

Unit 203: Scientific principles for domestic, industrial and commercial plumbing

Outcome 4

Principles of heat in relation to plumbing systems

Principles of heat

Heat transfer

There are three methods by which heat can be transferred:

- Conduction
- Convection
- Radiation

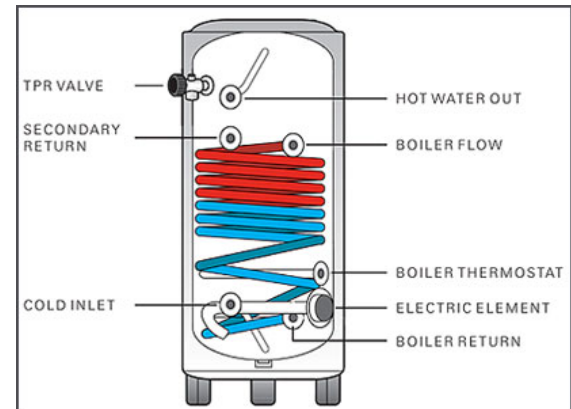
Principles of heat

Conduction

Conduction happens when heat travels through or along a material (one molecule to the next).

Heating copper tube to solder, or heating coil in a DHWC.

Copper is a very good thermal conductor. Plastics tend not to be good thermal conductors.



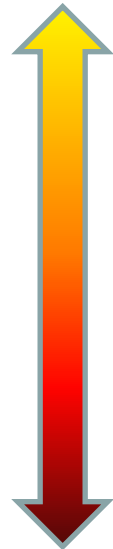
Principles of heat

Conduction

Not all materials are good thermal conductors, and we can use the bad conductors as insulators. The faster heat travels, the better conductor the material is.

Copper
Aluminium
Iron
Glass
Brick
Water
Wood
Polystyrene
Still air

Good conductor



Bad conductor

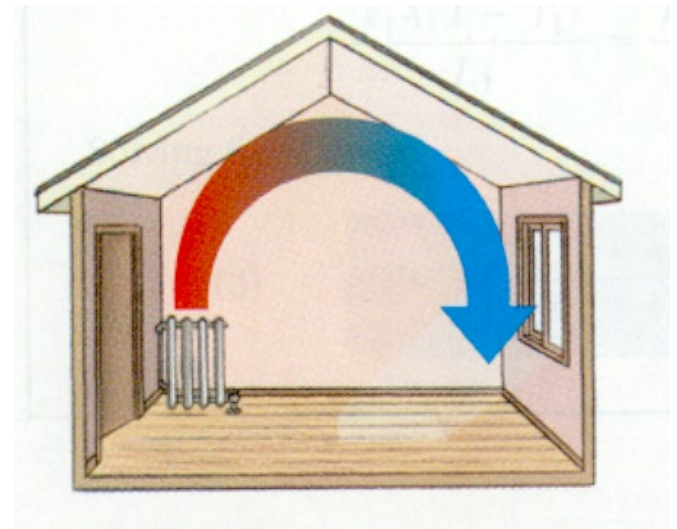
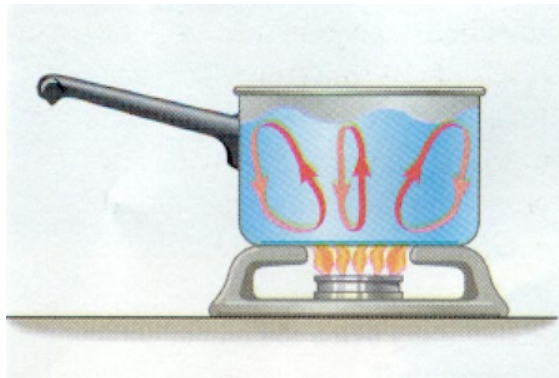
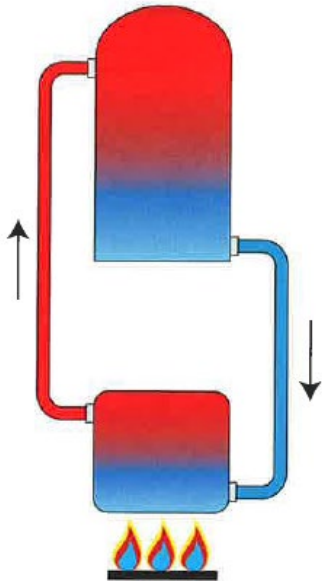
Materials that are good thermal conductors are also good electrical conductors.

Principles of heat

Convection

Can only take place in a fluid or gas.

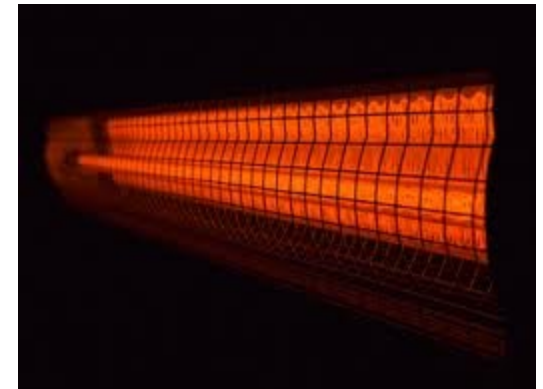
Convection occurs because when molecules are heated, they heat and rise, and when they cool they fall. This is the main way a DHWC heats the water up by.



Principles of heat

Radiation

This is heat transfer via infrared light. It transfers heat from one body to another without heating the space in between.



Principles of heat

Heat transfer

Heat is measured in $^{\circ}\text{C}$ or scientifically in Kelvin (K).

Certain situations mean that heat needs to be retained – and at other times emitted – but always controlled.

Hot water cylinder pipes need insulating to keep the heat in, so the hot water does not lose its temperature (efficiency).



Principles of heat

Heat transfer

Cold water mains pipe needs to be insulated to stop condensation forming on the pipe.

White cars are more common in hot countries, as white reflects the sun's heat. In solar panels, shiny surfaces are needed to absorb the heat from the sun.

Dark colours absorb heat – unpainted cast iron.
Light colours reflect heat – polished aluminium.

Heat remains in the pipework when it is insulated and therefore increases efficiency and reduces running costs.



Principles of heat

Heat transfer

Needs to be controlled: Building Regs part L.

Programmers – only on when needed.

Boiler stat – not too high (primary circuit).

Cylinder stat – not above 60°C (secondary circuit).

Room stat – as low as possible.

TRVs – control individual rooms.

Zones – upstairs and downstairs.

