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# 6 Common Radiator Failures

This section has been compiled by investigating radiator failures in the past twenty years at Denso. These failures occur to all makes of radiators, due to incorrect maintenance and/or poor installation techniques.

We discuss the causes, results and prevention/repair method for each type of failure.

## 1. Contamination

### Foreign Matter Inside the Radiator

**Cause**

- Insufficient flushing of the engine cooling system prior to fitting the new radiator.
- This includes the engine block, heater system and overflow bottle.
- Inadequate levels of fluid in the system for prolonged periods.
- Inadequate preparation prior to fitting the radiator, causing contamination of the engine cooling system.

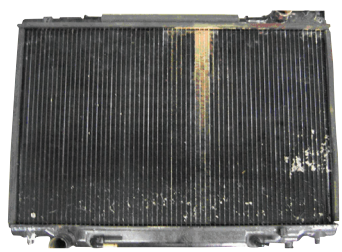
**Result**

- Blockages of the radiator's tubes, header plate and tank.
- Reduction in cooling performance and efficiency.
- Engine overheating.
- Deterioration and failure of critical radiator components causing loss of coolant.

**Prevention**

- Regular service of the cooling system.
- Use the manufacturer's recommended coolant.
- Adequate flushing of the cooling system during coolant change.

A radiator leak caused by contaminated coolant.



Large deposit of foreign matter inside the radiator tank.

The headerplate and inside tube are covered with brown residue.

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## 2. Corrosion

Mechanical and chemical deterioration of the radiator's tubes and header plates leading to holes and cracks in the core.

### Cause

- Insufficient flushing of the engine cooling system prior to fitting the new radiator.
- This includes the engine block, heater system and overflow bottle.
- Mixing of different coolants.
- Contamination of the coolant via an additive.

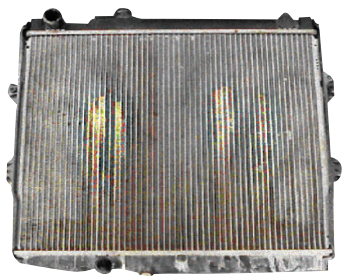
### Result

- Severely reduced corrosion protection.
- Tubes become weak and brittle eventually develop holes and cracks.
- Reduction in cooling performance and efficiency leading to conditions such as overheating.
- Loss of coolant.

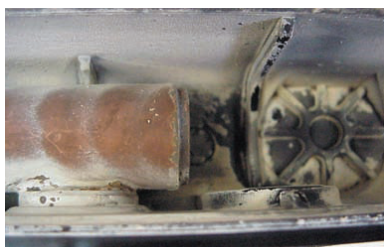
### Prevention

- Regular service of the cooling system.
- Use the manufacturer's recommended coolant.
- Adequate flushing of the cooling system during coolant change.
- Never mix different brands or types of coolant.

Evidence of corrosion on the radiator tube.



Lower tank covered in white residue.



The tubes on the header plate have become brittle and broken away.

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## 3. Pitting Corrosion

Oil cooler failure is often caused by pitting corrosion, which is mainly due the following factors.

### Cause

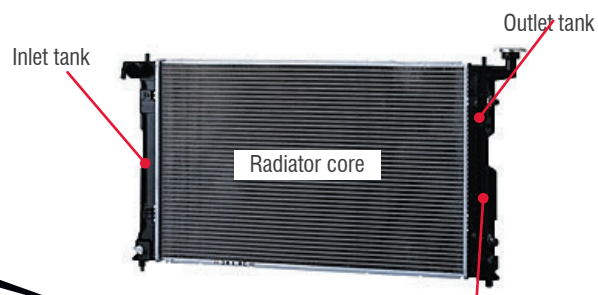
- Insufficient flushing of the engine cooling system prior to fitting the new radiator.
- This includes the engine block, heater system and overflow bottle.
- Mixing of different coolants.
- Incorrect concentration of coolant either at the time of change over or caused by dilution over a period of time
- Inadequate preparation prior to fitting the radiator, causing contamination of the engine cooling system.

### Result

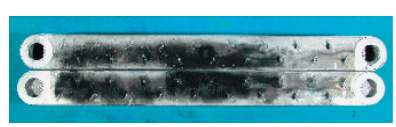
- The mixing of coolant/auto transmission fluid.
- Coolant enters automatic transmission.
- Damaging other cooling system components i.e. hoses.

### Prevention

- Regular service of the cooling system.
- Use the manufacturer's recommended coolant.
- Adequate flushing of the cooling system during coolant change.
- Never mix different brands or types of coolant.




Oil cooler inside the radiator outlet tank.



Corrosion occurred on the surface of the coolers.

Oil cooler cut out section.
Cross section magnified by 100k.

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## 4. Electrolysis

Also commonly called “Stray Current” corrosion. This is a systematic removal of the protective layer on the inside of the radiator tubes due to improper grounding of one or more of the vehicle’s electrical components.

### Cause

- Poor installation of aftermarket accessories.
- Existing stray current problem was not diagnosed and/or required prior to fitting a new radiator.

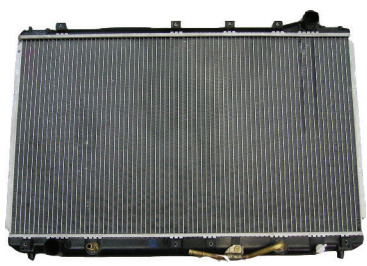
### Result

- Systematic removal of the corrosion protection layer on the inside of the radiator’s tubes.
- Corrosion of the tubes typically resulting in multiple holes.
- Build-up of aluminium oxide blocking passages.
- White aluminium oxide powder visible through the inlet and outlet pipes.

### Prevention

- Test for stray current in the cooling system.
- Repair poor electrical grounding.
- Check fitment of aftermarket accessories.

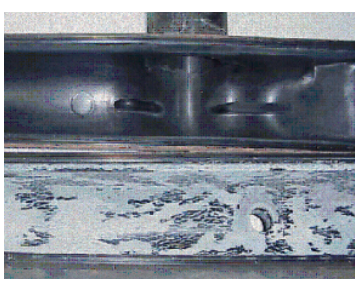
Dark pigmentation along the fins.



Blackening of the header plates. The tubes and brazed joints have corroded away.

Top header plate discoloured.

Evidence of the aluminium oxide residue settle inside the tank.



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## 5. Thermal Shock

Thermal shock/stress is caused by drastic differences in temperatures.
Note: This only occurs in some models.

### Cause

- Hot and high pressure coolant surging into the inlet side of the radiator can cause stress and fatigue to the radiator and in some cases cracking of the radiator tubes.

### Result

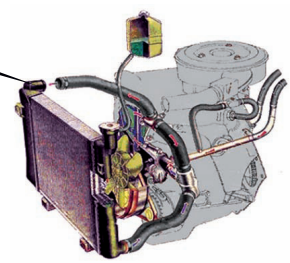
- Tube fatigue failure.
- Leaking tube to core plate near inlet pipe.
- Leak will only start as slow seepage.

### Prevention

Note: These repair methods are only effective for some models.

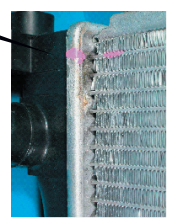
- Install thermostat with bleed hole, this will reduce thermal fluctuations by softening thermostat influence.
- Consult your repair shop for a replacement radiator.
- Always use original design radiator.
- Maintenance of coolant is also very important. Any corrosion to tube wall will accelerate tube fatigue.

Big temperature difference when hot coolant enters radiators causing tubes to flex.

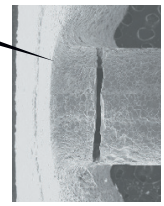


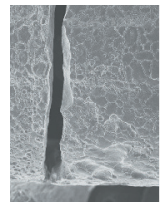
Thermal shock affects tubes on the inlet side.

Coolant leakage, as a result of thermal shock.



Cut out tube section with crack.
Cross section magnified by 35x





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## 6. Radiator Cap

The radiator cap keeps the coolant level in the radiator at the desired amount. The cap releases coolant to the over flow bottle, at a certain pressure, then draws it back as the engine cools, to maintain the correct coolant level.

### Cause

- Cracked or swollen gasket.
- Missing rubber seal.
- Weak Spring Tension.
- Melted by heat

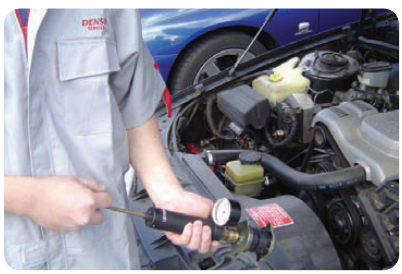
### Result

- Coolant leaking from the radiator.
- Pressure not maintained.
- Over pressure caused by fluid not being able to be passed to the flow bottle

### Prevention

- When checking the coolant, also check the radiator cap for worn or cracked rubber gaskets. If the cap does not seal properly, fluid will be lost and the engine will overheat. A pressure test should be performed on your radiator cap to ensure it is working properly.

A weak radiator cap (or the wrong one for the application) can allow excessive amounts of coolant to escape into the overflow reservoir when the engine gets hot. Then prevents it from being siphoned back into the radiator as the engine cools leading to a low coolant level. So always pressure test the cap to make sure it holds pressure and meets the specifications for the application.



Cap gasket swollen by oil

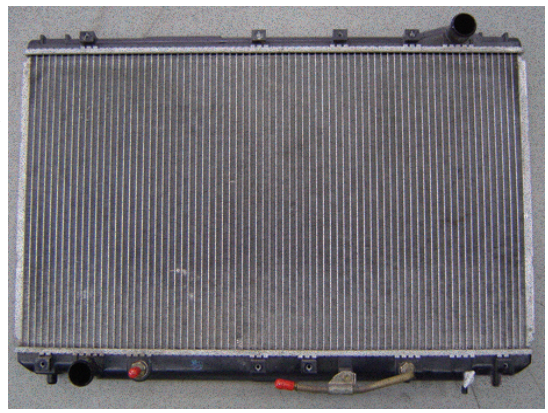
Plastic portion of cap melted by overheated engine

# Sample of a Well Maintained Radiator

Condition: At 135,000km regularly serviced and always using the recommended coolant.

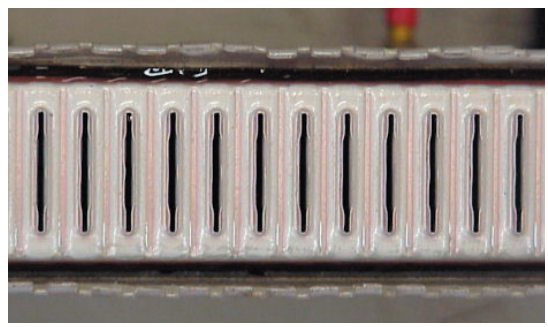
### Tubes

The radiator tubes were clear and the brazing appeared to be good



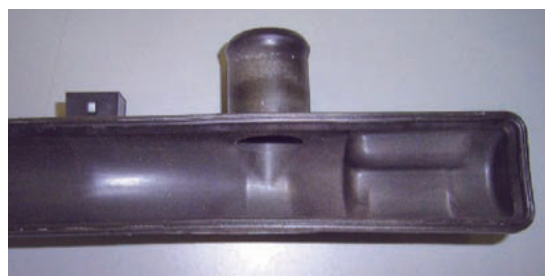
### Plates

The header plate was as new.
No visual sign of corrosion.



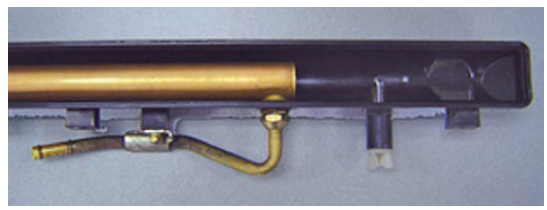
### Tank

No signs of abnormal residue or foreign materials in the tank.



### Oil Cooler

No visual sign of corrosion on the oil cooler.



# How to Measure a Car Radiator Core



1. Ensure that the radiator is in an upright position. (The Filler-neck opening should be facing upward)
2. There are three specific measurements of the core required to determine the size of the radiator; height, width and thickness.
3. Determine whether the radiator is a Downflow or Crossflow type

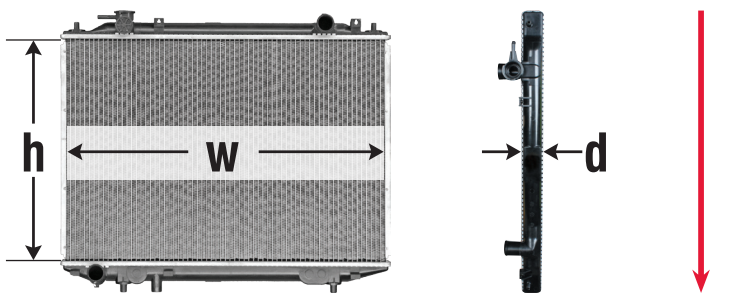
### Downflow versus Crossflow Type Radiators

There are two basic types of radiator design which are distinguished from one another by the location of the two end tanks and the direction of the coolant flow

### Downflow Type Radiator

Tubes are mounted vertically as these radiators are designed to enable coolant to flow from the top tank downward to the bottom tank.

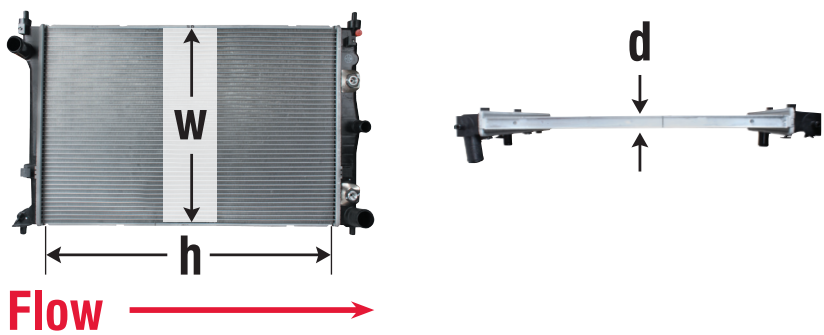
## Downflow




### Crossflow Type Radiators

Tubes are mounted horizontally and the tanks are mounted on the sides as these radiators are designed to enable coolant to flow horizontally from tank to tank.

## Crossflow




**Key:**

**H** = Core Height measurement is always taken from header to header between the two tanks, no matter how the radiator is positioned in the vehicle.

**W** = Core Width measurement is the distance between the side plates. (Not including the side plates)

**D** = Core Depth measurement is the thickness of the radiator core. Tip: Insert a wire between the fins until the end is flush with the other side of the core. Mark and measure the wire for the depth measurement.