

**Online learning**  
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**This module and unit is design for trainees who are in level (2) or Intermediate**

**Module: C&D**

**Unit#**

C04 – Overhaul and repair cooling systems

D08 – Check engine cooling system.

**Objective of this lesson the learner will be able to:**

- ✓ Understanding the importance of a cooling system
- ✓ Making necessary checks for faults or arising issues
- ✓ Trouble shooting and replace components

**Engine cooling system**

**What is the purpose of the engine cooling system?**

Due to the *high temperature* that an internal combustion engine produces, these high temperatures have to be *reduced to a lower temperature* to avoid engine failure or engine seize. The cooling system in an engine simply cools the engine reducing the temperature with the circulation of coolant through the coolant passages in the engine.

**Function of the cooling system:**

- ❖ It removes excess heat from the **engine**
- ❖ It maintains the **engine** operating temperature where it works most efficiently
- ❖ It brings the **engine** up to the right operating temperature as quickly as possible

There are two types of cooling system and ways of removing the heat from an engine:

- Water cool or liquid cool
- Air cool

Today's focus will be on water cool type system found mostly on internal combustion engine which is widely used on modern day motor vehicle. This system uses a series of components that aid in a very efficient way of removing the heat generated.

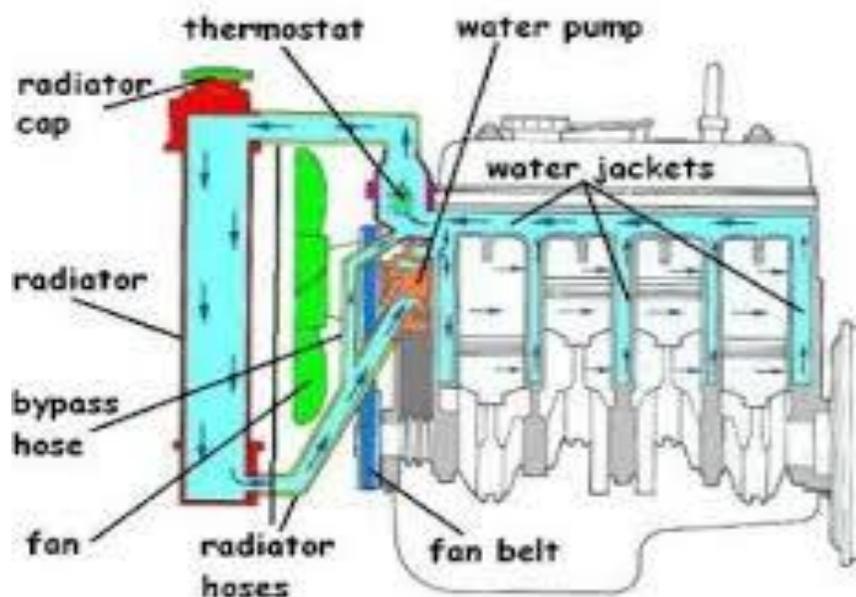
**List of various component that makes up the Water cool or liquid cool system as following:**

- I. Water pump
- II. Cooling fan
- III. Radiator
- IV. Thermostat valve
- V. Radiator hoses

**Components function listed below:**

- I. **Water pump:** This device can either be driven by gear or belt its main role due to the design of the fins situated in the pump housing is to cycle the engine coolant throughout the internal passage way inside of the cylinder head and block.
- II. **Cooling fan:** Due to the design of the deflexed of the blades, when its being rotated it pulls the incoming cool air from the outside environment through the radiator fins. Some fans are belt driven or electric operated.
- III. **Radiator:** Act as a reservoir for holding the engine coolant in the cooling system.
- IV. **Thermostat valve:** This valve helps control the engine temperature at all times.
- V. **Radiator hoses:** This part is normally made from a special silicone heat type rubber material to allow flexibility and transmit the coolant to and from the engine/radiator.

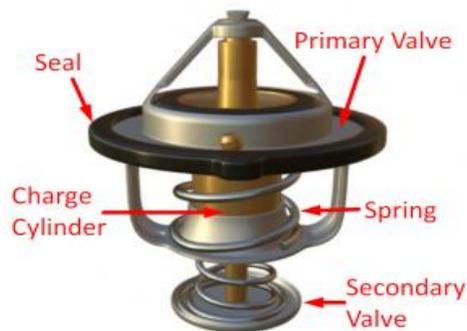
**Diagram of a liquid cooling system**



## System operation

This works by sending a **liquid coolant** through passages in the engine block and heads. As the **coolant** flows through these passages, it picks up heat from the engine. The heated **fluid or coolant** then makes its way through a rubber hose to the top of radiator, which then flows down in the tubes in the radiator which is normally located in the front of the car. The radiator fan pulls the incoming cool outside air which passes through the fins in the radiator, cooling the high temperature liquid ,then the cycle repeats it's self.

The engine **thermostat** is normally located at the top of the engine cylinder head area; some other manufacturers choose different locations for example on the engine block. Its main function is to stop the coolant flow allowing the engine to heat up quickly to its operating temperature. When the engine reaches to its operating temperature the heat wax filled thermostat will react causing the thermostat *valve to open and allow free flow of coolant* to the radiator.



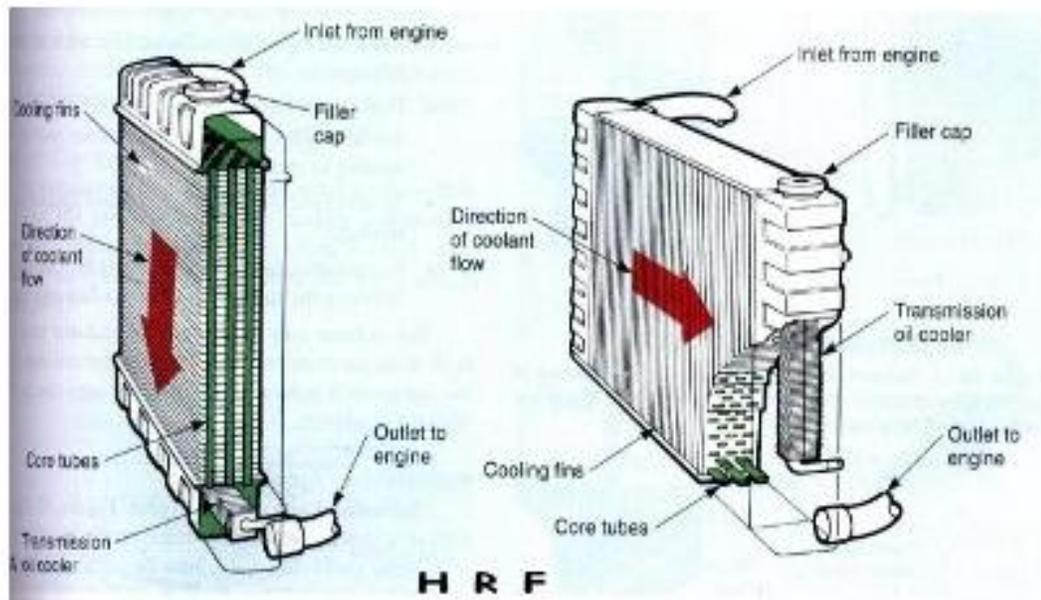
**Engine Thermostat Components**

**NB:** A faulty thermostat will show signs of rise in engine temperature by a stuck valve in a close position, causing the coolant to not cycle in the passage in the engine block. This will cause the engine coolant temperature to rise and this will have a major damaging effect to your engine, blowing the head gasket, blowing out the top radiator tank and losing all of the engine coolant which will result in the engine overheating.

A thermostat and the engine coolant must be replaced at 100k or according to the manufacture's specification.

## Radiator types

There are two types of liquid cool radiators



Down flow

Cross flow

Common radiator symptoms:

Related radiator issues from time to time: they normally *burst out, clog, leak, corrode and in some case they are not properly secured*. Due to the extent of its life service, it must be regularly inspected and checked for any of the above mentioned signs and should be addressed urgently.

## Radiator cap



As the engine's coolant heats up, it expands, increasing pressure inside the closed coolant system. The radiator cap controls this expansion and provides constant pressure on the system.

The radiator cap also allows the engine's coolant to expand and contract without allowing air to enter the cooling system. The upper seal seals and protects the system at all times. After the engine warms and system pressure reaches the caps rated pressure, the pressure spring compresses and pressurized coolant flows into the reservoir or coolant overflow tank. It allows for the expansion of the heated fluid.

The radiator cap also allows the coolant to flow back into the radiator as the engine cools. It also contains a vacuum valve. As temperatures drop and the coolant contracts, a vacuum is created in the engine's cooling system. The vacuum valve opens and allows coolant to flow from the overflow tank back into the radiator. This valve allows for contraction as the fluid cools.

Signs of a defective radiator cap are as follows:

- Leaking radiator cap
- Damage upper rubber seal or the main seal
- Extremely soft spring tension of the sealing spring
- Stuck or non functioning vacuum valve

**NB:** Always ensure that the radiator cap PSI rating is with the correct manufacturer specification

## **Module**

### **D08 – Check engine cooling system.**

Checking of a cooling system will be based on a complaint by the owner of the vehicle or the vehicle mileage (100k) it had already covered. It can also be visual observation of the entire system and making recommendation.

Here are some signs to look for that could cause future problems to your engine and the following checks must be considered:

- Coolant leaks
- Coolant corrosion build up anywhere in the system mostly where hoses are connected this will indicate a slow leak
- Non circulation of the coolant in your radiator
- When engine is cool remove radiator cap and look for blockage in the radiator tubes
- Soft hoses in the system: it must be felt -if it squeezes easily it should be replaced
- Bobbling sound from your expansion tank
- Discolored coolant
- Coolant lost or no coolant in radiator
- Electric fan or clutch fan spin too slow at times or not spinning when it should
- Rise in engine temperature shown on gauge either in traffic or driving
- Dirty or rusty coolant inside of your radiator and expansion tank
- Expanding top radiator hose
- Contraction of the lower radiator when engine is accelerated

It is very important to always check and look for the above mentioned signs that could result in failure of your engine. Hence the reason for a preventive maintenance chart with respect to your vehicle avoiding breakdown.

## **Module**

### **C04 – Overhaul and repair cooling systems**

This module mainly covers the replacement of items or failure of a part that urgently have to be addressed. Replacing of all engine components that entails the cooling system will be based according to manufacturer's specification, vehicle mileage, or present condition.

*Further to this module will be a practical session or due to the current pandemic situation trainees can view online YouTube video for their own practicum session which can be discuss.*

## **Evaluation**

Trainees are ask to conduct internet research or use text book for their information

Question:

1. What will be the cause if the expansion tank coolant level rises and over flows?
2. What is the main reason for oil contamination in a radiator?
3. What is most likely the cause for a leaking radiator cap?
4. What are some of the possible causes for the coolant not cycling in the system?
5. List the signs and causes for overheating issues.

This will be corrected and mark as soon as school reopens or through the online classes.