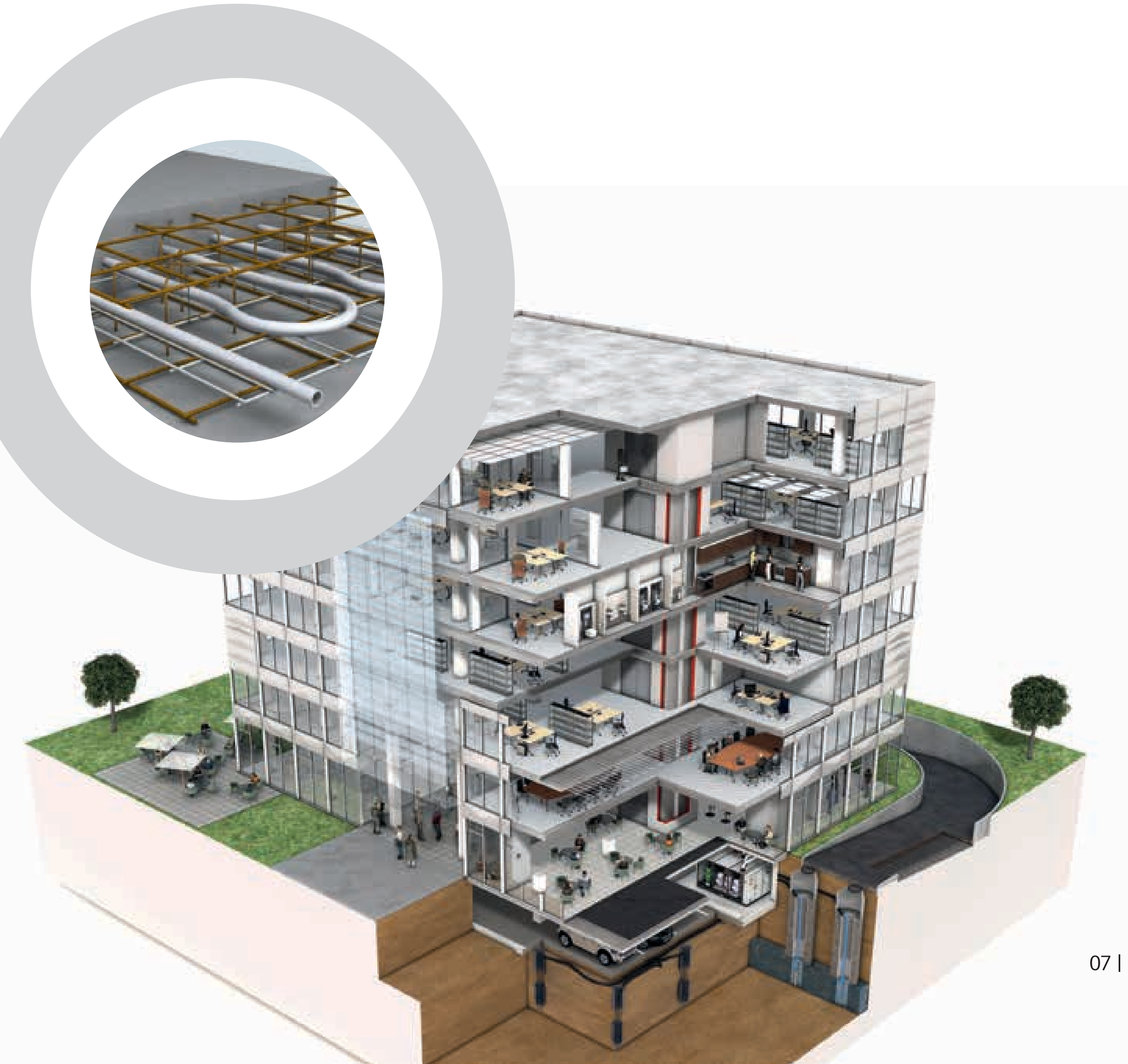
Uponor Contec
Why select TABS?

THERMALLY ACTIVE BUILDING SYSTEMS



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This chapter highlights system features which result in clear benefits for both occupants and building owners. These benefits are due to the high quality of indoor environment provided by the system, and the low life-cycle costs associated with a thermally-active system and its integration into a building.

Short and long-term benefits of the Uponor Contec system:

High level of thermal comfort for occupants:

TABS (reference ISO11855-1) is silent in operation. There is no noise from fans, it creates neither dust nor indoor draughts, and heat exchange occurs by means of pleasant uniform radiation in all parts of a room, thus eliminating temperature asymmetry. TABS performs via large surface emitters with low gradient. The system provides a better, healthier indoor environment for a perfect place to live or work.

Low investment and energy-efficient operation:

Life-cycle cost assessments show: the longer the lifetime of system components, the lower the overall whole-life costs. For TABS and borehole heat exchangers with 50+ years of lifetime (equal to the lifetime of a building), this creates a substantial advantage compared to short-life components such as fan coils. Furthermore, the operation of long-life components is, to a great extent, maintenance free, and primary energy use is significantly lower than for all-air systems.

Optimised utilisation of renewable energy sources:

Low temperature heating and high-temperature cooling with TABS is the key to integrating renewable energy sources into high-performance buildings. The use of large surface emitters allows heating and cooling at temperatures very close to that of the ambient environment. This means that renewable energy available from the ground, ground or sea water, sun and air can be easily integrated and utilised.

The TABS large surface emitters are highly suitable for the use of free or low cost energy in accordance with low exergy design principles. This is due to the low lift between ambient temperature, flow temperature and room temperature which enables extensive free cooling (approx. 75 % in Europe) during the summer period. The chiller/GSHP operates with a very high COP.

Complete freedom of room utilisation – no restrictions in room design:

TABS, as an active storage system for cooling and heating, is integrated into the structural concrete. Due to the reduced size of the technology used in water-based heat exchangers, TABS has no space requirements, unlike the air ducts required for an all-air system.

Thus, the partitioning of future offices and room utilisation can be determined independently of the embedded system. The possibility of using exposed concrete in their design is one reason why architects and designers favour the invisible cooling option provided by TABS.

Reliability & trust in a proven system:

The Uponor system was the first of its kind in thermally-active building systems and has been proven in more than 1,000 buildings since 1997. It is made of durable and long lasting components, and has successfully been installed worldwide in the highly divergent climatic regions of four continents. This includes climates as diverse as Moscow in Russia, Central Europe, inland and coastal Europe, Southern Europe, the Middle East, Southeast Asia, South Africa and North America.

Thermal comfort

This chapter offers a detailed look at how TABS enhances thermal comfort. It outlines the basic principles and definitions of the term thermal comfort as well as the parameters required to create it, followed by specific system information.

According to ISO 7730 thermal comfort is "That condition of mind, which expresses satisfaction with the thermal environment". Influencing parameters are indicated in two value tables describing a person's activity:

- MET, corresponding to heat production
- CLO, corresponding to clothing level and thermal insulation

An additional three measured parameters describing the thermal environment at the workplace are taken into account:

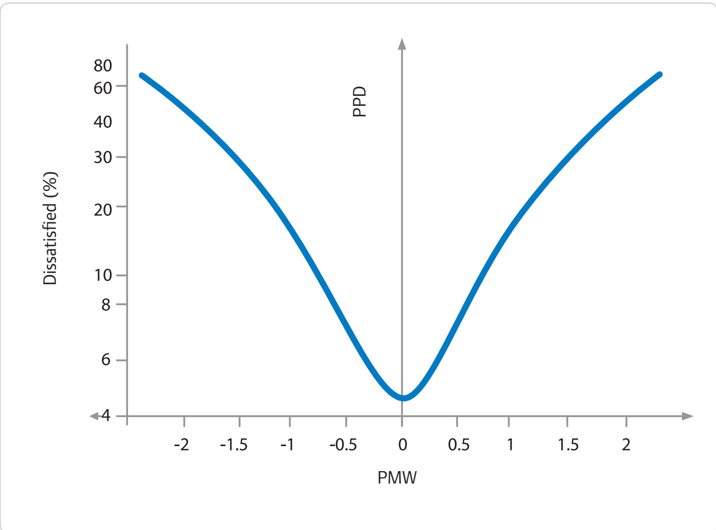
- Operative temperature
- Air velocity
- Humidity

PMW and PPD

EN ISO 7730 is an international standard that can be used as a guideline to ensure an acceptable indoor thermal environment which is typically measured in terms of Predicted Percentage Dissatisfied (PPD) and Predicted Mean Vote (PMV). PMV/PPD basically predicts the percentage of a large group of people that are likely to feel "too warm" or "too cold" (EN ISO 7730 does not replace national standards and requirements, which must always be followed). For the purpose of design and assessment, indoor environmental input parameters and their interaction are defined in EN 15251.

The PMV is an index that predicts the mean value of votes for a given thermal environment from a large group of people. It encompasses a seven-point thermal sensation scale from +3 to 0 to -3 (hot, warm, slightly warm, neutral, slightly cold, cool, cold), based on the heat balance of the human body. Thermal balance is obtained when the internal heat production in the body is equal to loss of heat to the environment.

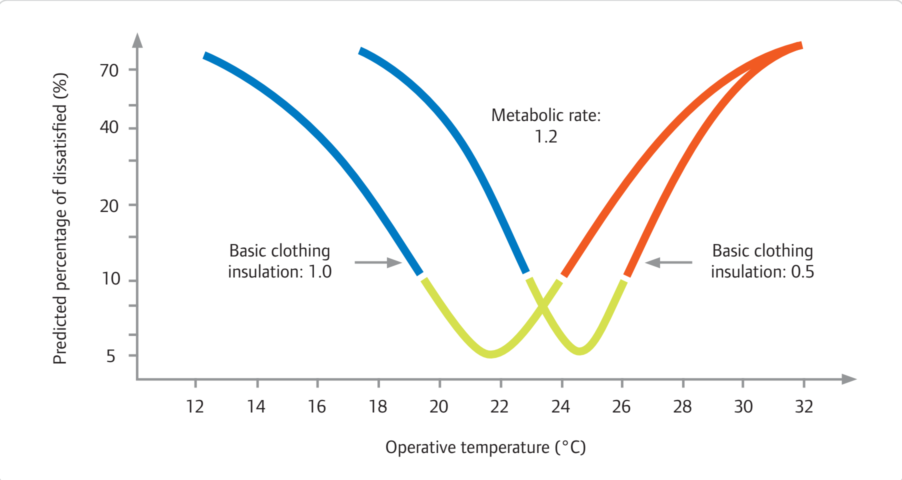
The PPD predicts the number of thermally dissatisfied persons among a large group of people. The rest of the group will feel thermally neutral, slightly warm or slightly cool. The table below shows the desired operative temperature range during summer and winter, taking into consideration normal clothing and activity level, in order to achieve different comfort classes.



Desired operative temperature range

ISO 7730 recommends a target temperature of 22 °C in winter and 24.5 °C in summer. The higher the deviation from these target temperatures, the higher the percentage of dissatisfied people. The reason for the different target temperatures is that different clothing conditions apply in the different seasons, as can be seen in the diagram below.

CLO 1.0 includes a normal long shirt, thin sweater, normal trousers, socks and shoes. CLO 0.5 includes a short sleeve shirt, normal trousers, socks and shoes.



Operative temperature for summer and winter clothing

Room operative temperatures

Convective cooling and heating with air conditioning systems enables the room air temperature to be kept almost constant during the occupied period. However, this is not necessarily positive: occupants bothered by draught or noise from fans will feel dissatisfied. Dissatisfaction may be compounded by the fact that windows cannot be opened.

As mentioned above, the factors affecting general thermal comfort are CLO, MET, air temperature, mean radiant temperature, air velocity and humidity in the room. A surface system mainly influences the air temperature and the mean radiant temperature, and only has limited effect on indoor air flow. Air temperature and radiant temperature are often quoted as a mean value. This mean value is called "operative temperature" or "dry resultant temperature" and is applicable to air velocity below 0.2 m/s.

The requirements for comfortable indoor climate therefore relate to an acceptable operative temperature range which combines both convective and radiative heat exchange.

Characteristic indoor climate

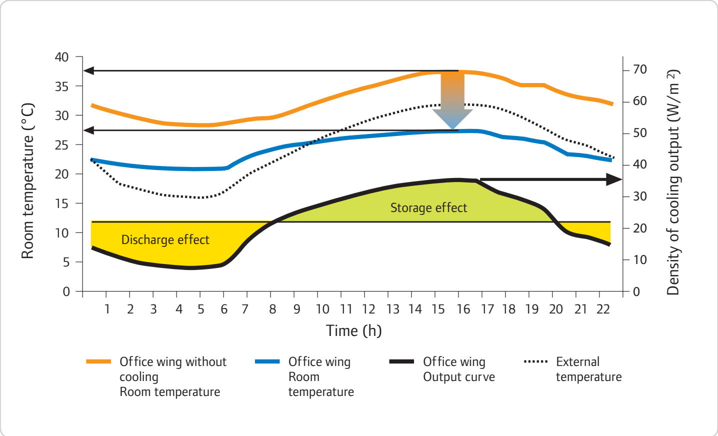
For structural and control reasons, TABS operates with small temperature differences. Its output is limited due to the relatively small difference between surface temperature and room temperature. In badly insulated buildings it is therefore not possible to fully compensate peak loads with immediate effect as energy is distributed over an extended period.

Room temperature will therefore rise slowly as a result of internal loads and ambient temperature or solar radiation (external load). However, the temperature tends to remain within a range that is perceived to be thermally comfortable. The system is particularly useful for preventing overheating of buildings during extended hot spells. Many occupants perceive the radiant heat exchange which is accompanied by relatively cool room surfaces as very pleasant. Draughts are avoided due to low air velocities and low air turbulence rates.

Airborne systems that perform cooling primarily by convection are, however, able to keep room air temperature close to a setpoint. To achieve the setpoint in peak hours and the same operative temperature without cooled radiating surfaces, an increase in cooled air volume is required. Higher air volumes increase the percentage of dissatisfaction in relation to perceived comfort.

The operative temperature is used as a reference value for the room temperature in heating demand calculations (EN 12831). However, cooling load calculations (EN 15255, EN 15243) are still based on room air temperature. It is advisable to use the operative temperature for this purpose, as well. This is very important for surface systems, since it takes into account not only air temperature, but also radiant temperature and therefore surface temperature. Regardless of what system is used, general comfort is achieved with the same operative temperature, although the respective air and mean radiant temperatures may differ.

Most of the standards mentioned do not define a specific room temperature, but specify ranges for heating (20-24°C, winter) and cooling (23-26°C, summer) based on the dedicated category (ISO 7730 cat. A to C and EN15251 cat. I to IV). Normally, new buildings are designed to comply with category II or class B.



Diurnal temperature and cooling output curve. Comparison with and without concrete core activation

Class		Comfort requirements		Temperature range	
EN 15251	ISO 7730	PPD [%]	PMV [/]	Winter 1.0 clo 1.2 met [°C]	Summer 0.5 clo 1.2 met [°C]
I	A	< 6	- 0.2 < PMV < + 0.2	21-23	23.5-25.5
II	B	< 10	- 0.5 < PMV < + 0.5	20-24	23.0-26.0
III	C	< 15	- 0.7 < PMV < + 0.7	19-25	22.0-27.0

Adaptation acc. to ISO 7730

TABS utilises the operative room temperature range. Measurements confirm that the room temperature in the morning (in cooling mode) is at the lower limit, i.e. 21°C to 23°C, rising to the upper limit, i.e. 24°C to 26°C, during the day. Several studies with people showed that temperature changes of less than 4 K per hour are acceptable.

Thermal comfort can be assessed using the steady-state PMV-PPD method according to ISO 7730 when temperature ramps are below 2 K per hour. This means that when the operative temperature during the summer is in the range of 23°C to 26°C (clothing ~ 0.5 CLO), it can be assumed that the subjective rating remains within an acceptable range (0.5 on the PMV scale) as long as the rate of temperature change is less than 2 K per hour.

Higher temperature ramps never occur in buildings with a thermally-active building system, normally they reach max. 0.5 K/h in reference to Kolarik 2008.

Further comfort parameters

Factors such as radiant temperature asymmetry (effect of different surface temperatures), draught (air temperature, air velocity, turbulence), temperature stratification and floor temperature also affect thermal comfort.

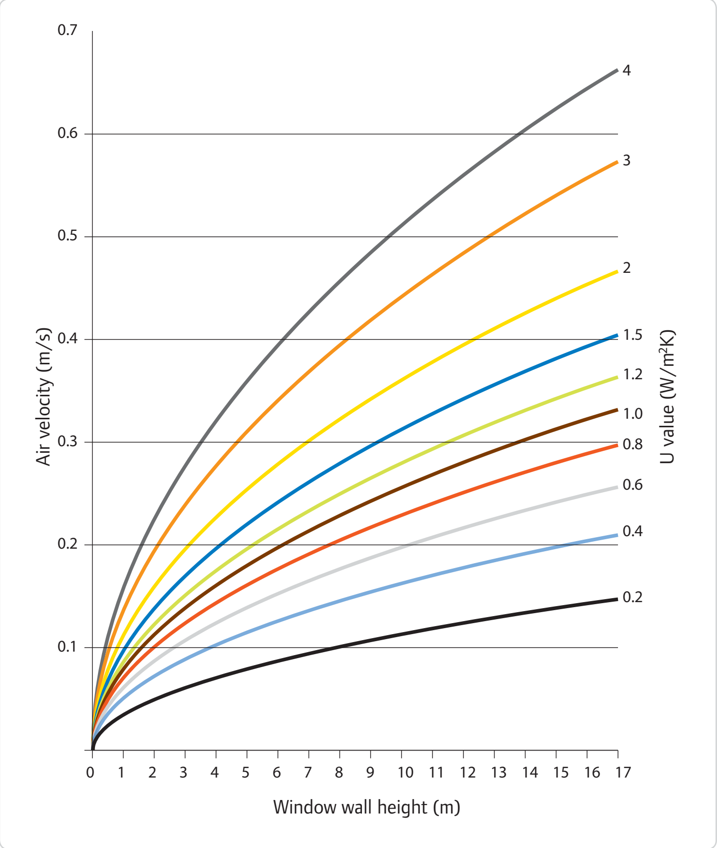
For ceiling systems, the requirement that radiant temperature asymmetry should be less than 5 K in heating mode means that, for normal room heights, the ceiling surface temperature should be less than 28-30 °C.

In cooling mode, radiant temperature asymmetry is not particularly significant. The surface temperature is limited by the requirement that the temperature must not fall below the dew point.

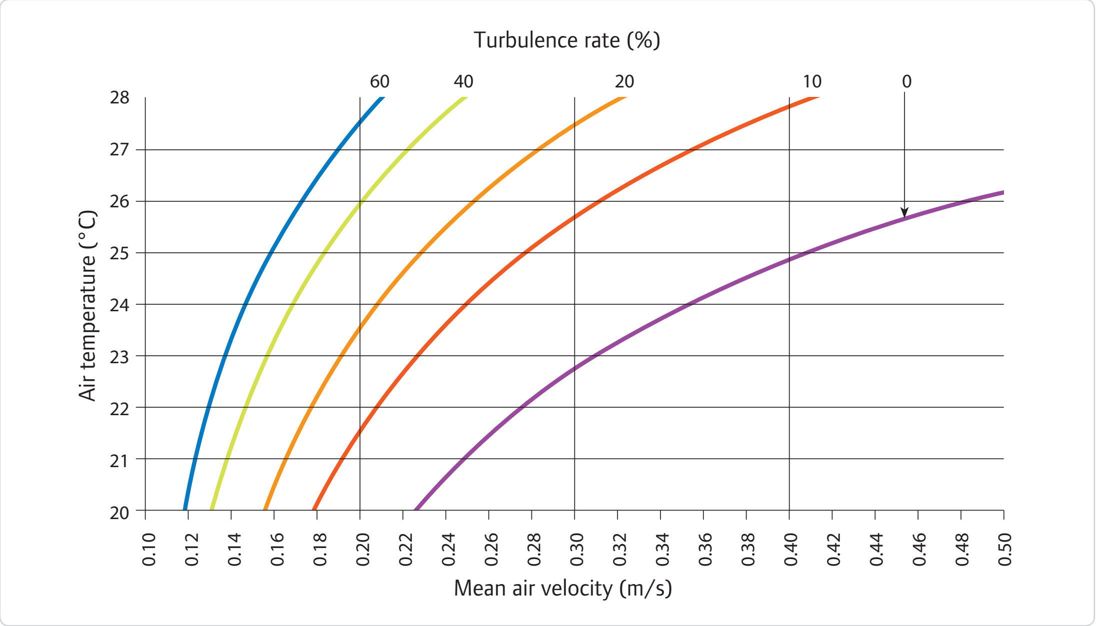
For thermally-active floors, floor temperature should be in the range 19-29 °C. The temperature in the peripheral zone (up to 1 m from the external wall) may go up to 35 °C. For sedentary activities, floor temperature should not fall below 20 °C.

In heating mode, the risk of downdraught of cold air near the windows should be prevented. For typical office room heights, this is best achieved through installation of windows with a small U value (< 1.5 W/m²K). In many new buildings the windows' U value is typically around 1.0 W/m²K, and this fact avoids the negative effect of cold downdraught.

The comfort limit for air velocity is approx. 0.18 m/s (draught rate = 15 %, air temperature = 21 °C, turbulence rate 10-20 %). The requirements for a draught rate of 15 % are shown in the diagram below.



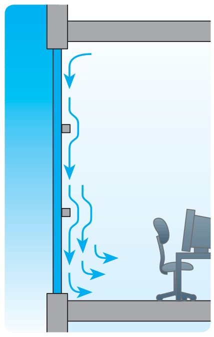
Relationship between window insulation and downdraught of cold air at -12 °C external temperature



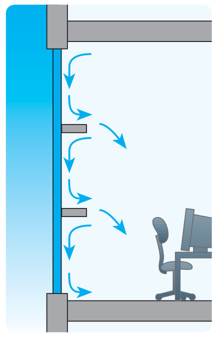
Acceptable mean air velocity as a function of air temperature and turbulence intensity (no more than 15 % of occupants dissatisfied due to draught)

In countries where local building code requirements for windows allow for higher U values than 1.5 W/m²K or where the external climate is more demanding, measures against downdraught of cold air include the installation of auxiliary floor heating in the peripheral zone up to 1 m from the external wall or, for very tall windows, installation of horizontal bars in order to interrupt any downdraught of cold air.

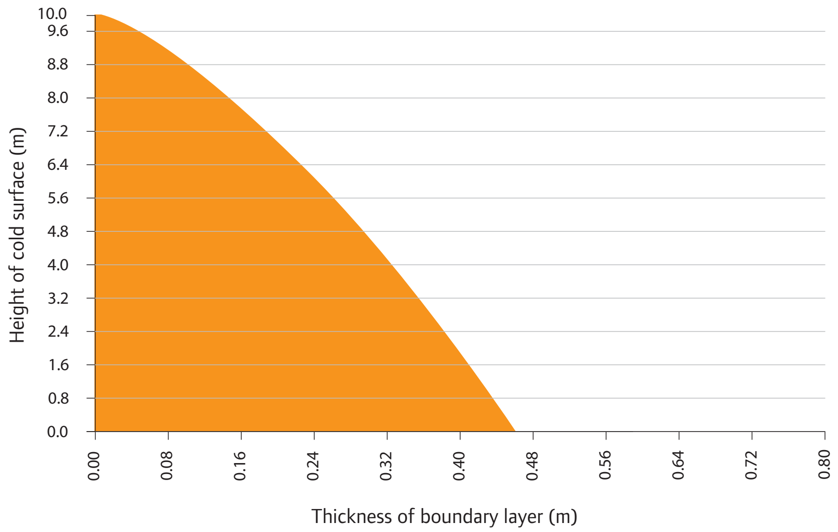
In the case of very tall windows of high U value, heating in the peripheral zone alone may not be sufficient. Here, the problem of downdraught can be solved by installing windows with better thermal insulation, or windows with horizontal bars that have a depth corresponding to the thickness of the boundary layer (see diagram below).



Horizontal bar has no effect



Cold air is interrupted



Thickness of boundary layer along the cold surface, U = 1.5 W/m²K, window height = 10 m

Surface heating and cooling systems can influence the room temperature, but cannot directly influence the humidity in a room. High humidity not only impairs comfort ('muggy' air) but can also limit the cooling output of surface systems if the temperature falls below dew point. Concrete core activation is therefore often installed in combination with mechanical ventilation systems, with the latter being designed for the minimum fresh air volumes required for health reasons (1-2 air changes per hour) rather than the conventional 4-6 air changes per hour. In summer, the supply air is cooled to 19-20 °C, in winter it is preheated to 20-22 °C. Part of the load is therefore covered via the ventilation system using active coil or heat recovery only. The air may be dehumidified via an air-conditioning system.

Hospital hygiene guidelines

According to German, Austrian and Swiss guidelines, TABS is even recommended for use in hospitals. This shows that, for health reasons, TABS is also a perfect solution for other types of buildings with less sensitive occupants.

Especially remarkable:
The joint air-conditioning working group of DGKH (German Association for Hospital Hygiene) recommends the use of radiant heating and cooling in combination with air conditioning for hospitals.

In its "Hospital hygiene guidelines for the design and operation of air-conditioning systems in hospitals", the joint air-conditioning working group of DGKH, Deutsche Gesellschaft für Krankenhaushygiene e.V. (German Association for Hospital Hygiene), SGSH, Schweizerische Gesellschaft für Spitalhygiene (Swiss Association for Hospital Hygiene), and ÖGHMP, Österreichische Gesellschaft für Hygiene, Mikrobiologie und Präventivmedizin (Austrian Association for Hygiene, Microbiology and Preventive Medicine), expressly recommends the installation of TABS or surface heating/cooling systems.

Extracts from the guidelines are quoted below:

...*"Hospital air conditioning concepts should be designed for the respective heating, cooling and ventilation demand, using separate systems as appropriate. In many cases, conventional systems involving large air-conditioned volume flows can be replaced with heated or cooled surfaces, often resulting in improved comfort. Water pipe registers installed in ceilings, floors and in some cases walls may be used for this purpose."*...

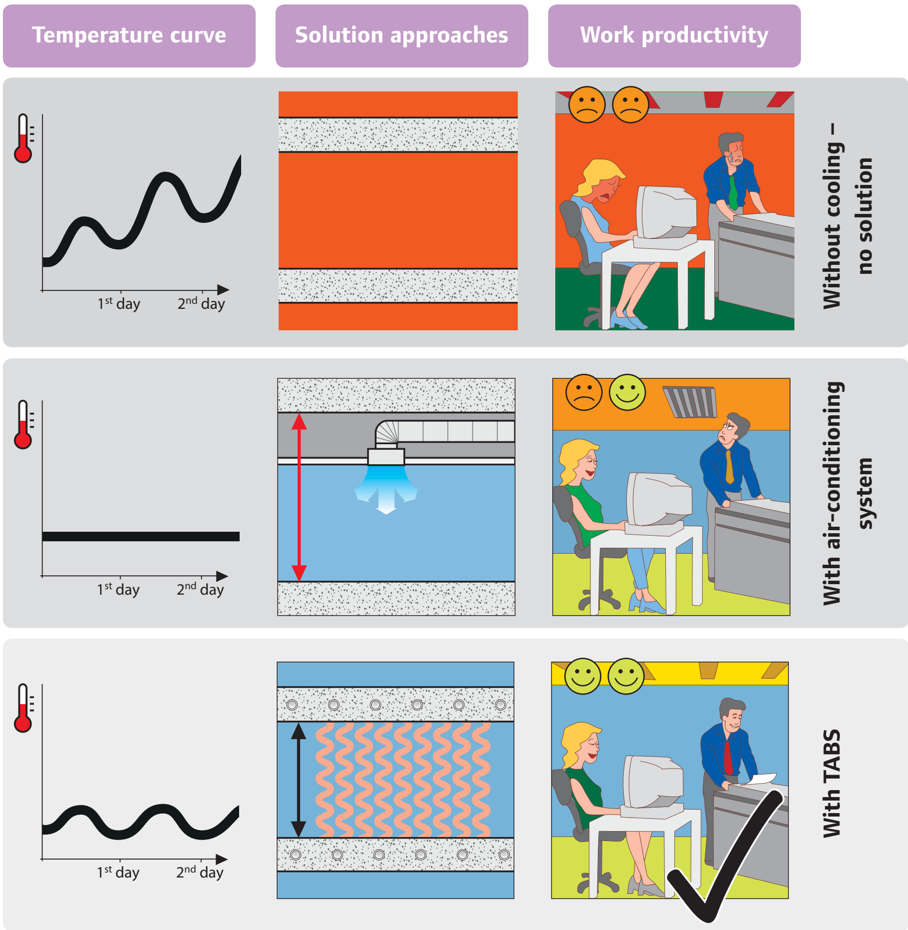
... *"In summer, operative room temperatures up to 25 °C are acceptable without problem, with the exception of operating theatres. With surface cooling, room air temperatures up to 26 °C are acceptable without violation of the comfort zone. If the fresh air volume flow required according to DIN 1946/2 is not sufficient for dealing with heat loads, cooling of structural components should be considered."*...

Recommendations that are defined as a "basis for cost-effective air-conditioning systems" and based on the exacting hygiene and comfort requirements in hospitals can be transferred to other building types and used as a standard for office and administration buildings.

Work productivity

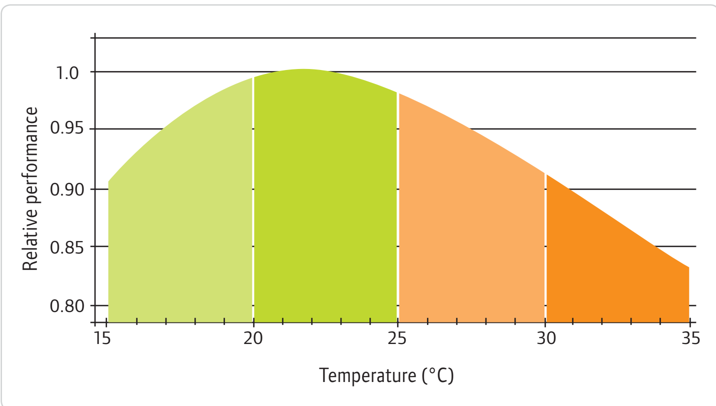
The use of TABS leads to an enhanced indoor climate. Creating a comfortable environment in commercial structures is a very important design consideration.

Employees that feel comfortable are more motivated and productive. Comfortable customers are more relaxed, contributing to the success of a business.



TABS leads to a comfortable indoor climate and hence higher staff motivation

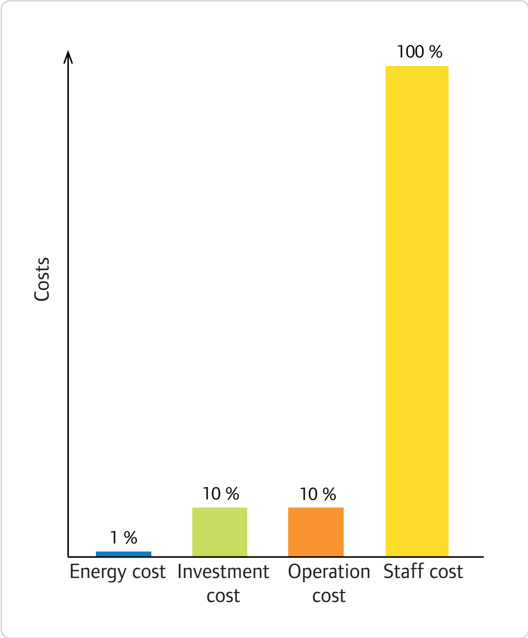
The indoor environment in office buildings directly affects both sick leave and work performance. The direct and indirect cost of an adverse indoor office climate can easily be as high as the costs for heating, cooling and ventilation. Djukanovic et al. (2002) showed that the annual increase in productivity was worth at least 10 times as much as the increase in annual energy and maintenance costs when improving the perceived air quality in office buildings. Due to productivity gains, a pay-back time of no more than 4 months can be achieved.



Relative performance of office work as a function of temperature
(source: Rehva guide book no 6., Seppänen et. al 2006)

The adjacent graph demonstrates the relationship between energy, investment, running and staff costs for office buildings during their life cycle.

Low quality and a deterioration in thermal comfort due to inappropriate conditioning systems means that investment costs which were initially saved will quickly be outweighed by illness-related absence and low staff productivity.



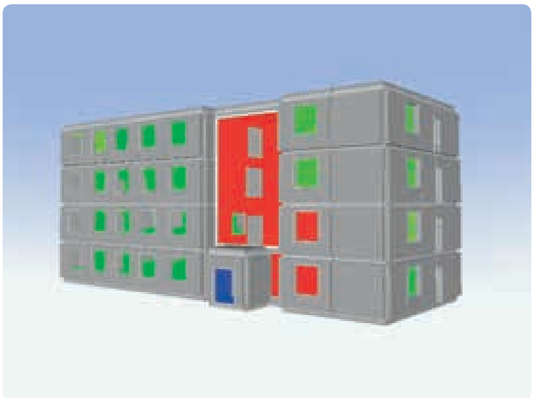
Source: Djukanovic et. al 2002

Life cycle cost of TABS compared to other HVAC schemes

The following case study example compares a Life Cycle Cost (LCC) analysis of a 1,000 m² office building using TABS with a traditional convective all-air conditioning, fan coils, displacement ventilation or variable air volume ventilation and chilled beam solution. This independent study is based on calculations conducted by international consultants.

The energy performance of the building was simulated using a building energy simulation tool (IDA ICE 4), and the LCC evaluation was carried out using the methodology of EU Regulation No 244/2012 for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements in terms of whole-life cost (global cost incl. initial investment, energy, running, disposal and subtracting the residual value) for a 15-year calculation.

The Building Energy Simulation (BES) modelling employed building envelope characteristics and internal/external climate load profiles typical for selected locations.



The local and central plant (HVAC system items) were sized based on cooling/heating loads and ventilation rates from BES modelling, using the same method as when completing a mechanical scheme design.

A full HVAC schemes design, including all necessary components, formed the basis of a quantity survey for each mechanical services method. Costs were obtained from a variety of sources, including manufacturers, construction economists, and the consultants' own expertise.

Compared HVAC schemes

The study was carried out for five countries (UK, Germany, France, Spain and Russia) and in each of these in two main locations. The HVAC schemes used in this comparative study were selected based on what is commonly specified in the countries. The table below shows the UK example with five HVAC schemes:

	 Thermally active building system (TABS)	 TABS with ground source heat pump (GSHP)	 Fan coil units (FCU)	 Displacement ventilation (DV)	 Chilled beam (CB)
Heat source	Boiler	GSHP	Boiler	Boiler	Boiler
Heat sink	Chiller	GSHP + free cooling	Chiller	Chiller	Chiller
Complimentary room units	Convectors in selected rooms	Convectors in selected rooms	–	–	–
Ventilation	Mechanical minimum fresh air	Mechanical minimum fresh air	Mechanical minimum fresh air	Mechanical	Mechanical
Description	TABS for cooling and base load heating supplemented by mechanical minimum fresh air ventilation with a heating coil and heat recovery. Gas condensing boiler and central chiller as a heat source/sink. Complimentary convector radiators only in six rooms (corner room or top floor) which couldn't be fully covered with TABS capacity.	TABS with ground source heat pump (GSHP): The same as option 1, but boiler/chiller is replaced by a ground source heat pump (GSHP) with bore holes, which work to certain extent of summer period in a free cooling mode.	AC fan coil for cooling and heating supplemented by mechanical minimum fresh air ventilation with a heating coil and heat recovery. Gas condensing boiler and central chiller as a heat soucre/sink.	Displacement ventilation with central AHU for heating, cooling and ventilation using heat recovery. Central water chiller and a gas boiler. Reheater box is put locally in zones.	Active chilled beams provide cooling and heating, mechanical ventilation with a heating coil and heat recovery. Central water chiller and gas condensing boiler.

The mechanical minimum fresh air ventilation system was introduced to create the same indoor air quality (IAQ) condition for all compared cases. Toilets in all cases are equipped with an exhaust fan only (no air supply).

Standard default control algorithms are applied for the fan coil, beam and displacement ventilation cases. The global cost comparison is based on the above-mentioned complete HVAC schemes.

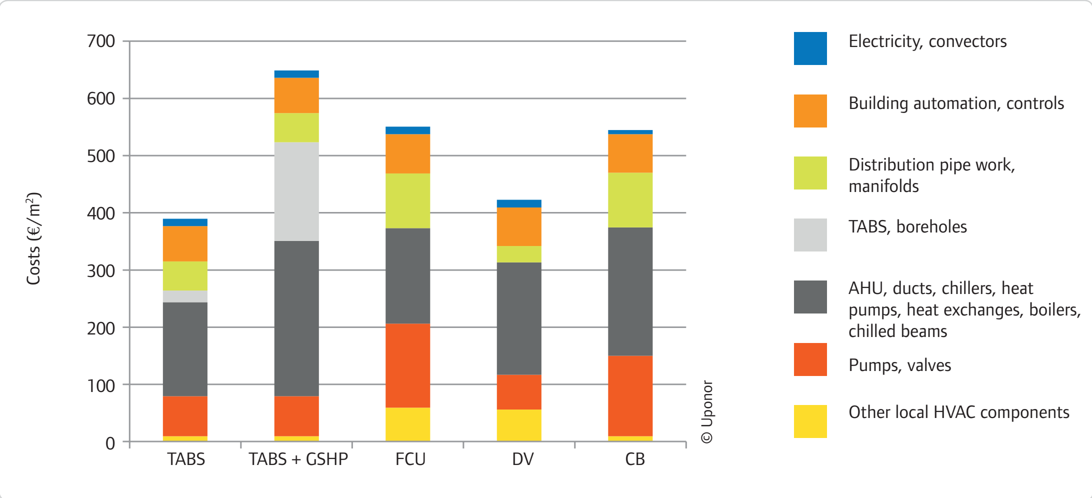
Cost of elements

Local and central plant (system items) are grouped based on the expected lifetime of each item (EN 15459). The items in each category all have the same predicted life expectancy:

No.	Lifetime categories	Equipment lifetime
1	Electricity, wiring, convector radiators	30 years
2	Building automation, controls	12 years
3	Distribution pipe work, manifolds	40 years
4	TABS, boreholes	50+ years
5	Central plant; AHU, ducts, chillers, heat pumps, heat exchangers, boilers, chilled beams, ductwork, attenuators, slot diffusers, pressurisation units	20 years
6	Pumps, valves	10 years
7	Other local HVAC components; FCU, VAV boxes, trimmer batteries, WC extract fans ductwork valves	12 years

Material and installation cost

Initial investment costs of mechanical systems (material and installation) is calculated as a sum of equipment lifetime categories. The diagram below shows an example for London, UK:



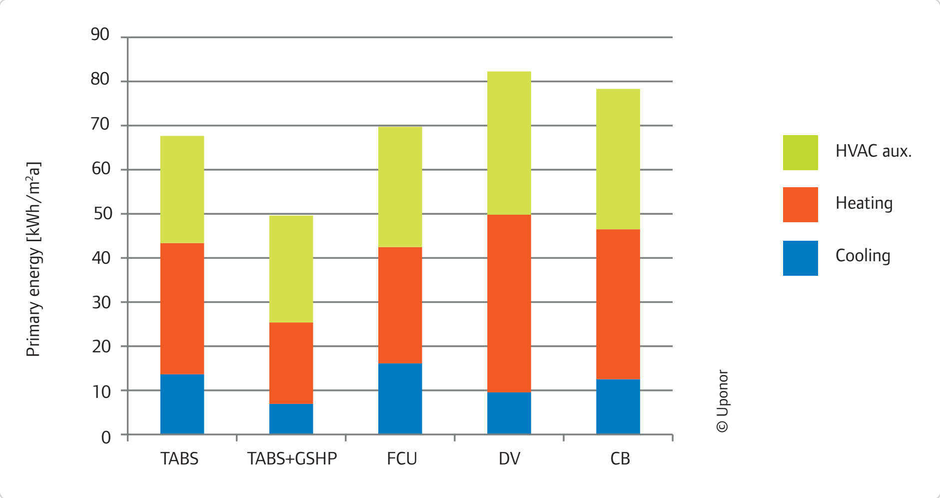
Due to differing indices of local costs, building insulation standards and climate conditions, the HVAC schemes are sized to different peak heating and cooling loads. This fact results in variations in material investment across countries. The first scheme, using TABS and a traditional heat source (boiler and chiller), requires the lowest investment cost. This is followed by air based HVAC schemes. The highest investment is related to the borehole field and a heat pump plant room as set out in the TABS + GSHP scheme.

Maintenance contract cost is assumed to be 5.5 % of the mechanical investment cost, excluding boreholes which are maintenance free throughout their lifetime. Annual costs cover all maintenance, inspection and cleaning, as well as minor replacements (e.g. filters).

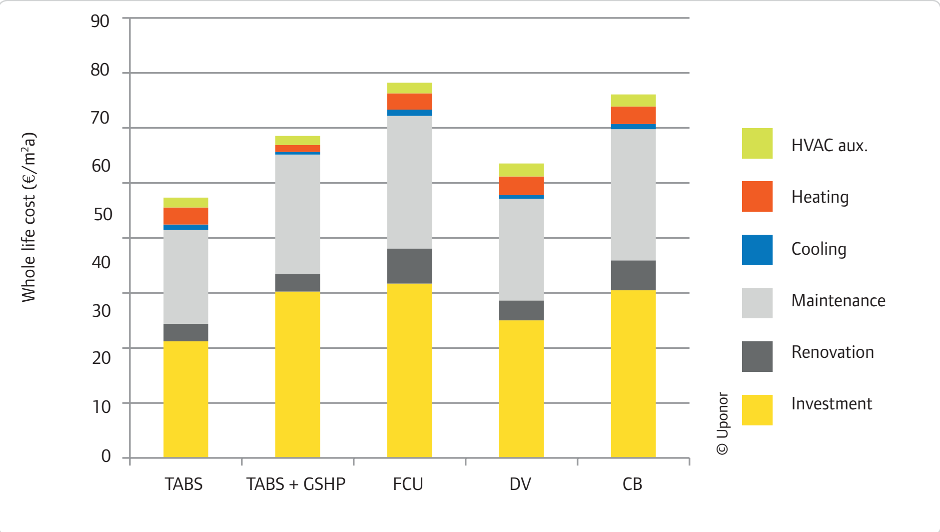
Utilities and fuel prices for electricity and natural gas supply are available from relevant local bodies, whilst cost per kWh, cost of installing a new connection and an annual standing charge are taken into account.

Primary energy use

Annual rate of primary energy used per m² shows the total sum that is used by the building. Primary energy refers to the energy carriers at the beginning of the energy conversion chains (natural resources) prior to undergoing any human-made conversions or transformations. Local primary energy factors for electricity and for natural gas are applied. The graph below shows an example for London, UK. It shows clearly that the use of boreholes for free cooling (bypassing GSHP) during 70-80 % of a cooling period enables significant energy savings. The GSHP or chiller, when applied, works with very high COP efficiency in conjunction with TABS, as flow temperature is very close to room temperature (max. difference of 5-8 K).

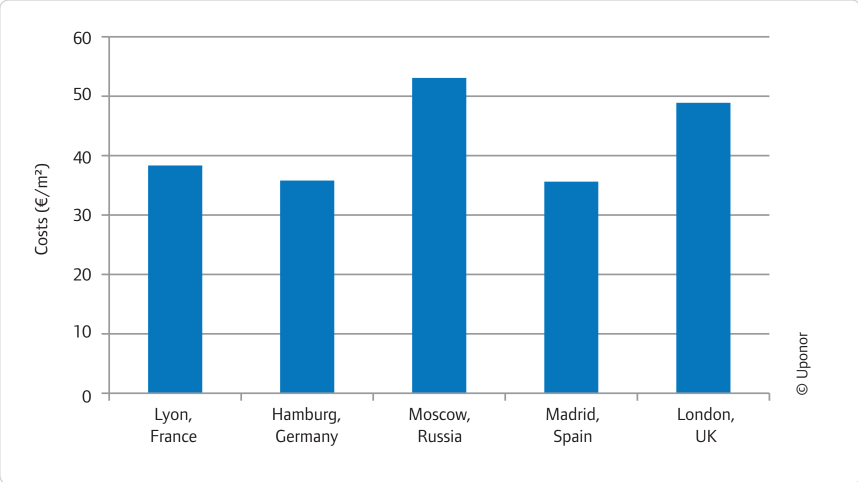


Whole-life cost per m² and year, calculation for 15-year period, medium price escalation of 3 % for gas and electricity. The example shown is for London, UK:



When TABS and borehole heat exchangers have 50 years of lifetime (the same lifetime as a building), this creates a substantial advantage over short-life components. The latter incur the highest whole-life costs as compared to long-life components.

The example below shows the different levels of investment for five countries in which the first scheme using TABS has been implemented. The differences are a result of differing local and labour costs:



Conclusions

In all locations and countries, the result proves that selecting Uponor Contec for the HVAC scheme will significantly decrease its whole-life cost compared to alternative HVAC schemes. The evaluation has found that TABS provides cost savings in the range of 12 to 40 %. The key is that TABS consists of long-lasting components of the same lifetime as a building. This provides the advantage of high residual value for any LCC calculation, which in turn is highly beneficial to the overall valuation of real estate as it becomes very attractive for investors. Moreover, the appropriate thermal comfort with TABS can be reached with lower energy use and lower peak load (chiller downsizing by 60 % is possible for continuous operation) compared to airborne technologies. The FCU, DV and CB are also able to reach the same temperature (comfort) levels as Uponor Contec, however, they would need to be upsized accordingly, thus increasing investment cost, maintenance cost and energy usage.

A life cycle cost comparison of the Uponor Contec system versus other HVAC systems is available for the UK, France, Germany, Russia and Spain. This report is based on an internal Uponor study "Full cost comparison of TABS vs. other HVAC" conducted in cooperation with independent consultants Equa Simulation Finland Oy and Mott MacDonald Limited, UK.

For further information about this study, please contact Uponor.

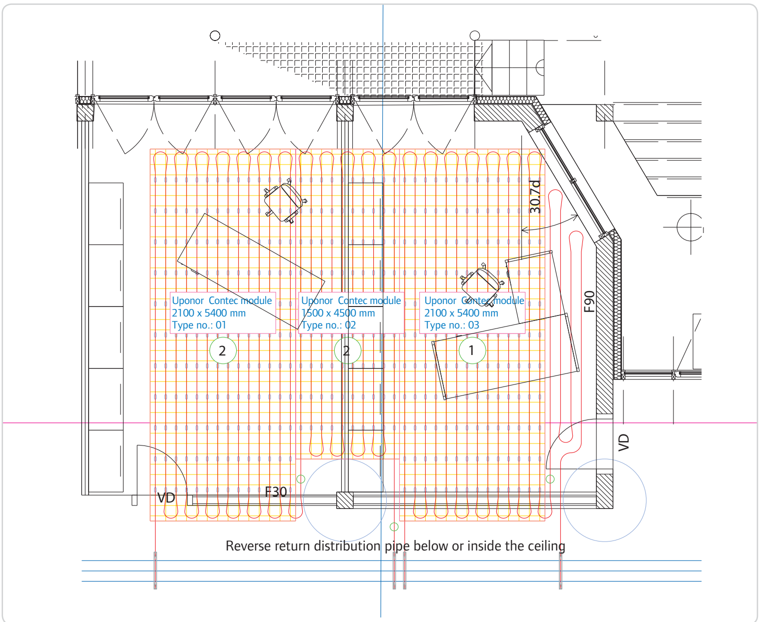
Ideal for intelligent, sustainable architecture

TABS, as an active storage system integrated into the structure of a building, has become an important component of modern architecture within a relatively short period of time, in effect since the late 90s. The architecture of the future aims to construct intelligent, sustainable buildings with ecological aspects in mind. Future statutory regulations that go beyond the EU energy-savings target of 2020, aim to further reduce the heating and cooling energy demand of buildings and will lead to new technical concepts for building equipment. However, these concepts will not necessarily be based on expensive high-tech components, but may well be based on a "new simplicity" that refers back to earlier fundamental innovations as well as scientific and technical developments. Within this context, the development of ceilings used for radiant heating and cooling in the 1930s to today's active storage systems presents a logical progression. So far, more than 1,000 buildings have been equipped with Uponor Contec in Europe, Asia, Africa and America.

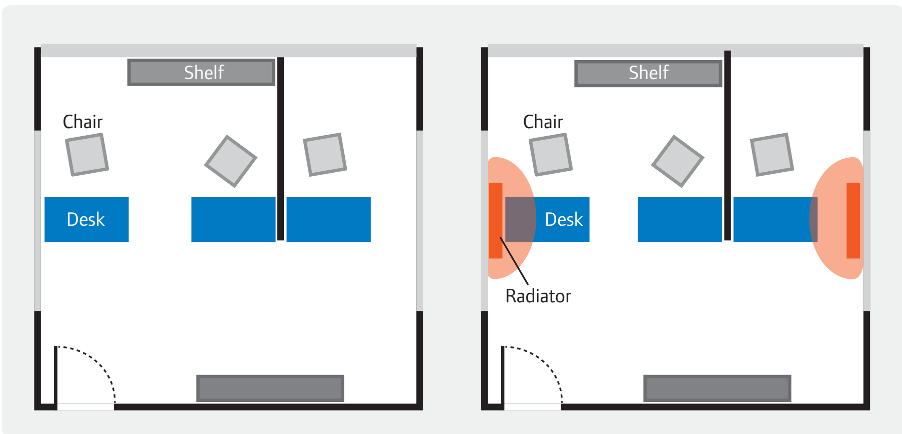
Flexibility and space utilisation

Flexible space utilisation – simple to fit out

The technical equipment of future office buildings should enable flexible space utilisation and variable partitioning. TABS systems meet these requirements. In contrast to other technologies, no costly structural modifications are needed to change air ducts or cooling equipment when new partitions are installed. The distribution pipework can be wholly integrated into the TABS construction, whereas radiators act as an obstacle to room fitting, especially when close to windows. They decrease the effective area of space utilisation and additionally, due to their fixed position, radiators and air-conditioning units do not allow for free room partitioning and easy changes.



Typical floor plan with possibility of free partitioning without obstacles (radiators). Rearranging the partitions is possible.

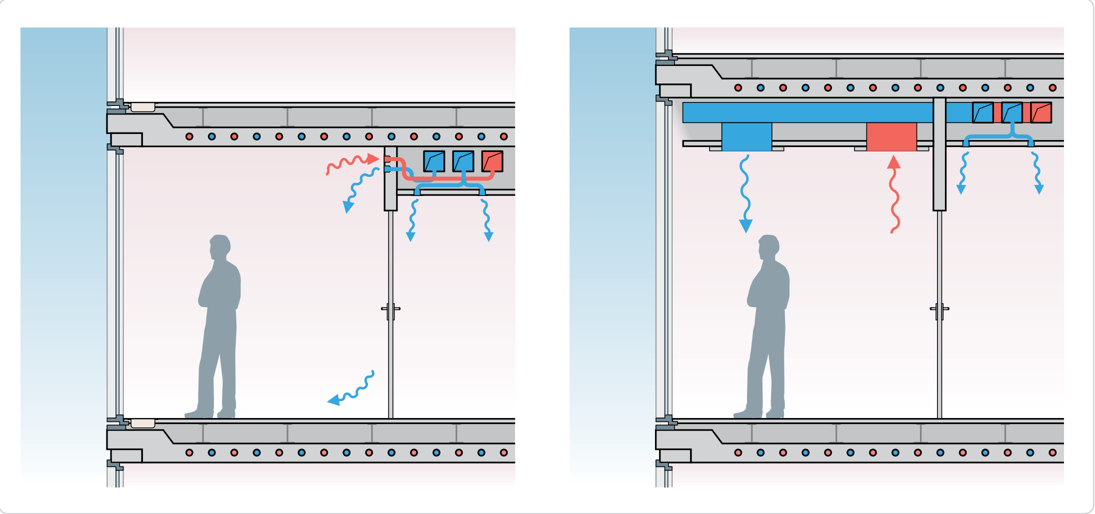


Comparison of room fit-out with and without radiators below the windows. The red markings show the positioning of radiators and the resultant wasted, inflexible space.

Building height savings

It should be noted that all-air systems have almost twice the space requirements for shafts and ducts as compared to alternative systems. This means that valuable office space is lost. TABS offers space saving through water-bearing systems integrated into structural components, with a massive **saving potential for building height** due to low ceilings and no suspended ceiling. On the other hand, a floor-to-ceiling height of 3.5 m is possible without an increase in building investment. This compares favourably to all-air conditioned buildings which traditionally have a ceiling height of 3.0 m.

TABS compensates the sensible thermal load so that any air-conditioning (mechanical fresh air) system that may be required can be designed purely for the purpose of maintaining indoor air quality. Decreased size results in lower space requirements for air system installation. Lower ceiling heights lead to a significant reduction in construction costs.



Comparison of the room height without suspended ceiling installation for traditional air ducts (TABS, left) and with suspended ceiling for air ducts (VAV, right). The room ceiling height is the same.

Selected examples of interiors:

Manchester Metropolitan University Business School, UK

Manchester Metropolitan University Business School, UK

ATMI Loyola Building, Indonesia

SOTE Semmelweis Medical University, Hungary

Bayer MaterialScience, China

Bayer MaterialScience, China

Uponor Academy, Spain

Summary of TABS advantages

- High thermal comfort for occupants resulting in enhanced work productivity
- Suitability for sensitive hospital rooms
- Optimised utilisation of renewable energy sources
- Low investment and operation costs (whole-life cost) compared to all other schemes
- System components are largely maintenance free
- Reliability – trust in a proven system
- Fully suitable for future, modern buildings
- Complete freedom of room utilisation (no restrictions in room design)
- Saving of building height as suspended ceiling for air ducts is omitted

Further advantages include:

- TABS enables thermally comfortable room temperatures during summer, in buildings with small to medium cooling loads typical for modern buildings. The system can also be used to cover the heating base load or full load in modern optimised buildings. The costs for auxiliary heating equipment are thus reduced. In certain cases (mainly future buildings) it is possible to omit all complimentary systems for heating and cooling.
- Avoiding physical injury to the elderly and to children. The pipework for TABS is often deeply embedded in the building structure compared to radiator convectors which act as obstacles.
- Avoiding painful bare hand/foot touch by the elderly or children of high temperature surfaces over the limit of 40-45 °C. With TABS, unlike radiators, this is not an issue.
- Energy carried by water is far more efficient than by air. Airborne systems perform cooling tasks mainly by convection. Without cooled radiating surfaces the same operative temperature requires more cooling energy due to the convection associated with high air volumes. This increases the risk for draught and discomfort. New systems should therefore be designed with separate components for heating and cooling or ventilation according to the energy-saving principle: water for heating and cooling, air only for ventilation (exclusively providing fresh air for health reason) and dehumidification (when appropriate).
- Due to thermal energy storage, peak load is flattened over longer periods of time and peak load on chillers can be lowered by over 50 % by continuous operation and by over 20 % by shorter night operation or pulse modulation.

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