QODA

QODA

w. qodaconsulting.com
e. enquiries@qodaconsulting.com

CIBSE TM52 - The Limits of Thermal Comfort: Avoiding Overheating in European Buildings

Highly insulated, air-tight buildings are an energy-efficient design during the heating season, but can increase the risk of overheating during summer months. During the design stage QODA can assess the likelihood of overheating using dynamic simulation modelling tools and, if necessary, advise on appropriate measures to design out the risk of having an uncomfortable building.

We use dynamic simulation modelling to assess the risk of overheating using the industry-standard methodology published in CIBSE TM52 - The Limits of Thermal Comfort: Avoiding Overheating in European Buildings. The TM52 methodology can be applied to all building types, although schools are still assessed using BB101.

The modelling software (such as IES or TAS) is used to replicate the geometry of the proposed building design then parameters including weather data, U-value fabric standards, window openings and internal heat gains are applied to the model. The following technical summary explains how the TM52 calculation tool (which is embedded within the modelling software) defines the risk of overheating.

TM52 uses an "adaptive thermal comfort" approach which is based on research showing that people adapt to recent changes in external temperature. This means that throughout the year there is no single fixed temperature that most people feel comfortable at, for example 18°C feels warm in spring after a cold winter but feels mild after a prolonged warm period.

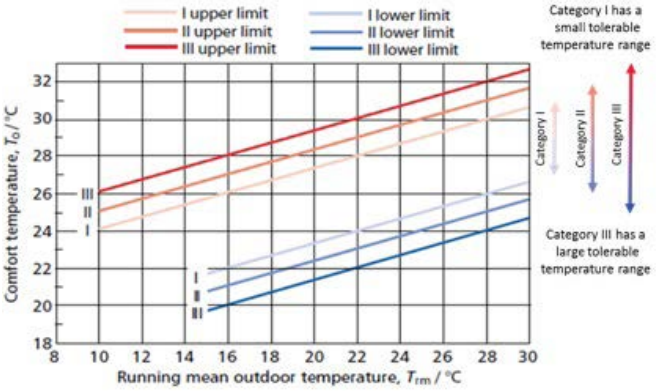
Therefore, in order to assess whether a building is at risk of overheating, the upper limit of the indoor comfort temperature needs to be known for each day. The maximum comfort temperature (T_{max}) is also calculated with consideration of the recent daily average outdoor temperatures.

The methodology also calculates the hourly operative temperature (T_{op}) within each room. T_{op} accounts for both air temperature and other room factors. CIBSE TM52 provides three criteria for defining the risk of overheating in buildings where each criterion sets a target for what T_{op} should be compared to T_{max}. If a room fails to achieve any two of the three criteria it is classed as overheating.

TM52 also accounts for different building categories, and therefore doesn't assume the same criteria is applicable to all building types:

- Category I – Buildings whose occupants are sensitive or fragile e.g. certain healthcare / recovery (4°C comfortable temperature (T_o) range)
- Category II – Normal expectation, used for new buildings and renovations (6°C comfortable temperature (T_o) range)
- Category III – Moderate expectation, used for existing buildings (8°C comfortable temperature (T_o) range)

It is the responsibility of the engineer to discuss and agree with the client what building type is most applicable before undertaking the assessment.



Criterion 1 sets a limit on the number of hours the operative temperature can exceed the maximum comfort temperature:

T_{op} should not exceed T_{max} by more than 1 degree for more than 3% of occupied hours during the months of May to September.

(When looking at results we are therefore looking for this number to be less than 3%).

Criterion 1 will show which rooms frequently overheat. This is likely to happen in rooms where heat gains are not dissipated sufficiently and heat accumulates over several days. This is often the case for rooms which don't have a night cooling/ ventilation strategy.

Criterion 2 sets a daily limit on the length and severity of the operative temperatures:

T_{op} should not exceed T_{max} by more than 6 degree-hours.

This means that, for example, T_{op} could exceed T_{max} by 1 degree for a maximum of 6 hours each day (i.e. 1 degree x 6 hours = 6 degree-hours), or by 2 degrees but only for 3 hours (i.e. 2 degrees x 3 hours = 6 degree-hours).

Criterion 3 sets an absolute upper temperature limit: T_{op} should never exceed T_{max} by more than 4 degrees Evaluating Criteria 2 and 3 together demonstrates the extreme conditions:

If T_{op} exceeds T_{max} by 4°C for 2 hours, the room will also fail to comply with Criterion 2 (4°C x 2 hours = 8 degree-hours).

By assessing the results of each criterion we can understand if the proposed building design is likely to suffer from prolonged overheating and/or severe temperature peaks. Based on this we can made recommendations to the design team on how to minimise the risk of overheating. Complying with TM52 can present design challenges but ultimately creates a more comfortable environment. By having a building resilient to climate changes and where occupants are comfortable can also prevent the need for costly retro-fitting of cooling systems in the future.