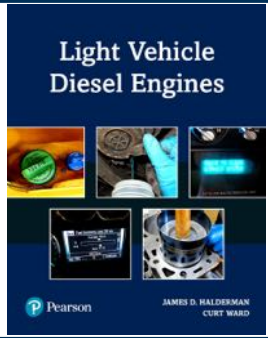


Light Vehicle Diesel Engines
First Edition



**Chapter 5
Diesel Engine
Cooling System**

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LEARNING OBJECTIVES (1 of 2)

- 5.1 Prepare for the Light Vehicle Diesel Engine (A9) ASE certification test content area "D" (Lubrication and Cooling Systems Diagnosis and Repair).
- 5.2 Discuss diesel engine cooling system operation.
- 5.3 Explain the purpose and function of the thermostat.
- 5.4 Discuss radiator design and construction.
- 5.5 Describe the purpose and function of water pumps.

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LEARNING OBJECTIVES (2 of 2)

- 5.5 Discuss cooling fans operation and diagnosis.
- 5.6 Describe cooling system diagnostic procedures.
- 5.7 Discuss coolant fundamentals.
- 5.8 Compare the different types of coolant.
- 5.9 Discuss coolant freezing/boiling temperatures.
- 5.10 Discuss coolant testing and replacement issues.

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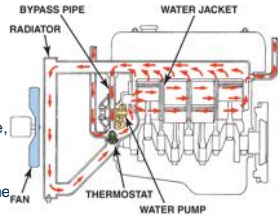
COOLING SYSTEMS (1 of 4)

• Cooling System

– Depends on design & operation of system

– Design based on

- Heat output, radiator size, coolant type, water pump size, fan type, thermostat, & pressure.
- Cooling system must allow engine to warm up
- To required operating temperature as rapidly
- As possible, maintain temperature



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QUESTION 1: ?

What is the purpose of the cooling system?

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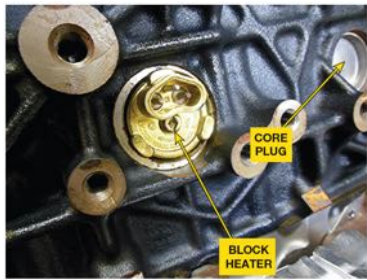
ANSWER 1:

The cooling system must allow the engine to warm up to the required operating temperature as rapidly as possible and then maintain that temperature.

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FIGURE 5-1 an engine block heater uses 110-volt AC household current to warm the coolant in the water jacket of this duramax V-8 diesel engine. The heater replaces a core plug in the side of the block.



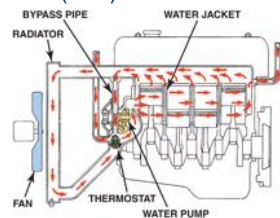
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COOLING SYSTEMS (2 of 4)

• Low-Temperature Engine Problems

- Temperature does not reach specified temperature
- Engine-related faults can occur
- P0128 diagnostic trouble code (DTC) can be set



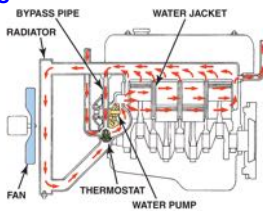
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COOLING SYSTEMS (3 of 4)

• High-Temperature Problems

- High temperatures oxidize engine oil producing
 - Hard carbon & varnish
 - Varnish causes lifters plungers to stick
- Cause oil to become thinner (lower viscosity)
 - Thinned oil gets into combustion chamber
 - Going past piston rings and through valve guides
 - Causing excessive oil consumption



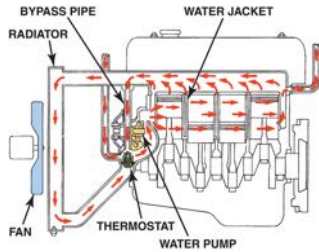
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COOLING SYSTEM OPERATION (4 of 4)

• Coolant Flows Through Engine

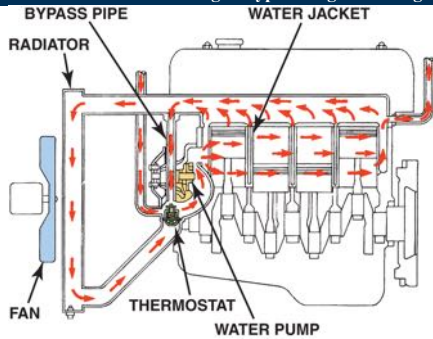
- Where it picks up heat
- It then flows to the radiator, where heat is given up to the outside air.
- Coolant continually recirculates through cooling system.



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FIGURE 5-2 Coolant flow through a typical engine cooling system..



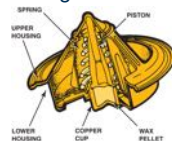
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THERMOSTATS (1 of 5)

• Controls Coolant Temperature

- Normal operating temperature range
- Between low-temperature & high-temperature.
- Thermostat controls minimum normal temperature
- Temperature-controlled valve
- Placed at engine coolant outlet on most engines



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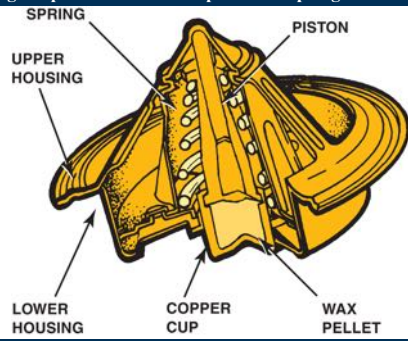
THERMOSTATS (2 of 5)

- **Thermostat Operation**
- **Thermostat Testing**
 - Overheated engine may result from faulty thermostat.
 - Engine does not get warm enough indicates bad thermostat.
- **Thermostat Replacement**

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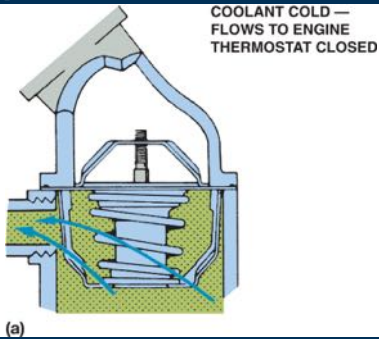
FIGURE 5-3 Cross section of a typical wax-actuated thermostat showing the position of the wax pellet and spring.



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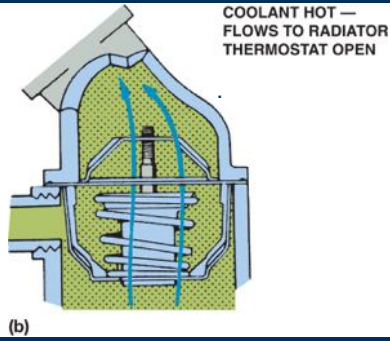
FIGURE 5-4A When the engine is cold, the coolant flows through the bypass.



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FIGURE 5-4B When the thermostat opens, the coolant can flow to the radiator



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CHART 5-1

THERMOSTAT TEMPERATURE RATING	STARTS TO OPEN	FULLY OPEN
180°F	180°F	200°F
195°F	195°F	215°F

CHART 14-1

The temperature of the coolant depends on the rating of the thermostat.

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FIGURE 5-5 thermostat stuck in the open position caused the engine to operate too cold. If a thermostat is stuck closed, this can cause the engine to overheat.



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QUESTION 2: ?

What happens when the thermostat is stuck open?

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ANSWER 2:

A thermostat stuck in the open position caused the engine to operate too cold. If a thermostat is stuck closed, this can cause the engine to overheat.

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THERMOSTATS (3 of 5)

• Electronic Thermostats

- Wax pellet to open, Spring to close it
- Uses electric heater controlled by PCM
- TO accurately control coolant temperature
- If radiator, water pump, & coolant passages
- Functioning correctly, be operating within
- Opening & fully open range of thermostat

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THERMOSTATS (4 of 5)

NOTE: A BYPASS around closed thermostat allows a small part of coolant to circulate within engine, past thermostat during warm-up. It is a small passage that leads from engine side of thermostat to inlet side of water pump. It allows some coolant to bypass thermostat even when thermostat is open. Bypass opening may be cast or drilled into engine and/or water pump parts.

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THERMOSTATS (5 of 5)

• Thermostat Testing

- 2 methods used
 - **Scan Tool Method**
 - Read actual temperature of coolant from ECT sensor.
 - Indicate what computer "thinks" is coolant temperature
 - **Infrared Thermometer Method**
 - Infrared thermometer to measure temperature of coolant near thermostat
 - Engine side of thermostat should be at highest temperature

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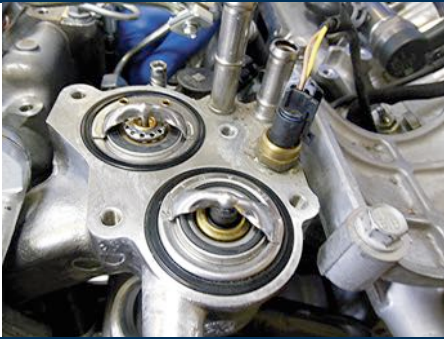
FIGURE 5-6 Scan tool can be used to monitor the engine coolant temperature (ECT).

Engine Data			Esc
Engine Speed	603	RPM	Decrease
Desired Idle Speed	600	RPM	
ECT Sensor	194	°F	Increase
IAT Sensor 1	143	°F	
IAT Sensor 2	158	°F	Pg Up
Ambient Air Temperature	-36	°F	
Cold Start-Up	No		Pg Dn
MAF Sensor	0.01	lb/s	
Engine Load	14.5	%	
Accelerator Pedal Position	0	%	
Throttle Position	4	%	

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FIGURE 5-7 Some diesel engines, such as this Duramax, use 2 thermostats that have slightly different temperature ratings so caution should be used to install the specified thermostat in the correct position.



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THERMOSTATS (1 of 1)

• Thermostat Replacement

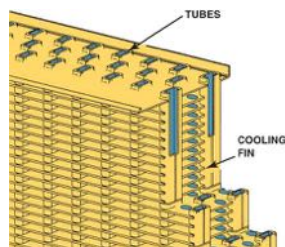
- Coolant drained from radiator drain petcock
- Lower coolant level below thermostat
- Not necessary to completely drain system
- Hose removed from thermostat housing neck
- Housing removed to expose thermostat

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RADIATORS (1 of 1)

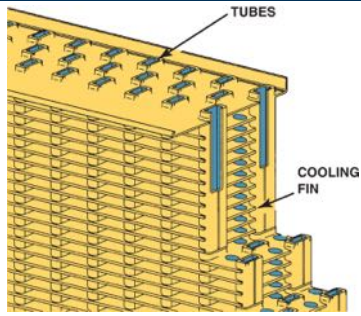
• Types

- Two types of radiator cores in common use in most vehicles are:
 - Serpentine fin core
 - Plate fin core



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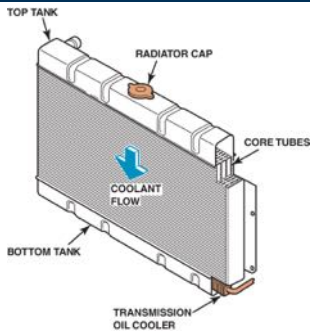
FIGURE 5-8 The tubes and fins of the radiator core.



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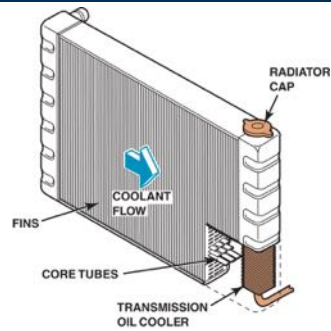
FIGURE 5-9A A radiator may be either a down-flow or a cross-flow type.



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FIGURE 5-9B A radiator may be either a down-flow or a cross-flow type.

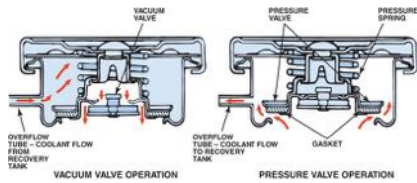


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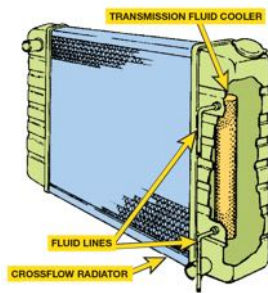
PRESSURE CAPS (1 of 1)

- Operation
- Functions
- Metric Radiator Caps



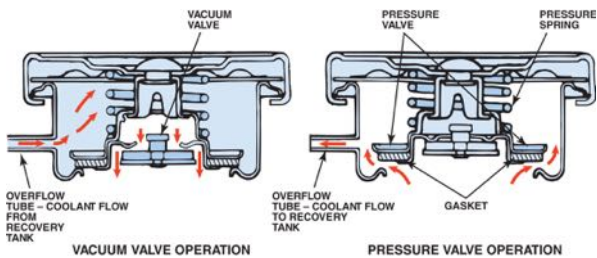
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FIGURE 5-10 Many vehicles equipped with an automatic transmission use a transmission fluid cooler installed in one of the radiator tanks



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FIGURE 5-11 The pressure valve maintains the system pressure and allows excess pressure to vent. The vacuum valve allows coolant to return to the system from the recovery tank.



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QUESTION 3: ?

What does the vacuum valve in the radiator pressure cap do?

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ANSWER 3:

The vacuum valve allows coolant to return to the system from the recovery tank.

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What Does the 1.1 on Radiator Cap Mean?



FREQUENTLY ASKED QUESTION

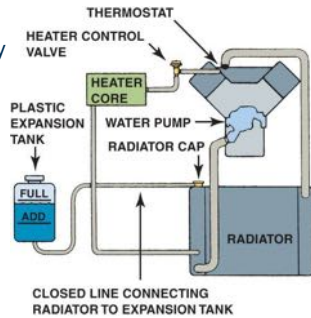
Most original equipment radiator caps are rated at 14 to 16 PSI (97 to 110 kPa). However, some vehicles manufactured in Japan or Europe use radiator pressure indicated in a unit called a bar. One bar is pressure of atmosphere at sea level, or about 14.7 PSI. When replacing a radiator cap, make certain it matches pressure rating of the original. Therefore, a 1.1 rating is a cap that is rated at 16 PSI (14.7 PSI * 1.1 * 16 PSI).

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COOLANT RECOVERY SYSTEMS (1 of 2)

- Purpose and Function
 - Excess pressure usually forces some coolant from system through an overflow.
 - Most cooling systems connect overflow to plastic reservoir to hold excess coolant while system is hot

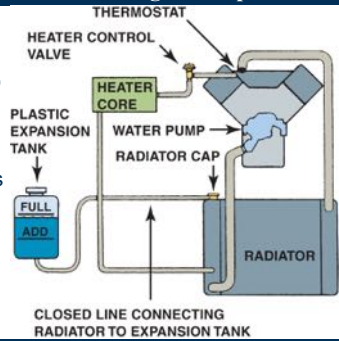


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FIGURE 5-12 The level in the coolant recovery system raises and lowers with engine temperature.

- Surge Tank
 - Smaller bleed hose attaches to side of surge Tank to highest point of radiator.
 - Bleed line allows Some coolant circulation through surge tank



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FIGURE 5-13 Some vehicles, such as this FORD F-250 pickup truck equipped with a 6.7 liter power stroke diesel engine, use an expansion tank, which is located at the highest level of the cooling system.



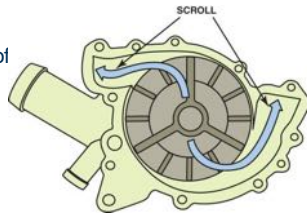
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WATER PUMPS (1 of 3)

• Water Pump

- (also called a coolant pump) driven by one of 2 methods.
- Crankshaft belt
- Camshaft



• Water Pump Service

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FIGURE 5–14 Water pump from front of Cummins 6.7 liter diesel engine.



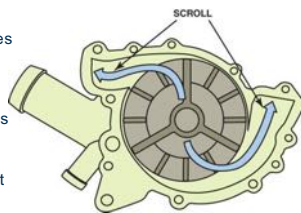
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WATER PUMPS (2 of 3)

• Water Pump Operation

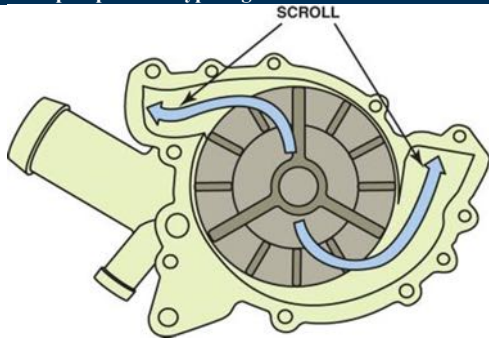
- Low-temperature coolant leaves radiator by bottom outlet
- Pumped into warm engine block, where it picks up heat
- From block, warm coolant flows to hot cylinder head, where it picks up more heat
 - NOT positive displacement pumps
 - Centrifugal pump that can move a large volume of coolant without increasing pressure of coolant



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FIGURE 5-15 Coolant flow through the impeller and scroll of a coolant pump for a V-type engine.



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FIGURE 5-16 bleed weep hole in the water pump allows coolant to leak out of the pump and not be forced into the bearing. If the bearing failed, more serious damage could result.



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WATER PUMPS (3 of 3)

• Water Pump Service

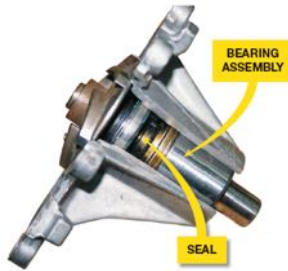
- Worn impeller can reduce coolant flow
- Seal fails, coolant will leak out of weep hole
- Bearing defective, pump will be noisy
 - Before replacing water pump
 - Due to loose or noisy bearing, check:
 - 1. Drive belt tension
 - 2. Bent fan
 - 3. Fan for balance



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FIGURE 5-17 cutaway of a typical water pump showing the long bearing assembly and seal. The weep hole is located between seal and the bearing. If seal fails, then coolant flows out of weep hole to prevent coolant from damaging bearing.



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COOLING FANS (1 of 1)

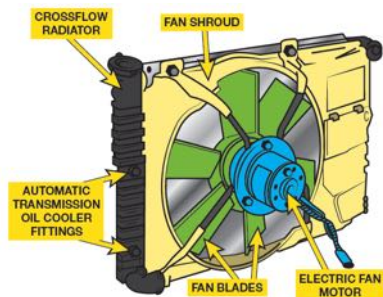
- Electronically Controlled Cooling Fan
- Thermostatic Fans
 - Silicone coupling
 - Thermostatic spring

NOTE: When diagnosing an overheating problem, look carefully at the cooling fan. If silicone is leaking, then the fan may not be able to function correctly and should be replaced.

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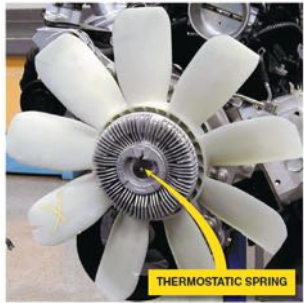
FIGURE 5-18 typical electric cooling fan assembly showing the radiator and related components.



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FIGURE 5-19 A typical engine-driven thermostatic spring cooling fan.



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COOLING SYSTEM TESTING (1 of 4)

• Visual Inspection

- Items that can be inspected visually include:
 - Water pump drive belt for tension or faults
 - Cooling fan for faults
 - Heater & radiator hoses for condition/leaks
 - Coolant overflow or surge tank coolant level
 - Evidence of coolant loss
 - Radiator condition

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FIGURE 5-20 A heavily corroded radiator from a vehicle that was overheating. Visual inspection discovered that corrosion had eaten away many of cooling fins, yet did not leak. This radiator was replaced and it solved the overheating problem.



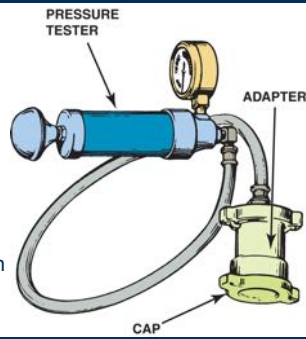
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COOLING SYSTEM TESTING (2 of 4)

• Pressure Testing

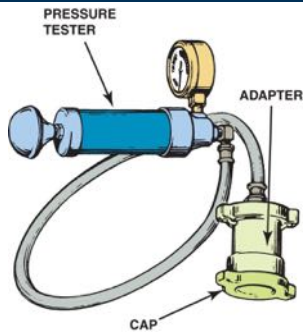
- Hand-operated pressure tester quick and easy cooling system test.
- Radiator cap removed (engine cold!), tester attached in place of radiator cap.
- By operating plunger on pump, entire cooling system is pressurized



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FIGURE 5-21 pressure cap should be checked for proper operation using a pressure tester as part of the cooling system diagnosis.



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COOLING SYSTEM TESTING (3 of 4)

- If pressure drops, look for evidence of leaks
 - 1. Heater hoses
 - 2. Radiator hoses
 - 3. Radiator
 - 4. Heater core
 - 5. Cylinder head
 - 6. Core plugs in side of block or cylinder head

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QUESTION 4: ?

What does the cooling system pressure tester do?

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ANSWER 4:

A typical hand-operated pressure tester applies pressure equal to radiator cap pressure. The pressure should hold; if it drops, this indicates a leak somewhere in cooling system. An adapter is used to attach the pump to cap to determine if radiator can hold pressure, and release it when pressure rises above its maximum rated pressure setting.

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COOLING SYSTEM TESTING (4 of 4)

• Best methods to check for a coolant leak

- Use a fluorescent dye in the coolant
- Specifically designed for coolant
- Operate vehicle with dye in coolant
- Engine reaches normal operating temperature.
- Use black light to inspect cooling system.
- When there is a leak, it will be easy to spot
- Dye in coolant seen as bright green



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FIGURE 5–22 Use dye specifically made for coolant when checking for leaks using a black light.



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COOLANT TEMPERATURE WARNING LIGHT (1 of 2)

• **Purpose and Function**

- Most vehicles equipped with heat sensor
- For engine operating temperature indicator light
- Warning light comes on during driving
 - (or temperature gauge goes into red danger zone)
- Coolant temperature is 250°F to 258°F (120°C to 126°C).
- This is still below boiling point of coolant
 - (assuming properly operating pressure cap and system).

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COOLANT TEMPERATURE WARNING LIGHT (2 of 2)

• **Precautions: Page 61**

• **Common Causes of Overheating**

- 1. Low coolant level
- 2. Dirty radiator, external debris blocking airflow
- 3. Plugged or blocked radiator
- 4. Defective fan clutch or electric fan
- 5. Low engine oil level
- 6. Broken fan drive belt
- 7. Defective radiator cap
- 8. Frozen coolant (in freezing weather)
- 9. Defective thermostat
- 10. Defective water pump
- 11. Blocked cooling passages in block or cylinder head(s)

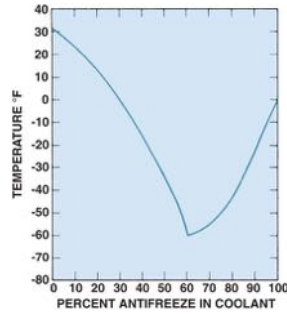
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COOLANT (1 of 4)

• **Coolant Purpose:**

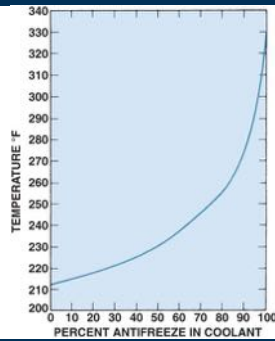
- Transfers heat from engine to radiator
- Protects engine & cooling system from rust & corrosion
- Prevents freezing in cold climates



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FIGURE 5-24 Graph showing the relationship of the freezing point of the coolant to the percentage of antifreeze used in the coolant.

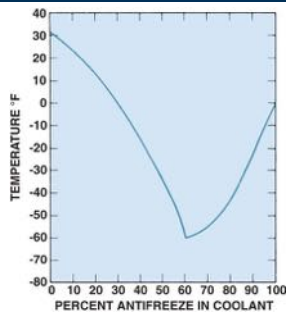


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COOLANT (2 of 4)

- Freezing point increases
- As antifreeze concentration > 60%
- Normal mixture is 50% antifreeze 50% water
- Ethylene glycol antifreeze contains:
 - Anticorrosion additives
 - Rust inhibitors
 - Water pump lubricants

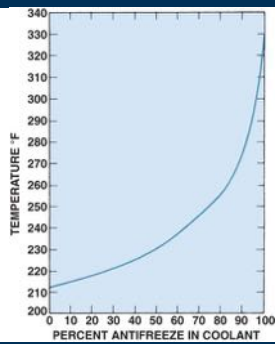


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COOLANT (3 of 4)

- Maximum level of protection
- 60% Ethylene glycol absorbs 85% as much heat as water
- Ethylene glycol based antifreeze
 - Has higher boiling point than water
- Graph shows boiling point of coolant increases as % of antifreeze increases
 - Coolant boils, it vaporizes & does not act as cooling agent
 - Because it is not in liquid form or in contact with cooling surfaces.



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QUESTION 5: ?

What is the difference between freezing & boiling point?

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ANSWER 5:

Freezing point: liquid to solid; increases as antifreeze concentration increases above 60%.

Boiling point: liquid turns to a vapor. Coolant boiling point increases as % of antifreeze increases. If coolant boils, it vaporizes & does not act as a cooling agent because it is not in liquid form or in contact with cooling surfaces.

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QUESTION 6: ?

How is the freezing temperature of coolant tested?

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ANSWER 6:

- The freezing temperature of the coolant can be tested using a hydrometer or refractometer..

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COOLANT (4 of 4)

- All manufacturers recommend use of ethylene glycol based coolant, which contains:
 - Ethylene glycol: 47%
 - Water: 50%
 - Additives: 3%



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TYPES OF COOLANT (1 of 6)

- **Inorganic Acid Technology (IAT)**
 - Conventional green antifreeze:
 - Sodium silicate (silicates)
 - Phosphates
 - Borates
- **Organic Acid Technology (OAT)**
 - Does not contain silicates/phosphates
 - **Orange** color
 - **ANSWER** First:
 - **GM DEX-COOL**



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FIGURE 5–25 Havoline was the first company to make and market OAT coolant. General Motors uses the term DEX-COOL.



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TYPES OF COOLANT (2 of 6)

- **Hybrid Organic Acid Technology (HOAT)**
 - Similar to OAT
 - Uses organic acid salts
 - pH above 11
 - Water pump non-abrasive
 - green, orange, yellow, gold, pink, red, or blue



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QUESTION 7: ?

Who was the first vehicle manufacturer to use **DEX-COOL**?

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ANSWER 7:

- **General Motors**

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What is Pet Friendly Antifreeze

? FREQUENTLY ASKED QUESTION

What is "Pet Friendly" Antifreeze?
 Conventional ethylene glycol antifreeze used by all vehicle manufacturers is attractive to pets and animals because it has a sweet taste. Ethylene glycol is toxic to any animal if swallowed, so any spill should be cleaned up quickly. There are two types of coolant that are safer for use around pets than the conventional type.

- **Propylene glycol (PG).** This type of antifreeze is less attractive to pets and animals because it is not as sweet, but it is still harmful if swallowed. This type of coolant, including the Sierra brand, should not be mixed with any other ethylene glycol based coolant.

CAUTION: Some vehicle manufacturers do not recommend the use of propylene glycol coolant. Check the recommendations in the owner manual or service information before using it in a vehicle.

- **Embittered coolant.** This coolant has a small amount of a substance that makes it taste bitter and therefore not appealing to animals. The embittering agent used in ethylene glycol (EG) antifreeze is usually diatomaceous boraxite, added at the rate of 33 PPM. Oregon and California require all coolant sold in those states since 2004 to be embittered. **SEE FIGURE 3-6.**

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Figure 5-26 Not all embittered coolant is labeled embittered.



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Why Use Premixed Coolant When Water is So Cheap? (1 of 2)



FREQUENTLY ASKED QUESTION

Water makes up for half of the coolant and can have an effect on the corrosion protection of coolant due to variations in its quality, which is often unknown. Main reason why premixed coolant is often recommended by vehicle manufacturers is because it can control the following:

1. Water/coolant ratio

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Why Use Premixed Coolant When Water is So Cheap? (2 of 2)



FREQUENTLY ASKED QUESTION

2. Quality of water can be controlled. Tap water could and **does have** chemicals or impurities that can cause problems in an engine if used with the coolant. These chemical and impurities include **Chlorine, Fluorine, Iron (rust), Lead, Nitrates** Even though premix coolant is more expensive, what is an engine worth? Also consider that coolant is only replaced after many years, miles, or hundreds of hours of operation. This makes the difference in price between premix and non-pre-mix coolant a minor issue.

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TYPES OF COOLANT (3 of 6)

- Water is about 1/2 of coolant
 - Used because of following qualities.
 - Inexpensive
 - Efficient heat exchange fluid
 - Due to excellent thermal conductivity
 - Good specific heat capacity
 - Takes more heat energy to increase temperature,
 - Versus one with low specific heat capacity.
 - Boiling point is 212°F (100°C) (at sea level)
 - Freezing point is 32°F (0°C)



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TYPES OF COOLANT (4 of 6)

- Freezing Point
 - Pure water
 - 32°F (0°C)
 - Pure antifreeze*
 - 0°F (-18°C)
 - 50/50 mixture
 - - 34°F (-37°C)
 - 70% antifreeze/30% water
 - - 84°F (-64°C)



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TYPES OF COOLANT (5 of 6)

- Boiling Point at Sea Level
 - Pure water
 - 212°F (100°C)
 - 50/50 mixture
 - 218°F (103°C)
 - 70/30 mixture
 - 225°F (107°C)



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TYPES OF COOLANT (6 of 6)

- Boiling Point with 15 PSI Pressure
 - Pure water
 - 257°F (125°C)
 - 50/50 mixture
 - 265°F (130°C)
 - 70/30 mixture
 - 276°F (136°C)



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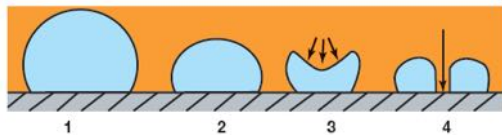
QUESTION 8: ?

Why is a 50/50 mixture of antifreeze and water commonly used as a coolant?

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FIGURE 5-27 (1) Cavitation starts when bubble is created by slight movement of cylinder wall causing low pressure area. (2) When cylinder wall moves outward during power stroke, bubble starts reducing due to increased pressure being exerted on it. (3) bubble begins collapsing. (4) When bubble collapses, coolant forced against side of cylinder wall with enough force to erode surface of cooling jacket.



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ANSWER 8



FREQUENTLY ASKED QUESTION

Why Is Most Coolant 50/50 with Water?

According to the freezing point, it appears that the lowest freezing point of coolant is achieved when 70% antifreeze is used with 30% water. While the freezing temperature is lower, the high concentrate of anti-freeze reduces the heat transferability of the coolant. Therefore, most vehicle manufacturers specify a 50/50 mixture of antifreeze and water to achieve the best balance between freeze protection and heat conductivity.

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COOLANT TESTING (1 of 5)

• Normal Coolant Tests:

- Visual inspection
 - Coolant should be clean and bright.
- Freeze/boiling point
 - high freezing point or Low boiling point indicates dilution (too much water)
- pH:
 - Wrong pH indicates buffer loss (>11)
 - Used to help maintain the pH level
- Coolant voltage.
 - High voltage indicates wrong pH
 - Or stray current flow



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COOLANT TESTING (2 of 5)

- Test Strip Testing
- Refractometer
- Ph
- Galvanic Activity
- Electrolysis
- Testing For Galvanic Activity And Electrolysis



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FIGURE 5-28 Test strip can be used to determine pH and percentage of glycol of coolant. Percentage of glycol determines freezing and boiling temperatures, as shown on bottle that contains test strips.



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TECH TIP: Ignore the Wind Chill Factor

TECH TIP

Ignore the Wind Chill Factor

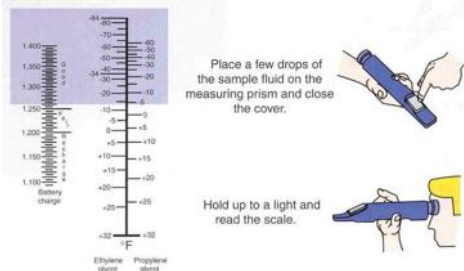
The wind chill factor is a temperature that combines the actual temperature and the wind speed to determine the overall heat loss effect on open skin. Because it is the heat loss factor for open skin, the wind chill temperature is *not* to be considered when determining antifreeze protection levels.

Although moving air makes it feel colder, the actual temperature is not changed by the wind, and the engine coolant will not be affected by the wind chill. If you are not convinced, try placing a thermometer in a room and wait until a stable reading is obtained. Now turn on a fan and have the air blow across the thermometer. The temperature will not change.

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FIGURE 5-29 Using a refractometer is an accurate method to check the freezing point of coolant.



Refractometer measures extent to which light is bent (refracted) to determine index of refraction of liquid sample..

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COOLANT TESTING: (3 of 5)

• pH

- French meaning "power of hydrogen"
 - Measure of acidity/alkalinity
 - <7 pH is considered acidic
 - >7 pH is considered alkaline
- pH varies according to coolant type
 - pH values for new coolant include:
 - IAT: 9 to 10.5 new
 - OAT: 7.5 to 8.5 new (G30 and G34 designations)
 - HOAT: 7.5 to 8.5 new (G05, G48, G11, or G12 designation)
 - PHOAT: 7.5 to 8.5 new



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FIGURE 5-30 meter that measures actual pH of coolant can be used for all coolants, unlike many test stripes that cannot be used to test the pH of red or orange coolants.

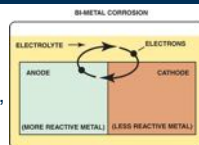


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COOLANT TESTING: (4 of 5)

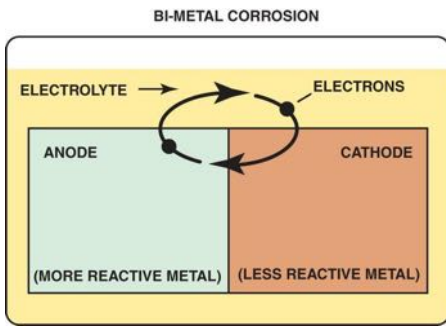
• Galvanic Activity

- **Flow** of electrical current
- Result of 2 different metals in liquid,
- Acts like a battery
 - Does not require outside voltage
- 2 different metals
 - Iron and aluminum
 - Become plates of battery
 - Coolant is electrolyte
 - Higher conductivity greater the corrosion



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FIGURE 5-31 Galvanic activity is created by 2 dissimilar metals in contact with a liquid, in this case coolant.



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COOLANT TESTING: (5 of 5)

• Electrolysis

- Requires an outside voltage source
- Source is usually a poor electrical ground
 - Electrical flow through cooling system may cause
 - Metal to flow into coolant
 - Metal transfer can eat holes in heater core/radiator
 - Electrolysis holes start from inside
 - Have a dark coloration

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QUESTION 9: ?

What is the difference between galvanic activity and electrolysis?

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ANSWER 9:

- **Galvanic activity** is flow of an electrical current as a result of 2 different metals in a liquid, which acts like a battery. **Galvanic activity does not require an outside source of voltage.**
- **Electrolysis** requires the use of an outside voltage source. The source is usually due to a poor electrical ground connection.

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COOLANT REPLACEMENT ISSUES: (1 of 3)

• Intervals

- Replaced by vehicle manufacturer's interval.
 - OAT/ HOAT: 5 years or 150,000 miles
 - Japanese brand 3 years or 36,000 miles
 - Coolant changed from a long life to IAT coolant
- Replacement interval
 - Every 2 years or 24,000 miles



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COOLANT REPLACEMENT ISSUES: (2 of 3)

• Passivation

- Chemical reaction between coolant additives
- And metal it protects
- **Chemical Barrier**
 - Created between coolant & metals of the engine
 - Passivation can take from a few days to a few weeks.
- Most experts
 - For best results do not change types of coolants.
 - Always use what vehicle manufacturer recommends.
 - Always check service information for coolant
 - And replacement interval



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COOLANT REPLACEMENT ISSUES: (3 of 3)

- Recycling Coolant
 - Coolant (antifreeze and water) should be recycled
 - **Caution: Most vehicle manufacturers warn that coolant should not be reused unless it is recycled and the acids restored.**



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Summary (1 of 2)

- Purpose and function of the cooling system is to maintain proper engine operating temperature.
- Thermostat controls engine coolant temperature by opening at its rated opening temperature to allow coolant to flow through the radiator.
- Coolant fans are designed to draw air through the radiator to aid in heat transfer process, drawing heat from coolant and transferring it to outside air through the radiator.
- The cooling system should be tested for leaks using a hand-operated pressure pump.

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Summary (2 of 2)

- Water pumps are usually engine driven and circulate coolant through the engine and the radiator when the thermostat opens.
- Coolant flows through the radiator hoses to and from the engine and through heater hoses to send heated coolant to the heater core in the passenger compartment.
- All coolants are ethylene glycol-based. Some aftermarket coolants use propylene glycol.
- The freezing temperature of the coolant can be tested using a hydrometer or refractometer.

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