

Cooling System: Fundamentals and Basics

Causes of Overheating

CAUSES OF OVERHEATING

Overheating problems can be separated into 4 basic categories:

- Insufficient Air Flow
- Insufficient Coolant Flow
- Coolant Leaks
- Insufficient Cooling Capacity

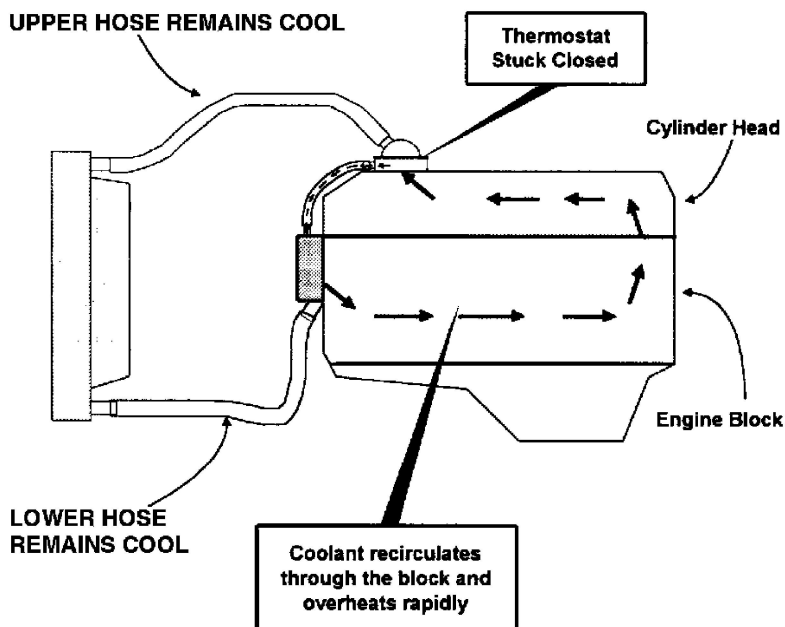
Insufficient Air Flow - To remove heat from the system, air flow must be drawn across the cooling fins of the radiator.

The cooling system utilizes two methods to provide air flow. While the vehicle is being driven down the road air is forced across the radiator by the speed of the vehicle. When the vehicle is stopped or at low speeds, a cooling fan is used to force air across the radiator.

Air Flow Problems

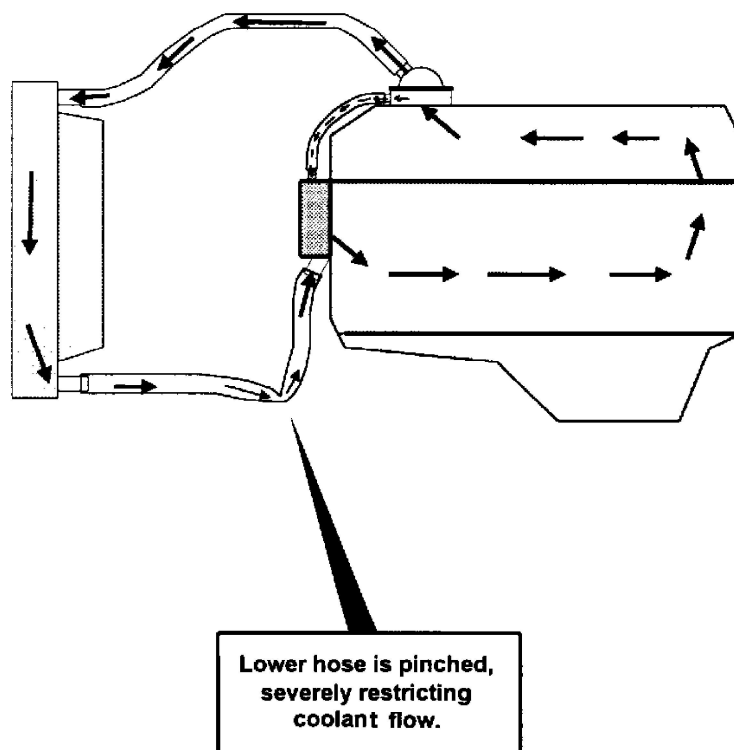
- Broken Fan Belt
- Fan Clutch Not Engaging
- Debris Blocking The Front Of The Radiator (bugs, leaves, and dirt) - Prevents air from flowing through the radiator
- Missing Cooling Fan Shroud - Allows air to flow around the radiator, rather than through.

Insufficient Coolant Flow - This can be the result of a blockage in the system or by a failure of the water pump.



Coolant Flow Problems

- **Thermostat Stuck Shut** - This completely stops all coolant flow through the radiator and results in rapid overheating.
- **Plugged Radiator** - Corrosion or sediment builds up inside the radiator coolant passages and reduces the amount of coolant flow through the radiator.

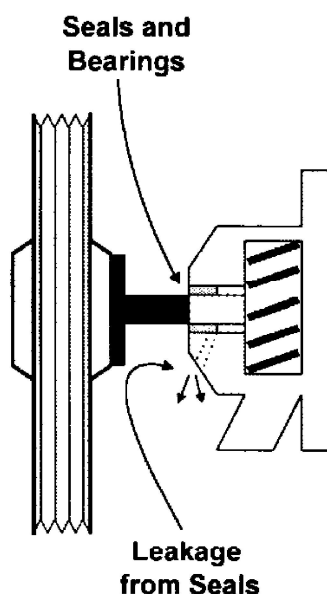


- **Pinched/Collapsed Coolant Hose** - A hose has been installed incorrectly resulting in a bend or fold that greatly reduces coolant flow.
- **Water Pump Belt Broken / Too Loose / Incorrectly routed** (serpentine only). A belt which is too loose or incorrectly routed may slip on the pulley, resulting in insufficient flow.
- **Water Pump Impeller Eroded** - The entire impeller may be come separated from the shaft or individual blades may become separated due severe corrosion.

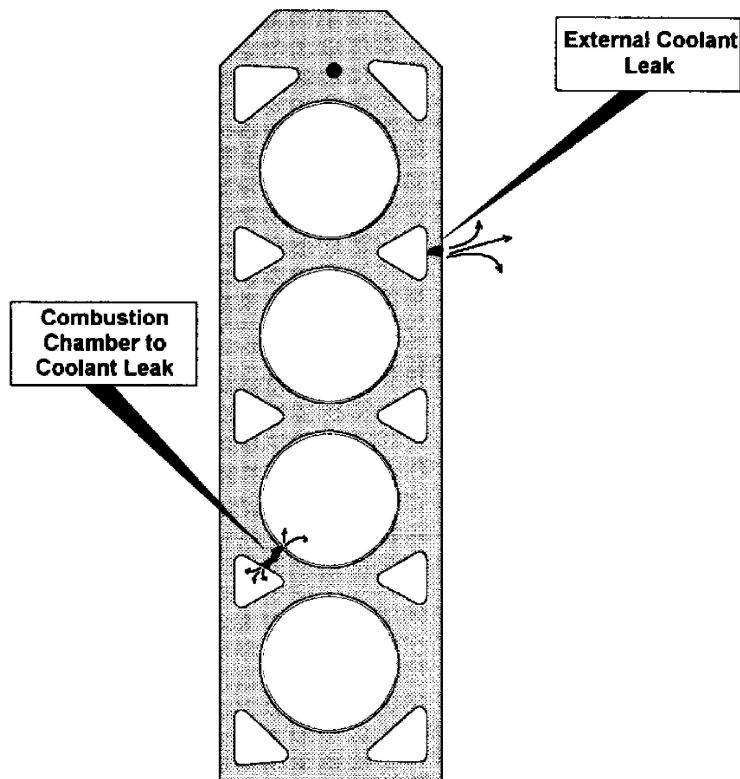
Coolant Leaks - Pockets of air/steam within the system, as a result of a leak, do not transfer heat as thoroughly as coolant and result in a reduced cooling system capacity.

Coolant Leak Problems

CAUTION: This drawing is meant to illustrate a principle and may not match the water on this vehicle.



- **Water Pump Shaft Seals** - As the pump ages, the shaft seal become worn allowing for leakage.
- **Coolant Hose Failure** - Hoses may fail as a result of age, oil contamination, over-pressure, or incorrect installation/removal techniques.
- **Radiator, Heater Core Leaks** - These are particularly fragile components, they may fail from corrosion or loose water box seals but are often damaged by accident or mistakes.

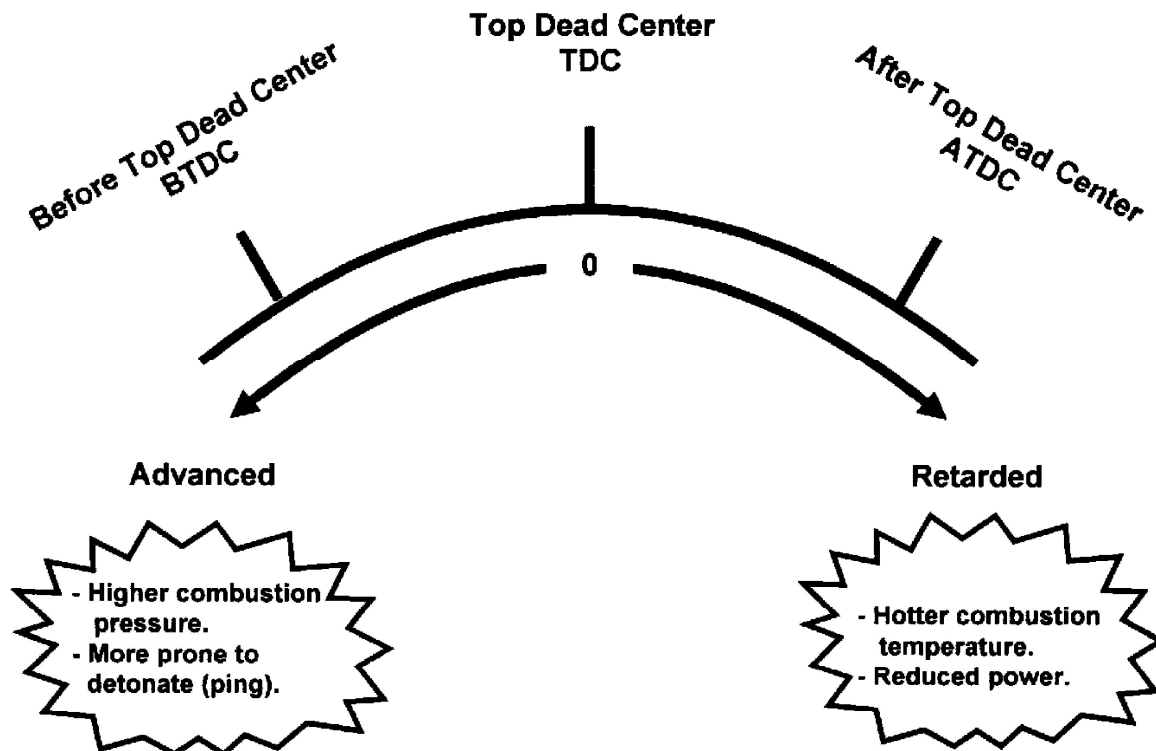


CAUTION: This drawing is meant to illustrate a principle and may not match the cylinder head on this vehicle.

- **Head Gasket Failures** - These not only result in a loss of coolant but may also result in heat from the piston exhaust stroke being injected directly into the cooling system. This may result in extremely rapid overheating conditions.
- **Internal Failures** - Cracked cylinder heads, cracked blocks. These leaks also result in engine oil contamination which may result in severe engine damage.

Insufficient Cooling System Capacity - This results when the heat removal requirements of the vehicle exceed the design capacity of the system.

System Capacity Problems



- **Retarded Ignition Timing** - This produces higher cylinder temperatures, resulting in increased heat removal requirements.

1996 Dodge Truck Caravan V6-201 3.3L

- **Add-on Coolers** - Turbo intercoolers, Transmission Coolers, Oil Coolers. The addition of extra coolers heats the incoming air before it passes through the radiator and reduces the total amount of air flow through the radiator.
- **Air Conditioning** - During periods of extreme engine load (climbing hills or towing) along with high temperatures, use of the A/C may exceed the capacity of the cooling system.

NOTE: The A/C system actually places two additional loads on the cooling system:

- A/C heat removal in the condenser (preheats incoming air before it reaches the radiator).
- Increased engine load from operating the compressor.