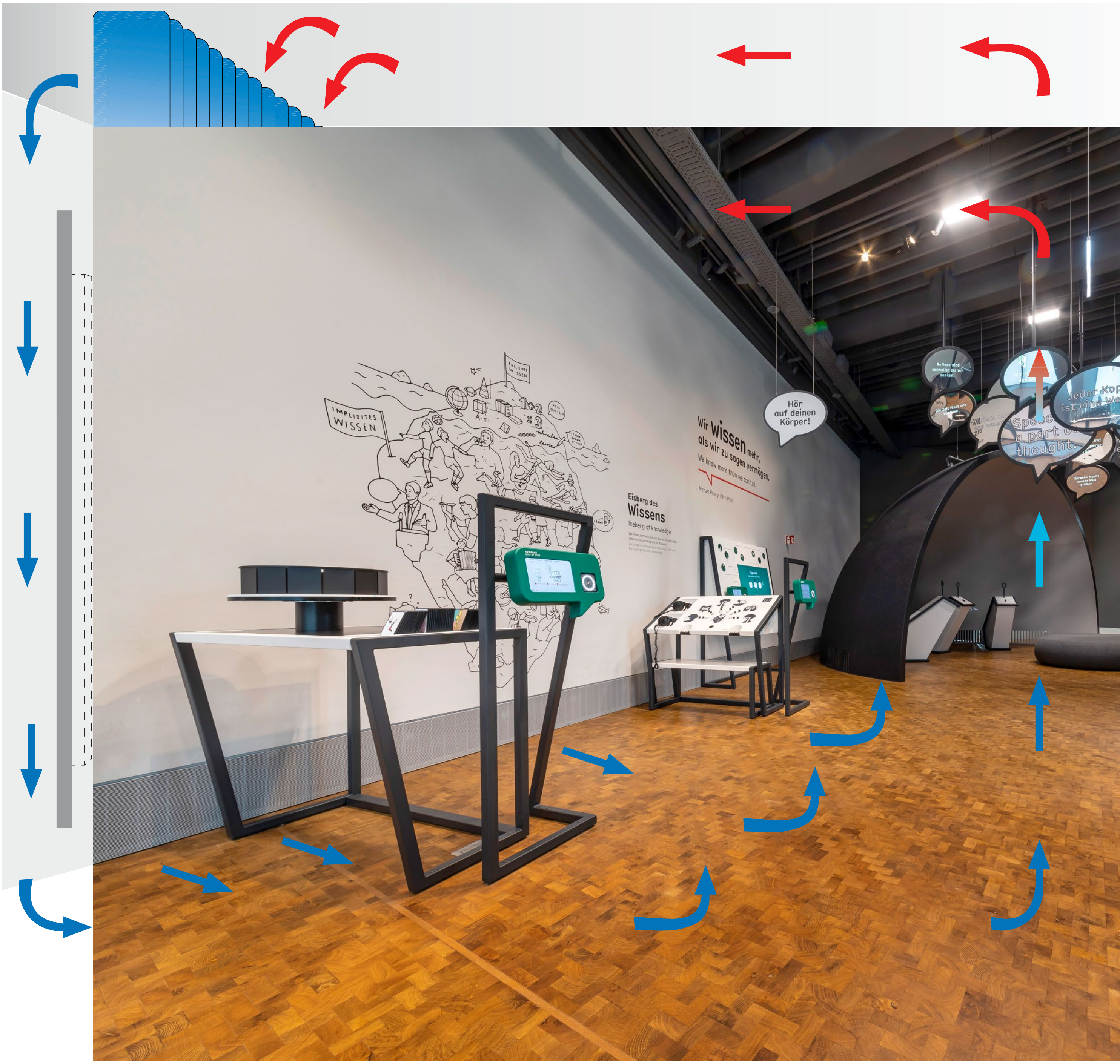
TTC Timmler Technology



GraviVent® – TTC Silent Gravity Cooling/Heating

Planning Documentation for Engineers and Plant Contractors

Order Key for Cooling Units

Order Key for TTC Cooling Units

AASS 08 33 2 L 1

Performance category

1 = for construction height 33 (effective duct height H_{eff} 1.5–6 m)
2 = for construction height 51 (effective duct height H_{eff} 1.5–7 m)

Water connection

L = left
R = right

Function

2 = 2-pipe-system

Construction height Axxx-series [cm] | Duct depth ISHK-series [cm]

33 > for series AASS, AVSS, AISI, AVSI
51 > for series AASS, AVSS, AISI, AVSI
15 > duct depth for series ISHK
25 > duct depth for series ISHK

Construction length [mm]

800 – 1000 – 1200 – 1400 – 1600 – 1800 – 2000 – 2200 – 2400 mm

Series

AASS	on duct; cabinet
AVSS	in front of duct; integrated
AISI	in duct; integrated
AVSI	on duct; integrated
ISHK	In duct, heating/cooling

Subject to technical changes · Issued 01/2023

Mitglied der DGNB
Deutsche Gesellschaft für Nachhaltiges Bauen
German Sustainable Building Council

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GraviVent® – Silent Gravity Cooling

Comfort and sustainability – two sides of one and the same coin

Climate change is one of the greatest challenges of today. Temperatures are rising, while natural meteorological events are increasing in frequency and becoming more extreme: Climatic changes are suddenly something we can all see and feel for ourselves. In order to avert imminent dangers to people and nature, or at least to reduce them, climate protection is imperative as a central global political task. However, the road to a society that declares sustainability to be one of its most important premises is long. And it's far from easy, since it often involves restrictions and sacrifices. Sustainability means that when we consume raw materials, we take future generations into account. We do not consume any more than can be regenerated.

Greenhouse gas emissions are rising worldwide. The Paris Agreement, to which the world's leading countries have committed, is intended to limit global warming to well below 2 °C compared with pre-industrial levels. However, implementing the Paris Climate Agreement is proving difficult and poses huge challenges for global society.

On average, a German citizen produces just over eleven tons of greenhouse gas emissions each year. Heating, traveling, living, eating – there are many areas where the desire for greater comfort unnecessarily increases the carbon footprint. The first step to change this is to raise awareness that every individual can make a less environmentally damaging choice in many of their decisions. Only if this message gets through to people will a reduction be possible in the long term. The offers made by industry with regard to consumer goods are only helpful if they are then embraced. Cars can consume less energy (bicycles run without fuel altogether), and special shower heads can save water, albeit only if citizens themselves actively decide to use them. If the available offerings are not embraced, they are of no use.

Consumers are most likely to readily accept changes to their habits if – no surprise – the ecological features are combined with cost savings and gains in convenience. Such products exist, and some have been on the market for 40 years, even though there was no talk of global warming and climate crisis when they were launched. In the background, Siegfried Timmler was already thinking back then that using less material also has commercial advantages. The less material used, the easier a product is to transport, the more straightforward it is to assemble, and the less susceptible it is to failure during operation.

One such example is the GraviVent silent gravity cooling system, which Siegfried Timmler developed in the 1980s and which is still on the market today – gently optimized on an ongoing basis with new technologies. GraviVent, a product of TTC Timmler Technology, is a cooling and heating system for buildings, relies on a simple physical principle, is cost-effective, and improves the quality of time people spend in the room. GraviVent is likewise an effective building block for obtaining certificates from DGNB, the German Sustainable Building Council. For example, the Science Center Experimenta in Heilbronn was the very first building to be awarded DGNB "Diamond" certification – thanks in part to TTC silent gravity cooling technology.

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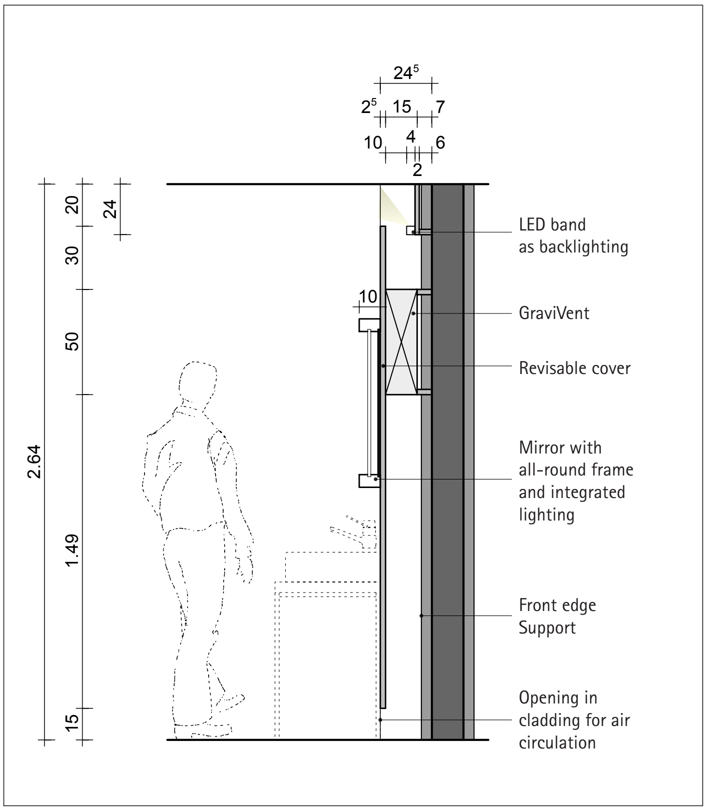

4.1 Project Vilotel

4.2 Project Vilotel

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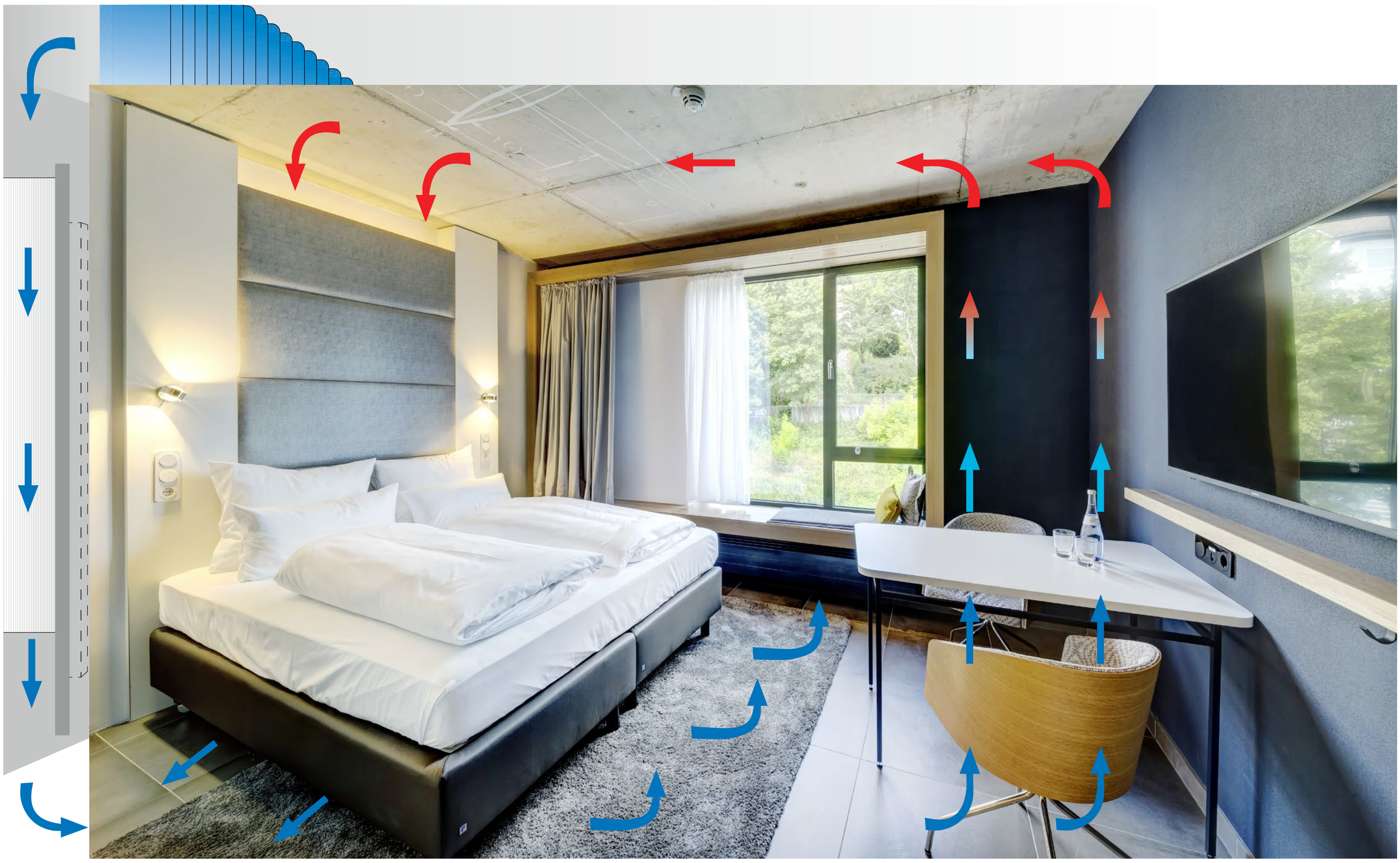
Comfort and sustainability –
two sides of one and the same coin

→ *continued from page 4*

Silent gravity cooling has proven its worth over decades in large-scale projects. Its first origins, however, can be found in ancient times. Back then, palaces and mosques were cooled according to the same basic principle, which is rooted in a simple law of nature: Warm air rises to the top, where it is dissipated and cooled. The thereupon heavier air moves downwards through a shaft and re-enters the room at ground level through air outlets. This technology is an ideal method to cool rooms silently and using less energy; indeed, it ensures even temperature distribution in the room. It is as simple as it is ingenious – and it requires neither a fan nor an air filter of the kind we see in widely used room air conditioning systems (AC). The advantages are obvious: no noise, no unpleasant air movements, no sources of germs, low maintenance. Advantages that are appreciated in office buildings and even in the Berlin Chancellery, but TV studios and terminals at airports likewise benefit from TTC's silent gravity cooling device. Silent gravity cooling avoids widely ramified ventilation ducts, which consume a lot of space and tie up resources unnecessarily. In addition, these conventional ventilation systems are often problematic for hygiene reasons. TTC's silent gravity cooling, on the other hand, has advantages in terms of energy efficiency as well – simply because it does not require any operational energy inputs. The cooling intensity can be individually adjusted locally without the need to forego the advantages of a central ventilation system. In addition, outside air can be supplied in a controlled manner – but only when required; for example, when there are many people in a room.

It's often the simple things that make life easier. GraviVent consumes no energy in operation and offers people the opportunity to control the room temperature according to their personal well-being. Those who ask incisive questions are the ones who discern the ecological benefits. 'Our guests want to feel good while having a clear conscience,' says, for example, the director of the "Vilotel" in Oberkochen, a hotel that relies on silent gravity cooling. The ecological footprint, says Birgitt Mönch, will be given more and more attention in hotel bookings in the future. Those who have a convincing answer in this regard will have an advantage over the competition. The federal government's central travel management, which handles travel for government employees, agencies, and other state institutions, also wants in the future to give preference to sustainable hotels when it comes to overnight stays. Its directory is to be converted to certified sustainable hotels by the end of 2023.

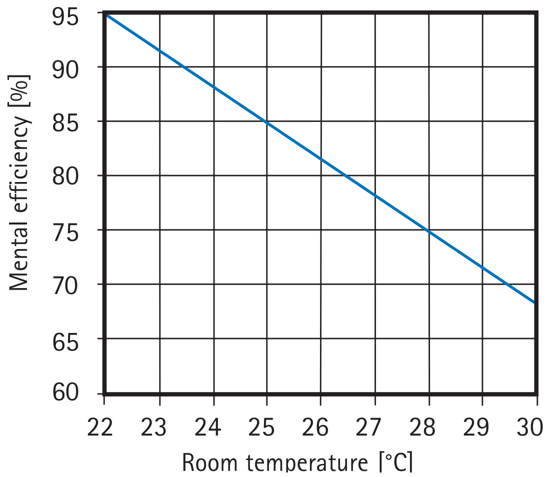
Managing Director Patrick Timmler of TTC Technology GmbH puts it in a nutshell: 'People have always been at the center of our solutions, but this has never precluded a holistic approach. Conserving resources is important not only from an ecological point of view, but also from a business perspective. Less material consumption, lower costs, and less susceptibility to faults.'



General Information

Why do we air condition rooms?

Working people spend the majority of their working life indoors. A maximum of physical and intellectual work is to be performed in this artificial environment. Studies with volunteers have shown that a persons productivity can be directly related to the thermal and air hygienical comfort of the room. In this context the air velocity, the relative humidity, the temperature gradient and the supply of primary air are of particular interest.
Fig. 6.1–6.3 show mainly the results of studies by Prof. Ole Fanger and D. Wyon with a select number of volunteers to determine peoples dissatisfaction with and acceptance of air-conditioning systems.

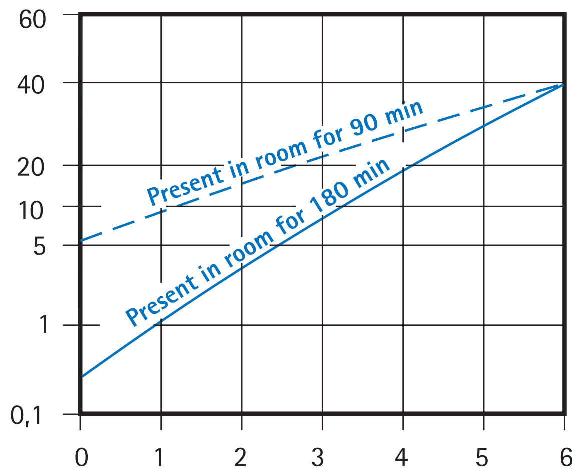


6.1 Mental performance of people at different room temperatures

Preferred cooling systems

Either water or air is generally the carrier for the cooling energy. The following solutions are commonly used to cool down commercial premises:

- Centrally treated and cooled primary air
- Cooling of structural elements
- Chilled ceiling systems
- Wall and ceiling systems with cooling units or chilled beams
- Cooling units or convectors combined with cooled primary air



6.2 Dissatisfaction of people at different room temperatures
Percentage of people who are dissatisfied with the rooms air conditioning, dependent on the:
- floor level (ankle height) 0.1 m and
- head height (person is seated) 1.1 m

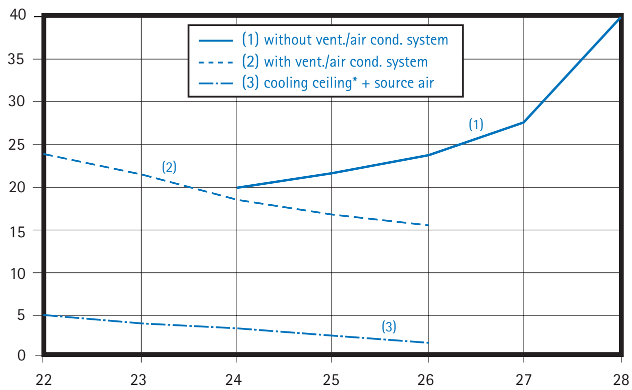
Advantages of TTC GraviVent®?

- No draughts, air speed 0.1–0.2 m/s
- Condensation tray as standard, to prevent damage to furnishings and the building if condensation occurs
- High fall ducts for the cooling air to provide high cooling capacity with a small space requirement
- Silent operation without ventilation
- Low running and investment costs for high comfort levels
- Easy to upgrade if alterations are required
- A wealth of design options for the room, for planners and architects
- High thermal and hygienic comfort if combined with a primary air system
- Room temperatures can be individually controlled
- 100 % recyclable according to life cycle (Cradle to Cradle)

Is ventilation required?

Relevant laws* and regulations* prorescribe a supply air rate of approx. 6-9 m³/(h · m²) or a 2-3 fold air change of the room volume to maintain air hygiene in commercially used rooms. With these minimal supply air flows, ventilation systems can be greatly reduced. This saves operating and investment costs.

* (German Work Place Directive, DIN 1946/Part 2/Paragraph 3.2)



6.3 Acceptance with different air conditioning systems
Acceptance with different air conditioning systems and room temperatures. (A study by P. O. Fanger and D. Wyon)
*) Note! Instead of cooling ceilings, cooling units or cooling convectors could be used.

General Information

How do TTC cooling units work?

The functional principle of the TTC cooling units is based on the natural law of different air density ρ [kg/m³] of warm and cold air.

At ceiling level warm air enters through the inlet grille [4] and is cooled down in the air cooler [1] through which cold water flows (**see Fig. 7.1**). If operated at high humidity, e.g. in a hotel room, special production rooms or when operated without preconditioned primary air, a condensation tray is supplied as standard underneath the air cooler. Through the fall duct [2] and an attractive air outlet [3] the cooled air is returned to the room. This cooled air is then warmed up again by heat sources in the room, e.g. people, lighting, computers and other electrical and electronic equipment, sunrays through the windows, the warmth of the walls and rises to the ceiling.

The air velocity generated in the room through thermal conditions is very low and can only be measured with special equipment. This minute air circulation results in high thermal comfort levels and minimum temperature gradients in the occupied zone. The characteristic curves shown in the capacity diagrams on pages 13–15 are based on test rig measurements and were carried out under defined installation and operating conditions.

Differing constructional conditions will need to be taken into account when determining the cooling performance of cooling units. TTC will be happy to help you with your calculations.

What factors reduce performance?

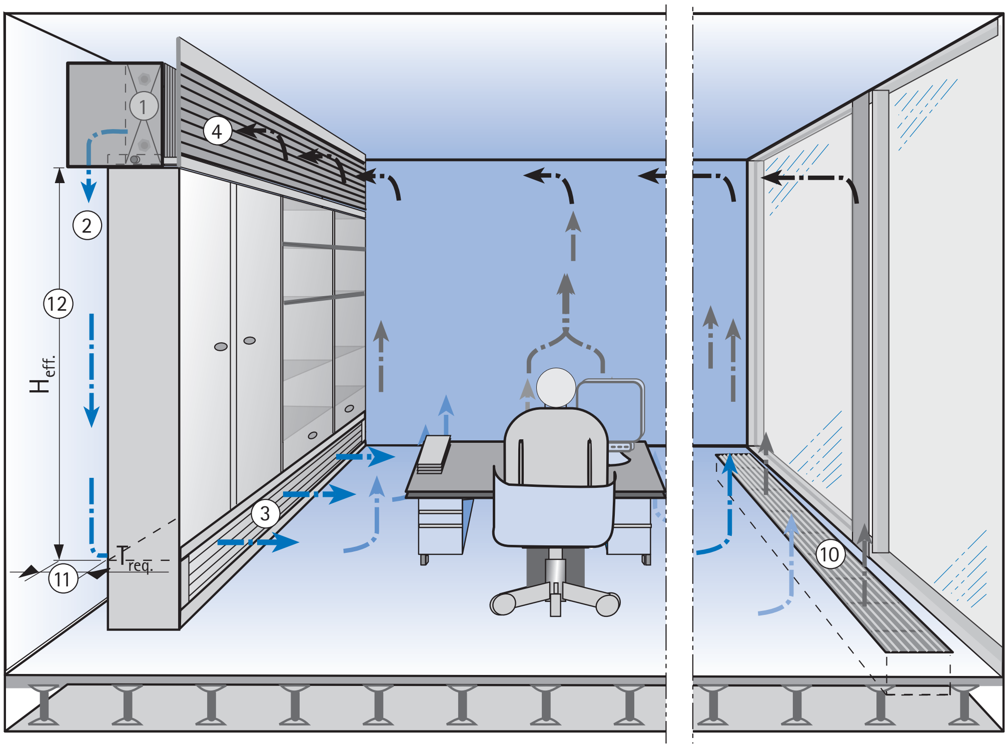
The performance of the TTC cooling units depends on many factors, for example:

- The effective fall duct height H_{eff}
- The fall duct depth T_{req} (for unit height 33 = 100 mm and for unit height 51 = 150 mm)
- Spacing between sealing off walls (desired 600–800 mm, see page 22)
- Smooth surface of the fall ducts and sealing off walls
- Duct insulation on front and rear walls
- The free cross-section of the inlet and outlet grilles (at least 70 % of the visible surface of the finned cooling unit)
- For other cross-sections see chapter »Reduced Preformance« on page 18
- Median temperature difference $\Delta\vartheta_m$ [K] between air intake and median temperature of the cooling medium
- Water viscosity and quality (VDI 2035)
- Flow path restriction caused by pipe work or structural obstacles
- Redirection of the cool air flow

Where are TTC cooling units used?

TTC GraviVent cooling units are ideally suited for all areas of application, where silent and efficient control of temperature is required:

Small and open plan offices, conference rooms, computer rooms, recording and TV studios, hotel rooms, public access areas, reception areas, department stores, printing and paper works, assembly and production facilities, to remove heat from electronic or electrical control cabinets, etc.



7.1 Room airflow in cooling mode using TTC cooling units

[1] Air cooler incl. condensation tray
[2] Fall duct for cold air
[3] Air opening min. 70 % free cross-section of the air cooler visible area
[4] Air inlet grating min. 70 % free cross-section of the air cooler visible area
[10] False floor convector for heating mode
[11] Required fall duct depth T_{req}
[12] Effective duct height H_{eff}

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Products in Use | Examples

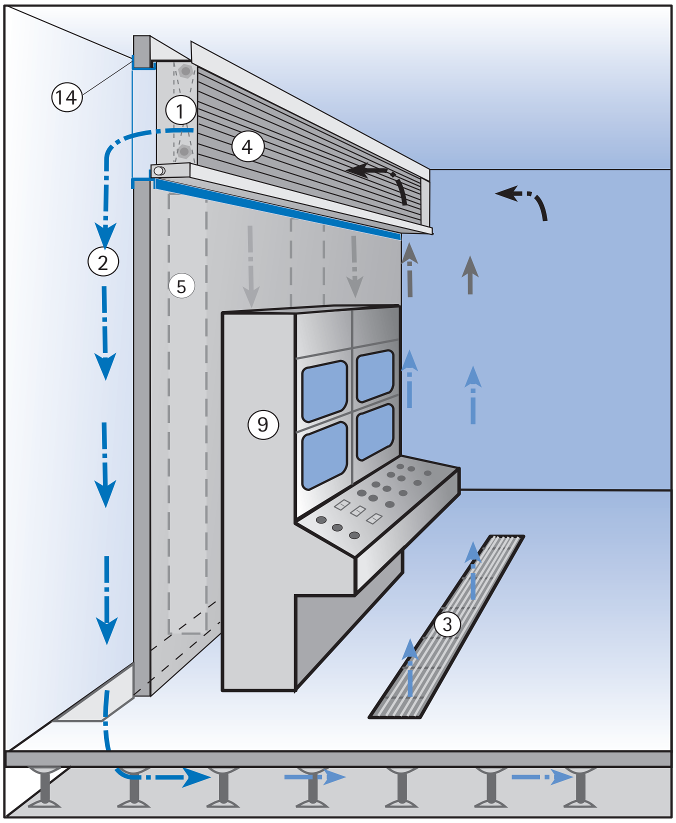
Example 1: Cooling unit on a wall

Fig. 8.1 shows the installation of an AVSS unit in a TV studio or a test centre on a wall (dry construction wall installed in post-and-beam construction).

Key to **Fig. 8.1**

[1] Cooling unit incl. condensation tray to collect condensate in dehumidification mode
[2] Fall duct with sealing off walls [5] (spacing 600–800 mm) The minimum depth D_{req} is 100 mm for unit height 33 and 150 mm for unit height 51.
[3] Floor outlet grille with a free cross-section of 70 % of the visible area of the finned air cooler
[4] Air inlet grille with a free cross-section of 70 % of the visible area of the finned air cooler
[5] Sealing off walls to stabilise the cold air flow
[9] Mixing desk or test console in studios or test centers
[14] Upper sealing bar

Note:
The minimum requirements under [2], [3] and [4] must be complied with to ensure the quoted capacities.
For other cross-sections see page 20 or contact TTC.



8.1 Room air flow with TTC cooling units in cooling mode

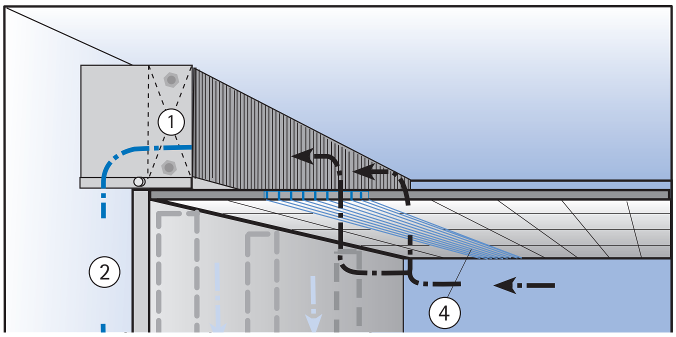
Example 2: Air intake for cooling units

Fig. 8.2–8.4 show three options for the air intake. Other options are available, please contact TTC.
Fig. 8.2 shows the air flow to the cooling unit [1] via an air inlet grill [4] which has been integrated into a false ceiling.
In **Fig. 8.3** the air inlet grating has been replaced by an air gap [7] in the false ceiling.
Fig. 8.4 shows ceiling panels with gaps [8] for the air intake.
Optionally slots may also be placed at the ceiling edges.

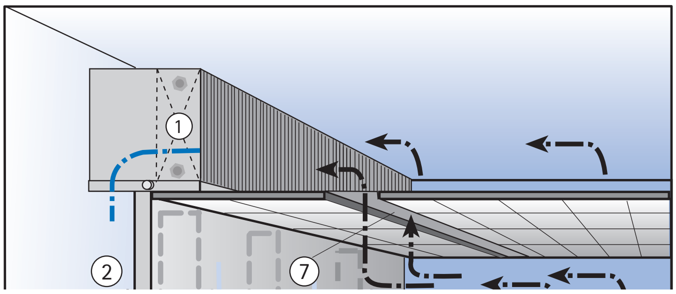
Key to **Fig. 8.2–8.4**

[1] Cooling unit incl. condensation tray to collect condensate in dehumidification mode
[2] Fall duct with sealing off walls [5] (spacing 600–800 mm) The minimum depth D_{req} is 100 mm for unit height 33 and 150 mm for unit height 51.
[4] Air inlet grille with a free cross-section of 70 % of the visible area of the finned air cooler
[7] Air gap in the false ceiling (70 % free cross-section)
[8] Ceiling panels with air gaps (free cross-section 70 % of the visible area of the finned air cooler)
[9] Gaps between wall and ceiling (not shown)

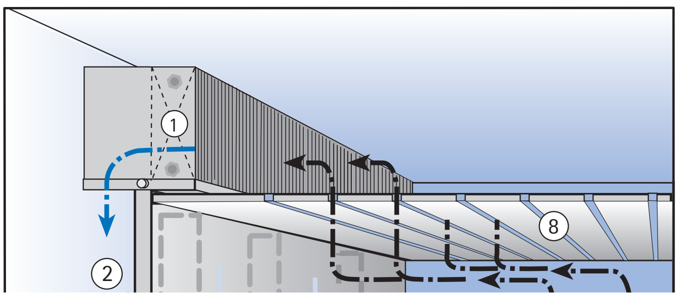
Note:
The minimum requirements under [2], [4], [7] and [8] must be complied with to ensure the quoted capacities.
For other cross-sections see page 20 or contact TTC.



8.2 Air intake through air inlet gratings in a false ceiling



8.3 Air intake through an air gap in the false ceiling



8.4 Air intake through ceiling panels

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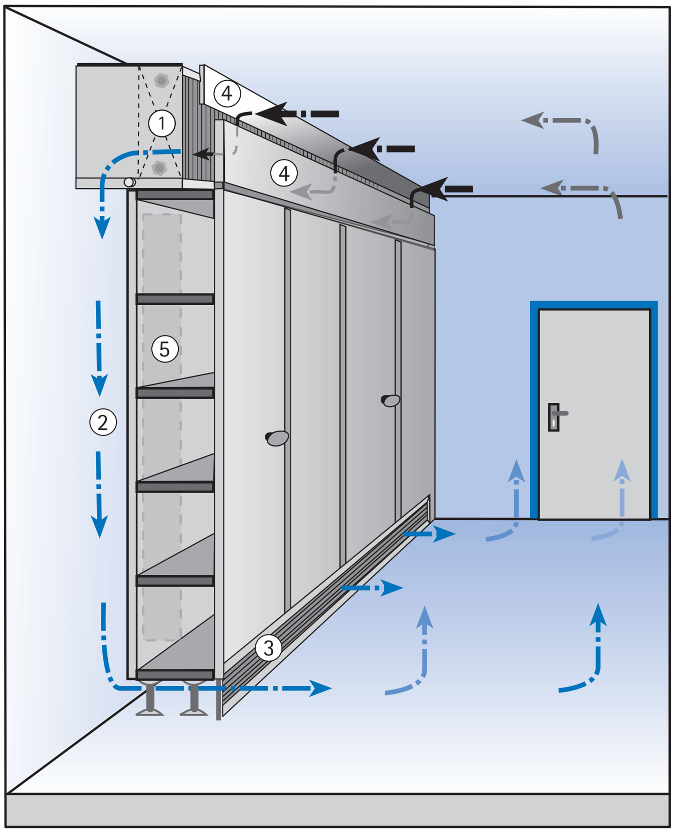


9.1 Room air flow with TTC cooling units in cooling mode

Example 3: Cooling unit behind a screen

The example **Fig. 9.1** illustrates the installation of an AASS cooling unit above a cupboard or shelve.

Key to **Fig. 9.1**

[1] Cooling unit AASS incl. condensation tray to collect condensate in dehumidification mode

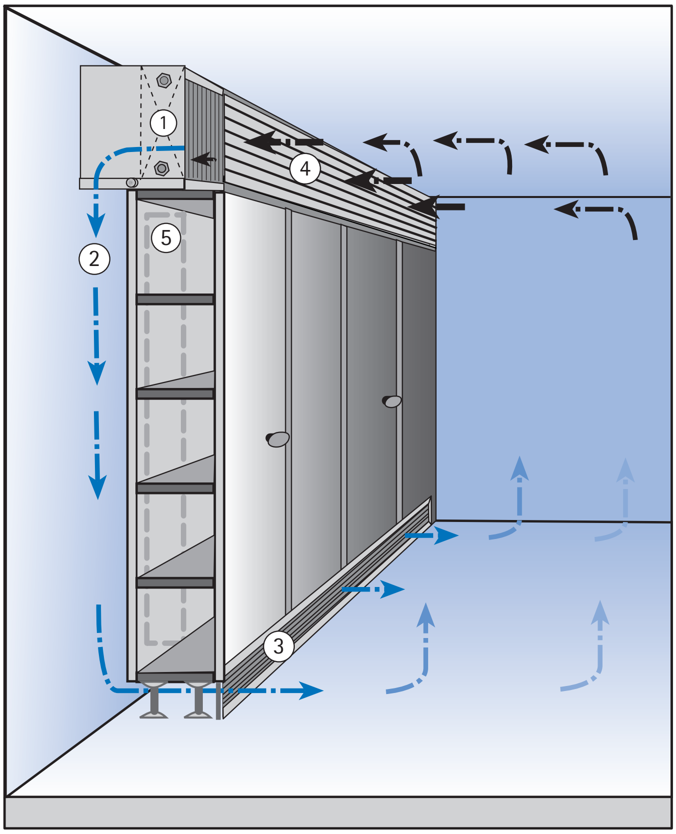
[2] Fall duct with sealing off walls [5] (spacing 600–800 mm) The minimum depth D_{req} is 100 mm for unit height 33 and 150 mm for unit height 51.

[3] Air outlet grille with a free cross-section of 70 % of the visible area of the finned air cooler

[4] Screened air inlet grille (the free air intake should be 70 % of the visible area of the finned air cooler)

[5] Sealing off walls to stabilise the cold air flow

Note:
The minimum requirements under [2], [3] and [4] must be complied with to ensure the quoted capacities.
For other cross-sections see page 18 or contact TTC.



9.2 Air inflow into the room via wall and floor grilles

Example 4: Air outlet grille into the room

Fig. 9.2 illustrates the option for air to be dispersed into the room through an air outlet grating [3]. This type of air flow into the room ensures a good, even temperature distribution. To dimension the floor air outlets consultation with a ventilation engineer is required.

Key to **Fig. 9.2**

[1] Cooling unit AASS incl. condensation tray to collect condensate in dehumidification mode

[2] Fall duct with sealing off walls [5] (spacing 600–800 mm) The minimum depth D_{req} is 100 mm for unit height 33 and 150 mm for unit height 51.

[3] Air outlet grille with a free cross-section of 70 % of the visible area of the finned air cooler

[4] Air inlet grille with a free cross-section of 70 % of the visible area of the finned air cooler

[5] Sealing off walls to stabilise the cold air flow

Note:
The minimum requirements under [2] and [3] must be complied with to ensure the quoted capacities.
For other cross-sections see page 18 or contact TTC.

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Example 5: Cooling unit integrated in the duct

Fig. 10.1 shows the AISI cooling unit [1] integrated into a fall duct [2]. On the room side the cooling unit is screened by an architecturally appealing air inlet grille which should have a free cross-section of 70 %. For this type of installation a mounting frame is supplied as standard. The top joint to the bare ceiling is formed, for example, by a waffle-type ceiling at the discretion of the architect and client.

Key to **Fig. 10.1**

[1] Cooling unit AISI incl. condensation tray to collect condensate in dehumidification mode

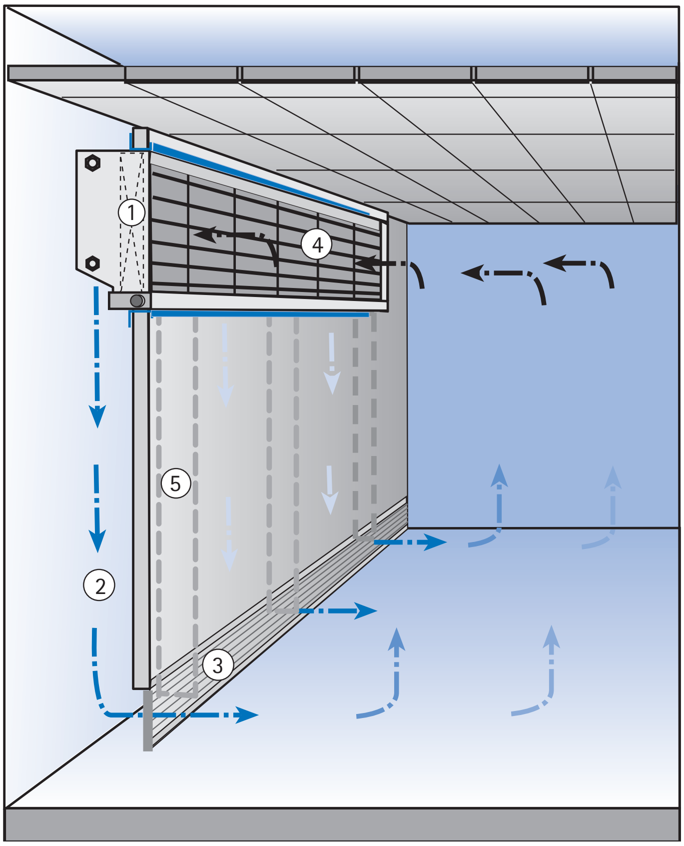
[2] Fall duct with sealing off walls [5] (spacing 600–800 mm) The minimum depth D_{req} is 100 mm for unit height 33 and 150 mm for unit height 51.

[3] Floor outlet grille with a free cross-section of 70 % of the visible area of the finned air cooler

[4] Air inlet grille with a free cross-section of 70 % of the visible area of the finned air cooler

[5] Sealing off walls to stabilise the cold air flow

Note:
The minimum requirements under [2], [3] and [4] must be complied with to ensure the quoted capacities. For other cross-sections see page 20 or contact TTC.



10.1 TTC cooling units integrated in the duct

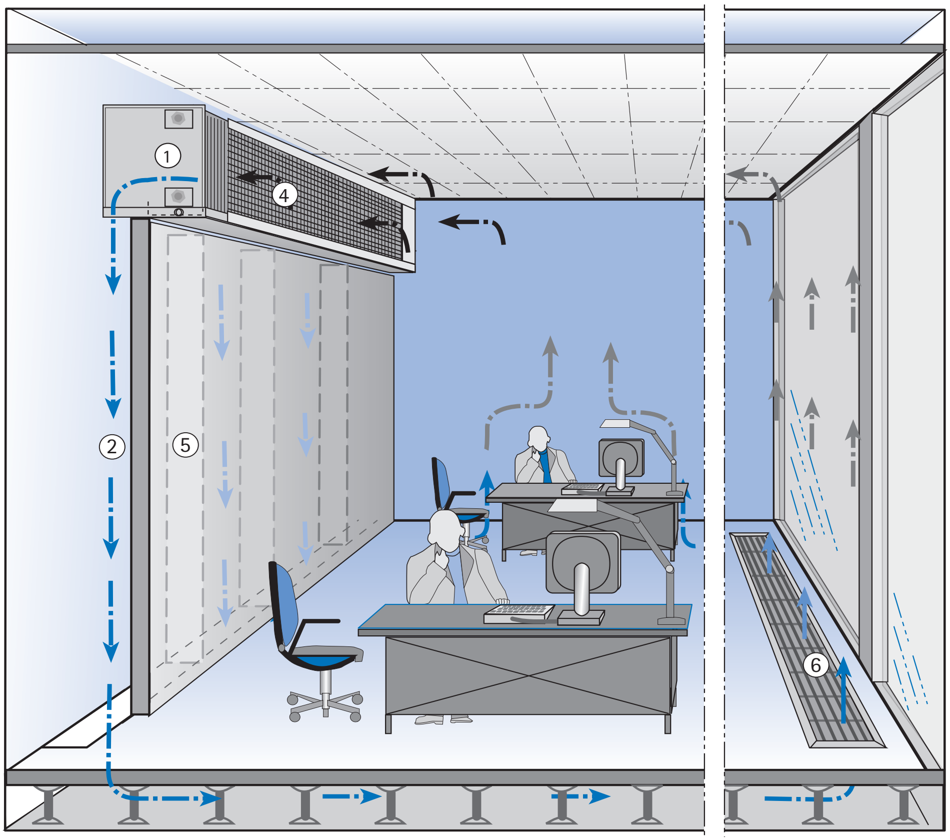
Example 6: Cooling unit on a wall with dispersed air outlet at the window

Fig. 10.2 shows a cooling unit [1] above a fall duct [2]. On the room side the cooling unit is screened by an architecturally appealing air inlet grille [4] which should have a free cross-section of 70 %.
The air is returned to the room through a floor grille at the window. This type of installation always requires a false floor.

Key to **Fig. 10.2**
Items [1], [2], [4] and [5] equivalent to **Fig. 10.1.**

[6] Floor grille integrated into the false floor as a dispersed air outlet

Note:
The minimum requirements under [2] and [4] must be complied with to ensure the quoted capacities. For other cross-sections see page 20 or contact TTC.



10.2 Air distribution via displacement air outlet in the floor

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Example 7: Cooling unit on a false ceiling with additional primary air mode function

Function

Example 7 (**Fig. 11.1**) shows how TTC units may be combined with a primary air system. Via the primary channel [7] conditioned outdoor air is blown at low speed into the fall ducts via channels or pipes. If suitable silencers are used the sound pressure level can be kept below 30 (dBA).

Installation

The cooling unit [1] can be installed on a wall between the bare and the false ceiling, on a cupboard or shelves. Design options showing how the cooling units could be covered on the room side are shown on page 8 (**Fig. 8.2–8.4**).

For the primary air intake the following variants would be suitable:
· Air outlet gratings [3] in walls, cupboards or shelves
· Air outlet gratings in the false floor, see **Fig. 10.2** on page 10
· Dispersed air outlets

Outdoor air flow

In rooms to be occupied by people the outdoor air flow needs to be sized dependent on how many people are present in the room at the same time and what the room is used for (see the table in the right).

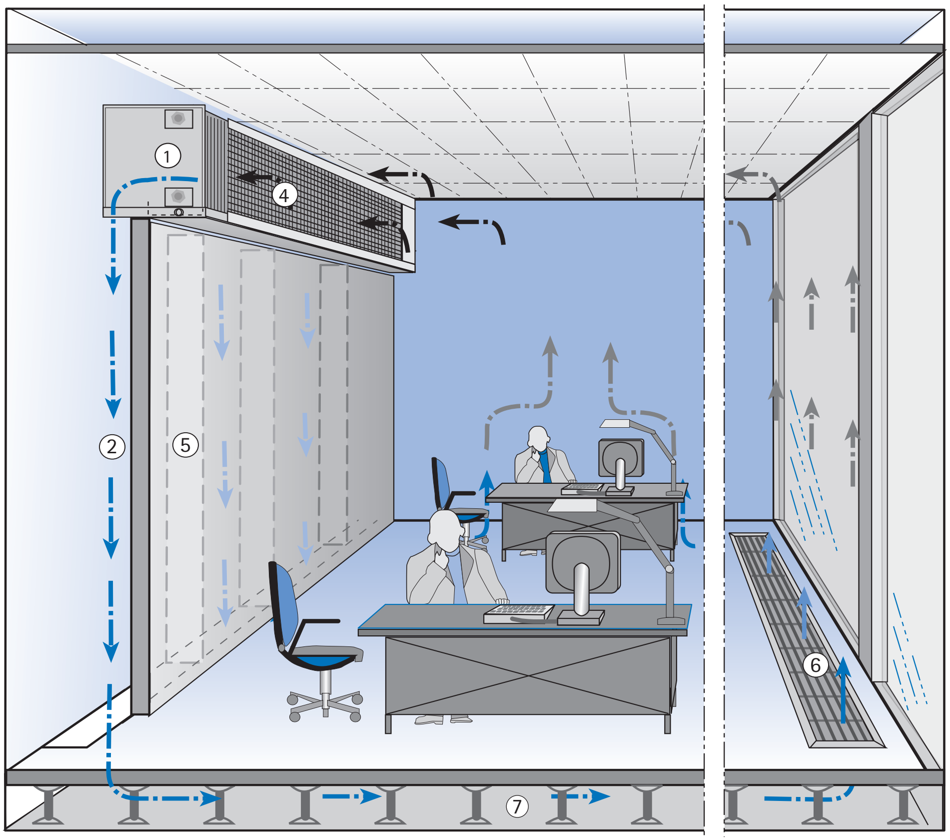
The outdoor air flow is frequently provided at 2.5–3 times the change of room air (see DIN 4701/Parts 1 and 2, as well as VDI 2078) the outdoor air flow can be reduced by 50 % of the minimum outdoor air flow per person.

For rooms with additional pollution through smells (e.g. tobacco smoke) the minimum outdoor air flow is increased by 20 m³/h per person.

Minimum primary air flow per person and hour*

Room type	m³/h
Small office	30
Open plan office	50
Theatre/Concert hall	20
Canteen	30
Conference room	30
Cinema	20
Banqueting hall	20
Rest room	30
Break room	30
Class room	30
Reading room	20
Lecture theatre	30
Show room	20
Shop	20
Museum	20
Hotel room	30
Public House/Restaurant	40
Gymnastic and sport hall with seating for spectators	20

*) in accordance with DIN 1946 / Part 2/Paragraph 3.2



11.1 TTC cooling unit with supply air operation

Key to **Fig. 11.1**

[1] Air cooler incl. condensation tray
[2] Fall duct for cold air
[3] Air outlet grille
min. 70 % free cross-section of the visible area of the air cooler
[4] Air inlet grille
min. 70 % free cross-section of the visible area of the air cooler
[5] Sealing off walls to stabalize the cold air flow
[6] Floor grille integrated as displacement flow diffuser in the raised floor
[7] Primary air channel

Series AASS + AVSS

Design | Specification | Dimensions

Series AASS 33/51**

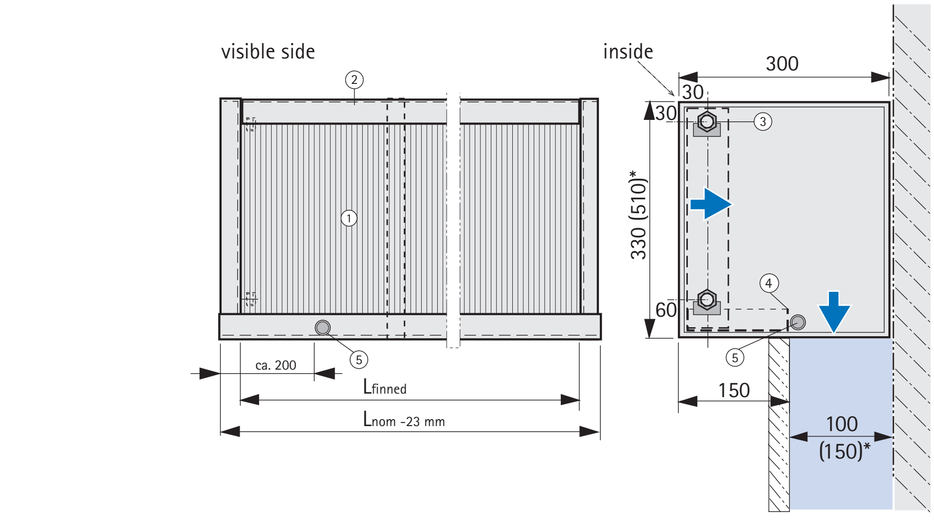
Design

1] Air cooler made of copper pipes with aluminium fins, max. operating temperature 90° C, max. operating pressure 10 bar
[2] Housing completely made of aluminium plate
[3] Water connection with R 3/4", torsion protection
[4] Condensation tray to collect condensate in dehumidification mode
[5] Condensate drain, G 1/2", mounted on the condensate tray and supplied as standard

Installation

The cooling unit can be installed above shafts, cupboards or shelves. For examples see pages 8–11.

Important:
To ensure optimum operation sealing off walls spaced at 600–800 mm need to be installed in the fall ducts.



*) Dimensions in brackets are for construction height 51

12.1

Subject to modifications

Part no. AASS .../...**	08	10	12	14	16	18	20	22	24
Finned length L_{finned} [mm]	662	862	1062	1262	1462	1662	1862	2062	2262
Total unit length L_{nom} [mm]	800	1000	1200	1400	1600	1800	2000	2200	2400
Total weight*** (33) ≈ [kg]	10	12	13	16	18	20	22	23	26
Total weight*** (51) ≈ [kg]	14	16	19	21	25	27	30	32	35

Series AVSS 33/51**

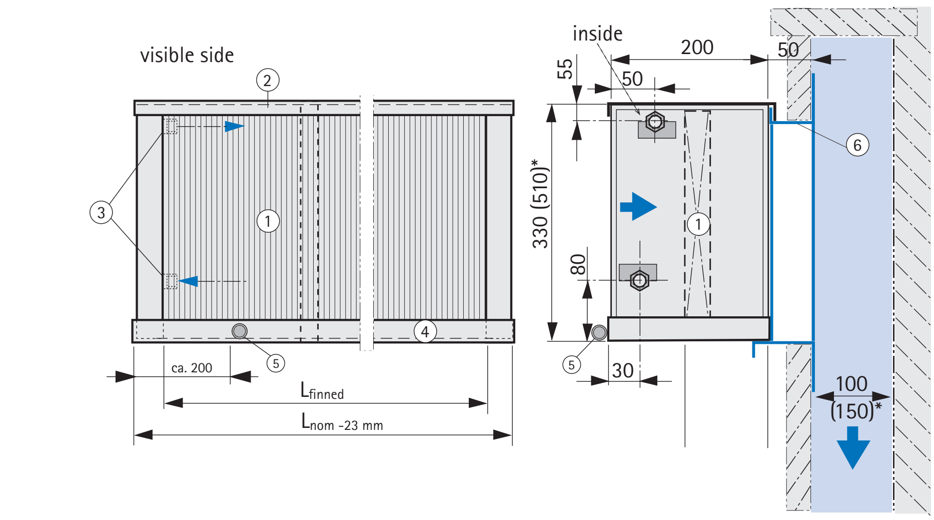
Design

[1] Air cooler made of copper pipes with aluminium fins, max. operating temperature 90° C, max. operating pressure 10 bar
[2] Housing completely made of aluminium plate incl. mounting frame [6]
[3] Water connection with R 3/4", torsion protection
[4] Condensate tray to collect condensate in dehumidification mode
[5] Condensate drain, G 1/2", mounted on the condensate tray and supplied as standard
[6] Mounting frame made of galvanized steel sheet, supplied as standard

Installation

The mounting frame is used to install the cooling unit in front of the fall duct wall.

Important:
To ensure optimum operation sealing off walls spaced at 600–800 mm need to be installed in the fall ducts.



*) Dimensions in brackets are for construction height 51

12.2

Subject to modifications

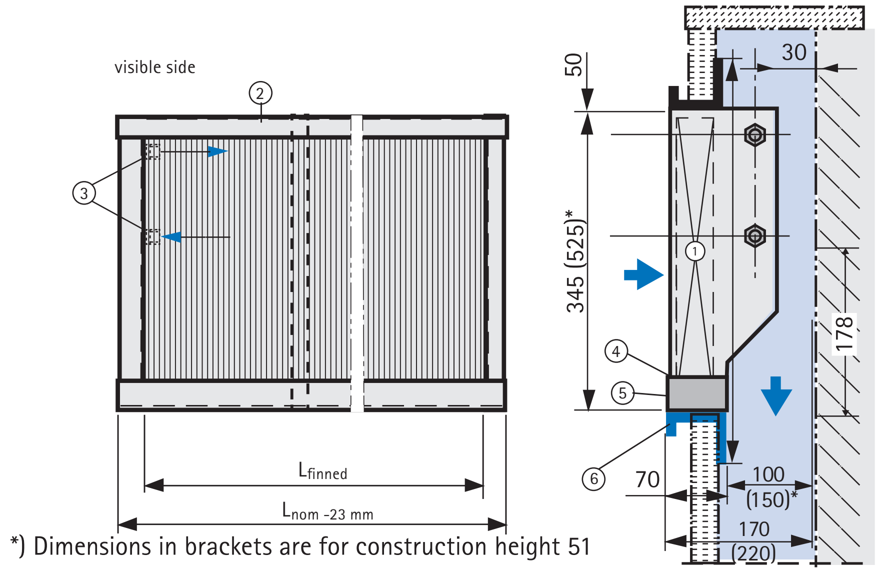
Part no. AVSS .../...**	08	10	12	14	16	18	20	22	24
Finned length L_{finned} [mm]	662	862	1062	1262	1462	1662	1862	2062	2262
Total unit length L_{nom} [mm]	800	1000	1200	1400	1600	1800	2000	2200	2400
Total weight*** (33) ≈ [kg]	15	19	21	24	26	30	32	35	38
Total weight*** (51) ≈ [kg]	20	24	28	30	34	38	40	44	46

** see order key on page 2 *** Unit weight + water content

Subject to technical changes · Issued 01/2023

Series AISI + AVSI

Design | Specification | Dimensions



*) Dimensions in brackets are for construction height 51

13.1 Subject to modifications

Part no. AISI .../...**	08	10	12	14	16	18	20	22	24
Finned length L_{finned} [mm]	662	862	1062	1262	1462	1662	1862	2062	2262
Total unit length L_{nom} [mm]	800	1000	1200	1400	1600	1800	2000	2200	2400
Total weight*** (33) ≈ [kg]	15	18	20	23	25	29	31	33	37
Total weight*** (51) ≈ [kg]	20	23	27	29	33	36	39	42	45

Series AISI 33/51**

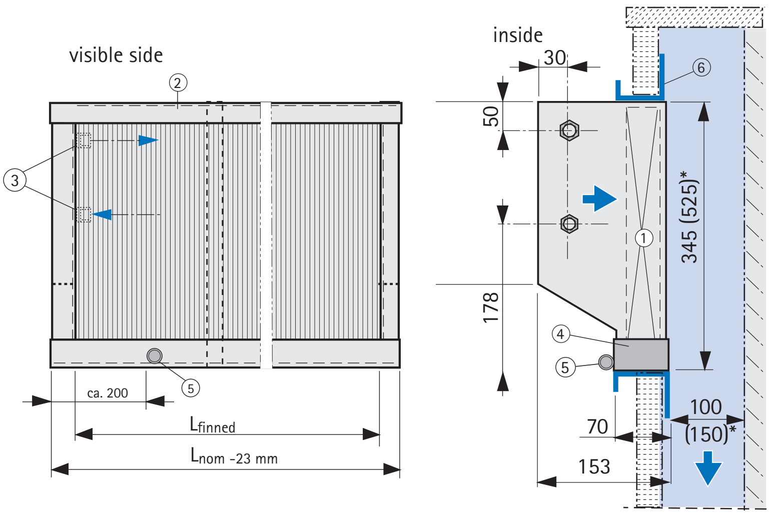
Design

[1] Air cooler made of copper pipes with aluminium fins, max. operating temperature 90° C, max. operating pressure 10 bar
[2] Housing completely made of aluminium plate incl. mounting frame [6]
[3] Water connection with R 3/4", torsion protection
[4] Condensate tray to collect condensate in dehumidification mode
[5] Condensate drain, G 1/2", mounted on the condensate tray and supplied as standard
[6] Mounting frame made of galvanized steel sheet, supplied as standard

Installation

The cooling unit is installed in the fall duct for the cold air (see page 10).

Important:
To ensure optimum operation sealing off walls spaced at 600–800 mm need to be installed in the fall ducts.



*) Dimensions in brackets are for construction height 51

13.2 Subject to modifications

Part no. AVSI .../...**	08	10	12	14	16	18	20	22	24
Finned length L_{finned} [mm]	662	862	1062	1262	1462	1662	1862	2062	2262
Total unit length L_{nom} [mm]	800	1000	1200	1400	1600	1800	2000	2200	2400
Total weight*** (33) ≈ [kg]	15	18	20	23	25	29	31	33	37
Total weight*** (51) ≈ [kg]	20	23	27	29	33	36	39	42	45

** see order key on page 2 *** Unit weight + water content

Series AVSI 33/51**

Design

[1] Air cooler made of copper pipes with aluminium fins, max. operating temperature 90° C, max. operating pressure 10 bar
[2] Housing completely made of aluminium plate incl. mounting frame [6]
[3] Water connection with R 3/4", torsion protection
[4] Condensate tray to collect condensate in dehumidification mode
[5] Condensate drain, G 1/2", mounted on the condensate tray and supplied as standard
[6] Mounting frame made of galvanized steel sheet, supplied as standard

Installation

The mounting frame is used to install the cooling unit in front of the fall duct wall.

Important:
To ensure optimum operation sealing off walls spaced at 600–800 mm need to be installed in the fall ducts.

Subject to technical changes · Issued 01/2023

Series ISHK xx.15
150 mm Duct Depth | Cooling/Heating
Design | Specification | Dimensions

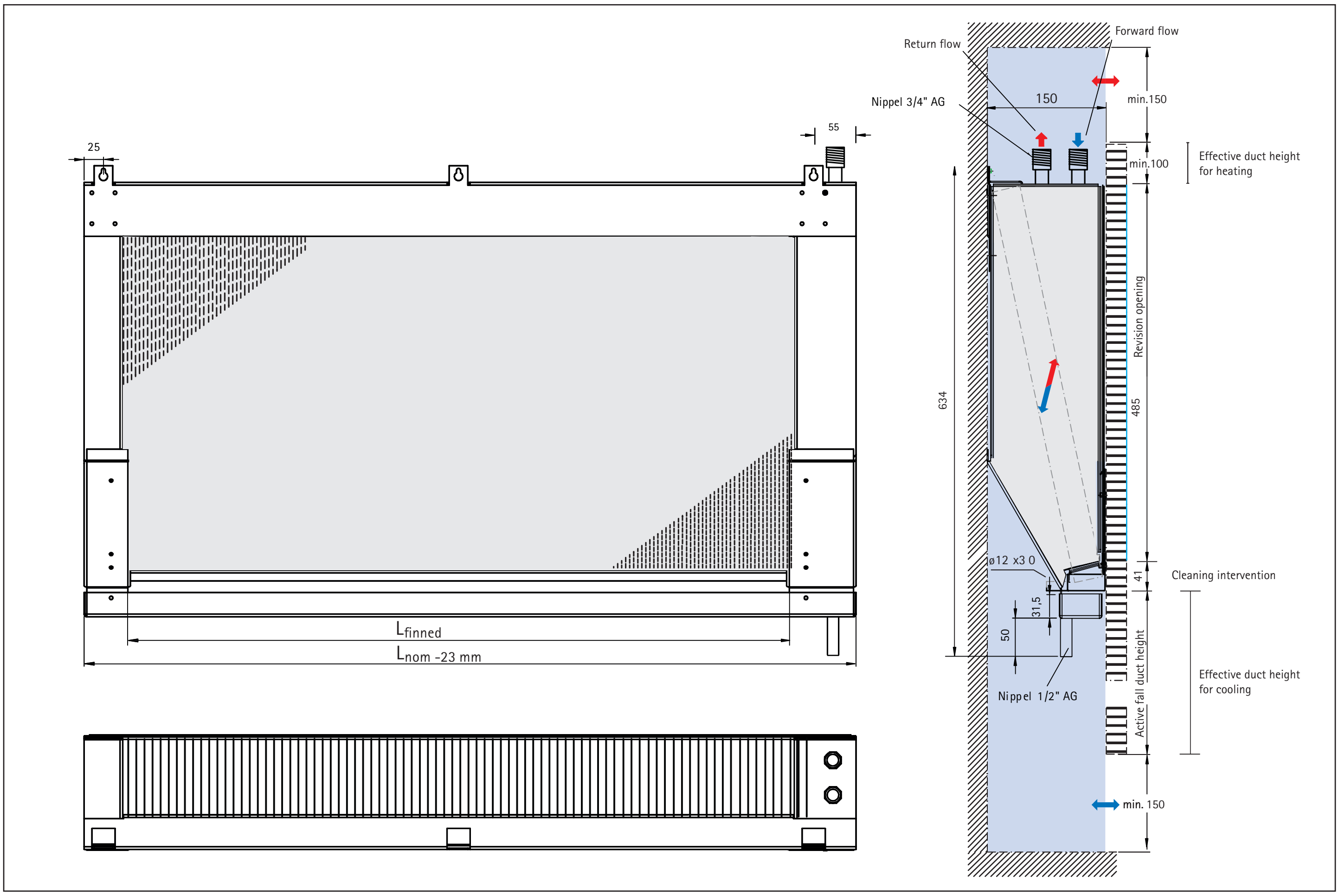
Specification of series ISHK xx.55

GraviVent® units are designed for concealed installation in fall ducts. They are ideally suited for the silent and energy-saving cooling of rooms and ensure an even temperature distribution in the room by the cooled circulating air exiting the fall duct horizontally at the bottom and then distributing itself into the room.

Heat exchanger
- Heat exchanger made of copper tubes with mounted aluminium fins
- Fixed mechanical connection between fins and tubes
- 2-pipe design
- Water quality of the cooling medium according to VDI guideline 2035
- Max. operating pressure 6 bar
- Max. operating temperature 90 °C
- Other pressures and temperatures possible

Connections
- Connection side seen from the room on the left. The nipple connections are 3/4-inch and protrude over the top of the unit.
- Condensate connection nipple 1/2-inch

Housing
- Aluminium housing, 1 mm
- Wall rail supplied for installation, on which the condensate drip tray of the housing is placed; in addition, the housing is screwed to the wall at the top.



14.1

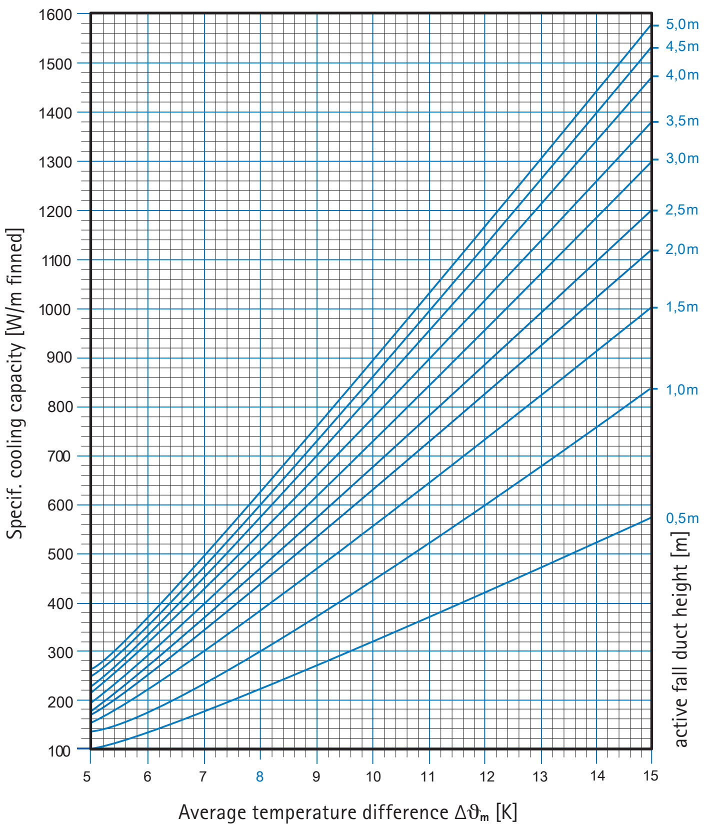
Part no ISHK xx.15**	08	10	12	14	16	18	20	22	24
Finned length L_{finned} [mm]	669	869	1069	1269	1469	1669	1869	2069	2269
Total unit length L_{nom} [mm]	800	1000	1200	1400	1600	1800	2000	2200	2400
Total weight*** (55) ≈ [kg]	9.9	11.1	13.1	15.4	17.1	19.4	20.8	22.8	25.0
Water content ≈ [kg]	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2

** see order key on page 2 *** Unit weight + water content

Subject to technical changes · Issued 01/2023

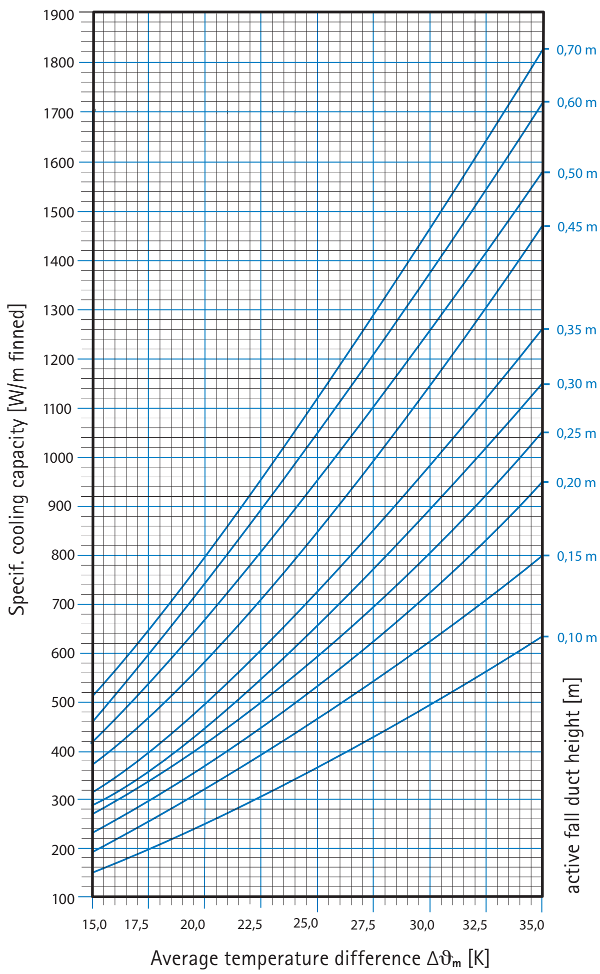
Series ISHK xx.15
150 mm Duct Depth | Cooling/Heating
Part no. | Capacity category 1

Specific cooling capacities ISHK xx.15 capacity category 1



15.1 Specific cooling capacities

Specific heating capacities ISHK xx.15 capacity category 1



15.2 Specific heating capacity

Formulas 1, 2 and 3 for calculating the average temperature difference in cooling mode, for calculating the cooling capacity, as well as for the approximate calculation of the water mass flow **can be found on page 16.**

Water content			Pressure drop [kPa]								
[m³/h]	[l/min]	[l/h]	08	10	12	14	16	18	20	22	24
0.10	1.7	100.0	1.0	1.0	2.1	2.5	2.8	3.0	0.7	0.7	0.8
0.13	2.1	125.0	2.0	2.5	3.0	3.4	3.9	4.4	0.9	1.0	1.0
0.15	2.5	150.0	3.0	3.5	4.1	4.7	5.4	5.9	1.2	1.2	1.3
0.20	3.3	200.0	4.3	5.9	6.9	7.9	8.9	9.9	2.0	2.0	2.2
0.25	4.2	250.0	6.5	9.1	10.6	12.1	13.6	15.0	3.0	3.2	3.5
0.30	5.0	300.0	9.0	12.7	14.8	16.8	18.9	21.0	4.2	4.5	4.8
0.40	6.7	400.0	16.0	21.0	24.5	27.8	31.0	34.0	7.0	7.5	7.9
0.50	8.3	500.0	–	30.5	35.4	40.1	45.0	50.0	10.1	10.8	11.3
0.60	10.0	600.0	–	42.3	48.8	55.2	61.7	68.0	14.0	14.9	15.6
0.70	11.7	700.0	–	–	–	–	–	–	19.0	20.0	21.2
0.80	13.3	800.0	–	–	–	–	–	–	23.4	24.8	26.1

15.3 Pressure drop ISHK xx.15

Series AASS/AVSS/AISI/AVSI xx.33 | Cooling

Capacitiy Charts Category 1

Formula 1
Calculating the average temperature difference $\Delta\vartheta_m$ for cooling mode

$$\Delta\vartheta_m[K] = t_R - \frac{t_{W1}[°C] + t_{W2}[°C]}{2}$$

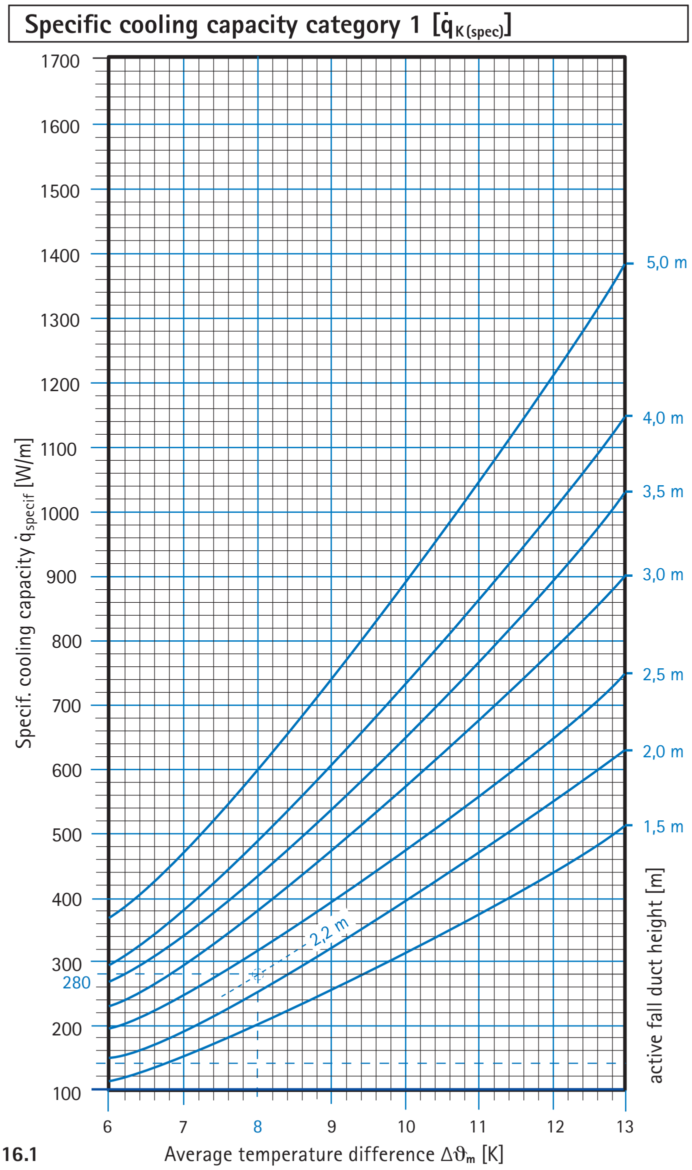
Formula 2
Calculating the total cooling capacity $\dot{Q}_{Ktot}$ (1 unit)

$$\dot{Q}_{K(tot)}[kW] = \dot{q}_{K(specif)}[W/m] \cdot L_{(finned)}[m]$$

Formula 3
Estimating roughly the water volume flow $\dot{m}_w$

$$\dot{m}_W[kg/h] = 860 \cdot \frac{\dot{q}_{(specif)}[kW/m] \cdot L_{(finned)}[m]}{t_{W2} - t_{W1}\ [K]}$$

$\Delta\vartheta_m[K]$ = Average temperature difference between two different media
$t_R[°C]$ = Room temperature
$t_{W1}[°C]$ = Water inlet temperature
$t_{W2}[°C]$ = Water outlet temperature
$\dot{m}_W[kg/h]$ = Water volume flow
$\dot{Q}_{K(tot)}$ = Total cooling capacity of a hilled beam
$\dot{q}_{K(specif)}[W/m]$ = Cooling power per metre of finned chilled beam length ($L_{(finned)}$)
$(L_{(finned)})$ [m] = $L_{(tot)}$[m] - 0,2 m
$\Delta p_{W(tot)}$[kPa] = Total pressure drop of a chilled beam
$\Delta p_{W(specif)}$[kPa/m] = Specific pressure drop of 1 m finned chilled beam length ($L_{(finned)}$)



16.1

Water content			Pressure drop [kPa]								
[m³/h]	[l/min]	[l/h]	08	10	12	14	16	18	20	22	24
0.10	1.7	100.0	1.2	1.0	1.7	0.5	0.5	0.5	0.5	0.5	0.5
0.13	2.1	125.0	1.7	2.1	2.7	2.8	1.2	1.3	1.4	0.5	0.5
0.15	2.5	150.0	2.4	2.9	3.3	3.8	1.6	1.8	1.9	1.1	1.2
0.20	3.3	200.0	4.0	4.8	5.5	6.3	2.7	3.0	3.2	1.9	2.0
0.25	4.2	250.0	6.0	7.2	8.3	9.4	4.0	4.4	4.8	2.8	3.0
0.30	5.0	300.0	8.4	9.9	11.5	13.0	5.6	6.1	6.6	3.9	4.2
0.40	6.7	400.0	14.3	16.8	19.3	21.9	9.4	10.2	11.0	6.6	7.0
0.50	8.3	500.0	20.1	23.8	27.6	31.4	12.7	13.8	15.1	8.4	9.0
0.60	10.0	600.0	26.4	31.6	36.9	42.0	16.0	17.6	19.3	10.0	10.8
0.70	11.7	700.0	35.1	41.9	48.7	55.5	21.0	23.3	25.6	13.3	14.3
0.80	13.3	800.0	44.8	53.5	62.1	70.6	26.8	29.7	32.5	16.9	18.2

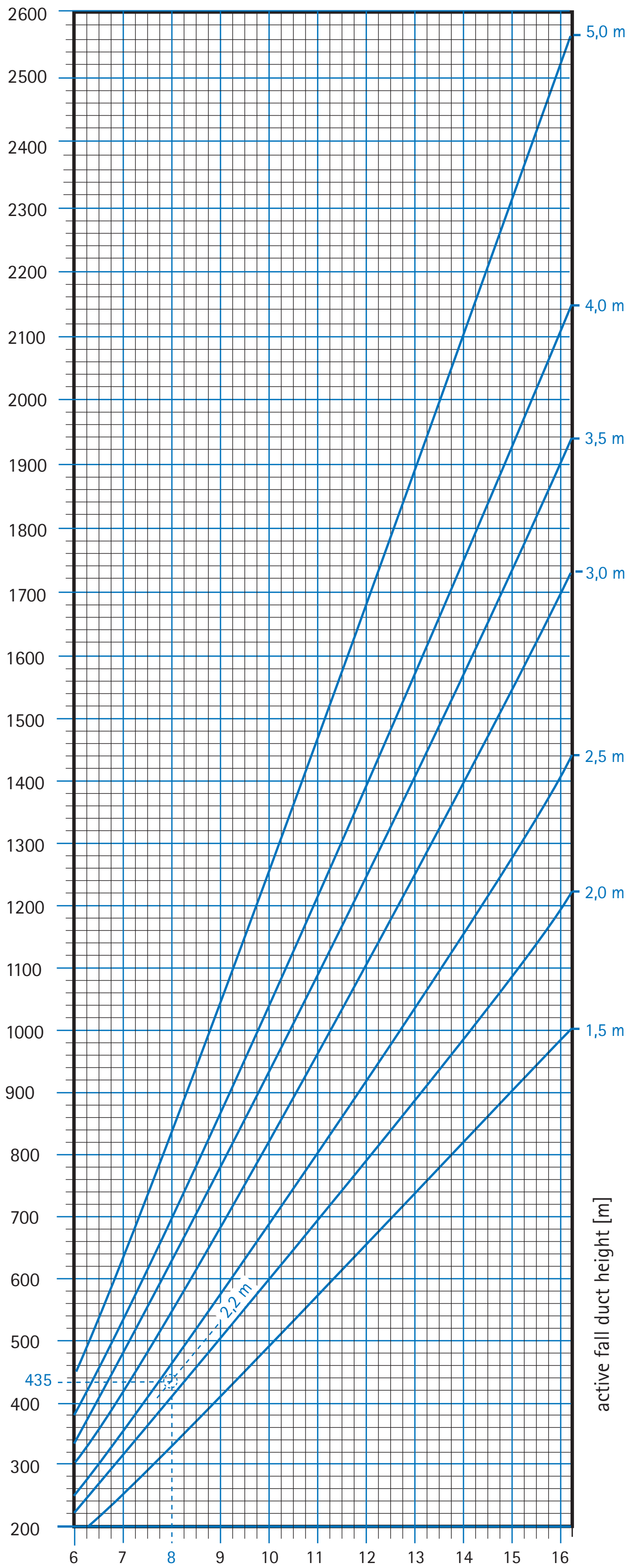
16.2 Pressure drop AASS/AVSS/AISI/AVSI xx.33 2L1

Subject to technical changes · Issued 01/2023

Series AASS/AVSS/AISI/AVSI xx.51 | Cooling

Capacitiy Charts Category 2

Specific cooling capacity category 2 [$\dot{q}_{K(spec)}$]



17.1 Average temperature difference $\Delta\vartheta_m$ [K]

$\Delta\vartheta_m$[K]	=	Average temperature difference between two different media
t_R[°C]	=	Room temperature
t_{W1}[°C]	=	Water inlet temperature
t_{W2}[°C]	=	Water outlet temperature
$\dot{m}_W$[kg/h]	=	Water volume flow
$\dot{Q}_{K(tot)}$	=	Total cooling capacity of a hilled beam
$\dot{q}_{K(specif)}$[W/m]	=	Cooling power per metre of finned chilled beam length ($L_{(finned)}$)
($L_{(finned)}$) [m]	=	$L_{(tot)}$[m] - 0,2 m
$\Delta p_{W(tot)}$[kPa]	=	Total pressure drop of a chilled beam
$\Delta p_{W(specif)}$[kPa/m]	=	Specific pressure drop of 1 m finned chilled beam length ($L_{(finned)}$)

Water content			Pressure drop [kPa]								
[m³/h]	[l/min]	[l/h]	08	10	12	14	16	18	20	22	24
0.1	1.67	100.0	0.6	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5
0.2	2.50	150.0	1.2	1.4	1.0	1.1	1.5	0.8	0.9	0.5	0.5
0.2	3.33	200.0	2.0	2.3	1.6	1.8	1.9	1.4	1.5	1.5	1.6
0.3	5.00	300.0	4.3	4.9	3.4	3.7	4.0	2.9	3.0	3.2	3.3
0.4	6.67	400.0	7.2	8.2	5.7	6.2	6.7	4.8	5.1	5.4	5.6
0.5	8.33	500.0	9.3	10.8	7.0	7.8	8.5	5.7	6.1	6.5	6.9
0.6	10.00	600.0	11.2	13.3	8.0	9.0	10.0	6.2	6.7	7.2	7.7
0.7	11.67	700.0	14.9	17.6	10.6	11.9	13.3	8.1	8.8	9.5	10.2
0.8	13.33	800.0	19.0	22.6	13.5	15.2	16.9	10.4	11.2	12.1	12.9
0.9	15.00	900.0	22.1	26.5	15.2	17.3	19.4	11.3	12.4	13.4	14.5
1.0	16.67	1000.0	30.8	36.0	22.3	24.9	27.4	17.6	19.0	20.2	21.5
1.3	21.67	1300.0	51.5	59.7	37.6	41.6	45.6	30.0	32.1	33.1	35.1

17.2 Pressure drop AASS/AVSS/AISI/AVSI xx.51 2L2

Formula 1

Calculating the average temperature difference $\Delta\vartheta_m$ for cooling mode

$$\Delta\vartheta_m[K] = t_R - \frac{t_{W1}[°C] + t_{W2}[°C]}{2}$$

Formula 2

Calculating the total cooling capacity $\dot{Q}_{Ktot}$ (1 unit)

$$\dot{Q}_{K(tot)}[kW] = \dot{q}_{K(specif)}[W/m] \cdot L_{(finned)}[m]$$

Formula 3

Estimating roughly the water volume flow $\dot{m}_w$

$$\dot{m}_W[kg/h] = 860 \cdot \frac{\dot{q}_{(specif)}[kW/m] \cdot L_{(finned)}[m]}{t_{W2} - t_{W1}\,[K]}$$

Design Example

Calculating a Cooling Unit for Cooling Mode

Task

An office (see page 17 **Fig. 17.1**) with a sensible cooling load $\dot{Q}_{K(sen)}$ = 2,000 W is to be cooled with AASS or AVSI series cooling units and also be ventilated with additional, preconditioned primary air. The unit is to be installed above a range of cabinets or a set of shelves at a height of 2.5 m, see **Fig. 17.1**. The room volume ist approx. 80 m³. The preconditioned primary air is blown into the room at 18 °C through flexible pipes in the fall ducts.

Other calculating criteria >

- Cold water temperature: t_{W1} = 16 °C And t_{W2} = 20 °C
- Room temperature: t_R = 26 °C
- Primary air temperature: $t_{L(prim)}$ = 20 °C
- Max. possible installation length L_{max} for the cooling unit(s) = 5.50 m
- The primary air rate $\dot{V}_{L(prim)}$ is 240 m³/h at 3 times room air change
- The sound pressure level shall not exceed 30 dB(A)
- Effective fall duct height $H_{eff} \approx 2.2$ m

The Solution (explained step-by-step)

1. Calculating the average temperature difference with formula 1 (see pages 16/17):

Calculate $\Delta\vartheta_m$ >

$$\Delta\vartheta_m[K] = t_R - \frac{(t_{W1} + t_{W2})°C}{2} = 26 - \frac{16°C + 20°C}{2} = 8\,K$$

2. Calculating the specific cooling capacity $\dot{q}_{K(specif)}$:

Determine $\dot{q}_{K(specif)}$ >

- Category »1« (**Fig. 16.1**) determins $\Delta\vartheta_m$ = 8 K = $\dot{q}_{K(specif)}$ = 280 W/m
- Category »2« (**Fig. 16.1**) determins $\Delta\vartheta_m$ = 8 K = $\dot{q}_{K(specif)}$ = 435 W/m

This results in:

a) Required finned length L_{finned} for category 1 = 2000 W : 280 W/m ≈ 7.15 m

b) Required finned length L_{finned} for category 2 = 2000 W : 435 W/m ≈ 4.60 m

Conclusion:

Required finned length L_{finned} >

- Due to structural restrictions (max 5.5 m) the length required under a) L_{finned} = 7.15 m cannot be used
- The length calculated under b) $L_{berippt}$ = 4.6 m meets the requirement

3. Select the required TTC cooling units

- Max. available TTC cooling unit length L_{tot} = 2.4 m with L_{finned} = 2.2 m
- To fulfill the requirement you will need 2 TTC category 2 cooling units

Required TTC cooling units > 2 units AASS.24.51.2._.2 (see order key on page 2)

Water-sided cooling capacity > 4. Calculating the actual water-sided cooling capacity:

Result >

$$\dot{Q}_{K(tot)}[W] = \dot{q}_{specif}[W/m] \cdot L_{(finned)}[m] \cdot n[unit] = 435\,W/m \cdot 2.32\,m \cdot 2 \approx 2020\,W = 2.02\,kW$$

(required 2.000 kW)

5. Calculating the additional cooling capacity of the primary air:

Cooling power of primary air >

$$\dot{Q}_{K(air)}[kW] = \frac{\dot{V}_{L(tot)}[m^3/h] \cdot p_L[kg/m^3] \cdot cp_L[kJ/kg{\cdot}K] \cdot \Delta t_L[K]}{3600}$$

$$\dot{Q}_{K(air)}(kW) = \frac{240\,(m^3/h) \cdot 1.2\,(kg/m^3) \cdot 1\,(kJ/Kg{\cdot}K) \cdot 8\,(K)}{3600} = 0.64\,kW$$

6. Total cooling capacity in the water and air side:

Total cooling capacity >

$$\dot{Q}_{K(water,\ air)} = 2.02\,kW\ (step\ 4) + 0.64\,kW\ (step\ 5) = 2.66\,kW$$

Please note > The free cross-section on the TTC air inlet and outlet grilles (see page 20) must be taken into account!

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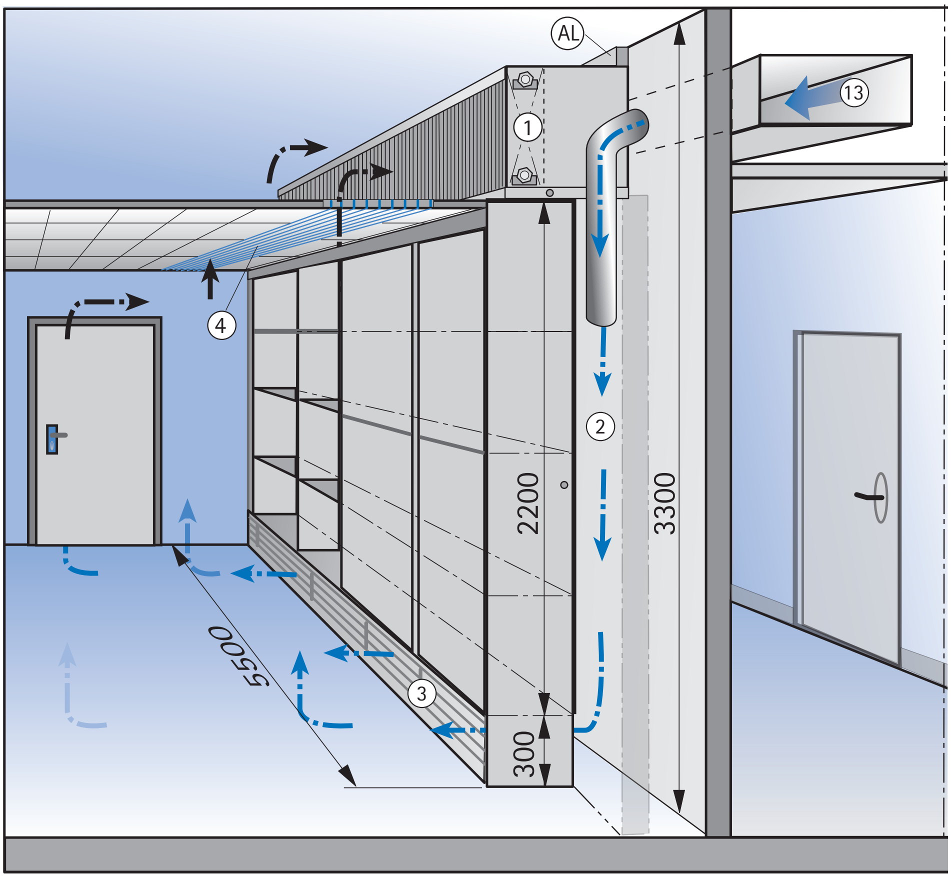
Design Example
Illustration of the System

Illustration of the system calculated in the design examples

Key to **Fig. 19.1**

[1] Air cooler with condensation tray
[2] Fall duct for cold air
[3] Air outlet grille
[4] Air inlet grille
[13] Primary air channel
[AL] Sealing batten against infiltrated air

Note:
For other free cross-sections of the air inlet and air outlet grilles please refer to page 20 or contact TTC.



19.1

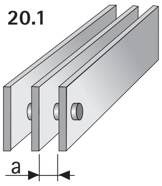
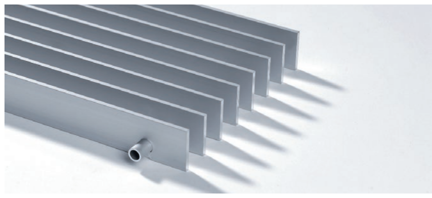
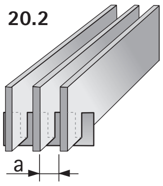
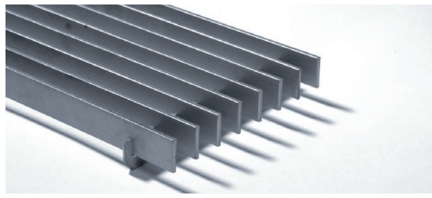
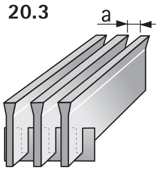
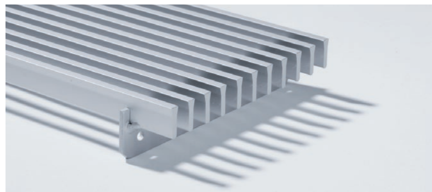
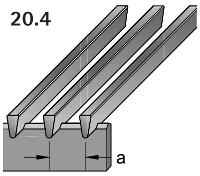
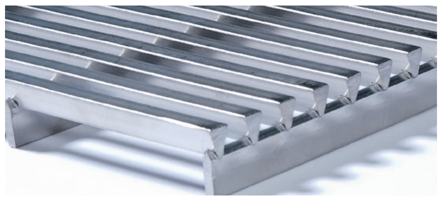
Subject to technical changes · Issued 01/2023

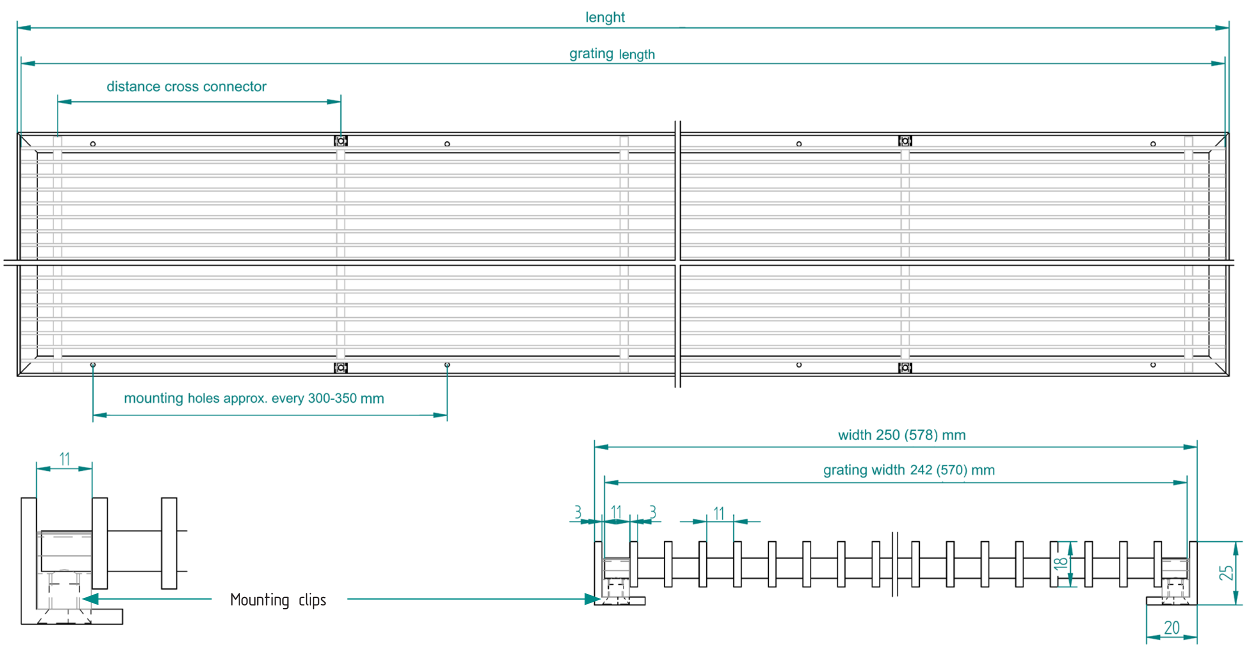
Air Inlet and Outlet Grilles

Part no.

Reduced performance of the TTC air outlets in conjunction with TTC cooling units

All specifications are based on identical length of cooling unit and air outlet grille.
For optical reasons, the grilles can also be designed as a band arrangement.

		Bar spacing »a« [mm]	Free cross-section [%]	
20.1 	**Longitudinal grille** rigid (full profile) made of aluminium, for air inlets and outlets in ceilings, walls and on the floor **Part no. TTC-LSF ❏ Alu**	20 15 10	88 83 77	
20.2 	**Comb grille** rigid (full profile) made of aluminium or V2A, for air inlets and outlets in ceilings, walls and on the floor **Part no. TTC-KSF ❏ Alu ❏ V2A**	20 15 10	87 83 77	
20.3 	**Comb grille** rigid (T-profile) made of aluminium, for air inlets and outlets in ceilings, walls and on the floor **Part no. TTC-KST ❏ Alu**	20 15 10	80 73 65	
20.4 	**Comb grille** rigid (full profile) made of V2A, for air inlets and outlets in ceilings, walls and on the floor **Part no. TTC-KSM-V ❏ V2A**	15 10	73 65	



20.5 Example ventilation grille LSF for series AISI 51

More information on the ventilation grilles can be found in the brochure »Homogeneous Gratings« or on ttc-technology.de

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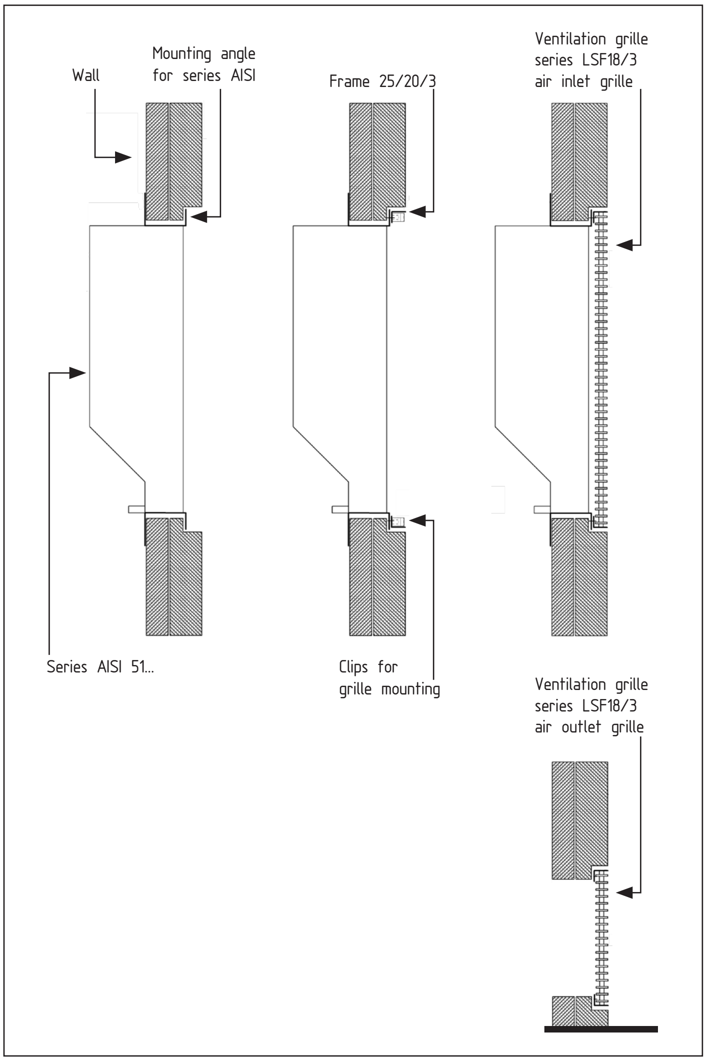
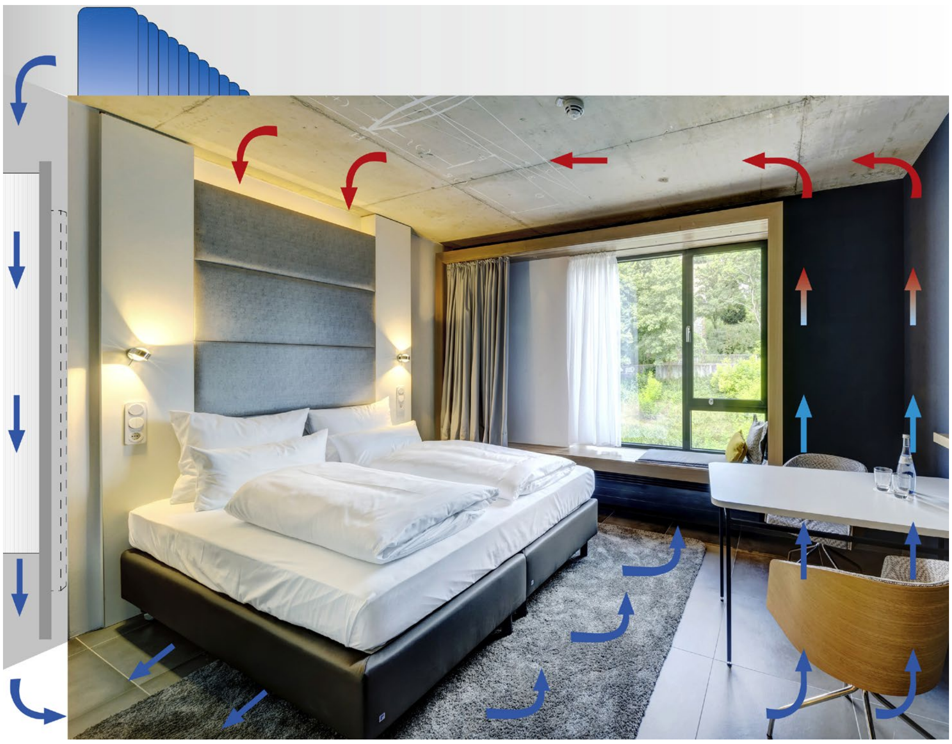


21.1 Installation

21.2 Duct installation series AISI

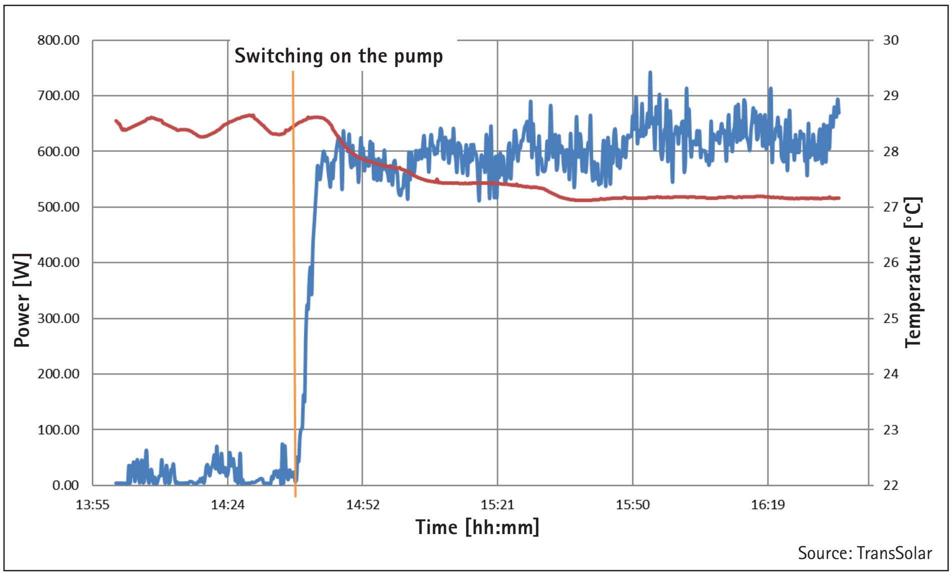


21.3 Project Vilotel, series ISHK

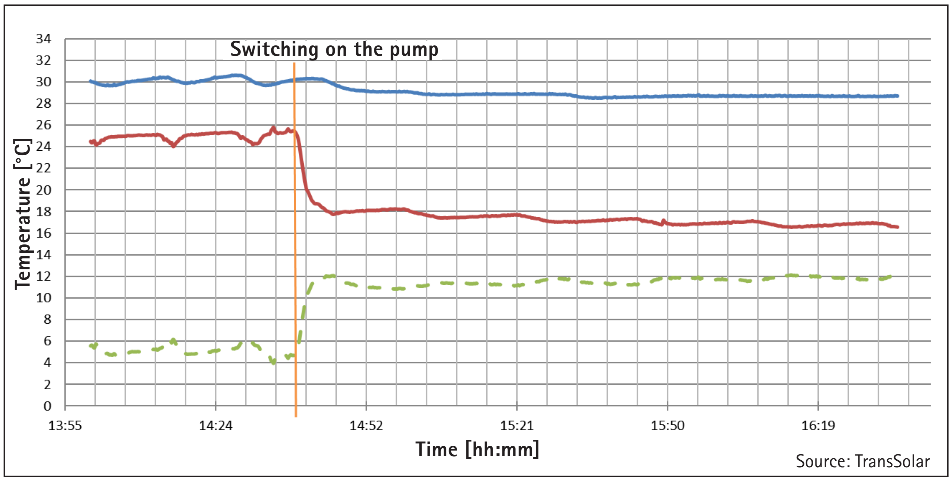
21.4 Project Copenhagen Concert Hall, series AISI

Start-up Behaviour | Laboratory Set-up

Diagram **22.1** shows the power curve when the GraviVent® system starts up.
In approx. 3.5 minutes the system is at 60 % (of 600 W) power. In approx. 6.5 minutes the system reaches 100 % (of 600 W) power. Over time, the power increases slightly because the ΔT between inlet and outlet temperature rises by increases by approx. 1 K.



22.1 Start-up behaviour of GraviVent system with natural convection without fan



22.2 Inlet and outlet air temperatures

22.3 2nd experimantal set-up with fan according to DIN EN 442-2

22.4 2nd experimantal set-up with fan

Flow Diagrams

23.1 Air intake at the cooling air inlet

The flow diagrams clearly show the functional principle of silent gravity cooling:

The accumulated warm air under the ceiling meets the heat exchanger at the air inlet and is cooled. This increases the density of the air, the cooled air falls through the shaft and natural convection occurs.

23.2 Air inlet flow at the air outlet

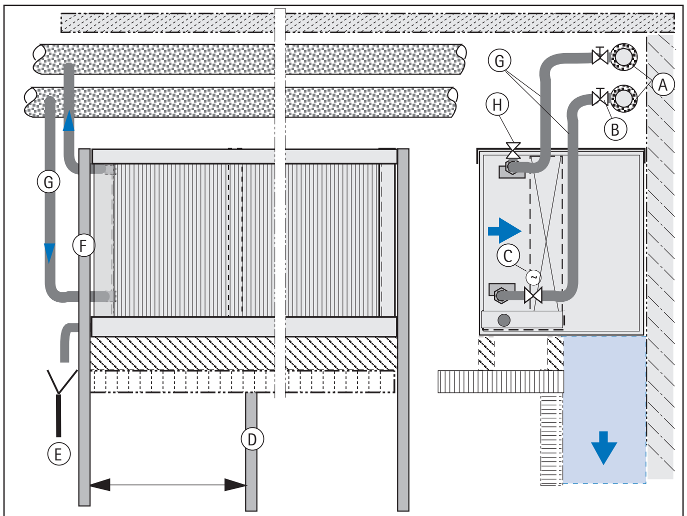
The cooled air then flows into the room at ~0.2 m/s and forms a kind of cool lake.

23.3 Air inlet flow at the air outlet

At heat sources, this cooled air rises again and heat exchange occurs once more. This leads to a pleasant cooling of the heat sources and at the same time causes the previously cooled air to heat up again. Through this process, the warmer air rises again due to its lower density and the cycle begins again.

Instruction for Pipe Work Installation

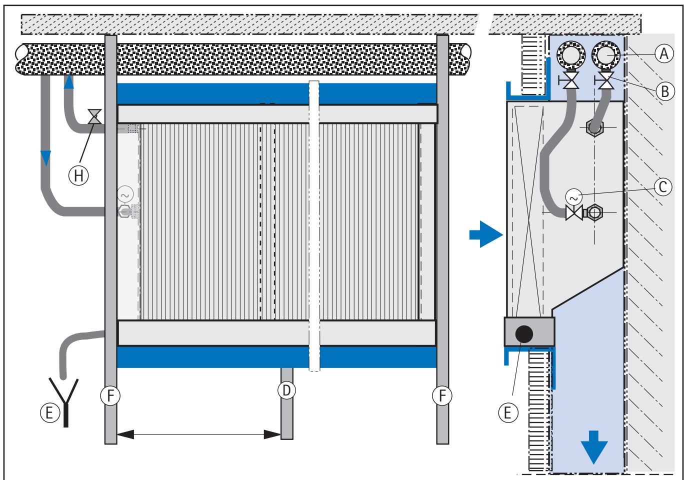
Example for a pipe work installation for AASS cooling unit



- A Cold water supply (do not install these in front of the air cooler)
- B Stop valves for forward and return flow
- C Electrical control valve
- D Sealing off walls in the fall duct for the cooling air
- E Siphon to drain condensation
- F Side seals on the cooling unit against infiltrated air
- G Flexible connecting hoses
- H Relief valve

24.1

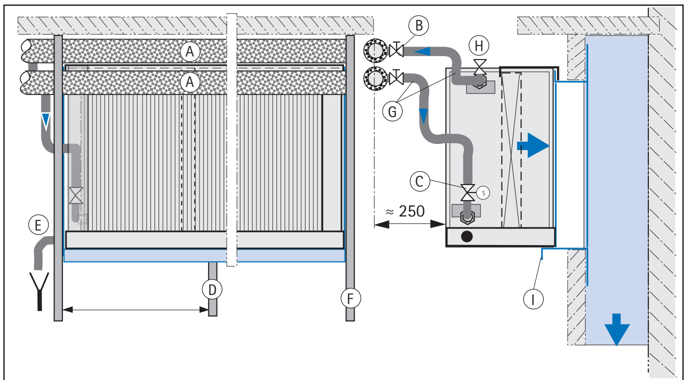
Example for a pipe work installation for AISI cooling unit



- A Cold water supply (do not install these in front of the air cooler)
- B Stop valves for forward and return flow
- C Electrical control valve
- D Sealing off walls in the fall duct for the cooling air
- E Siphon to drain condensation
- F Side seals on the cooling unit against infiltrated air
- G Flexible connecting hoses
- H Relief valve

24.2

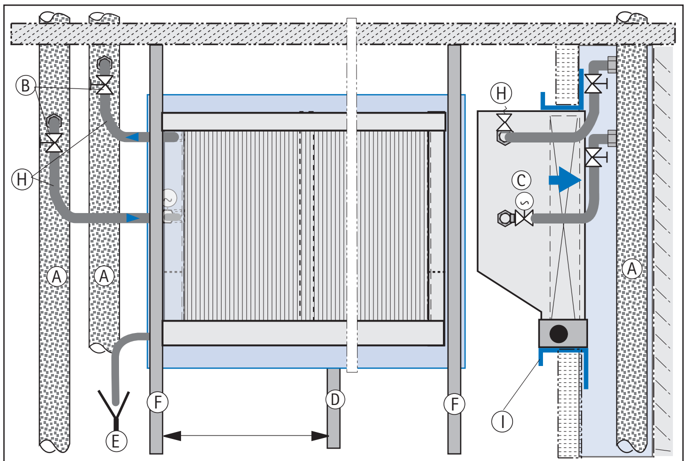
Example for a pipe work installation for AVSS cooling unit



- A Cold water supply (do not install these in front of the air cooler)
- B Stop valves for forward and return flow
- C Electrical control valve
- D Sealing off walls in the fall duct for the cooling air
- E Siphon to drain condensation
- F Side seals on the cooling unit against infiltrated air
- G Flexible connecting hoses
- H Relief valve
- I Mounting frame supplied as standard

24.3

Example for a pipe work installation for AVSI cooling unit



- A Cold water supply (do not install these in front of the air cooler)
- B Stop valves for forward and return flow
- C Electrical control valve
- D Sealing off walls in the fall duct for the cooling air
- E Siphon to drain condensation
- F Side seals on the cooling unit against infiltrated air
- G Flexible connecting hoses
- H Relief valve
- I Mounting frame supplied as standard

24.4

Subject to technical changes · Issued 01/2023

Flexible Hoses
for TTC GraviVent® – Silent Gravity Cooling

BASE INFORMATION

**ISOLATED FLEXIBLE HOSES
MADE OF STAINLESS STEEL**

Isolated flexible hoses

Isolated flexible antivibration hoses for connections between water network and TTC Gravity cooling units are made of stainless steel with outside braiding; nominal diametre 19 mm; they can withstand a variable working pressure 10 bar.

This EPDM based highly flexible closed cell insulation features outstanding material characteristics such as high weather and UV resistance, excellent temperature resistance and an absolutely low rate of thermal loss ($\lambda_{40^\circ C}$ =0,040 W/mK).

Insulation material

→ Light-weight, flexible closed cell insulation made of EPDM

→ Non-corrosiveness to copper and corrugated stainless steel pipes according to DIN 1988, Part 7

→ Temperature resistance from -50° C to 150° C,
remains flexible to -50° C,
but can be used easily at temperatures to -200° C

Fc | 3/4 | ø 19 mm

Mc | 3/4 | ø 19 mm

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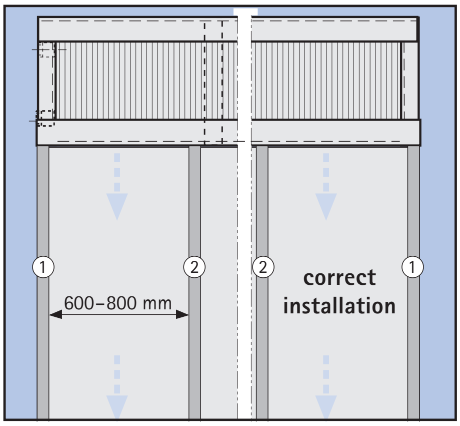
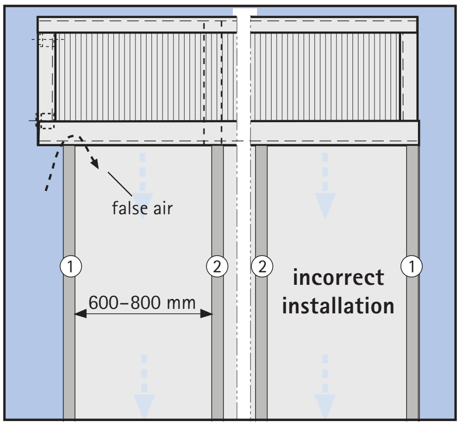
Assembly Instructions for Pipe Laying

Formation of side sealing off walls and fall ducts



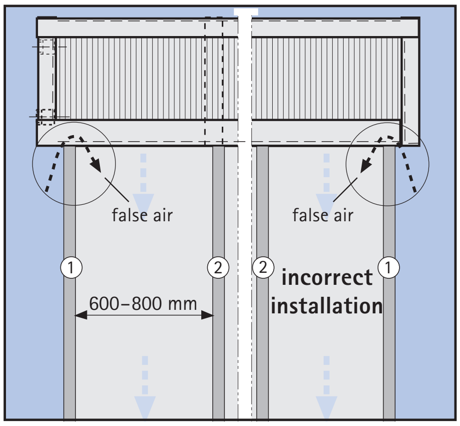
Professional installation of the cooling unit, no reduction in performance to be expected.
[1] Side sealing off walls
[2] Fall duct walls correctly arranged

26.1



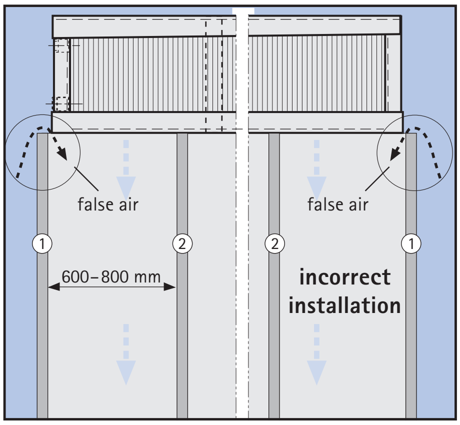
Cooling unit too large; the calculated performance is not achieved with this installation.
[1] Side sealing off walls
[2] Fall duct walls correctly arranged

26.2



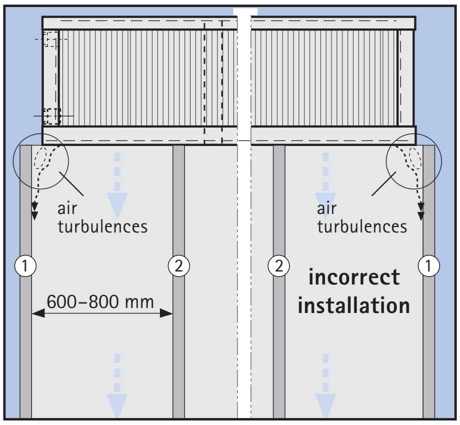
Cooling unit too large; the calculated performance is not achieved with this installation.
[1] Side sealing off walls
[2] Fall duct walls correctly arranged

26.3



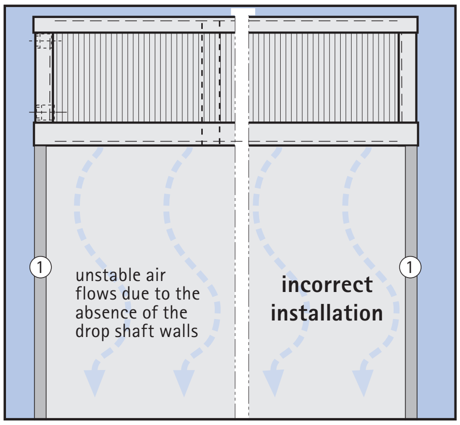
Cooling unit too small; the calculated performance is not achieved with this installation.
[1] Side sealing off walls
[2] Fall duct walls correctly arranged

26.4



Cooling unit too small; the calculated performance is not achieved with this installation.
[1] Side sealing off walls
[2] Fall duct walls correctly arranged

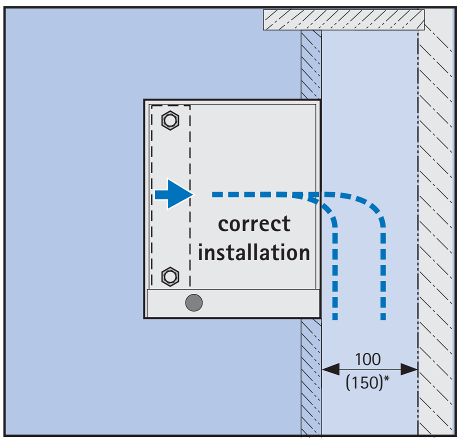
26.5



No fall duct walls installed;
the calculated performance is not achieved with this installation
[1] Side sealing off walls

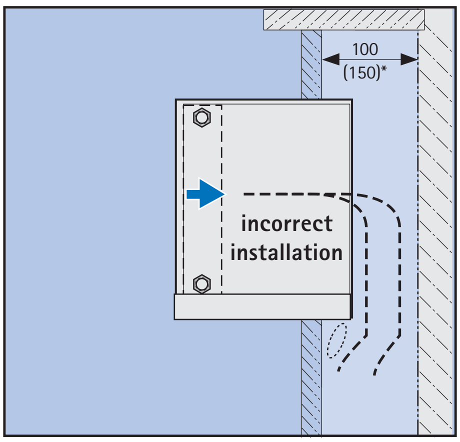
26.6

Installation in front of ducts



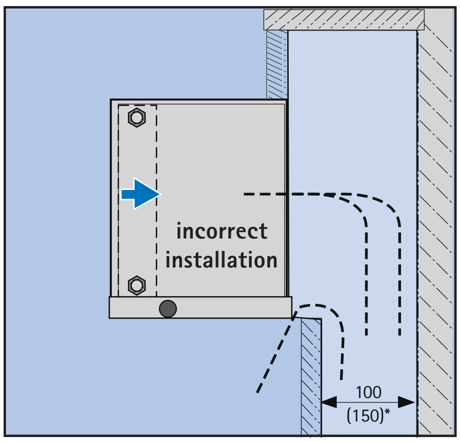
The calculated output is achieved with this installation. No false air possible.

26.7



The calculated output is not achieved with this installation (air turbulence).

26.8



The calculated output is not achieved with this installation (air leakage problems).

26.9

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Calculation and Order Sheet

Company ______________________________ Contact Person ______________

Address ______________________________ Position ______________

______________________________ Direct Dial ______________

Project ______________________________ Fax ______________

______________________________ Email ______________

Calculation parameters

1	Req. sensible cooling capacity $\dot{Q}_{K(sens)}$	[W]	______	W	With regard to the whole of the room
2	Clear room height h_{clear}	[m]	______	m	
3	Clear room width b_{clear}	[m]	______	m	
4	Clear room length l_{clear}	[m]	______	m	
5	Room volume	[m³]	______	m³	$h_{clear} \cdot b_{clear} \cdot l_{clear}$
6	Effective fall duct heigth H_{eff}	[m]	______	m	See page 7, Fig. 7.1
7	To be installed	>	❑ Cupb./shelve ❑ in front of/above ❑ in fall duct		Please check as appropriate
8	Max. width for cooling unit(s) $W_{(tot)}$	[m]	______	m	With reference to the installation space
9	Max. height for cooling unit(s) $H_{(tot)}$	[m]	______	m	With reference to the installation space
10	Cold water inlet t_{w1}	[°C]	______	°C	
11	Cold water outlet t_{w2}	[°C]	______	°C	
12	Room temperature t_R	[°C]	______	°C	
13	Primary air temperature $t_{L(in)}$	[°C]	______	°C	See page 9
14	Primary air volume flow $\dot{V}_{L(in)}$	[m³/h]	______	m³/h	
15	Max. sound pressure level for pr.air	[dB(A)]	______	dB(A)	

Calculating the required cooling unit

16	Average temperature difference Δ_m	[K]	______	K	Item 12 – [Item 10 + Item 11 : 2]
17	Specif. cooling capacity $\dot{q}_{K(specif)}$	[W/m]	> für Kat. 1: ______	W/m	From Fig. 16.1 (see page 16)
18	Total ripped length required L_{finned}	[m]	> für Kat. 1: ______	m	Item 1 : Item 17
19	Specif. cooling capacity $\dot{q}_{K(specif)}$	[W/m]	> für Kat. 2: ______	W/m	From Fig. 17.1 (see page 17)
20	Total ripped length required L_{finned}	[m]	> für Kat. 2: ______	m	Item 1 : Item 19
21	Select no. of cooling unit(s) required	[n]	______	n	see tables on pages 11/12
22	Req. length L_{finned} for 1 cooling unit	[m]	______	m	Item 18 oder Item 20 : Item 21
23	Cooling capacity $\dot{Q}_{K(1\ unit)}$ (1 unit)	[W]	______	W	Item 17 or Item 19 : Item 22
24	Corrected cooling capacity $\dot{Q}_{K(1\ unit)}$	[W]	______	W	see tables on page 18
25	Cooling capacity $\dot{Q}_{K(air)}$ from $\dot{V}_{L(in)}$	[kW]	______	kW	Item 14 · 0.0003 · (Item 12 – Item 13)

Calculating the water-sided pressure difference

26	Water mass flow $\dot{m}_W$	[kg/h]	______	kg/h	860 · [Item 23 (in kW) : Item 10]
27	Spec. water-sided pr. drop $\Delta p_{W(specif)}$	[kPa/m]	______	kPa/m	see pages 15–17
28	Total pressure drop $\Delta p_{W(tot)}$	[kPa]	______	kPa	Item 22 · Item 27

Important for your order

Part no. for cooling unit (see page 3)	Part no. for air inlet grating	Part no. for air outlet grating
Series ______	Series ______	Series ______
Manufacturer:	Manufacturer:	Manufacturer:
TTC Timmler Technology GmbH Christian-Schäfer-Str. 8 D-53881 Flamersheim	TTC Timmler Technology GmbH Christian-Schäfer-Str. 8 D-53881 Flamersheim	TTC Timmler Technology GmbH Christian-Schäfer-Str. 8 D-53881 Flamersheim

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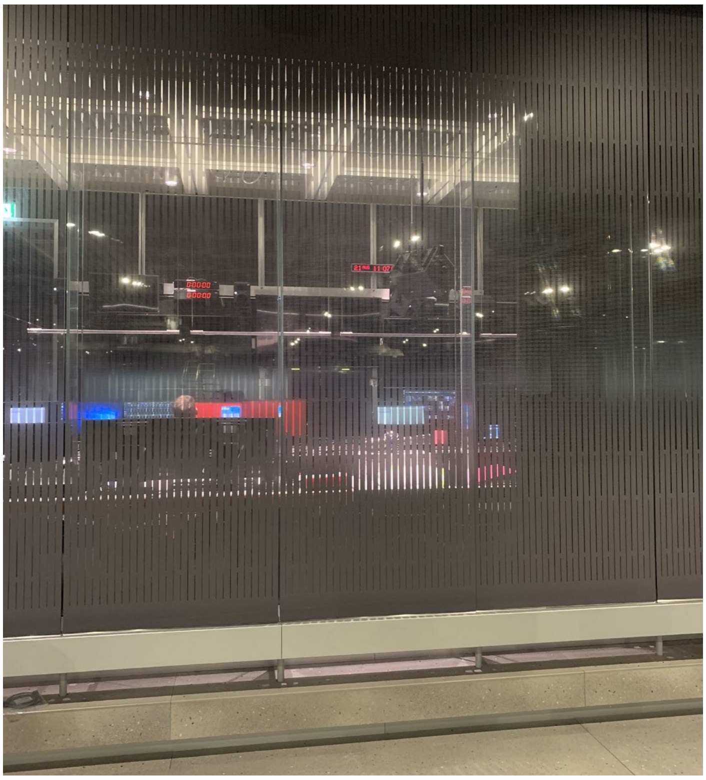
Reference projects

Data sheets for these and other reference projects on request

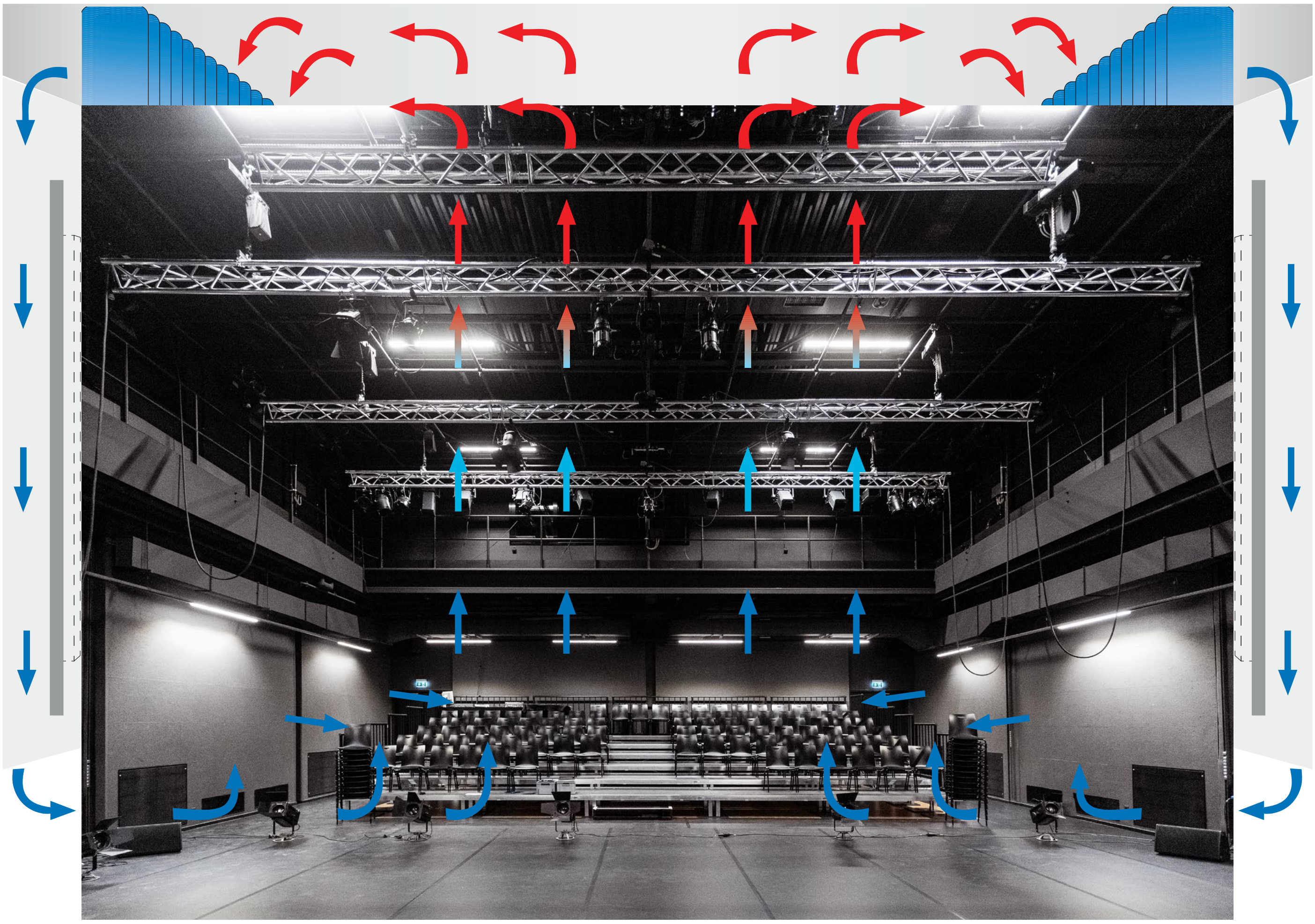
Fully digitalised broadcast studio, SRF, Zurich

Using a special process, silent gravity cooling was integrated into two transparent panes (glass + Makrolon), which are provided with a micro-perforation for the acoustics in a special process. This produces glass drop shafts which prevent unwanted draughts. In addition to silence, which is another important requirement when cooling broadcast studios.

- → Silent gravity cooling integrated in two glass panes with a special makrolon-window treatment with micro-perforation for acoustics
- → »Green« product: low energy costs, low maintenance requirements, 100 % recyclable after entire building cycle
- → Important component for DGNB/LEED certification
- → Optional with heating function



Theaterhaus Leipzig, Hall 7



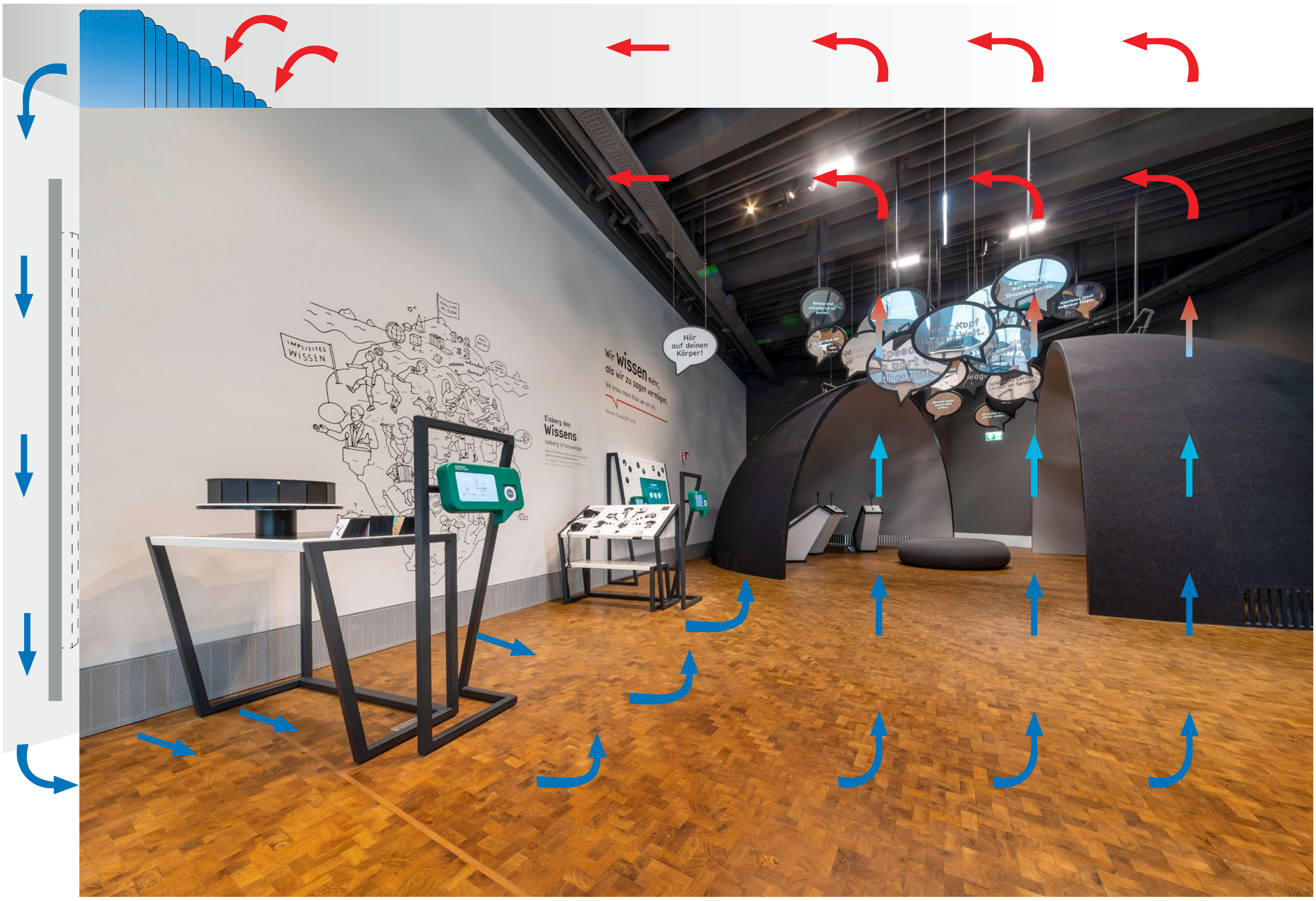
© Pictures: Tom Dachs (Theater), TTC Timmler Technology (Studio SRF)

Reference projects

Data sheets for these and other reference projects on request

Fraport, Frankfurt am Main

Experimenta, Heilbronn



©Pictures: Arnulf Hettrich (Experimenta), Marcus Bredt (FraPort)

Reference projects

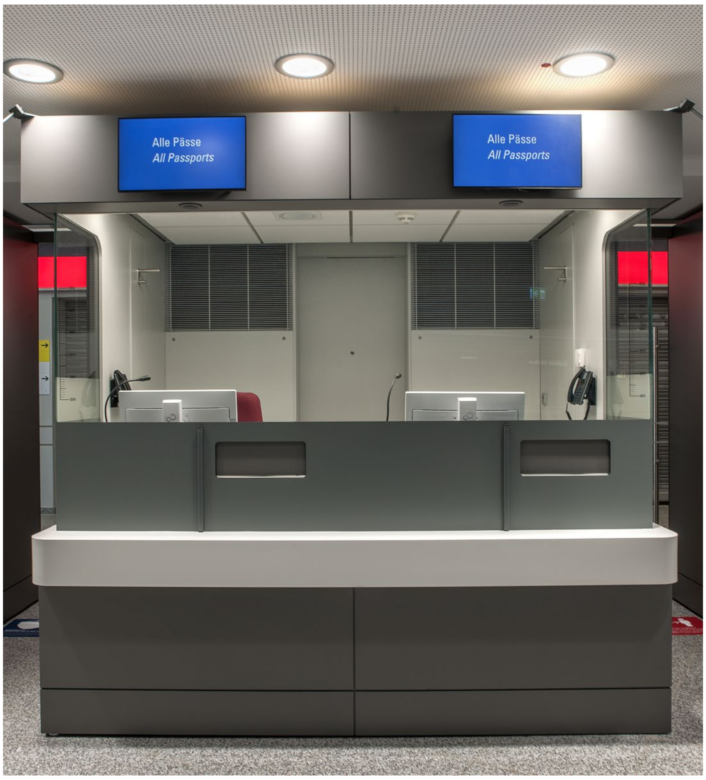
Data sheets for these and other reference projects on request

Passport control counters Hannover Airport

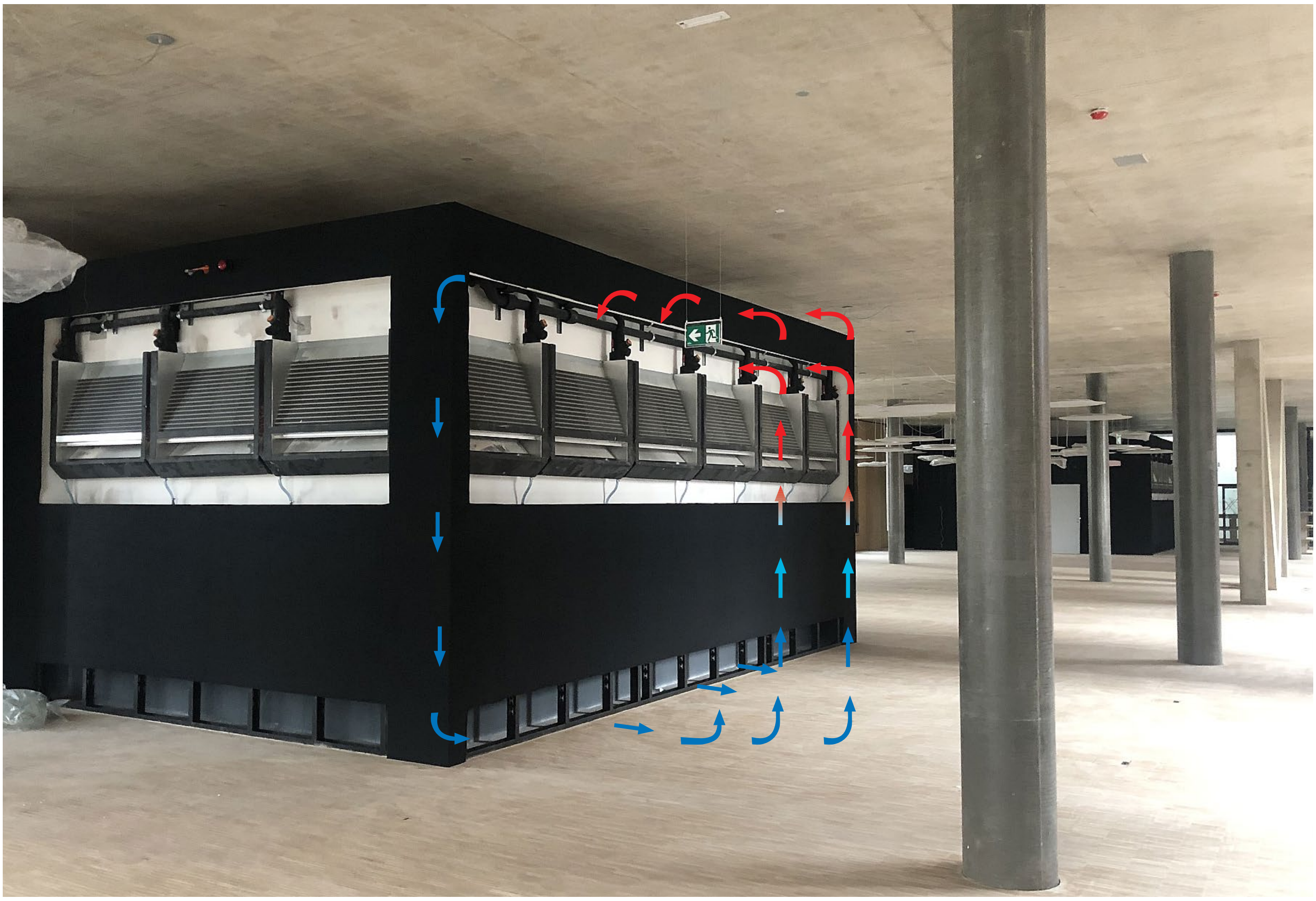
In cooperation with the airport company and the Federal Police, Hannibal Interior Design developed new passport control counters. Safety-relevant and technical requirements have to be met in a very small area, but thermal and air-hygienic comfort are also essential so that employees remain concentrated and efficient.

For this, the experts relied in GraviVent –the silent gravity cooling system from TTC Technology. The extremely high loads require a powerful cooling system, which, for architectural reasons, also had to be largely invisible. Silent operation without ventilation and without draughts ensures a pleasant climate for working through natural convection – even in such a confined space.

The coolers are controlled according to the wet-bulb temperature and are operated in a sliding mode. The flow temperatur of the cooling water ist 12 °C: the water is recirculated at 14 °C.



Library Campus Linz



© Pictures: TTC Timmler Technology (Campus), Marc Theis (Hannover)

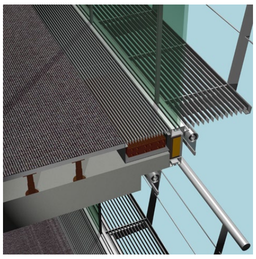
TTC Timmler Technology

Designing innovative solutions for new buildings and redevelopment together with architects and planners

Developing object specific solutions together with architects and specialist planners already during the planning phase is the strength of TTC Timmler Technology.
TTC provides smart building technology for contemporary living and working environments: LED light design, innovative air-conditioning systems, design-oriented façade elements and grating systems for interior and exterior areas.
With our extensive know-how we can balance modern design, energy efficiency, and economic efficiency. We design customized complete solutions in accordance with technical specifications, either made from standard components or made to your individual requirements.

Green and economical

People and environment are at the heart of all our endeavours. We develop natural airconditioning systems to go easy on resources and to save costs.



Multi-functionality
Our know-how for your planning

Multi-functionality is a special strength of TTC building technology. Below a few examples:

- LED Light Design – TTC lighting elements can be combined with channels and gratings as well as maintenance platforms, using striking illuminations to show your architecture in the best light. TTC light design offers a variety of options: From façade illumination with SpaceLights, high brightness LEDs, LED light lines and light tiles to wall washers – with our large choice of materials and individual design we can provide a customized solution for your project.
- TTC GraviVent® can be used to provide a consistent climate within a building. Energy-efficient, making use of natural gravity.
- TTC Chilled Beams ensure comfortable, silent ventilation in a wide variety of working environments. In consultation with architects and planners they can be individually fitted into the ceiling design.
- TTC Floorunits with a variety of functions such as heating, cooling, ventilation combine design with functionality and energy efficiency without disturbing the look of, for example, room height glass façades.
- Homogeneous grating systems create seamless transitions from the interior to the exterior on glass façades. TTC Floorunits provide heating, cooling and ventilation for interior areas and complement the TTC façade draining systems for exterior areas.

TTC Timmler Technology GmbH

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