What you get out is what counts

Heat loss and draw-off capacity must be considered to ensure cylinders operate at peak performance, according to Boris Bauer of HWA member Glen Dimplex

In many properties, hot water is provided to the various points of use from a storage cylinder, instead of being prepared when needed instantaneously.

Storing hot water has an advantage in that the time of hot water preparation and the time of usage can be independent from each other. Its operation and capacity can also be provided in the most efficient way in relation to the energy source.

A typical example of this is the use of stored hot water in direct electrically-heated properties using off-peak electricity, where the hot water can be prepared during times of low-cost energy supply, and then used as and when required.

Other examples include renewable energy sources such as solar thermal and heat pumps, which have constraints on their availability because of their nature and/or the maximising of efficiencies.

To maximise the benefits of a stored hot water system, the means of inputting the energy into the cylinder, the retention of energy and the means of extracting the stored hot water all have to be considered.

A lot of attention to detail has been given by manufacturers to all these aspects, as an efficient energy input is often required to ensure that the heat source can work at its maximum efficiency.

This applies as much to conventional fossil fuel-based systems, with or without condensing effect, as it does to renewable sources such as solar thermal and heat pumps.

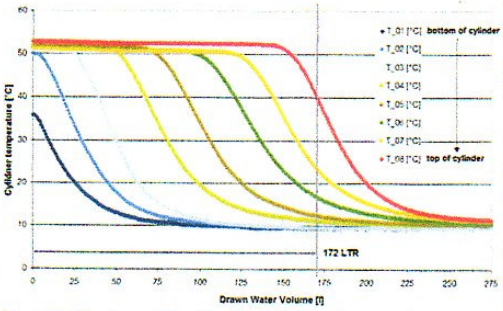


Figure 2: The draw-off profile of a 200-litre storage cylinder

Less known, however, are the efforts made to ensure that the stored hot water remains at its maximum temperature for as long as possible, and that a maximum amount of the stored hot water is delivered at the desired temperature.

With continually decreasing energy requirements to satisfy the space heating demand in properties, the preparation of hot water becomes a more significant factor when ensuring the CO_2 impact of the building is kept to a minimum, as reflected in Part L of the Building Regulations.

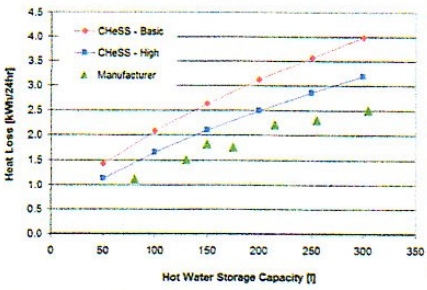


Figure 1: CHeSS standing heat loss requirements

Although, in many cases, the hot water cylinder is positioned within the heated building envelope, ensuring that its heat losses still have some contribution to make in heating the property, these losses are not always welcomed and should therefore be kept to a minimum.

The Domestic Heating Compliance Guide and the Central Heating System Specification CHeSS require minimum insulation levels for cylinders, as shown in figure 1.

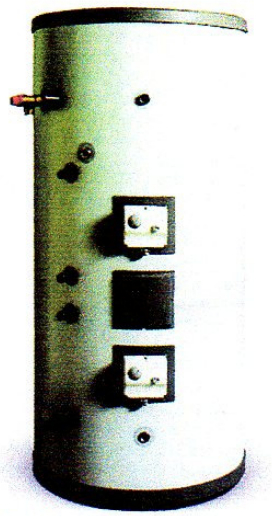
For comparison, published heat loss figures from one manufacturer are shown in figure 1, to show the actual ability of modern hot water cylinders to retain the energy stored in the hot water.

The storage cylinder must also be able to deliver the stored hot water to the outlets as efficiently as possible. Particular attention must be given to the stratification of the stored hot water in the cylinder.

For example, a 200-litre cylinder is completely heated to 60°C. Assuming that no re-heat has taken place during the draw off, it will not be possible to draw 200 litres of hot water at 60°C, as the incoming cold water will mix with the stored hot water and reduce its temperature.

Attention has to be given to the means of allowing the cold water to enter the cylinder, and the means of extracting the hot water from the cylinder.

Figure 2 shows a draw-off profile of a well-designed hot water storage cylinder which was heated to 52°C, in this case using an air-to-water heat pump. The draw-off profile will vary slightly depending on the flow rate through the cylinder.



Hot water cylinders allow hot water preparation to be independent from the time of usage

The draw-off performance shown in figure 2 was achieved at 10 litres/min, which corresponds to a high performance shower.

Figure 2 shows that approximately 85% of the overall volume of the cylinder can be drawn before the outlet temperature will reduce to unusable levels, which offers an excellent delivery performance.

Both the standing heat losses and the actual draw off capacity should be considered when specifying the hot water cylinder, the heat source and the control system.

This is the only way to make sure that the user can enjoy all the benefits of the stored hot water system without any unnecessary inconvenience, running costs and adverse impact on the environment.