# Safe Heating in Educational Establishments

***Introduction***

When specifying heating for educational establishments it is essential to consider the special requirements of such premises. As well as ensuring the correct temperature levels are achieved and maintained, it is necessary to consider the safety aspects of radiator design and positioning. Other considerations include energy efficiency, ease of maintenance and aesthetics.

***Considerations for heating Educational Establishments***

The design of heating systems in educational establishments is dictated by a combination of regulations and best practice.

Guidance on minimum temperatures is provided by the Education (School Premises) Regulations 1996, stating "Each room or other space in a school building shall have such a system of heating, if any, as is appropriate to its normal use". This means that the heating system not only needs to achieve the minimum temperatures (shown below) but also take account of the Duty of Care to the staff and pupils.

The minimum temperatures required for different areas of an educational establishment are as follows:

| Areas | Temperature |
| --- | --- |
| Areas where there is a lower than normal level of physical activity because of sickness or physical disability including sick rooms and isolation rooms but not other sleeping accommodation | 21°C |
| Areas where there is the normal level of physical activity associated with teaching, private study or examinations | 18°C |
| Areas where there is a higher than normal level of physical activity (for example arising out of physical education) and washrooms, sleeping accommodation and circulation spaces. | 15°C |

In each case the temperature is measured at a height of 0.5m above floor level when the external air temperature is -1°C.

## Avoiding hot surfaces

Most educational establishments use a conventional ‘wet’ heating system, with radiators located around most rooms in the building, served by central boiler plant. For spaces with high ceilings, such as halls and gymnasia, underfloor heating may be the best solution, but in all other areas radiators are generally the most cost-effective and efficient option.

However, standard radiators and associated pipework can reach a temperature as high as 75°C, hot enough to cause serious burns within seconds. For this reason, it is important to ensure that children cannot come into contact with these hot surfaces.

The Education (School Premises) Regulations 1996 includes provisions relating to risks from hot surfaces, especially those catering for younger children. The regulations dictate that in special schools, nursery schools and teaching accommodation used by nursery classes, radiators and exposed pipes which are located where pupils might touch them must not become hotter than 43°C.

## Low surface temperature radiators (LSTs)

The most practical way to prevent children from coming into direct contact with hot surfaces is to use radiators that are designed to eliminate this possibility by incorporating a casing that covers all hot surfaces. Low surface temperature radiators (LSTs) are designed to do just that, providing a safe, cool-touch solution

The casing of a cool touch LST covers the pipework as well as the radiator, so that all hot surfaces are concealed. For areas where very young children may be crawling at floor level, a bottom grille is also required to ensure that hot surfaces cannot be accessed from below.

*Avoiding sharp edges*

Another consideration is the likelihood of children falling onto the radiator and injuring themselves from the impact. Conventional radiators tend to have sharp edges that can cause serious injury. The outer casing of an LST radiator must be designed to avoid sharp edges, using rounded corners and edges to minimise the risk of injury.

*Positioning of radiators*

With any type of radiator, positioning is important in achieving optimum performance. The standard approach is to position radiators below windows, as this is the area of maximum heat loss from a building. This also helps to prevent condensation forming on cold windows.

As insulation standards improve with the use of the latest thermally efficient double, and even triple glazing, in line with the requirements of Approved Document L2 of the Building Regulations, this is less of a consideration so positioning needs to be considered in relation to the thermal insulation of each building.

Educational establishments must also provide easy access for disabled people and this is covered in Approved Document M of the Building Regulations, which states: “Corridors and passageways in the entrance storey should be sufficiently wide to allow convenient circulation by a wheelchair user. Consideration should be given to the effects of local obstruction by radiators and other fixtures”. This condition is satisfied if “elements such as columns, radiators and fire hoses, do not project into the corridor, or where this is unavoidable, a means of directing people around them, such as a visually contrasting guard rail, is provided.

Greater flexibility in positioning of radiators is achieved through the use of slim line radiators that protrude only a short distance into the room or corridor. Low water content radiators (discussed below) are particularly compact and therefore more versatile from a positioning perspective.

*Aesthetics*

There is a clear correlation between the attitude and motivation of pupils and the interior design of the educational environment. As a result, there is now considerably more thought given to the décor of schools, with greater emphasis on creating a pleasant, stimulating environment that is conducive to learning.

As a highly visible element of a room, radiators need to be designed to complement the rest of the décor. LST radiators offer a high level of flexibility in this respect as the casing can be adapted to a wide range of spaces and shapes and supplied in a diversity of colours. Or the casing can be designed to blend with other decorative or architectural features so that it is barely visible.

Slim line radiators, discussed above, offer a compact and discrete solution that will suit the aesthetic requirements of many educational establishments.

*Security and robustness*

In most schools it will be necessary to take measures against tampering and vandalism. Radiator casings should, therefore, be resistant to physical abuse and use tamper-resistant fixings so the casing can only be removed by special tools.

In areas such as corridors where there is the possibility of collision with cleaning trolleys etc, the casings should be specified for extra strength and impact resistance.

**Sizing of radiators**

Choosing the right size of radiator is essential for optimising performance. A radiator that is too small for the space will not achieve the required temperature on cold days. One that is too big will achieve the required temperature more quickly but could waste energy doing so if the thermpstatic temperature controls do not react quickly enough, or if the radiator is a high mass unit which reacts slowly.

The size of radiator is determined by the volume of the room, the desired temperature and the level of insulation of the room – the latter determining the heat output in watts per cubic metre required to maintain the temperature. The table below gives a rough guide to the watts per cubic metre (W/$m^3$) needed relating to different levels of insulation.

| | **Watts/$m^3$** | |
|---|---|---|
| **INSULATION** | **Room temp 20°C** | **Room temp 24°C** |
| **Excellent** | 45 | 55 |
| **Good** | 65 | 75 |
| **Average** | 85 | 95 |
| **Poor** | 100 | 115 |

*Worked example*

Using these figures is clearly illustrated by a worked example for a room with excellent insulation, measuring 3m long x 3m deep and 2.5m high. The desired temperature is 24°C and the water temperatures are 80°C flow and 60°C return.

Calculate the volume of the room by multiplying length x depth x height:

$$3 \times 3 \times 2.5 = 22.5\text{m}^3$$

For excellent insulation and a desired temperature of 24°C, the W/m$^3$ = 55
Multiply the room volume by the W/m$^3$ = 22.5 x 55 = 1237.5W

Thus the required output is 1237.5W but a correction factor needs to be applied to take account of the water temperatures being used in the building, in this case 80°C flow and 60°C return. The correction factor is determined by the Euronorm standard EN442 and for these flow and return temperatures it is 0.9. To arrive at the final output of the radiator the figure derived above (1237.5) is divided by the correction factor (0.9), giving an output of 1375W. A radiator with this output is then selected.

AVERAGE CORRECTION FACTORS ACCORDING TO EN442 - 75/65/20

| Tv | TL | Tr>20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | 20 | 0.63 | 0.69 | 0.75 | 0.81 | 0.87 | 0.94 | 1.00 | 1.07 | 1.13 | 1.20 | 1.27 | 1.34 | 1.41 | 1.48 |
| | 24 | 0.54 | 0.59 | 0.65 | 0.71 | 0.77 | 0.83 | 0.90 | 0.96 | 1.03 | 1.09 | 1.16 | 1.23 | 1.29 | 1.36 |
| 85 | 20 | 0.57 | 0.63 | 0.69 | 0.75 | 0.81 | 0.87 | 0.94 | 1.00 | 1.07 | 1.13 | 1.20 | 1.27 | 1.34 | |
| | 24 | 0.48 | 0.54 | 0.59 | 0.65 | 0.71 | 0.77 | 0.83 | 0.90 | 0.96 | 1.03 | 1.09 | 1.16 | 1.23 | |
| 80 | 20 | 0.51 | 0.57 | 0.63 | 0.69 | 0.75 | 0.81 | 0.87 | 0.94 | 1.00 | 1.07 | 1.13 | 1.20 | | |
| | 24 | 0.43 | 0.48 | 0.54 | 0.59 | 0.65 | 0.71 | 0.77 | 0.83 | 0.90 | 0.96 | 1.03 | 1.09 | | |
| 75 | 20 | 0.46 | 0.51 | 0.57 | 0.63 | 0.69 | 0.75 | 0.81 | 0.87 | 0.94 | 1.00 | 1.07 | | | |
| | 24 | 0.37 | 0.43 | 0.48 | 0.54 | 0.59 | 0.65 | 0.71 | 0.77 | 0.83 | 0.90 | 0.96 | | | |
| 70 | 20 | 0.41 | 0.46 | 0.51 | 0.57 | 0.63 | 0.69 | 0.75 | 0.81 | 0.87 | 0.94 | | | | |
| | 24 | 0.32 | 0.37 | 0.43 | 0.48 | 0.54 | 0.59 | 0.65 | 0.71 | 0.77 | 0.83 | | | | |
| 65 | 20 | 0.35 | 0.41 | 0.46 | 0.51 | 0.57 | 0.63 | 0.69 | 0.75 | 0.81 | | | | | |
| | 24 | 0.27 | 0.32 | 0.37 | 0.43 | 0.48 | 0.54 | 0.59 | 0.65 | 0.71 | | | | | |
| 60 | 20 | 0.30 | 0.35 | 0.41 | 0.46 | 0.51 | 0.57 | 0.63 | 0.69 | | | | | | |
| | 24 | 0.23 | 0.27 | 0.32 | 0.37 | 0.43 | 0.48 | 0.54 | 0.59 | | | | | | |
| 55 | 20 | 0.26 | 0.30 | 0.35 | 0.41 | 0.46 | 0.51 | 0.57 | | | | | | | |
| | 24 | 0.18 | 0.23 | 0.27 | 0.32 | 0.37 | 0.43 | 0.48 | | | | | | | |
| 50 | 20 | 0.21 | 0.26 | 0.30 | 0.35 | 0.41 | 0.46 | | | | | | | | |
| | 24 | 0.14 | 0.18 | 0.23 | 0.27 | 0.32 | 0.37 | | | | | | | | |
| 45 | 20 | 0.16 | 0.21 | 0.26 | 0.30 | 0.35 | | | | | | | | | |
| | 24 | 0.13 | 0.17 | 0.22 | 0.26 | 0.31 | | | | | | | | | |
| 40 | 20 | 0.10 | 0.14 | 0.18 | 0.23 | 0.27 | | | | | | | | | |
| | 24 | 0.12 | 0.16 | 0.21 | 0.26 | | | | | | | | | | |
| 35 | 20 | 0.06 | 0.10 | 0.14 | 0.18 | | | | | | | | | | |
| | 24 | 0.08 | 0.12 | 0.16 | | | | | | | | | | | |
| 30 | 20 | 0.03 | 0.06 | 0.10 | | | | | | | | | | | |
| | 24 | 0.05 | 0.08 | | | | | | | | | | | | |

EXAMPLE

Average correction factor for boiler temperatures 82/71/21 °C **= 1.15**

The indicated outputs with ΔT 50 and ΔT 60 are the exact outputs. ΔT 50 output measured in accordance with EN 442 and ΔT 60 output calculated according to EN 442. An average correction factor is given in the table above for all other ΔT outputs, applicable for all dimensions.

If necessary, the radiator manufacturer will be able to assist with these calculations.

***Energy Efficiency***

Heating and hot water account for some 60% of the total energy consumption of most schools. For this reason, it is essential that the heating system is energy efficient as well as effective.

Most conventional perimeter heating fluctuates widely through the course of the day, starting at full output on a cold morning and gradually easing off as the ambient temperature rises. However, it is also important that the heating system reacts quickly to changes in the space temperature caused by other factors, such as variable occupancy of rooms or solar heat gains, especially in modern well insulated buildings.

The high water volume and high mass of conventional radiators makes them quite slow to respond in this respect. A more responsive, and therefore more efficient, solution is the use of low mass low water content heat emitters. These contain as little as 10% of the water content of a traditional radiator, so they buffer less heat and react at least three times faster to fluctuations in temperature. As a result, they heat up immediately if the temperature falls below the set-point and stop heating as soon as the set-point is exceeded. Independent testing by the Building Research Establishment has shown that this can provide a saving in energy consumed of between 5% and 15% depending on outside weather conditions.

### *Maintenance*

Once an efficient system has been designed and installed it will require regular maintenance to ensure that efficiency continues. As well as servicing of boilers, radiators should be bled annually and visibly inspected for leaks or damage. Because of thermal air currents, there will also be a build up dust on grilles and these will require regular cleaning.

The chosen radiators should therefore be easy to access and maintain. With LST radiators, access should be as easy as possible without compromising on security. Useful features to look for are the ability to remove grilles separately from the casing for cleaning, as well as the ability to remove the casing completely without needing to drain the central heating system. This latter feature will also be useful when decorating is carried out.

### *About Jaga*

Jaga offers a wide range of safe, cool-touch LST radiators, designed to minimise risk and comply with regulations without compromising on performance or style. Jaga’s LST radiators are created through a combination of innovation, experience and engineering excellence, making them ideal for any project where safety is paramount.

Widely used in schools, care homes, hospitals and other applications where vulnerable people need protection from hot surfaces, Jaga’s LST radiators include features such as low mass low water content (low-$H_2O$), impact resistance, anti-tamper fixings and dirt-repellent finishes. For ease of maintenance, casings can be removed and replaced without disturbing the heating elements.

The compact nature of Low-$H_2O$ radiators allows them to be built into a wall recess or behind seating and other wall-mounted items to provide a powerful and efficient, yet unobtrusive LST heating solution.

### Sustainability and the environment

Jaga has a policy of manufacturing ecologically sustainable products, using the minimum amounts of raw materials and energy in their construction, backed by the use of environmentally friendly paint shops without solvents and with total recovery. All Jaga products are fully recyclable.