and spark control operations. For further information regarding fuel and spark control operation you may refer to the "Fuel and Ignition" book.

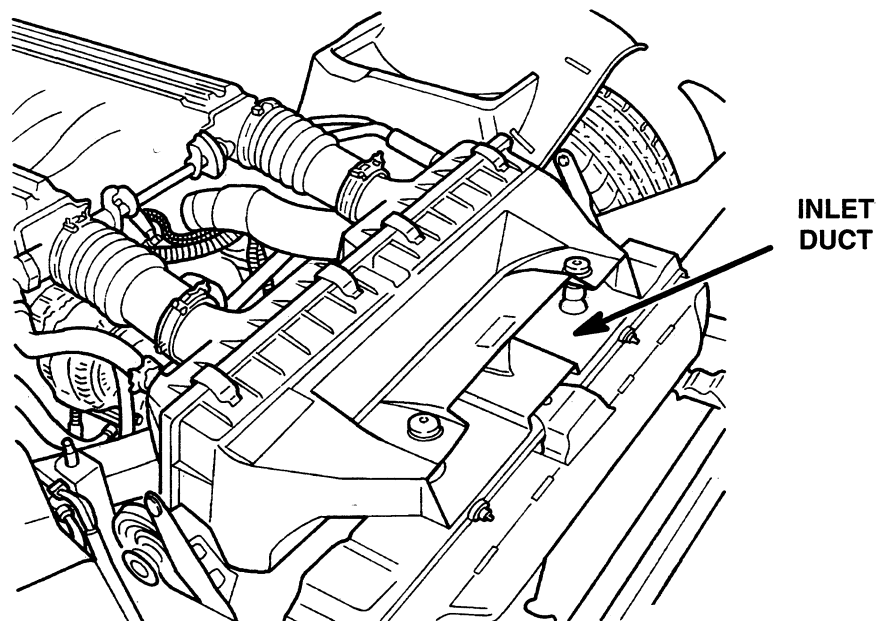
### *Air Cleaner*

The air cleaner assembly has been redesigned for the Coupe V-10 (fig. 13). This modified design draws air through the outside air duct versus above the radiator shroud.

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1996 ROADSTER



1996 COUPE

96001-124

Figure 13 Air Cleaner Assembly

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## Throttle Synchronization Shaft

A Throttle Synchronization Shaft has been incorporated into the throttle body assembly of the Coupe (fig. 14). The throttle cable controls the left side (driver's side) throttle plate and mechanical motion is transmitted to the opposite throttle plate through the synchronization shaft. This shaft is not an adjustable component. It is calibrated at the factory and is serviced as a replaceable component only.

The integration of this shaft resulted in the need to relocate the generator. The value of this design is that only one cable is required and motion of the accelerator cable is transmitted directly to both throttle plates with virtually no lost motion.

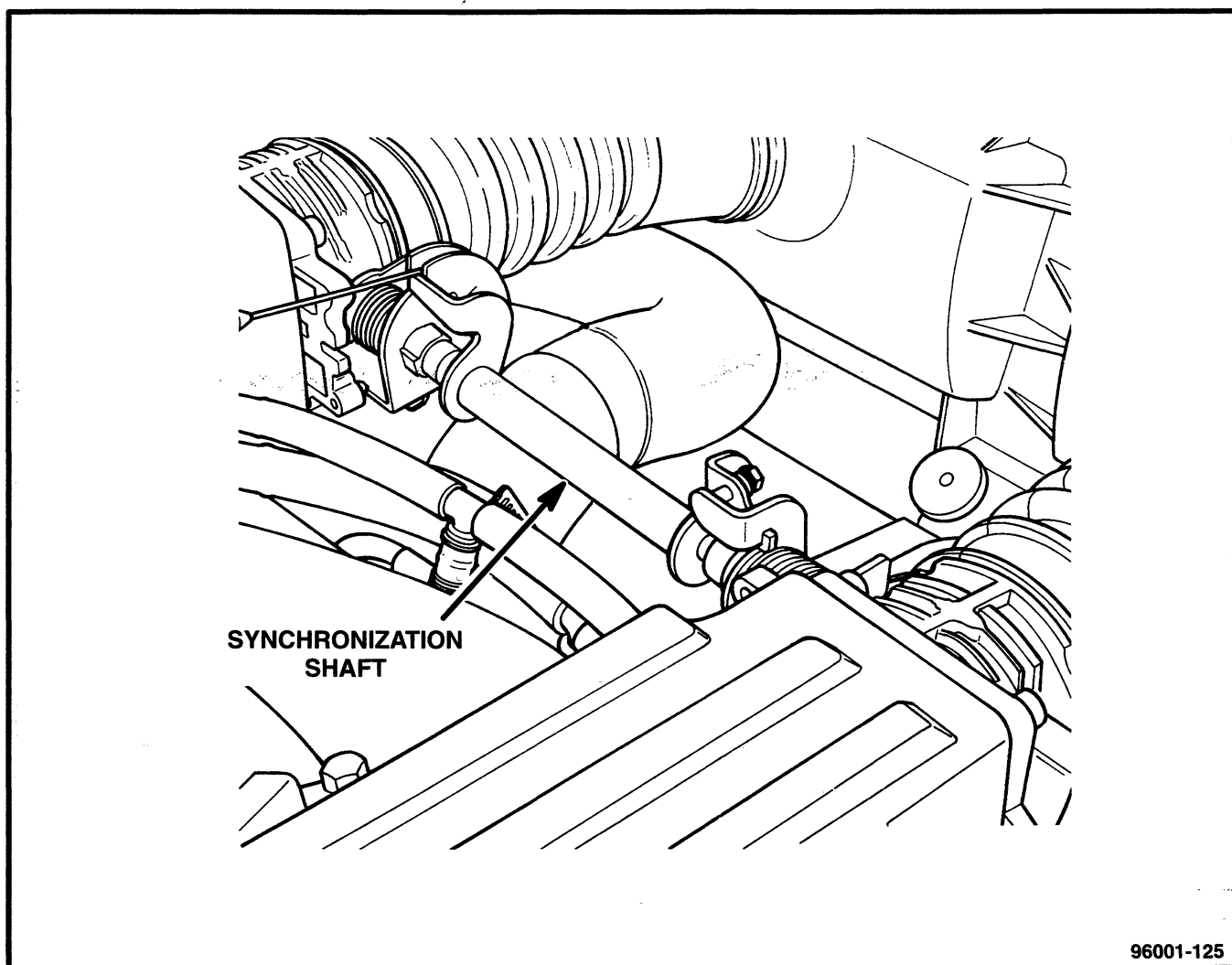


Figure 14 Throttle Synchronization Shaft



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## PCV Valve

The PCV Valve is relocated from the rear of the right cylinder head cover to the front of the engine, beside the thermostat housing (fig. 15).

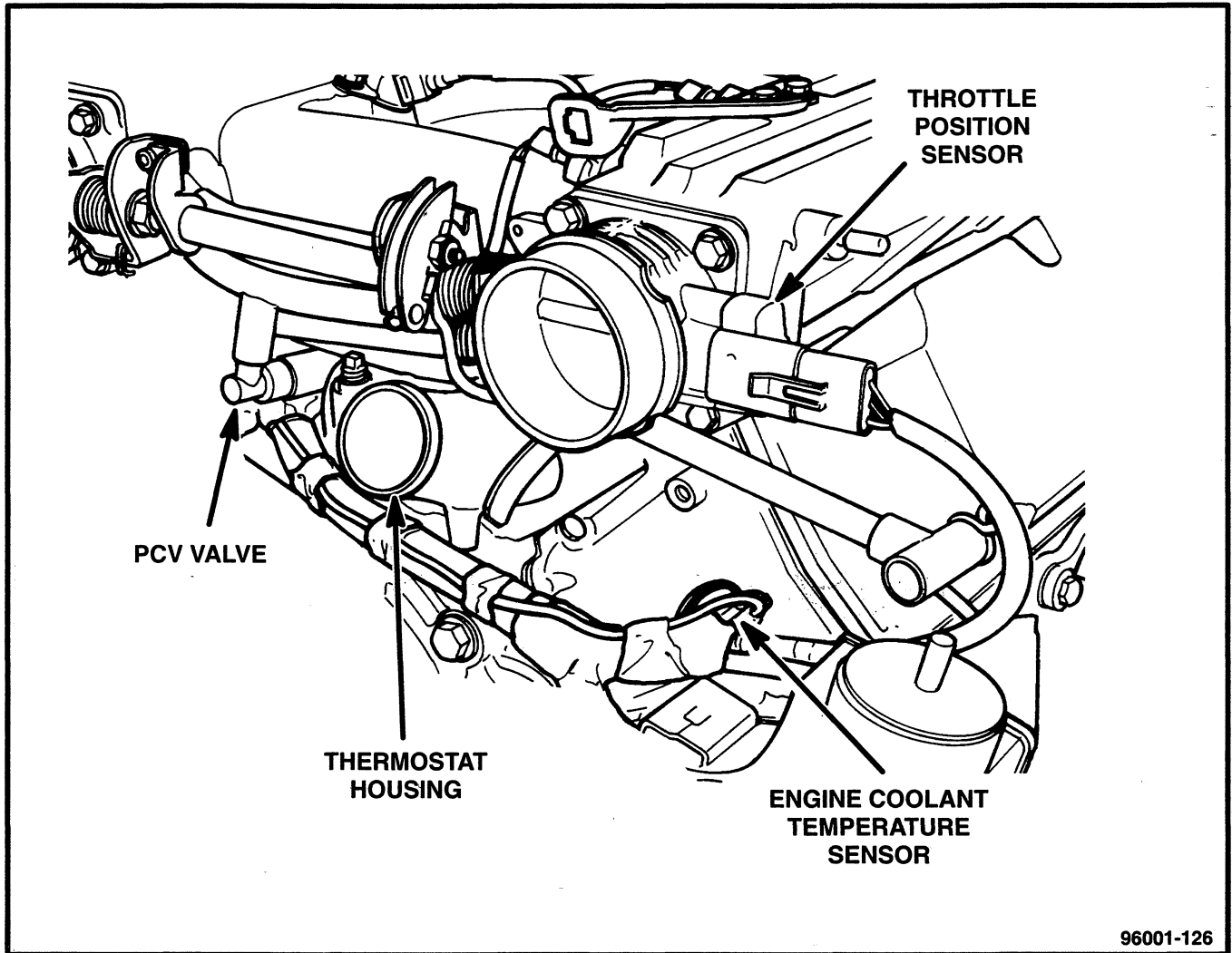


Figure 15 PCV Valve Location

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## Engine Coolant Temperature (ECT) Sensor

The Engine Coolant Temperature (ECT) Sensor is still located near the thermostat housing as before (fig. 16). The main difference is that the thermostat and housing have been moved to the front of the engine, and with it, the ECT. The ECT threads into the front of the driver's side cylinder head.

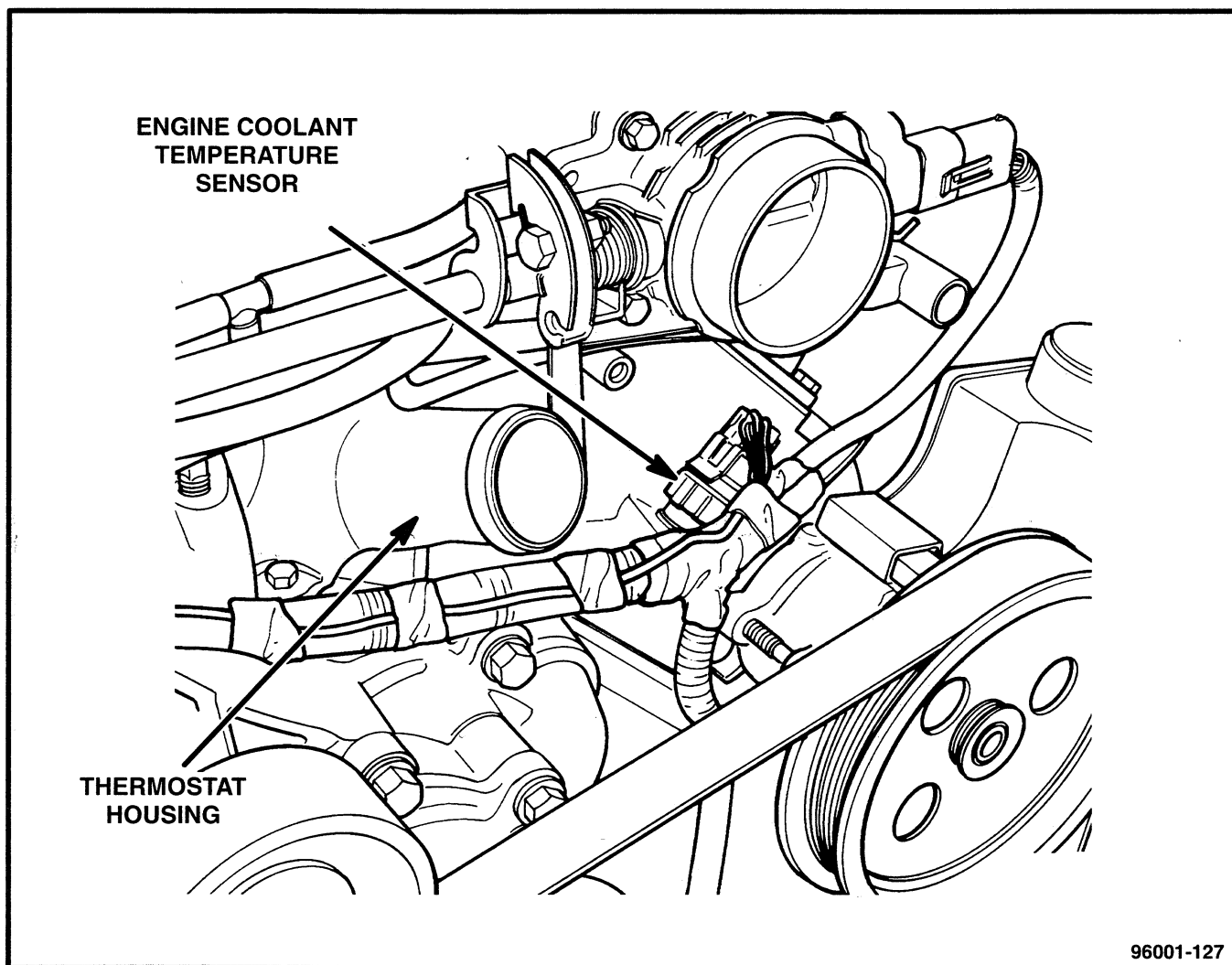


Figure 16 Engine Coolant Temperature (ECT) Sensor

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## Ignition Coil Packs

There are a few components that have been relocated from the rear of the engine block up to the front, as described previously. With the added room at the rear of the engine, it was possible to mount the ignition coil packs in a more accessible location (fig. 17). The coil packs are now mounted to a common bracket and are located higher and more towards the center of the engine.

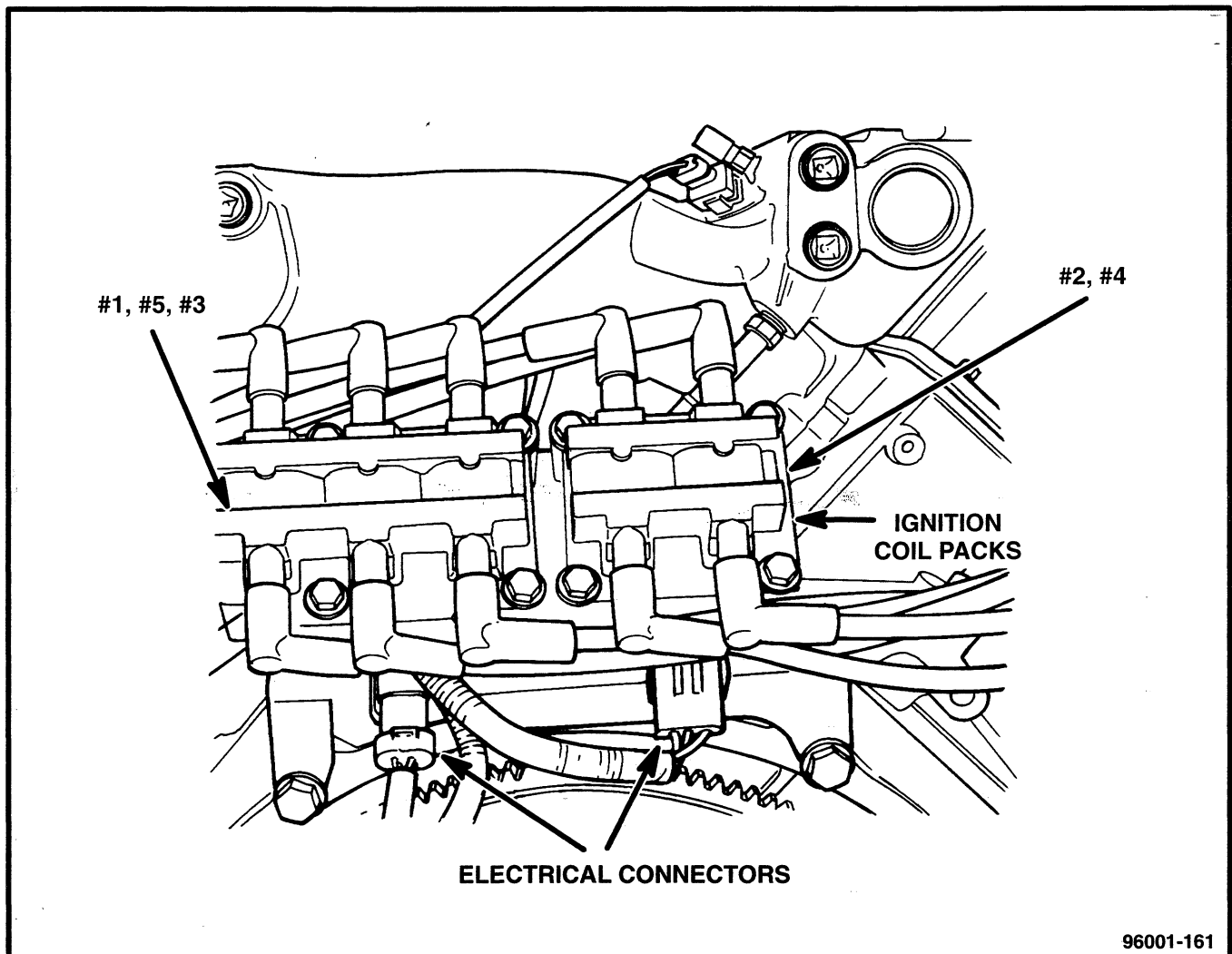


Figure 17 Ignition Coil Packs

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## ACTIVITY SIX IDENTIFYING V-10 ENGINE CHANGES

In this Activity, you will perform removal and installation procedures for various V-10 engine components and identify differences between the Coupe's engine and the Roadster. The class may be divided in two groups. In this case, one group will perform the Activity on one engine and the other group will perform the same procedures on the other engine. You will also find service "notes" throughout that should help identify some of the more subtle differences between the two engines. Following the outline below, in conjunction with the 1996 Viper Service Manuals for Roadster and Coupe, perform all the Tasks. As you progress through this Activity, answer all questions.

### Task One

For this Task, you will remove the Intake Manifold in order to get a better look at the PCV and Thermostat.

1. Refer to the 1996 Service Manual and begin the procedures outlined for Intake Manifold removal.
2. Which service procedure must you perform prior to beginning removal of the Intake Manifold?

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3. Which tools are required for this procedure?

---

---

4. Of all the components that you remove or disconnect, which one is attached to the Air Cleaner Assembly?

---

After completing the Intake Manifold removal procedures, you will be able to locate the PCV and Thermostat assemblies.

5. How is the PCV and Thermostat different on the Coupe compared to the Roadster?

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6. How does the PCV system attach to the engine block?

---

7. What is the Intake Manifold constructed of?

---

8. "The Intake Manifold is interchangeable between the Roadster and the Coupe."

TRUE

FALSE

9. Set all disassembled parts to the side and proceed to Task Two.

## Task Two:

For this Task, you will remove a cylinder head in order to get a good look at the pressed-in liners.

10. Refer to the Cylinder Head removal procedures in the Service Manual and perform the removal procedures. When finished, answer the following questions.

11. Are the head bolts the same size between the Coupe and Roadster?

YES

NO

A weight reduction of about 4 lbs. is achieved by using new bolts.

12. Are the torque procedures the same?

YES

NO

13. What is the maximum out-of-round specification for the cylinder bores?

---

If this specification is exceeded on the Coupe's engine, which procedure should you perform?

---

What tool is used to perform this procedure?

---

Cylinder liner kits are available for the Roadster V-10. The liners on the Roadster are serviceable components and deglazing or honing of the bores is not permitted.

14. Set all disassembled parts to the side and continue with Task Three.

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Task Three

For this Task, pull the Oil Pan and remove one of the Main Bearing Caps.

15. Refer to the Service Manual and perform the Oil Pan removal procedures.
  16. What is the engine oil capacity for the Coupe?
- 

17. Remove the baffle.

As described previously, the oil pick-up tube has been modified. The oil pan has an integral, cast-in passage that runs from the screen to the oil pump inlet.

18. Remove the Windage Tray.
  19. By looking at the main bearing caps, how are they different from previous designs?
- 

20. How many bolts are used for each Main Bearing Cap?
- 

Is this different from Roadster?

YES

NO

21. Perform the installation procedures for all parts removed.

The torque specification for the Intake Manifold bolts has been reduced from 200 in. lbs. on the Roadster, to 95 in. lbs. on the Coupe. Torque sequence is the same.

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