

Name: \_\_\_\_\_ Date: \_\_\_\_\_  
Instructor: \_\_\_\_\_ Period: \_\_\_\_\_

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## Cooling System Fundamentals



**Objective:** After studying this chapter, you will be able to describe the operation of a modern automotive cooling system.

1. List the functions of a typical **cooling system**:

A. \_\_\_\_\_  
B. \_\_\_\_\_  
C. \_\_\_\_\_  
D. \_\_\_\_\_

### **Cooling System Functions**

2. What are the advantages of rapid engine warm-up? \_\_\_\_\_

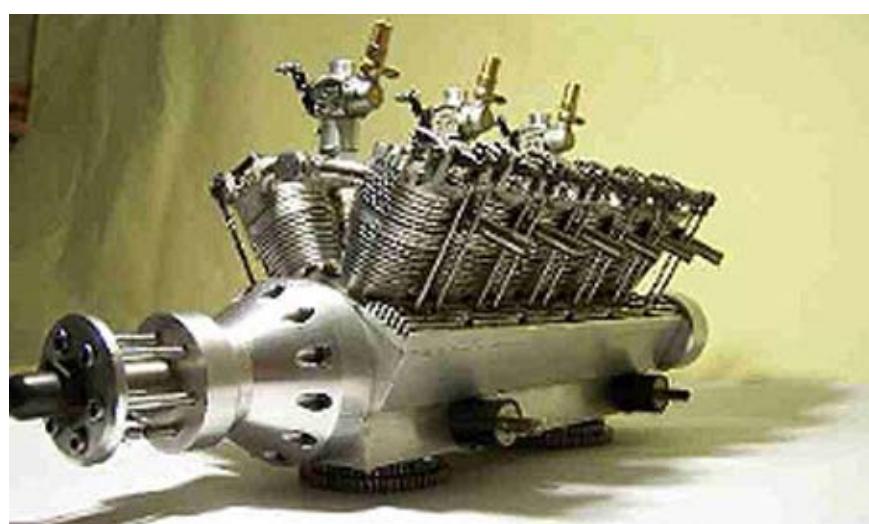
3. What are the advantages of maintaining proper operating temperature? \_\_\_\_\_  
\_\_\_\_\_

4. A typical automobile engine operates from \_\_\_\_\_ to \_\_\_\_\_ degrees Fahrenheit.

5. What is the biggest disadvantage of **not** removing excess heat from the engine? \_\_\_\_\_

6. What is the typical combustion flame temperature? \_\_\_\_\_

7. What cooling system components are missing from this **air-cooled** engine?  
\_\_\_\_\_ and \_\_\_\_\_



8. What would be used to direct air-flow onto and around the cylinder fins of the engine shown in #7? \_\_\_\_\_

9. List and describe **four (4)** advantages of a **liquid cooled** engine over air cooled:

- A. \_\_\_\_\_  
B. \_\_\_\_\_  
C. \_\_\_\_\_  
D. \_\_\_\_\_

10. When is **reverse cooling** more advantageous than conventional liquid cooling:

\_\_\_\_\_

## **Basic Cooling System**

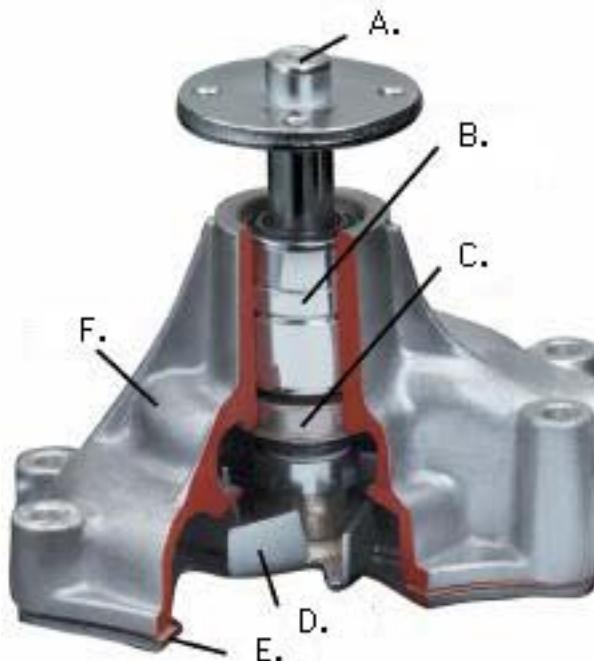
11. Explain the purpose of the following cooling system components:

- Radiator** \_\_\_\_\_  
**Radiator Hose** \_\_\_\_\_  
**Fan** \_\_\_\_\_  
**Thermostat** \_\_\_\_\_  
**Water Pump** \_\_\_\_\_

12. Water pumps use centrifugal force to move fluid throughout an engine. What shape of the pump impeller blades uses the least power? \_\_\_\_\_

13. Identify the parts of the automotive water pump:

- A. \_\_\_\_\_ B. \_\_\_\_\_ C. \_\_\_\_\_  
D. \_\_\_\_\_ E. \_\_\_\_\_ F. \_\_\_\_\_



14. The tanks on a **vertical** flow radiator are on the \_\_\_\_\_ and \_\_\_\_\_, while the tanks on a **cross flow** radiator are on both \_\_\_\_\_.

15. Why are transmission fluid coolers built into the radiators of automobiles equipped with automatic transmissions? \_\_\_\_\_

\_\_\_\_\_

**Match the correct water pump parts to the correct description:**

16. \_\_\_ Fits between the water pump and the engine to prevent leakage.
17. \_\_\_ Steel shaft that transmits the turning force from the hub to the impeller.
18. \_\_\_ Provides a mounting place for the belt, pulley, and fan.
19. \_\_\_ Iron or aluminum casting that forms the main body of the pump.
20. \_\_\_ Disk with fan-like blades, the impeller spins and produces pressure and flow.
21. \_\_\_ Prevents coolant leakage between pump shaft and pump housing.
22. \_\_\_ Plain or ball-bearings that allow the pump shaft to spin freely in housing.
- A. Water pump shaft
- B. Water pump bearing
- C. Water pump housing
- D. Water pump impeller
- E. Water pump gasket
- F. Water pump seal
- G. Water pump hub

**Match the correct term to definition:**

23. \_\_\_ Hold the radiator hoses and heater hoses onto their fittings.
24. \_\_\_ Frequently used in the lower radiator hose to prevent the hose from collapsing.
25. \_\_\_ Carry coolant between the engine water jackets and the radiator.
26. \_\_\_ Has an accordion shape and can be bent to different angles.
27. \_\_\_ Uses a worm gear that engages slots in the clamp strap to allow tightening around the hose.
28. \_\_\_ Small-diameter hoses that carry coolant to the heater core.
29. \_\_\_ Manufactured in a special shape, with bends to clear the cooling fan and other parts.
- A. Radiator hoses
- B. Molded hose
- C. Flexible hose
- D. Hose spring
- E. Heater hoses
- F. Hose clamps
- G. Worm-drive hose clamps

30. List four functions performed by the **radiator cap**:

A. \_\_\_\_\_  
B. \_\_\_\_\_  
C. \_\_\_\_\_  
D. \_\_\_\_\_

31. Modern radiator caps are equipped with a **vacuum valve**. What would occur in the cooling system without this valve? \_\_\_\_\_

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## Closed and Open Cooling Systems

32. A **closed cooling system** uses an \_\_\_\_\_ and an \_\_\_\_\_ tube which is routed into reservoir tank, while an open cooling system allows excess coolant to leak onto the \_\_\_\_\_.

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### Match the following terms:

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- |  |                              |
|--|------------------------------|
| 33. _____ Provide cooling action with an electric motor and a thermostatic switch.     | A) Fluid coupling fan clutch |
| 34. _____ Filled with silicone-based oil Slips at higher rpm                           | B) Thermostatic fan clutch   |
| 35. _____ Bolts to the water pump hub and pulley.                                      | C) Flex fan                  |
| 36. _____ A small direct-current motor.  | D) Engine powered fan        |
| 37. _____ Has a temperature-sensitive, Bi-metal spring that controls clutching action. | E) Electric cooling fans     |
| 38. _____ High rpm cause blades to flex, reducing blowing action.                      | F) Fan Motor                 |

39. In vehicles with a **PCM-Controlled Fan**, when cold, the \_\_\_\_\_ does not energize fan relays.

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40. How does the **radiator fan shroud** help engine cooling? \_\_\_\_\_

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41. Why do modern automobiles use higher coolant temperatures? \_\_\_\_\_

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42. The thermostat is \_\_\_\_\_ when the engine is cold, and no coolant flows in the radiator.

43. A \_\_\_\_\_ valve allows partial coolant flow in the engine when the thermostat is closed.

44. A thermostat \_\_\_\_\_ valve helps eliminate trapped air in the housing.

45. How does a **temperature warning light** work? \_\_\_\_\_

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46. List two (2) benefits of adding **Antifreeze** to a cooling system? \_\_\_\_\_

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47. The most common **water to Antifreeze** mixture is \_\_\_\_\_

48. The boiling point of a 50/50 mixture of anti-freeze and water is \_\_\_\_\_°F and the freezing point of the same is \_\_\_\_\_°F.