



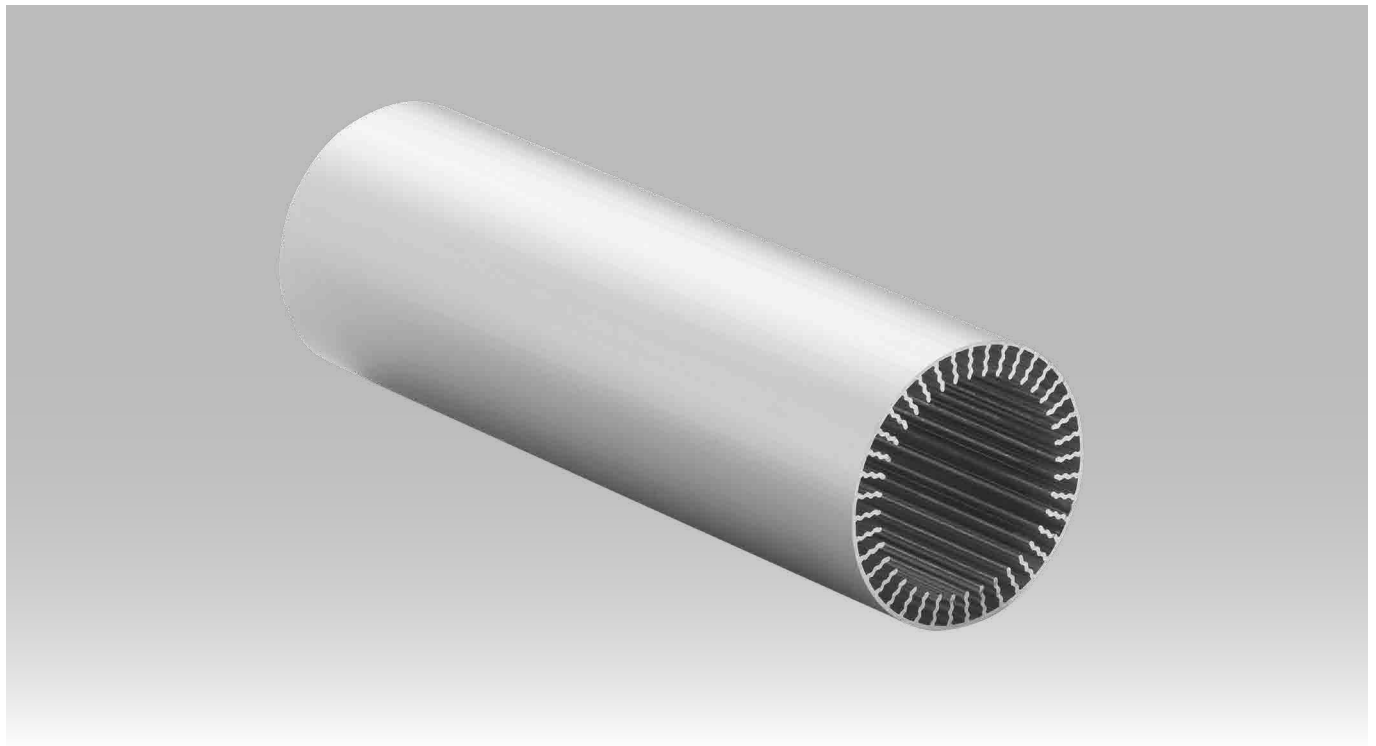
▲ CONCRETCOOL – Sebastian-Lotzer-Middle School, Memmingen. Photo © Klaus Mauz

# CONCRETE CORE COOLING CONCRETCOOL



An innovative symbiosis between component temperature control and supply air creates comfort with high energy efficiency through maximum utilisation of free cooling. Supply air induction is practically invisible, resulting in above-average user satisfaction.





## CONCRETCOOL – INNOVATIVE ACTIVATION OF BUILDING STRUCTURES

Building component activation operates in the same way as a chilled ceiling, but one that also has a large volume of stored energy. This makes it possible to discharge stored heat at times when it makes more sense to do so from an energy perspective (during the night or in the early hours of the morning). The thermal capacity of the building component creates only a slight temperature rise in the room during the day. Two systems have become established on the market, one of which works with water as the energy source; the other simply with outdoor air, making efficient use of free cooling and linking building component activation to the ventilation function at the same time. A building component activation system is generally fairly slow to respond to changes. A rapid change to the medium temperature, therefore, only produces a very slow change in the surface temperature of the ceiling. However, this is not a drawback to the system. An increase in the room load, and therefore the ambient temperature, produces an instant energy output from the ceiling, i.e. an immediate response without any complex control measures.

In building component activation with air, air instead of water is used as the energy source to charge the building structure. Cool outdoor air, at temperatures

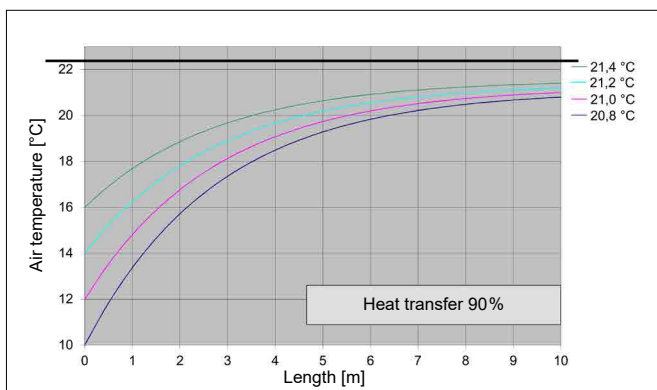
below 12°C, is there for the taking for up to 6000 hours per year (approx. 70 %). So air beats water – and at the same time, it supplies rooms with fresh air and can reduce room air humidity in summer.

Locations	Annual mean outside air [°C]	Share of annual hours ≤12 °C [%]	Share of annual hours ≤14 °C [%]	Share of annual hours ≤16 °C [%]
Hamburg	8.7	65	75	84
Berlin	8.8	63	72	80
Cologne	9.4	62	47	83
Dresden	8.8	63	72	80
Frankfurt	10.4	58	67	76
Stuttgart	10.4	58	67	76
Munich	8.2	64	74	80
CH-Basel	10.0	59	68	75
CH-Zurich	9.1	62	70	77
CH-Geneva	9.8	59	67	75
A-Vienna	9.9	57	65	73
L-Luxembourg	10.1	64	73	80
NL-Amsterdam	9.5	63	74	83
GB-London	10.8	59	71	80
I-Milan	11.7	51	58	66
F-Paris	11.2	56	65	74

The CONCRETCOOL Concrete Core Cooling system using incoming air allows the cooling potential of outside air (mean annual level 8–11°C) as detailed above to be harnessed for direct cooling of concrete ceilings. It follows that the cooling is free for most of the periods of use.

## FUNCTION

Cooling tubes, made of aluminium with high thermal conductivity and with diameters of 60 or 80 mm, are cast into concrete ceilings in a grid. The internal surface is ribbed to improve heat transfer. The supply air is not fed directly to the rooms: it firstly flows through the cooling tubes within the concrete ceilings. This warms the cold supply air to approximately ceiling temperature, the required heat being taken from the ceiling. This withdrawal of heat provides the cooling for the ceiling. This supply air is then fed to the room through Kiefer air diffusers, meeting the hygiene requirement for fresh air. An outlet temperature of approximately 21 °C is achieved for the supply air without using a supplementary heater. No primary energy is required, the process is self-regulating and virtually free of variation. The temperature is extremely stable owing to the high storage capacity of the concrete ceilings. Heat recovery by the ventilation system is increased to over 95% by the addition of the CONCRETCOOL system. As a result, the requirements set out in the German Renewable Energies Act are exceeded. Combined with the potential of free cooling, this results in unparalleled operating costs and high energy savings.



CONCRETCOOL heat-transfer efficiency based on measurements by HLK/University of Stuttgart

## TECHNICAL DATA

Cooling capacity (unsteady)	30 - 70 W/m <sup>2</sup>
Tube diameter	60 and 80 mm
Material	Aluminium
Heat transfer	up to 90 %
Ceiling strength	22 - 30 cm
Specific air flow rate	6 - 7,5 m <sup>3</sup> /hm <sup>2</sup>



### ENERGY

High energy savings through maximum use of free cooling and an overall heat recovery rate of > 95 %.



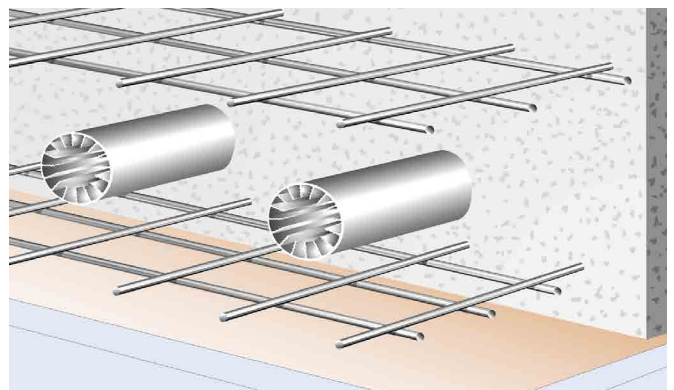
### DESIGN

The air ducts are not visible from within the room – air diffusers are unobtrusively integrated into the concrete ceiling or corridor partition wall.



### TECHNOLOGY

The cooling medium is air, so there is no risk of it freezing on building sites in winter, and drilling into the tubes will not result in water damage.



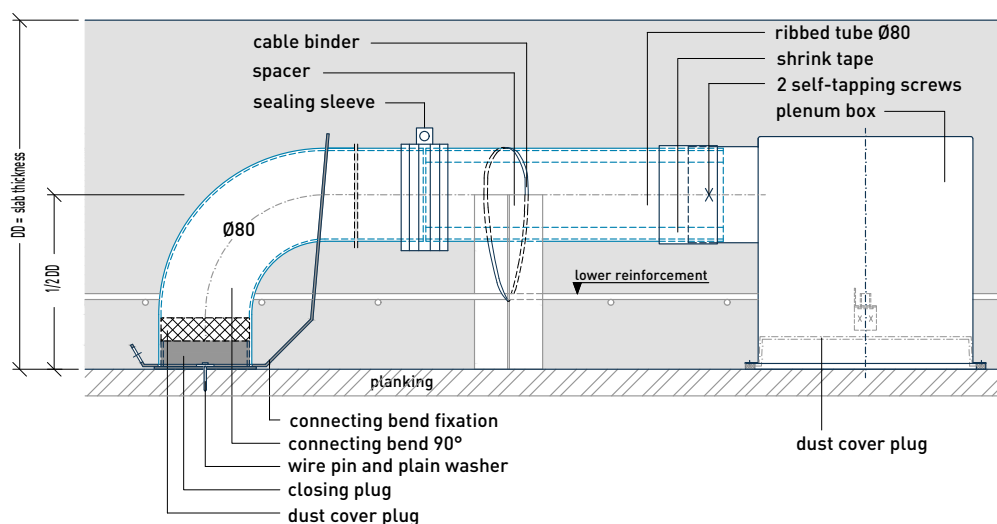


## INSTALLATION SITUATION CONCRETCOOL

To achieve a high storage capacity for the thermal energy, prefabricated cooling tubes are installed in the structurally neutral part of the concrete ceiling, between the upper and lower reinforcements. They are fixed in place with spacers and secured to stop them floating. The cooling tubes are embedded in concrete when the ceilings are cast. The joist-free flat ceilings are 22 to

30 cm thick. The system is straightforward to integrate without modifying the structural dimensions. The cooling tubes can be installed with cast in-situ concrete, filigree ceilings and factory-cast ceilings. The finished ceiling has a storage capacity of 165 to 200 Wh/m<sup>2</sup>K, depending on thickness and concrete quality.

### detail - CONCRETCOOL- cooling tube coil in concrete ceiling

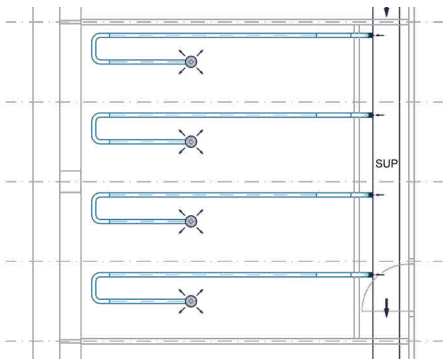


## INNOVATIVE VENTILATION CONCEPT

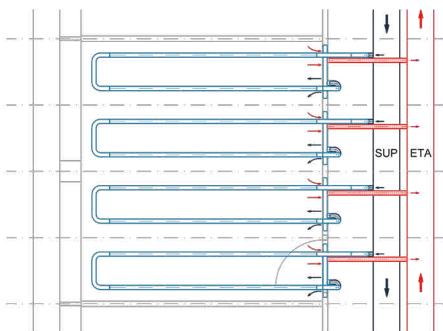
The CONCRETCOOL Concrete Core Cooling ventilation system is particularly suitable for schools and educational facilities, where plenty of fresh air is needed for a high density of occupants in a relatively small space. Continuous replacement of the ambient air prevents the CO<sub>2</sub> level in the room from rising. This is essential for maintaining concentration, leading to more successful learning outcomes. A comfortable ambient temperature is also ensured through the combination of supply air and an activated ceiling for cooling. The CONCRETCOOL system maintains a high level of efficiency, whilst satisfying all of the main requirements for creating an atmosphere that is conducive to learning.

## INSTALLATION SITUATION COOLING TUBE COIL

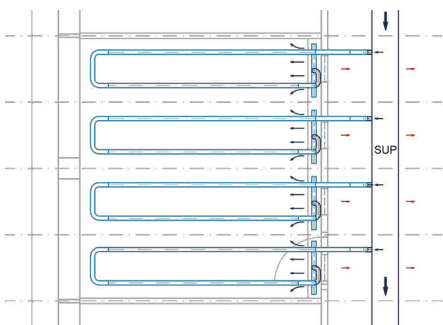
Cooling tubes made of heat conducting aluminium are cast into concrete ceilings, in line with the building grid. The cooling tubes can be installed in in-situ concrete, filigree ceilings and factory cast slabs.



Cooling tube in combination with GLS 230 ceiling air diffuser;  
connector behind the ceiling panelling



Cooling tube with the INDULSNAP wall air passage;  
supply and extract air version



Cooling tube in combination with the INDUL linear air diffuser  
behind the ceiling panelling





Photo © Kiefer GmbH

# **GRIMMELSHAUSEN GYMNASIUM, GELNHAUSEN**

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**ARCHITECTS** hkr.Architects, Gelnhäusen  
**PLANNING OFFICE** Ingenieurbüro TGE, Gelnhäusen



Photo © Stefan Müller

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**PLANNING OFFICE** Zibell, Willner + Partner, Berlin



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**ARCHITEKT** Helmut Jahn, Chicago. US  
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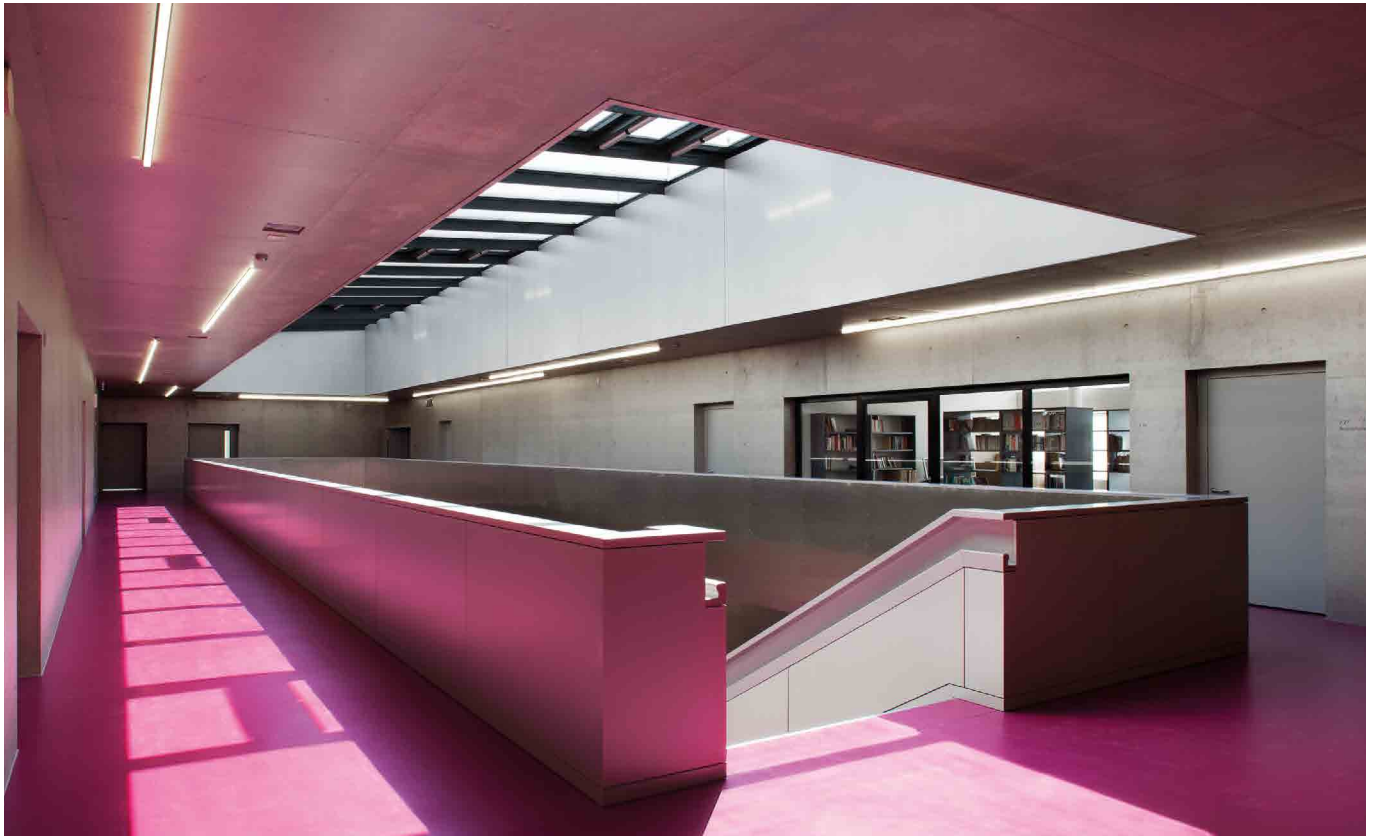


Photo © Klaus Mauz

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**ARCHITECTS** mprdo Mauz Pektor, München, Herle + Herrle Architects, Neuburg  
**PLANNING OFFICE** Güttinger Ingenieure, Kempten



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### VOCATIONAL COLLEGES RECKLINGHAUSEN

**PROPRIETOR** Kreis Recklinghausen – Der Landrat  
**ARCHITECTS** Scholl Architects GmbH, Stuttgart  
**PLANNING OFFICE** Pfeil & Koch Ingenieurgesellschaft, Stuttgart



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