Radiators are simple heat exchangers which distribute the heat by natural air circulation (very little heat is transferred through radiation – despite the name). 80 or so years ago most radiators were made from cast iron – now they are mostly made from pressed steel: a few are made from aluminium. Manufacturers all produce data sheets showing the output of their radiators and many software companies (and radiator manufacturers) produce simple software so you can calculate radiator size. – page 3 shows two simple methods of sizing radiators. Normally manufacturers’ data sheets will quote radiator output when there is a temperature difference (water to air) of 50 °C. Where the temperature differs from this correcting factors are necessary to determine actual output and therefore size. So, for instance, if a radiator is required which will run at a lower temperature than normal, its size must be increased to compensate. Radiators can be single panel, or double panel and with, or without, fins (right). Doubling up the radiators and adding fins increases output without increasing the amount of space taken up by the radiator.

A wide range of radiators are available. Several examples of less common types are shown below.

In most domestic situations water enters at the bottom of the radiator. This is neater than the right hand example but probably not as efficient.

In kitchens and bathrooms fan assisted skirting radiators can sometimes be used. They need electric power and can be noisy.

It’s normal practice to run the pipework below the radiators. If the floors are timber the pipework can be installed below the floorboards – care must be taken to avoid excessive notching where the pipes run at right angles to the joists. Pipes parallel to the joists will normally require support to stop the pipe flexing or bending. If the floors are concrete it is more likely to find high-level feed pipes (just below the ceiling) with fall-pipes feeding the radiators. Running the pipes at floor or skirting level is not usually practical because the pipes have to cross door openings (they can go round them but it looks messy and makes the system difficult to drain).

The pipework is most likely to be copper although plastic is becoming more and more popular. The section on Hot and Cold Water covers this in more detail. Note that where plastics are used a special barrier pipe is required to prevent oxygen getting into the system and causing corrosion.

Plastic pipework in coils threaded through the joists.

Cooper pipework in straight lengths set into notches. The felt minimises noise.

These radiators are part of the range offered by Feature Radiators.
Thermostatic radiator valves can sometimes stick – usually in the closed position. This is usually discovered when the heating is first turned on at the end of the summer. The outer casing can be removed and the sliding pin freed with a pair of pliers.

If the top of the radiator is cold it usually means the radiator needs bleeding.

If the bottom of the radiator is cold it may mean the radiator is blocked with rust or sludge.

If the radiators upstairs are cold it may mean the feed and expansion cistern tank in the roof has run dry or the boiler pressure (combi) is low.

If the radiators nearest the boiler tend to be the hottest they may not have been balanced properly. Balancing is done by adjusting the lockshield valves (below). Radiators on a one pipe system are always difficult to balance.

If all the downstairs radiators are cold the pump may not be working properly.

One Pipe & Two Pipe Systems

Many of the earlier pumped systems used what is known as a one-pipe system. In this approach, shown in the diagram below, water flows from radiator to radiator and then back to the boiler. However, as the water flows into each radiator, heat is drawn from it and therefore the water, which re-enters the flow pipe, is slightly cooler. Indeed, towards the end of the run the radiators are significantly cooler. This can be overcome to a certain extent by progressively increasing the size of the radiators – this is expensive and looks rather odd.

In a two pipe system there are two pipe circuits, one a flow pipe and the other a return: each radiator is connected to both. The water, which leaves the radiator, flows into a return pipe, which goes back to the boiler. The same process occurs in all the other radiators. Therefore, all of the radiators receive water at more or less the same temperature.

Chrome inlet and outlet (lockshield) valves. The advantages of thermostatic inlet valves are explained in the section on Controls.

One Pipe & Two Pipe Systems

Radiators need to be balanced to make sure they are all roughly at the same temperature (before any control is exercised via thermostatic radiator valves). There is a problem, otherwise, of radiators near to the boiler getting quite hot and radiators further away staying cool. To avoid this, the outlet of each radiator is fitted with a 'lockshield valve' which needs to be adjusted when the system is first installed. Balancing the rads evens out the flow of water through each radiator so that when the central heating system is working normally, the temperature drop across each radiator is about 12°C. Balancing procedure is beyond the scope of this article but it usually involves checking the incoming and outgoing water temperature at each radiator.

Adjustments can be made by tightening or loosening the lockshield valve – this controls the water flowing through the radiator. Once the radiators have been balanced, no further adjustment should be required until the boiler is renewed or radiators are changed.

Radiator Problems
The heat output of the radiators should be carefully calculated. Two simple methods are shown below – they give the same answer – this is coincidence so don’t buy a radiator based on information on this page!

To work at their best radiators, except when fitted in a room with a room thermostat, should be fitted with a TRV (see Controls). Radiators should, where possible, be sited under windows to counteract cold down-draughts and to give a more comfortable environment in the room. Radiators should be installed close to the floor, preferably 100–150mm above finished floor level. Wide, low radiators will be more effective at heating the room evenly than tall, narrow ones. Enclosures around radiators reduce the heat output but might be required to prevent vulnerable people getting burnt.

The heat loss calculation is normally done on a room–by–room basis to work out rad sizes. For each room the heat loss through each construction element is established. The heat loss is the ‘area x ‘U’ value x temperature difference inside and outside’ (standard values are normally used – see table). In addition allowance has to be made for heating the air due to air changes. Note that in some rooms there will be a flow of heat INTO the room. When the heat loss has been calculated a correction factor is normally applied when sizing the radiator. For example, if a condensing boiler is being used and the radiators are running fairly cool (to ensure the water in the return pipe will condense in the boiler) the correction factor may be as high as 50%. In this case the radiator will have to have an output of nearly 1200 watts. Adding together the total heat loss (in all the rooms) helps size the boiler. Another method of boiler sizing, based on the same principles (but less complex), is shown on another page (Boiler Sizing).

### Radiator Sizing

#### Rule of thumb method.

Find the volume of the room in cubic metres (length x width x height) – about 30 in the example above. Then add the following correction factors:

- Lounges and dining rooms multiply by 50.
- Bedrooms multiply by 40.
- Common areas and kitchens multiply by 30.
- Bathrooms multiply by 90.
- For rooms facing north add 15%.
- For French windows add 20%.
- For double glazing deduct 10%.
- For very exposed sites, or very cold weather add 10%

Based on this rule of thumb method, the radiator should be a 1200 watts – a bit of a coincidence I suspect.