Technical Paper

SILCOCK DAWSON & PARTNERS

Avoiding Overheating in medium & high rise apartments

The recent changes to Building Regulations and the requirements for higher levels of Code for Sustainable Homes compliance over the past few years, has meant that new homes are being built to increasingly high thermal standards including improved fabric insulation and air tightness.

Whilst these improved standards have reduced the winter heating requirements, there has been a consequential undesirable effect of summertime overheating in some developments. The increasing use of communal heating systems linked central plant can exacerbate the problem due to hot water being circulated through the system 365 days a year to provide the domestic hot water needs adding to the heat gain in dwellings and communal areas. The predictions of rising temperatures in the future due to global warming is likely to cause even higher internal temperature to be experienced.

These problems are most prevalent in medium and high rise apartment blocks in city locations particularly where a extensive areas of glazing is used on the building façade.
In recent investigations into overheating problems we have measured internal temperatures in apartments in excess of 30°C for excessive periods which caused significant discomfort to the occupiers.

Typical modern apartment block with extensive glazing

Current Statutory Requirements

The only current statutory requirements relating to avoiding overheating is Part L of the Building Regulations

The 2010 version of Part L of the Building Regulations requires that the effects of solar gain in summer are limited to avoid excessive heat gain. Compliance is demonstrated through Appendix P of the SAP calculation. Whist the SAP calculation provides a prediction of the risk of overheating it is our experience that compliance does not guarantee that extensive temperatures will not be experienced. Neither does it assess the risk of overheating to common areas such as internal corridors etc.

Design Standards

There is currently no universally adopted standard for assessing the risk of overheating in dwelling other than the SAP calculation. Other relevant guidance recommendations include;

CIBSE Guide A / TM36

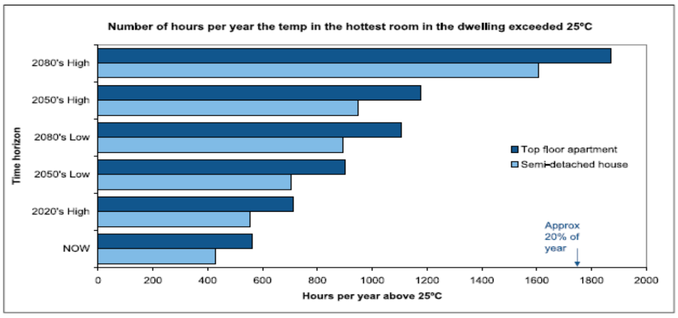
These guides recommend that internal temperatures should not exceed 28°C in living rooms and 26°C in bedrooms, for more than 1% of the annual occupied period.

Passivehaus

The Passivehus standards recommend that internal temperatures are limited to not exceed 25°C for more than 10% of the occupied period.

BS EN15251:2007

BS EN 15251:2007 applies an 'adaptive' approach and assesses indoor temperature against the prevailing outdoor temperatures over the previous week. This allows for higher indoor temperatures within naturally ventilated buildings during spells of warm weather. It assumes that occupants will adjust their clothing, open windows and be more tolerant of higher operative temperatures when the external temperature has been high.



Predicted annual hours over 25°C based on modelling : Source Zero Carbon Hub.

Assessment Methods

In 2010 the NHBC Zero Carbon Hub published a Topic Report on Future Climate Change called for immediate action to gain a better understanding of overheating in dwellings and that a suitable model is identified for determining potential overheating in dwellings.

To assess whether a dwelling will meet any of the above criteria at the design stage it is necessary to carry out thermal modelling. The thermal model will predict the internal temperatures over a typical year taking into account; the total heat gains including; solar, people, equipment, lighting etc.
The modelling should be based on the Design Summer Year (DSY) for the particular location of the building. The internal temperature will be affected by a number of factors including;

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- Heat gains
- Orientation
- The quantity and specification of glazing
- Shading
- Ventilation strategy
- Thermal mass of the building fabric
- Occupancy

Use of external shading to reduce solar gains on a residential apartment

Whilst thermal modelling of the building is required to predict internal temperatures, there are some good practice rules that can be applied to minimise the risk. These include;

- Minimise solar gain by careful window / shading design and specification.
- Maximise the thermal mass of the building.
- Effective mechanical and natural ventilation strategy including opening windows with cross ventilation wherever possible.
- Minimise internal heat gains by specifying low energy lighting and appliances wherever possible.
- Avoid heat gain from community heating systems and equipment.
- Ventilate common corridors and service risers containing heating pipe work.

Successful ventilation strategy includes both the mechanical ventilation and the natural ventilation. Mechanical ventilation is required to meet Part F of the Building Regulations as a minimum. Carefully designed enhanced mechanical ventilation can assist in extracting heat from dwellings, however natural ventilation, (opening windows), will be required to purge any excessive heat build up. Cross ventilation should be provided wherever possible. Common corridors where communal heating pipe work is distributed should be ventilated to avoid excessive heat build up. This should ideally be by natural ventilation but where this not possible mechanical ventilation should be provided.
This can often be provided by operating the smoke ventilation on a low extract rate.

Heat should be extracted from cupboard containing heat generation equipment such as hydraulic interface units (HIUs) commonly used on community and district heating systems.
Heating emitting equipment and pipe work should be well insulated to minimise heat gains.

Many of the factors that can affect the performance of the building in respect to thermal comfort are decided in the early stages in design such as; orientation, façade design and treatment, natural ventilation strategy etc. The early involvement by an engineer to provide thermal modelling and design advice is a key factor in avoiding overheating issues.

Until a universally accepted method of assessing the risk of overheating in dwellings is developed, the industry is at risk of building homes that may overheat in the current climate and will not be fit for future rises in temperature due to predicted climate change.
If we are to future proof our buildings a completely new approach to design and construction may be necessary where lightweight cladding systems and plasterboard walls are replaced with high thermal mass construction, windows are provided with controllable external shading and natural cross flow ventilation is provided.

Apartment building in Australia with high thermal mass construction and controllable external solar blinds.

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