ThermaCool®

CEILING TILE

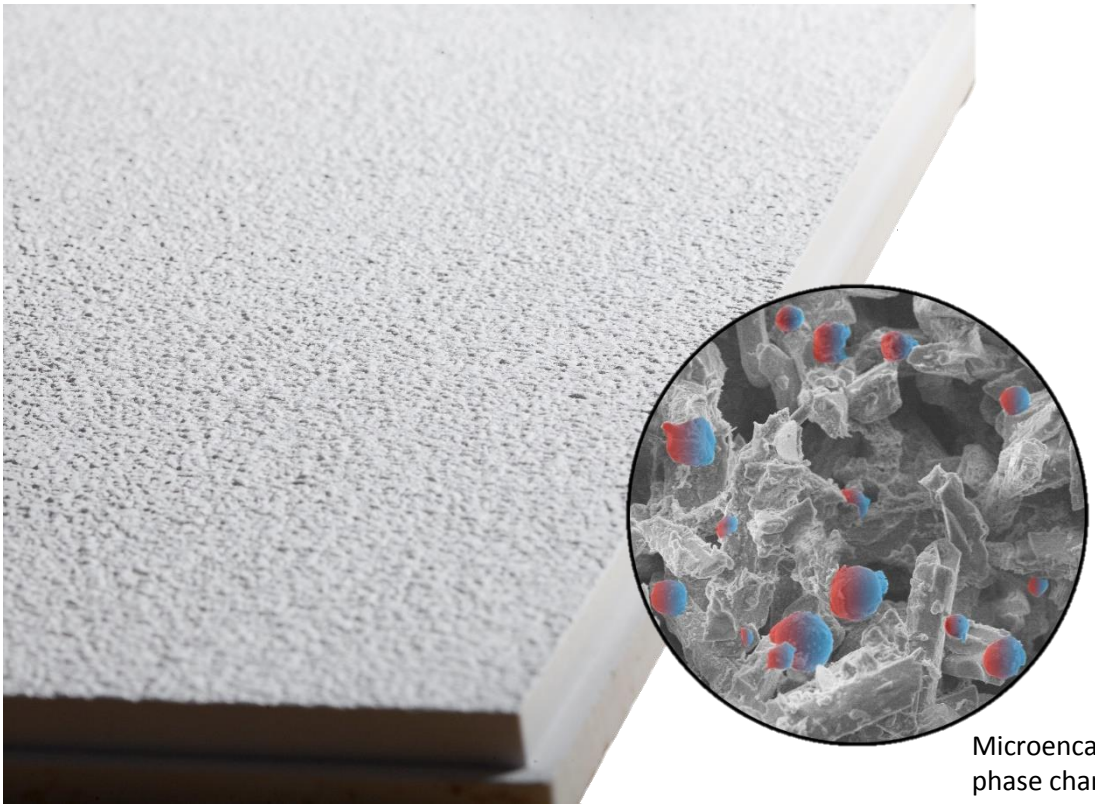
Thermal Mass

Passive Cooling

Thermal Comfort

ThermaCool®

ThermaCool® ceiling tiles incorporate a phase change material that absorbs, stores and releases excess internal heat gains, providing a lightweight thermal mass solution as well as thermal comfort through passive cooling.



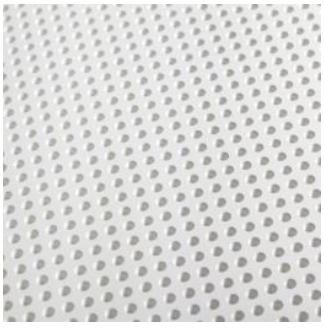
Microencapsulated phase change material

ThermaCool® Preformed Mineral Tile

The ThermaCool® Preformed mineral tile is manufactured from abundant natural minerals and incorporates a microencapsulated phase change material that can be installed as either a replacement for existing tiles in a retrofit project or as a complete system for new build construction, provides a thermal mass solution.

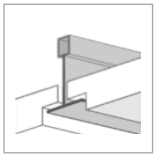
In buildings where the thermal mass benefits from the building fabric is lost due to improved insulation and airtightness measures, or in steel or timber structures which have little or no thermal mass performance, the ThermaCool® tile offers an easy to install, cost effective and lightweight thermal mass solution.

The ThermaCool® Preformed Natural Mineral Tile is available either as a perforated acoustic tile or a solid with light texture finish. The tiles are supplied with either a square or tegular edge profile to suit ThermaCool® Profile 15mm or 24mm T-Grids.

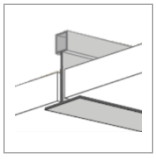


Perforated / Acoustic

Caprice Light Texture



Tegular



Square

Hygroscopic

In addition to the heat storage capability, the tile has excellent hygroscopic characteristics, absorbing the excess humidity in the atmosphere, and then gradually restoring the balance in dry and hot periods and as such improving the indoor air quality.

Life Cycle Performance

Over 10,000 thermal cycles have been completed on the phase change material which is the equivalent to over 30 years life performance without degradation.

How ThermaCool® Preformed Ceiling Tiles Work

The ThermaCool® ceiling tile incorporates tiny capsules of phase change material that absorb, stores and releases excess latent heat from within the building.

In building applications, these processes occur within a narrow temperature range close to the human comfort temperature with large amounts of heat being absorbed and released.

During the transition phases, the core of the microcapsule will melt as the room temperature reaches the transition temperature and in doing so will absorb latent heat where it will be stored until such time that the room temperature cools whereby the heat is slowly released back into the room.

ThermaCool® ceiling tiles are installed in to a suspended ceiling system. The heat is then absorbed from the room by means of radiation and convection, as long as the surface temperature of the ThermaCool® ceiling tile remains lower than the room temperature.

ThermaCool® compliments the natural dampening effect of the building mass. Part of the cooling demand in the building is therefore shifted to night time. This enables the utilisation of free cooling by the cooling night time air, and use to be made of lower cost electricity at night. The dampening effect during the day reduces the maximum mechanical cooling capacity required.

Thermal Mass using ThermaCool® Ceiling Tiles

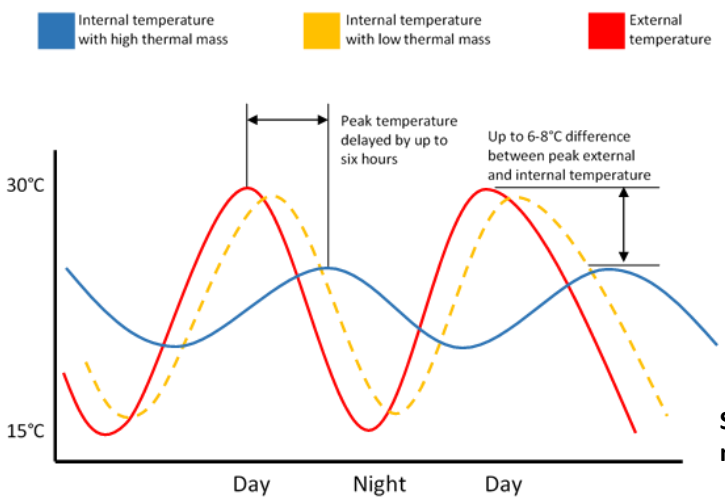
What is Thermal Mass?

A thermal mass is a material that absorbs heat from a heat source, and then releases it slowly. In buildings, thermal mass is provided by the structure of the building, the level of which is determined by the material the building is constructed from.

Buildings constructed of lightweight materials such as steel or timber are not considered to have good thermal mass properties compared to concrete, brick and stone for the reasons that they either have low thermal conductivity performance therefore a low ability to absorb heat, or can absorb large amounts of heat but the rate of heat release is also high.

The role of a buildings thermal mass can be of benefit throughout the year. During the warm weather in summer, heat will be absorbed by the thermal mass in order to prevent overheating in the building, providing a more comfortable living or working environment in naturally ventilated building or in air-conditioned building, reduces the cooling demand on mechanical air-conditioning systems. Allowing cool air to ventilate the building at night allows heat that has been stored throughout the day to be removed.

This daily heating and cooling cycle works particularly well in countries such as the UK and Europe where night time temperatures are typically around 10 degrees less than peak daytime temperatures, making it an effective way of drawing heat from the structure of the building.



Stabilising effect of thermal mass on internal temperature.

"The benefit of thermal mass in residential buildings is well understood in warmer parts of Europe, but is also becoming increasingly relevant to other regions where the impact of climate change is leading to more frequent occurrences of overheating. Its application in commercial buildings is also growing, where one of the key benefits is lower running costs of air conditioning systems."

Stabilising effect of thermal mass on internal temperature and quoted text has been sourced from: Thermal Mass Explained, The Concrete Centre

Thermal Mass using ThermaCool® Ceiling Tiles

Summertime Overheating

The effectiveness of thermal mass for reducing summertime overheating has been well established for both commercial and domestic buildings and has also been found to be an important part of low energy adaption responses to a warming climate under climate change.

The benefit of thermal mass in buildings is well understood in warmer parts of Europe, but is also becoming increasingly relevant to other regions where the impact of climate change along with more rigorous building regulations for improved thermal efficiency and air tightness of buildings, is leading to more frequent occurrences of overheating.

During warm weather, much of the heat gain in heavyweight buildings is absorbed by the thermal mass in the floors and walls, helping prevent an excessive temperature rise and reducing the risk of overheating.

This makes naturally ventilated buildings more comfortable and in air-conditioned buildings with thermal mass the peak cooling load can be reduced and delayed.

However as buildings become more thermally efficient and air tight through the installation of internal wall insulation, the thermal mass element of the buildings fabric no longer becomes of benefit.

Work by CIBSE and Arup suggests that most people begin to feel ‘warm’ at 25°C and ‘hot’ at 28°C. Their report also defines 35°C as the internal temperature above which there is a significant danger of heat stress. However, overheating is not just a function of high temperature, other factors such as lack of air movement and sustained exposure to high temperatures will also affect the comfort level of occupants.

The health impacts of overheating can include an increased risk of illness from respiratory and cardiovascular disease, and the consequences of exposure to extreme warm temperatures sustained over a period are significant with increased numbers of deaths as a result.

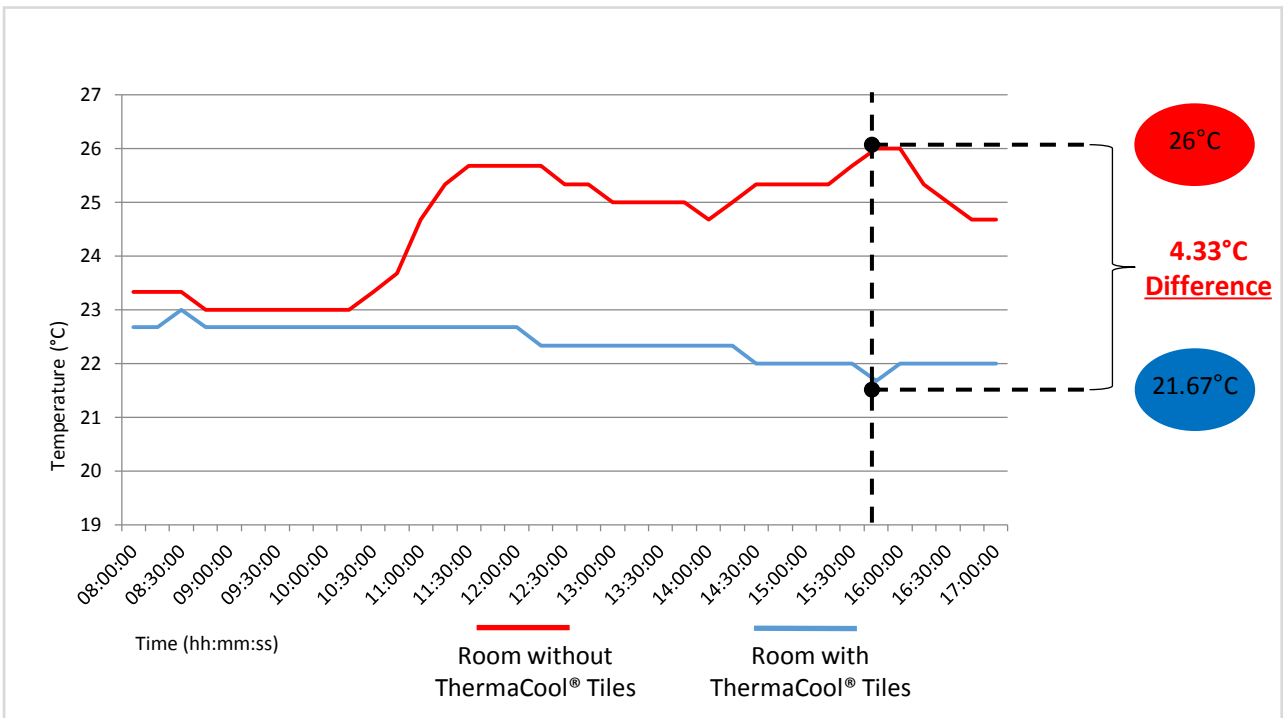
ThermaCool® Ceiling Tiles – Case Study

Situated on the south bank of the River Thames, London the Ofcom Head Office building is built using typical modern commercial building construction methods comprising of a steel structure and fully glazed façade with internal lightweight stud and plasterboard partitions and standard metal ceiling tiles.

Due to the lack of thermal mass offered by the structure, the contribution of internal heat gains from solar, occupant, lighting and small electrical equipment placed a significant demand to the existing HVAC system to provide thermal comfort.

By installing the ThermaCool® Ceiling Tiles into problematic areas within the building, the internal thermal comfort levels were significantly improved utilising the passive thermal mass performance of the tiles to reduce peak heat temperatures by up to 4.3°C compared to areas with standard metal ceiling tiles installed.

Graph 1: Internal temperature comparison between a room with ThermaCool® Ceiling Tiles installed compared to standard metal ceiling systems



ThermaCool® Ceiling Tile Applications

Commercial

Conventional building materials continually increase in temperature as they absorb heat during the working day and this heat has to be mitigated by air conditioning. Furthermore, due to improved building regulations for the requirement of higher insulation to the fabric of the building and aggressive levels of airtightness, is now contributing significantly to serious overheating problems in commercial buildings which places additional energy cooling demands on HVAC systems.

The demand for air conditioning in non-domestic buildings is growing rapidly in response to more intensive building use and increased demands for comfort by occupants. As such there are increasing opportunities to exploit free cooling by adopting passive and cost effective technologies, such as the ThermaCool® ceiling tile.

Educational Buildings (Schools, Colleges and Universities)

The Priority School Building programme (PSBP) is a centrally managed programme set up to address the condition needs of the schools most in need of urgent repair. Through the PSBP, 261 schools will be rebuilt or have their condition needs met. The first school will be completed in 2014.

Adopting an economic approach to the construction of school buildings often results in the construction of lightweight structures with very low thermal mass. This approach does not allow any high heat gains to be absorbed by the thermal mass parameters of the building.

The adaptive comfort approach follows the methodology and recommendations of European Standard EN 15251 to determine whether a building is likely to overheat, or in the case of an existing building whether it can be classed as overheating.

- -New guidelines for adaptive thermal comfort from the Education Funding Agency.
- Schools should be designed to incorporate thermal mass and night cooling to prevent summertime overheating.
- The building should be designed so as to limit the maximum internal temperature and should be assessed for overheating using the most relevant weather files from CIBSE's Summer Design Reference Years. Incorporating thermal mass and night cooling into the design to prevent summertime overheating should also be considered.

ThermaCool® Preformed Mineral Ceiling Tiles

Product Specification and Technical Performance

CAPRICE LIGHT TEXTURE

Dimensions: Module Size (mm): 600 x 600

Thickness (mm): 20mm

Weight: 10.83kg/m²

Peak Melting Temperature: 23°C

Total Heat Capacity (10-30°C): 82Wh/m²

Surface Finish: Light Texture

Sound Reduction
Ceiling construction based on 200mm suspension: 35 Db Dnfw

Accessibility: Fitted within a suspended T-grid the tile are easily installed or removed to gain access to services within the plenum.

Cleanability: Periodic cleaning with a vacuum and wet wiped with a damp cloth. In extreme cases the tiles can be painted.

Humidity Resistance:
10 µ (dry), 4 µ (wet)

Light Reflection:
75% - 80%

Fire Performance: Euroclass B s2, d0
(EN13501-1)

Installation: ThermaCool® ceiling tiles must be installed in accordance to installation diagrams and installation guides.

Indoor Climate: ThermaCool® ceiling tiles are manufactured from hygroscopic materials that help improve the indoor environments by controlling the moisture content of the room.

ThermaCool® Preformed Mineral Ceiling Tiles

Product Specification and Technical Performance

PERFORATED ACOUSTIC

Dimensions: Module Size (mm): 600 x 600

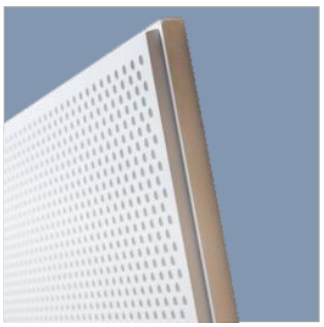
Thickness (mm): 16mm

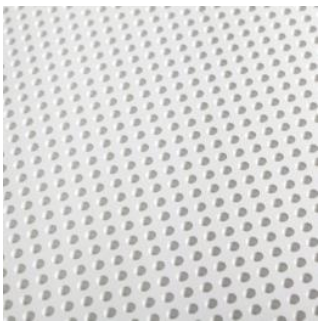
Weight: 12.5kg/m²

Peak Melting Temperature: 23°C

Total Heat Capacity (10-30°C): 93Wh/m²

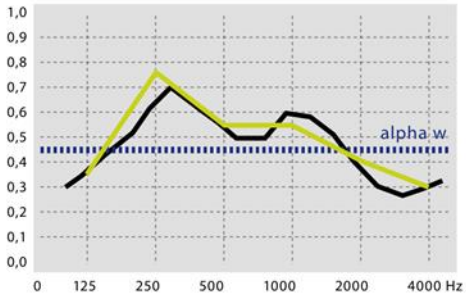
Surface Finish: Perforated: (6.4mm Ø)





ACOUSTIC
Sound Absorption: Test results according to EN ISO 354:2004

- αp Practical sound absorption coefficient
- αs Practical sound absorption coefficient



Product: ThermaCool® Acoustic Preformed Tile – TCP85

Absorption class: alpha w = 0.45 (L), Class D
alpha w = 0.7 (C), Class C

Acoustic insulation: 54.2dBA; 57 (-3;-9)db

Accessibility: Fitted within a suspended T-grid the tile are easily installed or removed to gain access to services within the plenum.

Cleanability: Periodic cleaning with a vacuum and wet wiped with a damp cloth. In extreme cases the tiles can be painted.

Humidity Resistance:
10 µ (dry), 4 µ (wet)

Light Reflection:
75% - 80%

Fire Performance: Euroclass B s2, d0
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