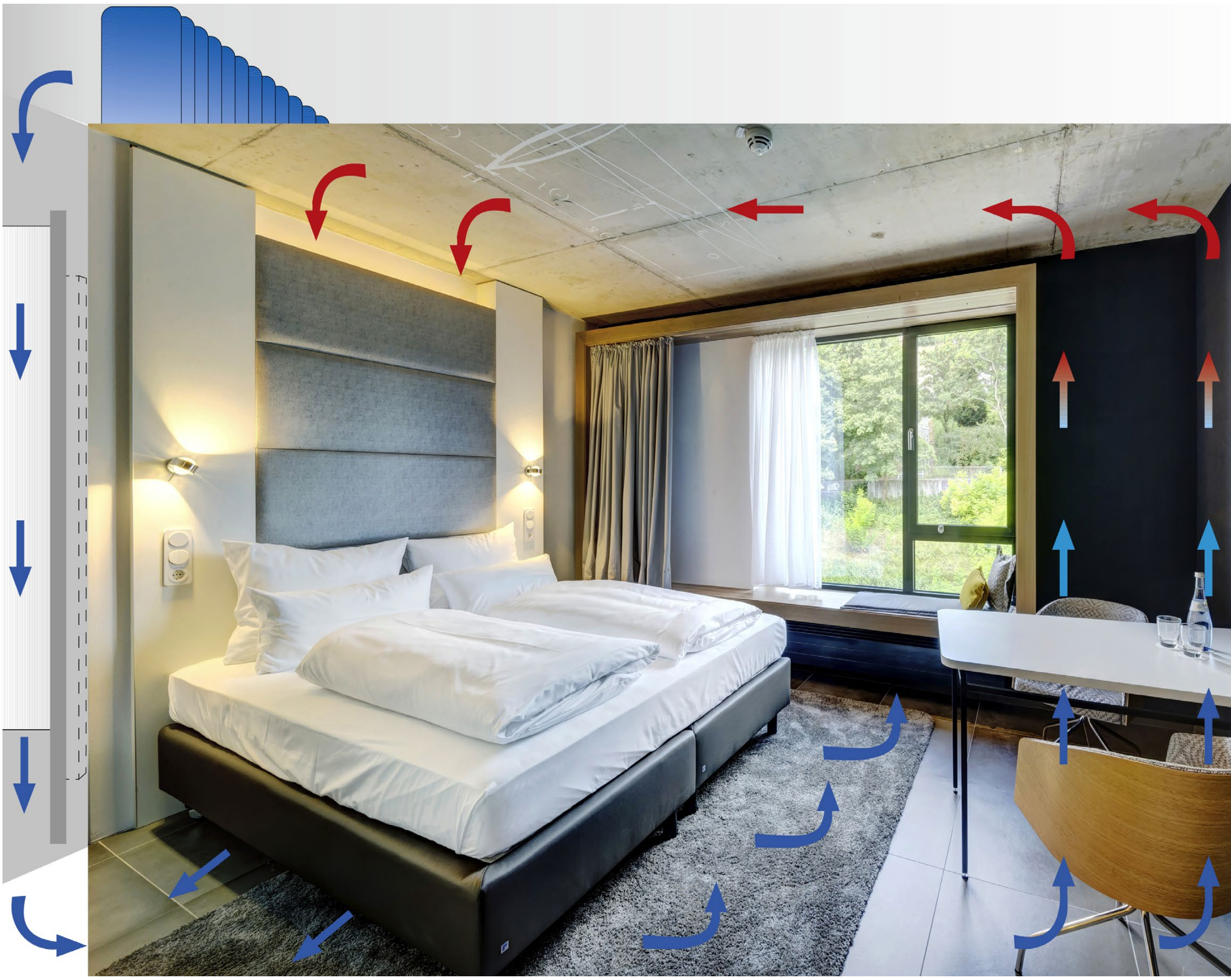
TTC Timmler Technology



GraviVent® – TTC Silent Gravity Cooling/Heating
GraviWalls | ISHK [ISHK-W] | ISHK-WHP
Planning Documentation
for Engineers and Plant Contractors

Contents

GraviVent® – Silent Gravitiy Cooling/Heating | GraviWalls

Series	
ISHK	in duct, heating/cooling
ISHK-W	in duct, heating/cooling – with condensate accumulation

Subject to technical changes · Issued 01/2023

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

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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.

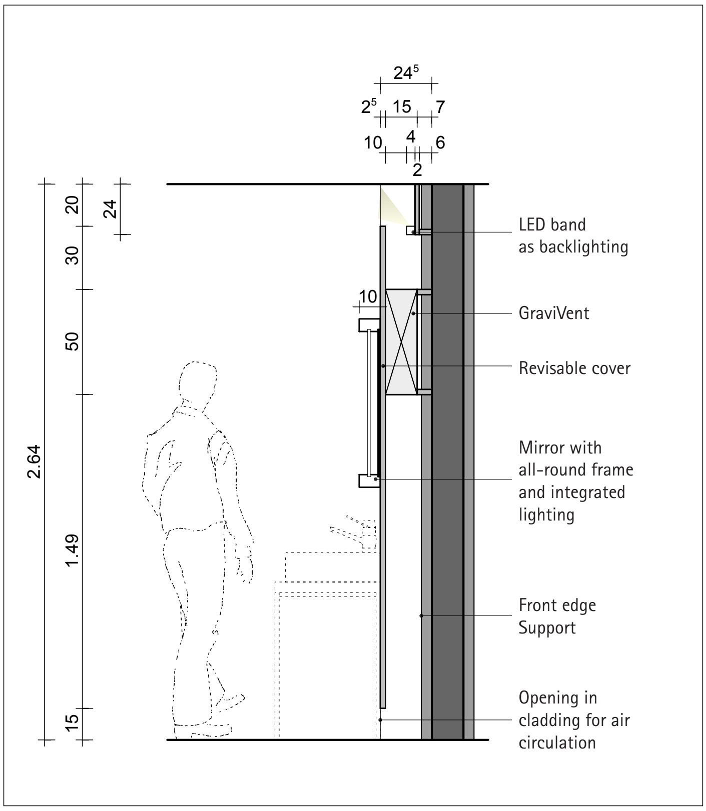
Greenhouse gas emissions are rising worldwide. The Paris Agreement, to which the world's leading countries have committed, is intended to limit global warming to well below 2 °C compared with pre-industrial levels. However, implementing the Paris Climate Agreement is proving difficult and poses huge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

continue to page 4 →



3.1 Project Vilotel

3.2 Project Vilotel

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

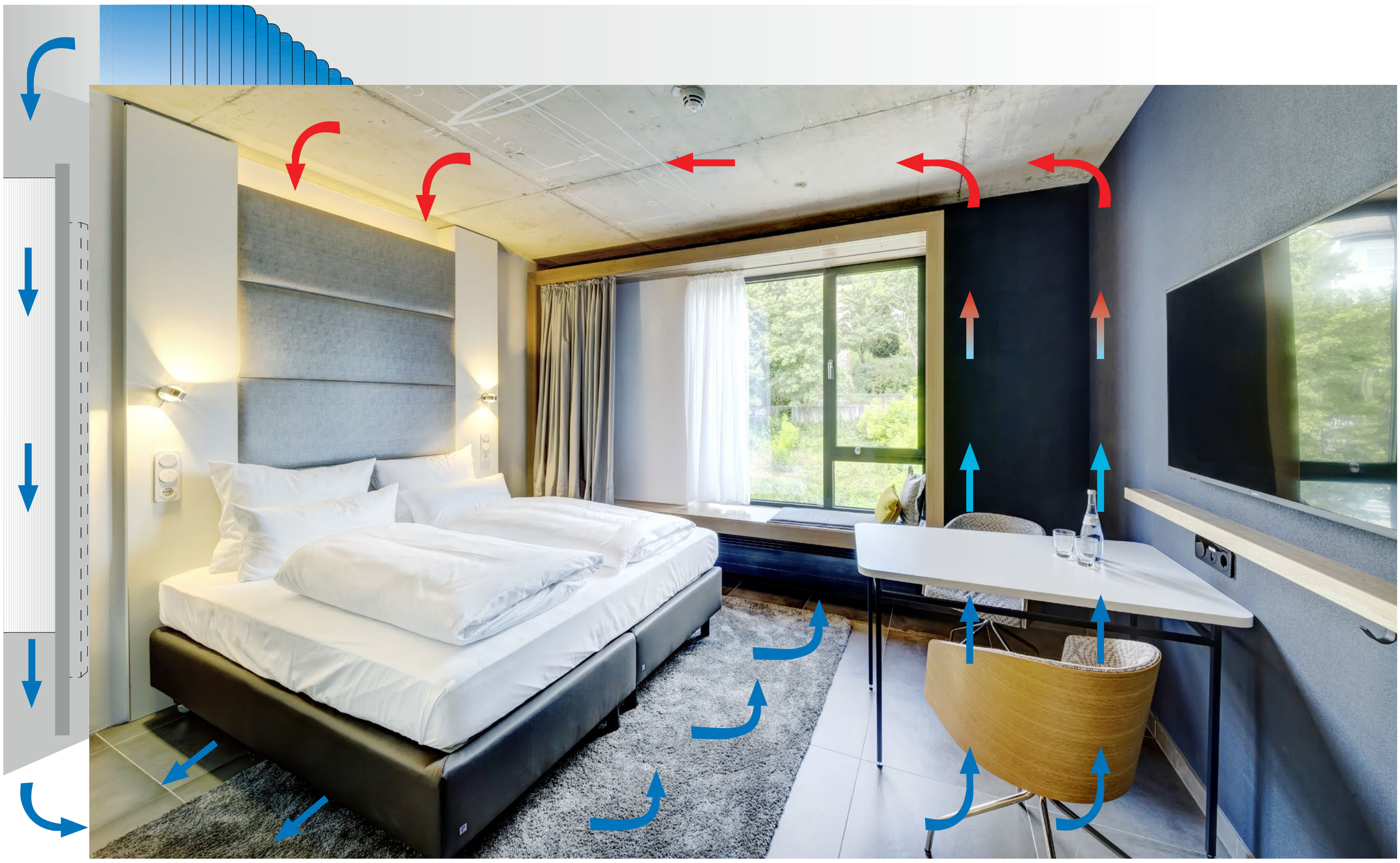
→ *continued from page 3*

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.'



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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. 5.1**). 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 8–9 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?

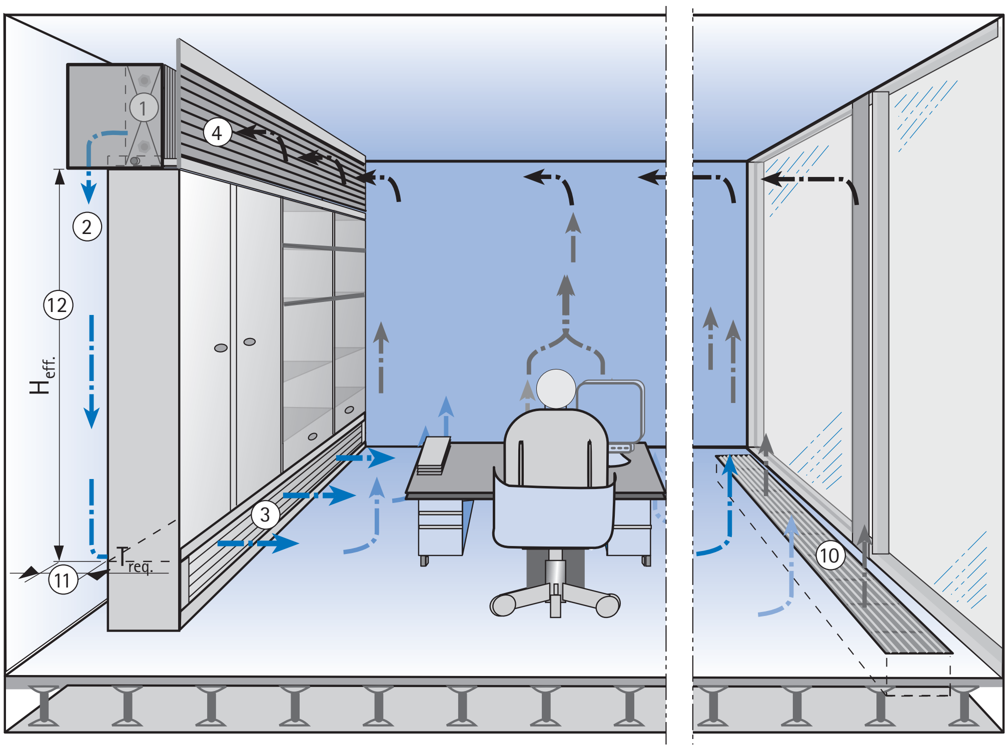
The performance of the TTC cooling units depends on many factors, for example:

- 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 16
- 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.



5.1 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}

Subject to technical changes · Issued 01/2023

Series ISHK xx.15/25 [ISHK-W with condensate accumulation] 150/250 mm Duct Depth | Cooling/Heating

Types | Specifications | Dimensions

Specification of series ISHK xx.15 [ISHK-W with condensate accumulation]

GraviVent® units are designed for concealed installation in drop shafts. 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 drop shaft horizontally at the bottom and then distributing itself into the room. The flat design enables use in shallow drop shafts.

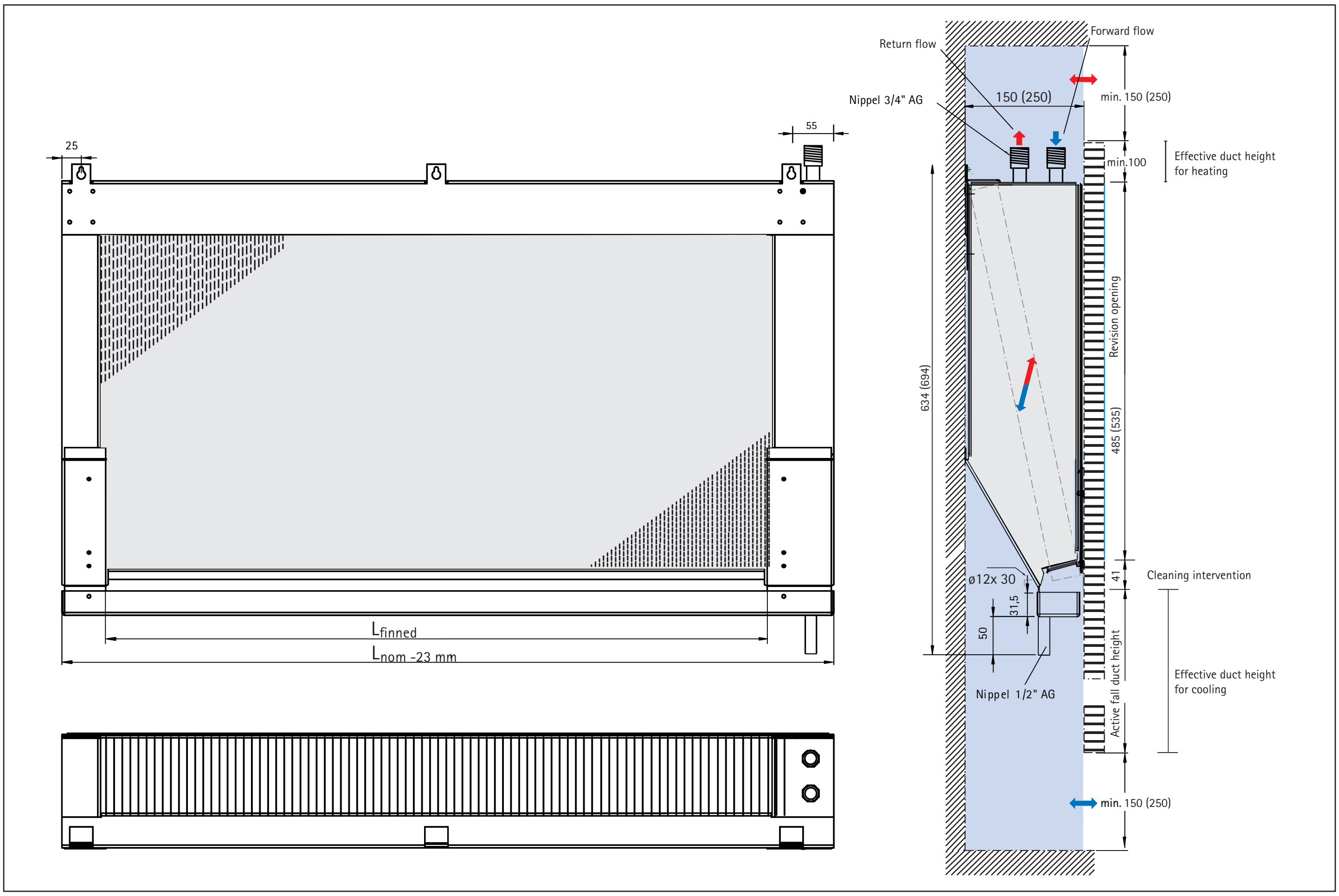
The standard version requires a shaft depth of 150 or 250 mm. If the design is not sufficient, there are various possibilities to further increase the performance. For example, a flow temperature closer to the condensate limit can be selected, or if higher condensate accumulation is expected, the ISHK-W version is recommended. This is designed for higher condensate accumulation through insulation of the frames and improved condensate absorption.

Too little output or too low a flow temperature?
Then the ISHK xx.25 variant comes into question. Thanks to a larger shaft and a larger thermally active surface, it provides significantly more output per metre of finned length. It is also available as a W version. For peak performance, the ISHK xx.25 is also available with a fan (see page 8ff).

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.



Series ISHK xx.15/25 [ISHK-W with condensate accumulation] 150/250 mm Duct Depth | Cooling/Heating

Part No. | Pressure Drop

Part no. ISHK(-W) xx.xx	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 (806)	1000 (1006)	1200 (1206)	1400 (1406)	1600 (1606)	1800 (1806)	2000 (2006)	2200 (2206)	2400 (2406)
Part no. ISHK(-W) xx.15									
Total unit 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
Part no. ISHK(-W) xx.25									
Total unit weight** (55) ≈ [kg]	13.9	17.0	20.1	23.2	26.2	29.3	32.3	35.4	38.6
Water content ≈ [kg]	3.2	3.8	4.4	5.0	5.6	6.2	6.8	7.4	8.0

* In brackets for ISHK-W ** Unit weight + water volume

Water content			ISHK[-W] xx.15 | 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

7.1 Pressure drop ISHK[-W] xx.15

Water content			ISHK[-W] xx.25 | 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	1.2	–	–	–	–	–	–
0.15	2.5	150.0	1.8	2.1	2.4	1.5	1.6	1.8	1.9	–	–
0.20	3.3	200.0	2.8	3.5	4.0	2.5	2.7	2.9	3.1	1.6	1.7
0.30	5.0	300.0	6.2	7.2	8.2	4.9	5.4	5.9	6.3	2.9	3.0
0.40	6.7	400.0	9.9	11.8	13.4	7.5	8.5	9.2	10.0	4.0	4.2
0.50	8.3	500.0	13.4	15.7	18.1	10.3	11.4	12.5	13.6	5.5	6.0
0.60	10.0	600.0	16.7	20.0	23.0	13.0	14.5	16.0	17.5	7.0	7.7
0.70	11.7	700.0	–	–	–	16.8	18.0	20.7	22.7	9.0	9.7
0.80	13.3	800.0	–	–	–	20.5	23.0	25.6	28.0	11.0	11.9
0.90	15.0	900.0	–	–	–	24.6	27.6	30.7	33.7	13.0	13.9
1.00	16.7	1000.0	–	–	–	29.7	33.3	36.9	40.5	15.7	16.9
1.20	20.0	1200.0	–	–	–	–	–	–	–	20.9	22.5
1.40	23.3	1400.0	–	–	–	–	–	–	–	26.4	28.5

7.2 Pressure drop ISHK[-W] xx.25

Series ISHK xx.15 [ISHK-W mit with condensate accumulation] 150 mm Duct Depth | Cooling/Heating

Capacity Charts Category 1 | Calculation Formulas

Calculation formulas capacity category 1+ 2

Formula 1

Calculating th 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)

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

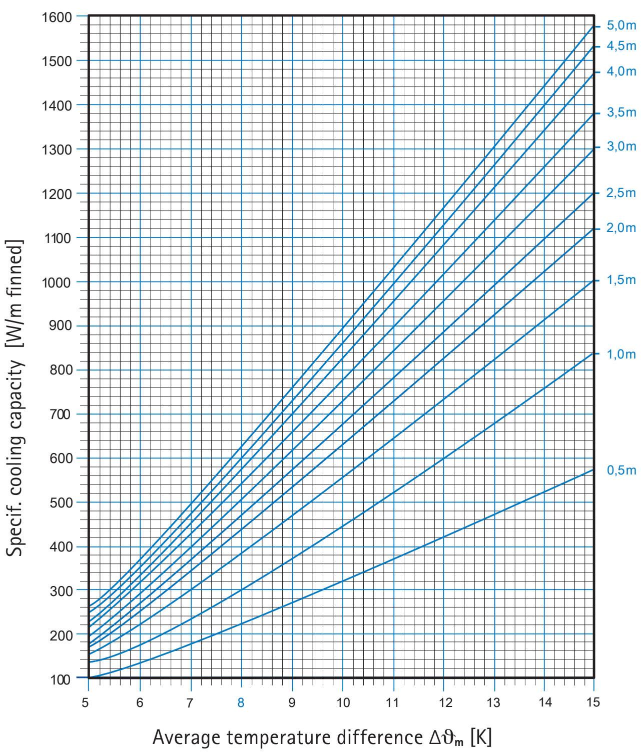
Formula 3

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

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

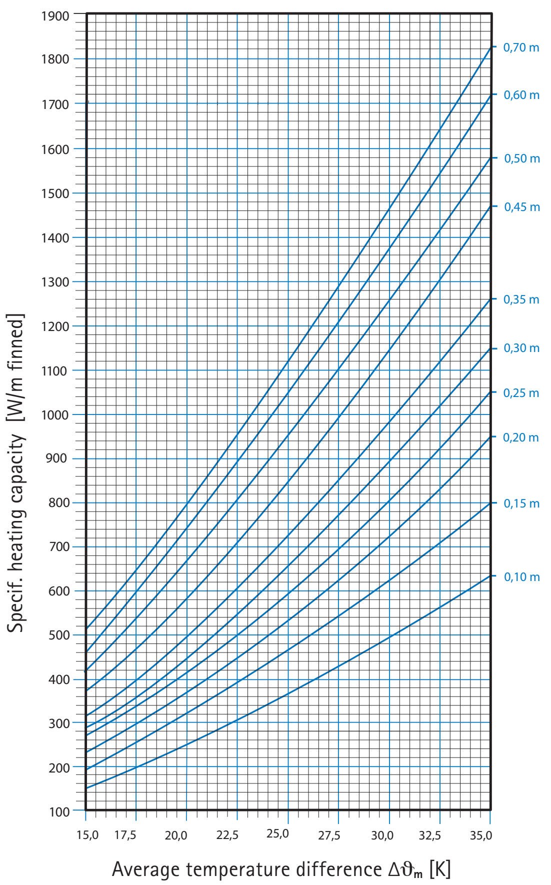
$\Delta\vartheta_m[K]$ = Average temperature difference between two different media
$t_R[°C]$ = Room temperature
$t_{W1}[°C]$ = Water inlet temperature
$t_{W2}[°C]$ = Water outlet temperature
$\dot{m}_W[kg/h]$ = Water volume flow
$\dot{Q}_{K(tot)}$ = Total cooling capacity of a hilled beam
$\dot{q}_{K(specif)}[W/m]$ = 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 ($L_{(finned)}$)

Specific cooling capacity ISHK [ISHK-W] xx.15



8.1 Specif. cooling capacities ISHK [ISHK-W] xx.15

Specific heating capacity ISHK [ISHK-W] xx.15



8.2 Specif. heating capacities ISHK [ISHK-W] xx.15

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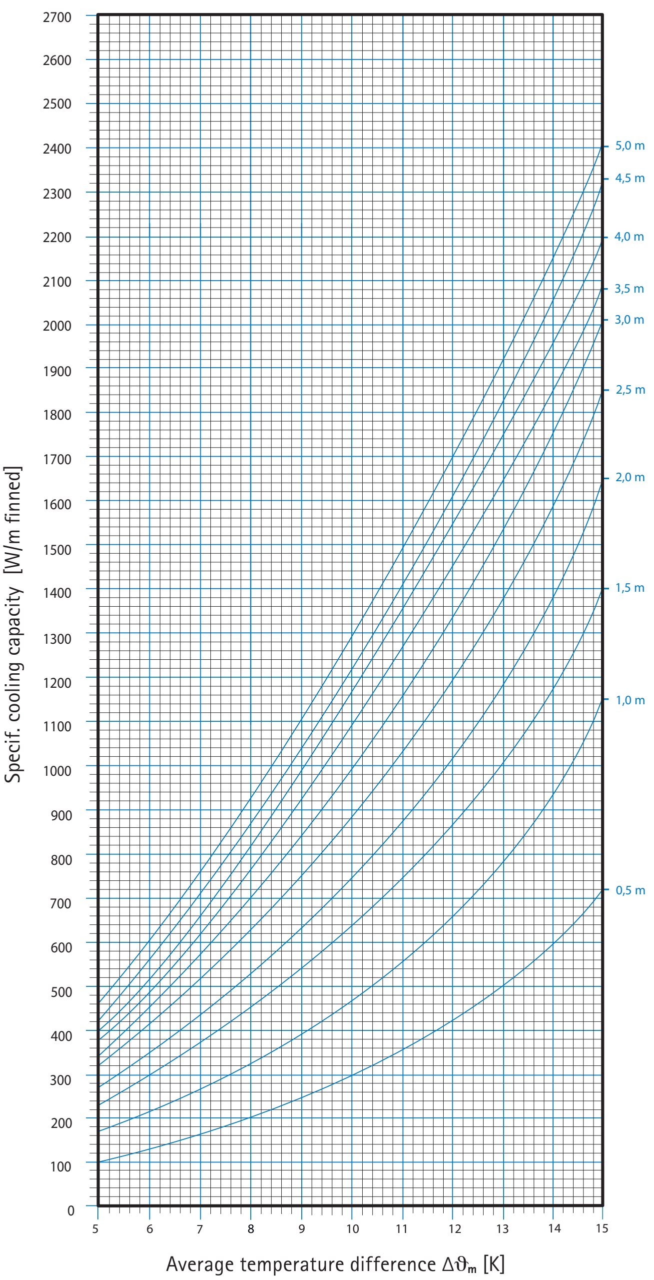
Series ISHK xx.25 [ISHK-W mit with condensate accumulation] 250 mm Duct Depth | Cooling/Heatin

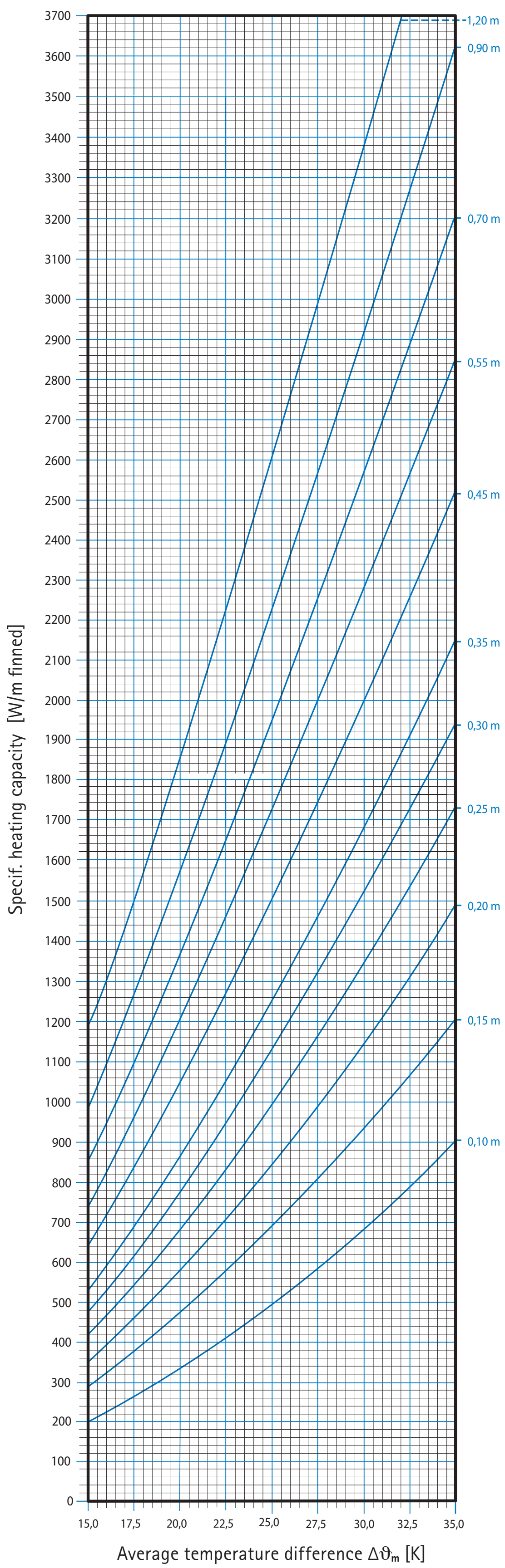
Capacity Charts Category 2

Specific cooling capacity ISHK [ISHK-W] xx.25



9.1 Specif. cooling capacities ISHK [ISHK-W] xx.25

Specific heating capacity ISHK [ISHK-W] xx.25



9.2 Specif. heating capacities ISHK [ISHK-W] xx.25

Subject to technical changes · Issued 01/2023

Series ISHK-WHP.xx.25 | Passive/Active Mode
250 mm Duct Depth | Cooling/Heating
Types | Specifications | Dimensions

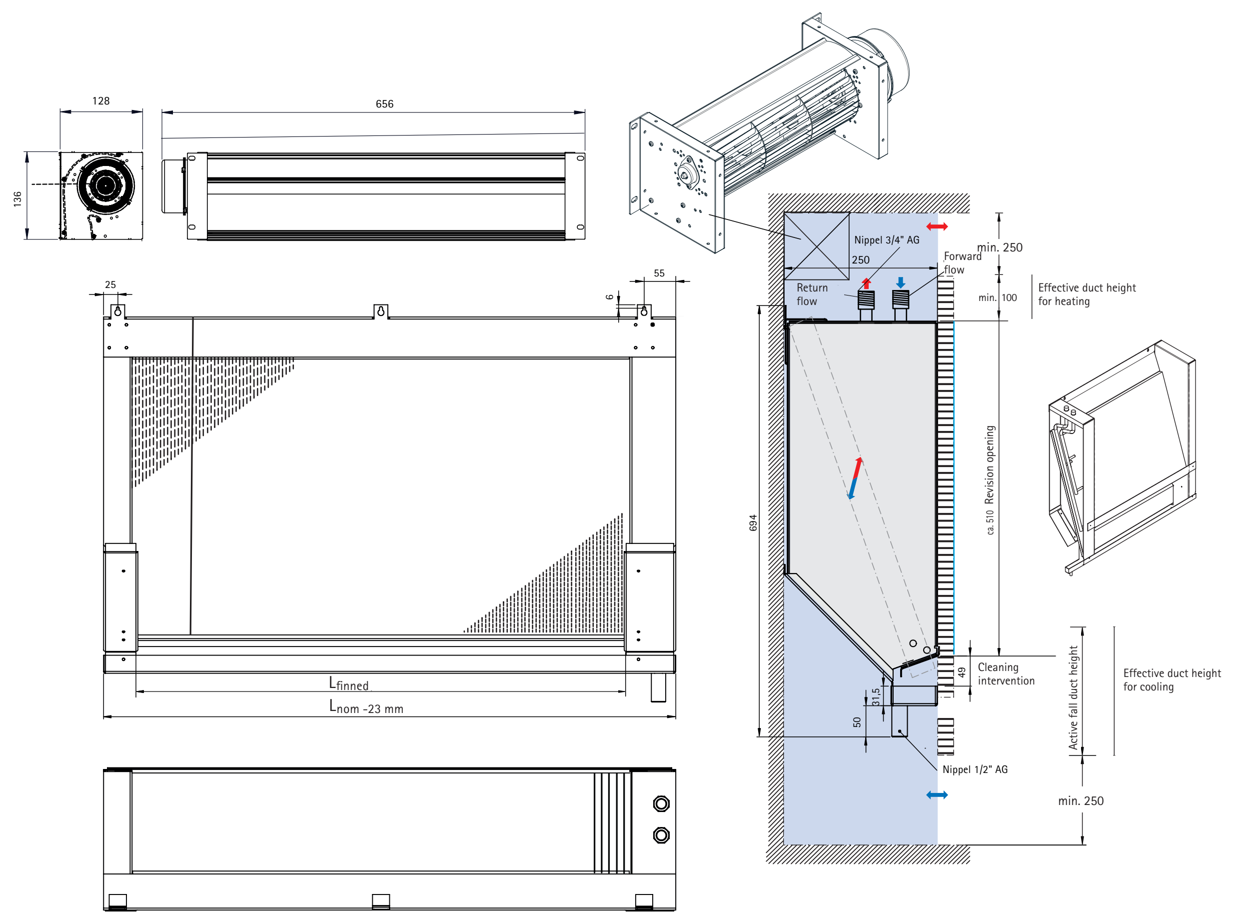
Specification of series ISHK-WHP.xx.25

GraviVent® units are designed for concealed installation in drop shafts. 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 drop shaft horizontally at the bottom and then distributing itself into the room. The flat design enables use in shallow drop shafts.

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.



10.1

Part.-No. ISHK-WHP.xx.25	08	10	12	14	16	18	20	22	24
Finned length L_{finned} [mm]	669	869	1069	1269	1469	1669	1869	2069	2269
Total length L_{nom} [mm]	800	1000	1200	1400	1600	1800	2000	2200	2400
Total weight* (55) ≈ [kg]	13.9	17.0	20.1	23.2	26.2	29.3	32.3	35.4	38.6
Water content ≈ [kg]	3.2	3.8	4.4	5.0	5.6	6.2	6.8	7.4	8.0
Number of fans		1			2			3	

* Unit weight + water volume

Subject to technical changes · Issued 01/2023

Performance Enhancement through Cross Flow Fan [F-ISHK]

Task

Object of investigation is the GraviVent® series ISHK-WHP.xx25 gravity cooling system.

The special features of the system are

→ switchable fan for increased performance (Cross flow fan no. F-ISHK 24V640)

→ integrated condensat drain for operating conditions below the dew point temperature

The cooling capacity of the system is determined for different variants of construction height and fan operation. The measurement procedure is based on DIN EN 14518.

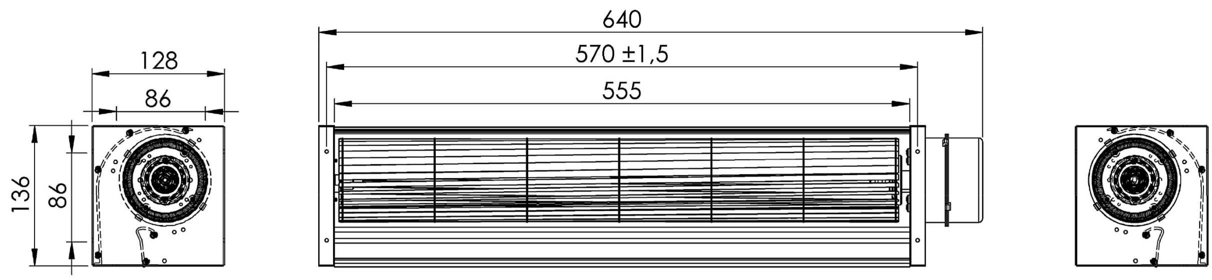
The water-sid flow temperatures and the fan speeds were determined by the customer for each mesurement.

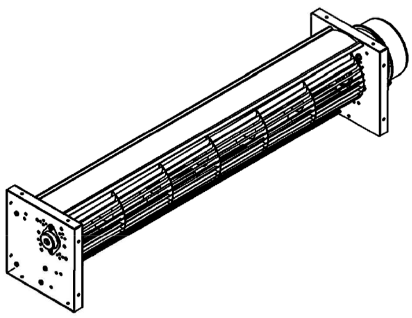
The increase in performance depends on various factors (including room temperature, flow temperature, water flow rate and duct height)

A measurement example is shown in Table 1.
Further information on request info@ttc-technology.eu

Table 1
Measurement example for performance improvement with F-ISHK (based on DIN EN 14518)

Room conditions	Fall duct height	Water-side flow temperature	Fan	Water flow rate	Temperature difference between cooling unit and room	Performance enhancement to purely passive operation
26 °C; 55 % RH	1500 mm	17 °C	3 V	240 l/h	9 K	100 %
			6 V	240 l/h	9 K	150 %





DC 24V

SPEED control(v)	Rated Current A	Speed R.P.M	Max Pressure mmAq	Maximun Air Flow m³/min	Noise dBA
0V	0	0	0	0	0
1V	0.15	300			26
2V	0.24	550	0.4	4.1	28
3V	0.43	750	0.9	5.9	35
4V	0.65	1000	1.7	7.7	42
5V	0.92	1150	2.9	9.2	48
6V	1.23	1300	3.9	10.5	52

The sound level measurement has been carried out 1 m in front of the tangential fan.

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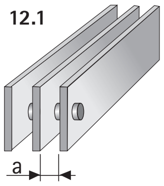
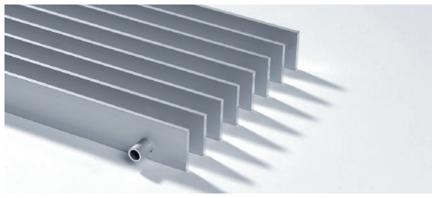
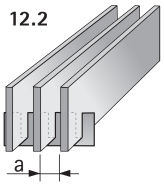
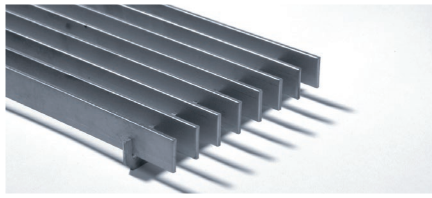
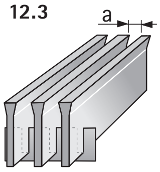
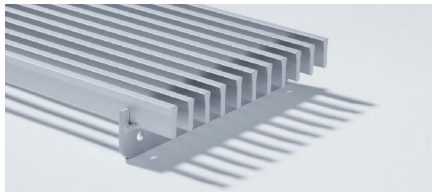
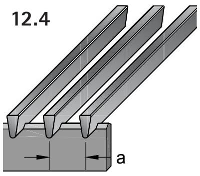
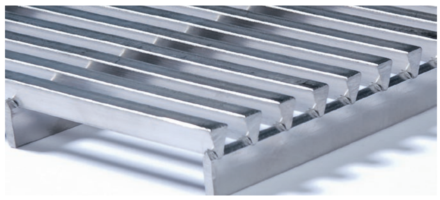
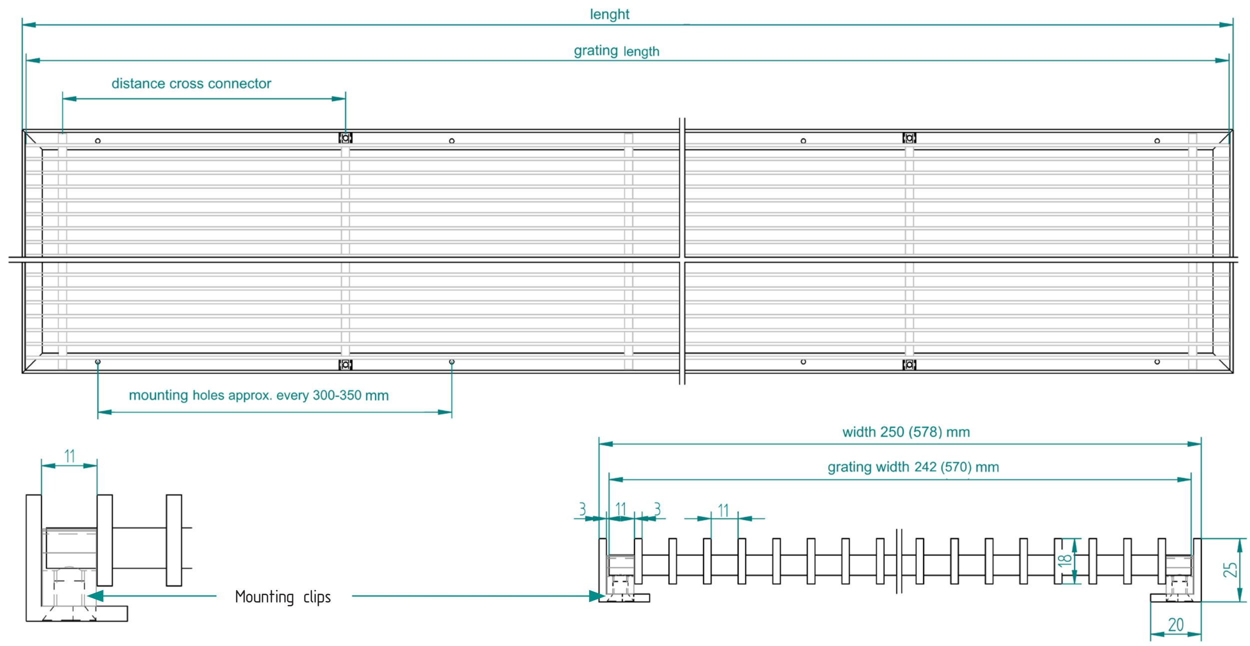
Air Inlet and Outlet Grilles

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.

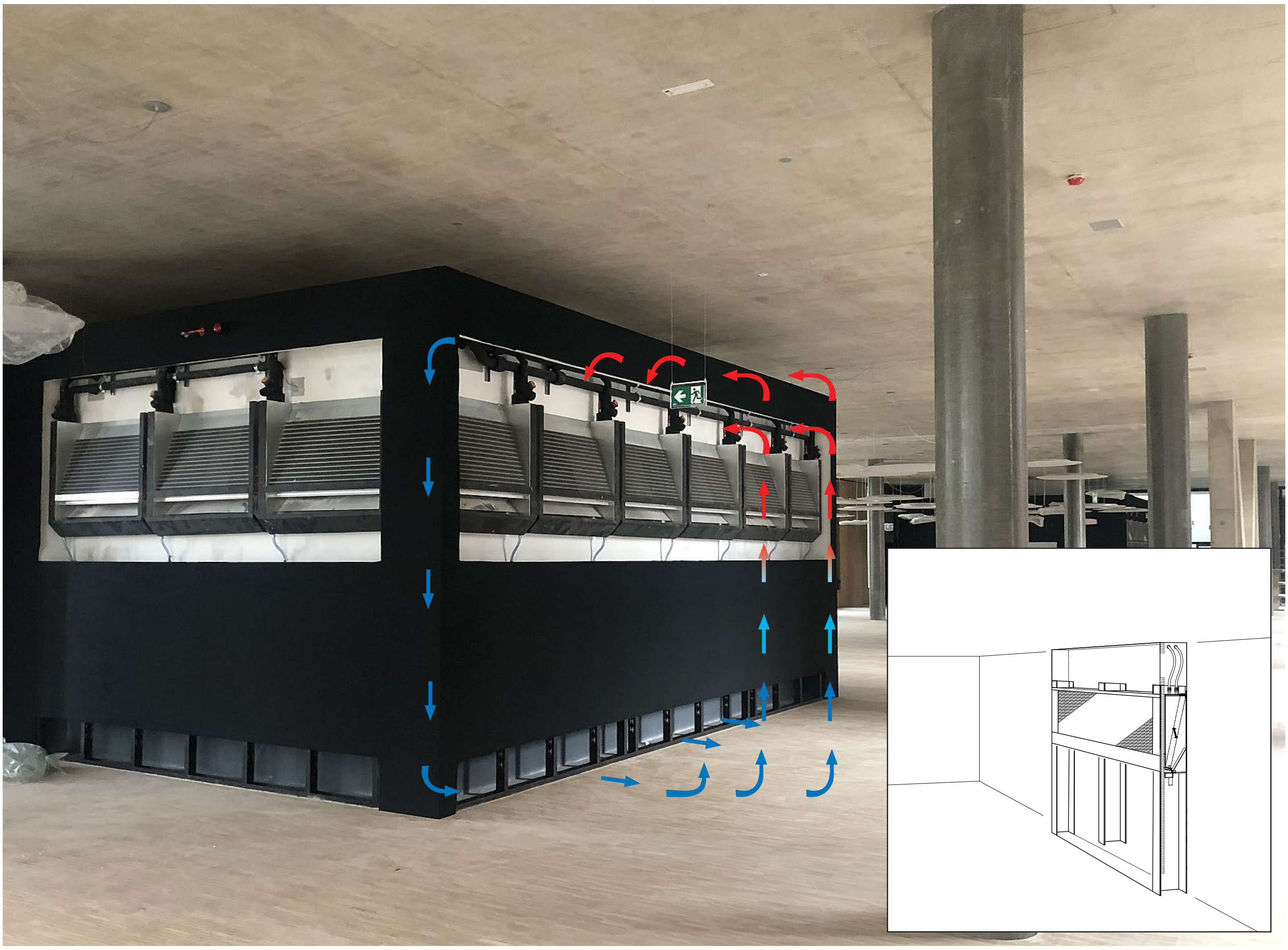
		Bar spacing »a« [mm]	Free cross-section [%]	
12.1 	**Longitudinal grille** rigid (full profile) made of aluminium, for air inlets and outlets in ceilings, walls and on the floor **Part no. TTC-LSF ❑ Alu**	20 15 10	88 83 77	
12.2 	**Comb grille** rigid (full profile) made of aluminium or V2A, for air inlets and outlets in ceilings, walls and on the floor **Part no. TTC-KSF ❑ Alu ❑ V2A**	20 15 10	87 83 77	
12.3 	**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	
12.4 	**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	



12.5 Example ventilation grille LSF for series AISI 51

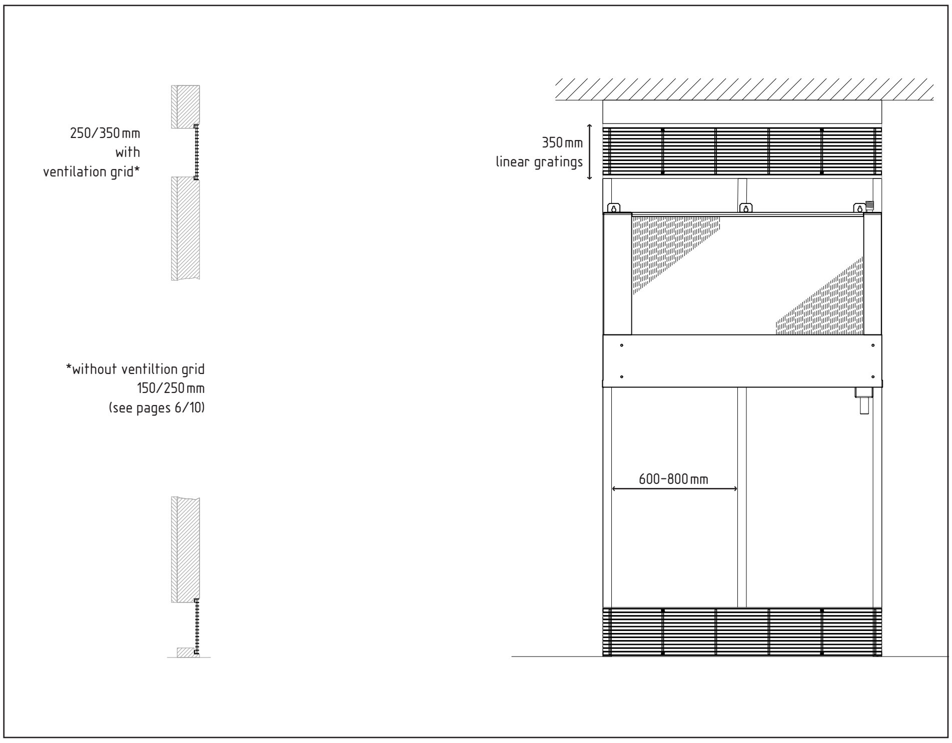
More information on the ventilation grilles can be found in the brochure »Homogeneous Gratings« or on ttc-technology.de

Installation and Assembly Example



13.1 ISHK-WHK.xx.25 + Mounting bulkheading

13.2 Example of a revision opening

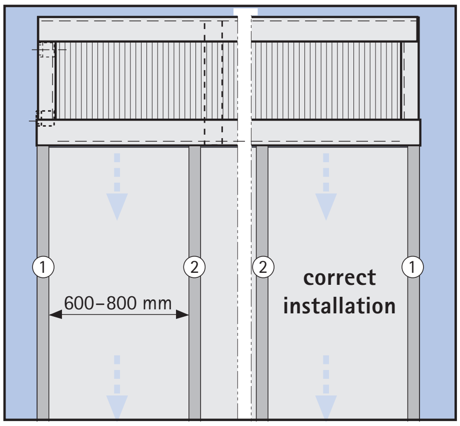


13.3 Ventilation principle illustration and overview bulkheading

©Pictures: TTC Timmler Technology

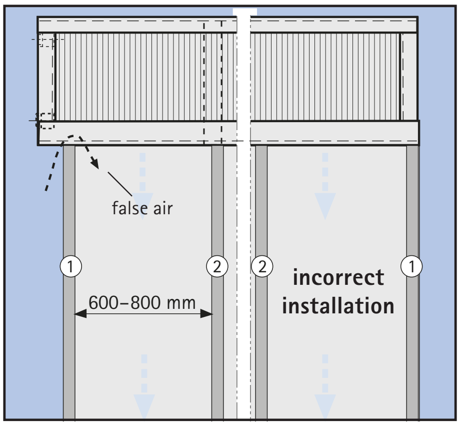
Assembly Instructions for Pipe Laying

Formation of side sealing off walls and fall ducts



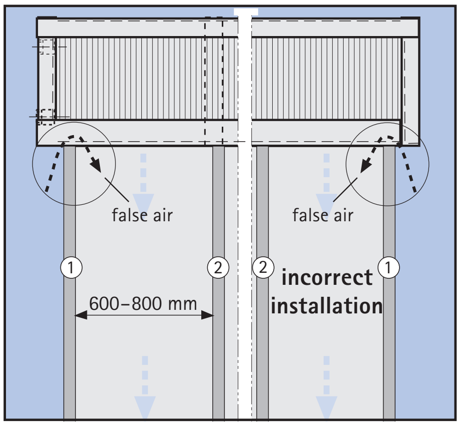
Professional installation of the cooling unit, no reduction in performance to be expected.
[1] Side sealing off walls
[2] Fall duct walls correctly arranged

14.1



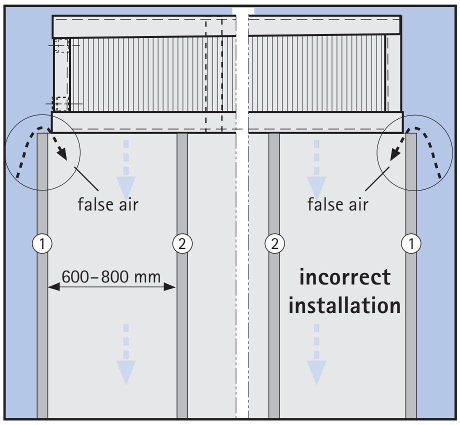
Cooling unit too large; the calculated performance is not achieved with this installation.
[1] Side sealing off walls
[2] Fall duct walls correctly arranged

14.2



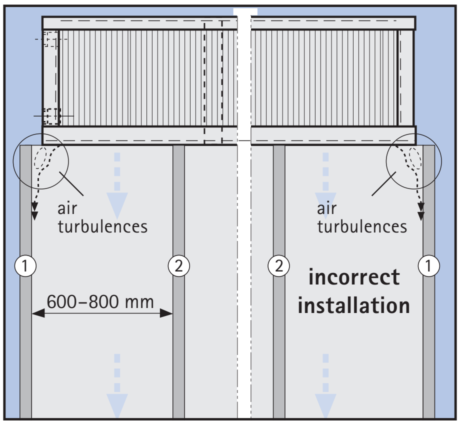
Cooling unit too large; the calculated performance is not achieved with this installation.
[1] Side sealing off walls
[2] Fall duct walls correctly arranged

14.3



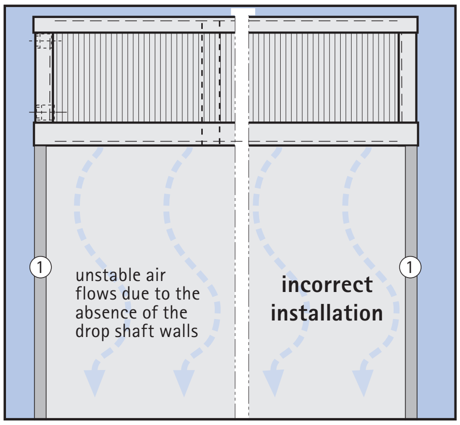
Cooling unit too small; the calculated performance is not achieved with this installation.
[1] Side sealing off walls
[2] Fall duct walls correctly arranged

14.4



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

14.5



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

14.6

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 ($\lambda_{40°C}$ =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

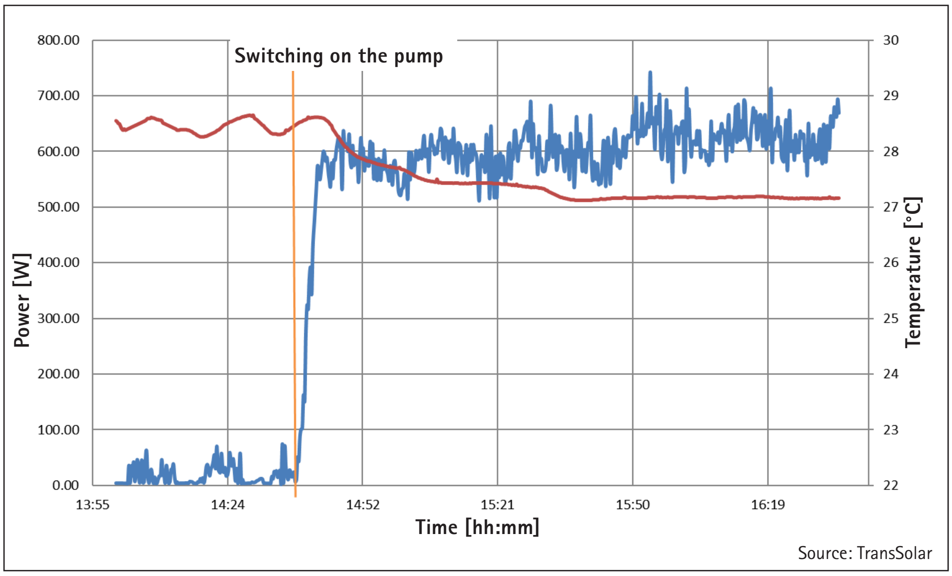
→ Temperature resistance from -50° C to 150° C,
remains flexible to -50° C,
but can be used easily at temperatures to -200° C

Fc | 3/4 | ø 19 mm

Mc | 3/4 | ø 19 mm

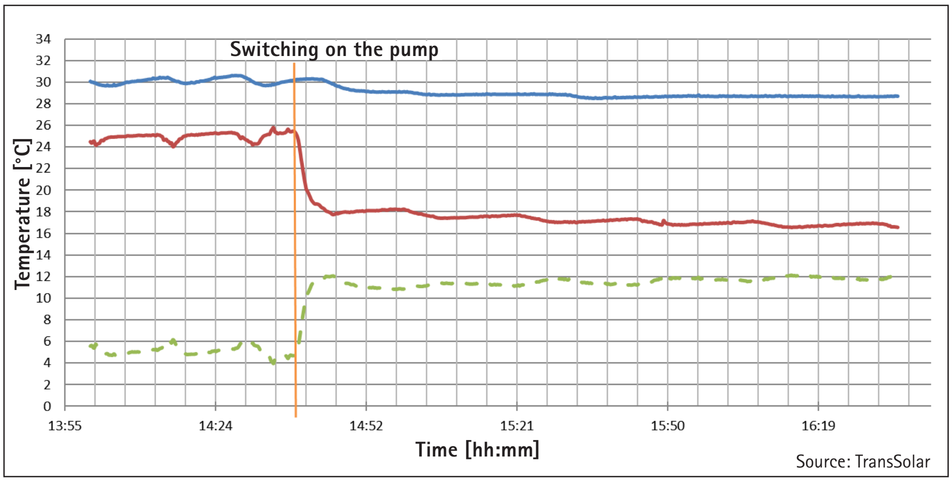
Subject to technical changes · Issued 01/2023

Start-up Behaviour | Laboratory Set-up



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

Diagram **16.1** 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.



16.2 Inlet and outlet air temperatures

16.3 2nd experimantal set-up with fan according to DIN EN 442-2

16.4 2nd experimantal set-up with fan

Subject to technical changes · Issued 01/2023

Flow Diagrams

17.1 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.

17.2 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.

17.3 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.

Reference projects

Data sheets for these and other reference projects on request

Fully digitalised broadcast studio, SRF, Zurich

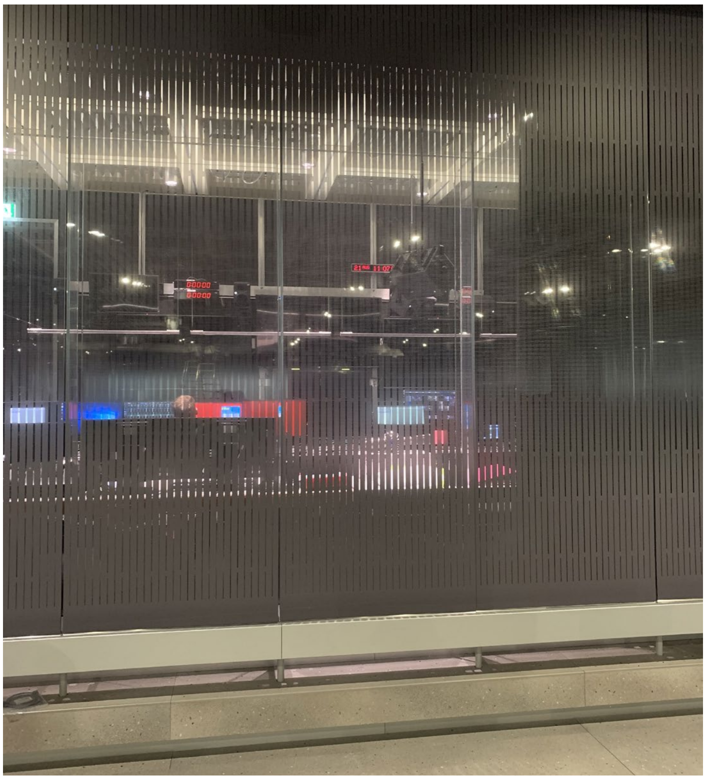
Using a special process, silent gravity cooling was integrated into two transparent panes (glass + Makrolon), which are provided with a micro-perforation for the acoustics in a special process. This produces glass drop shafts which prevent unwanted draughts. In addition to silence, which is another important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

→ Silent gravity cooling integrated in two glass panes with a special makrolon-window treatment with micro-perforation for acoustics

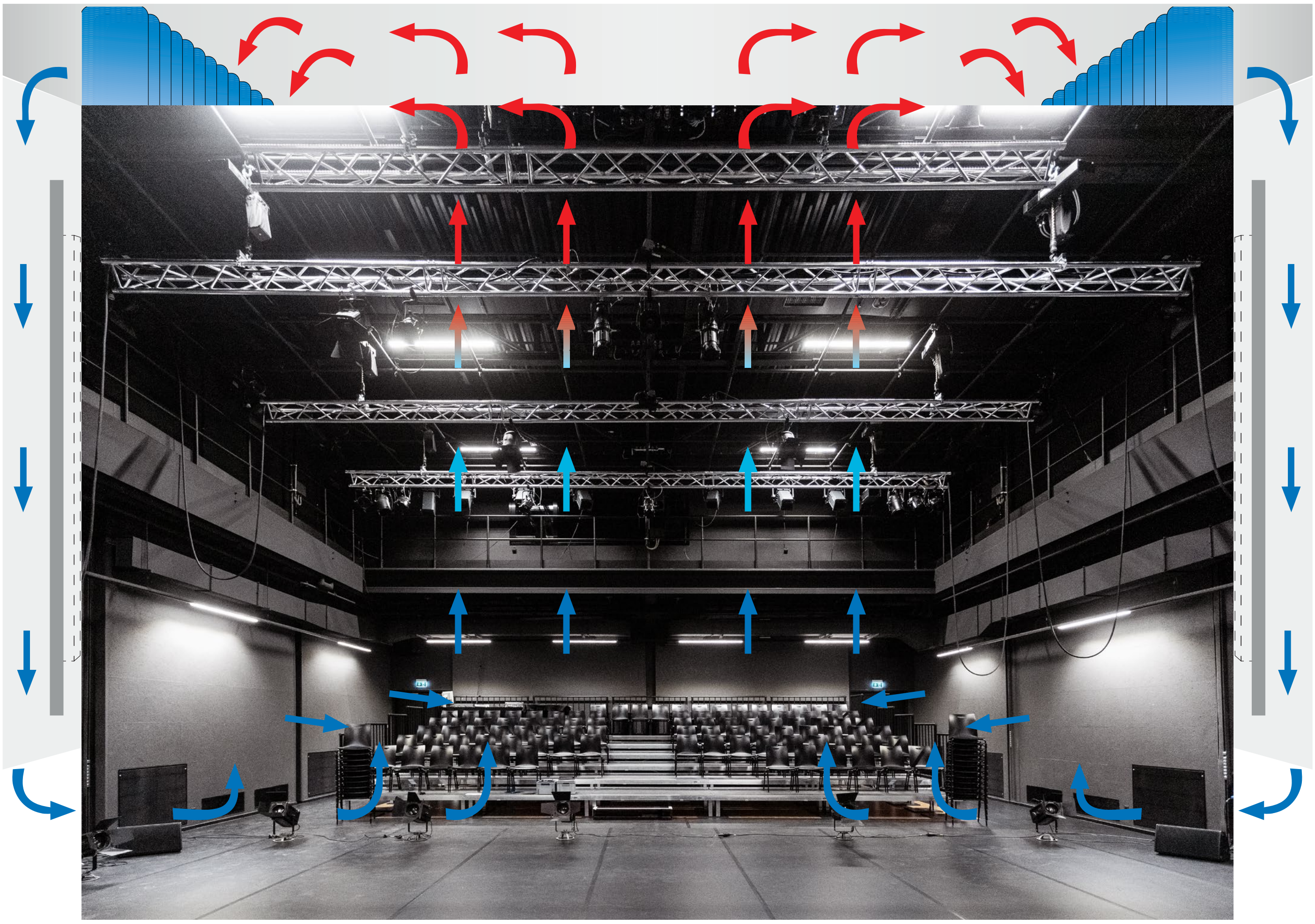
→ »Green« product: low energy costs, low maintenance requirements, 100 % recyclable after entire building cycle

→ Important component for DGNB/LEED certification

→ Optional with heating function



Theaterhaus Leipzig, Hall 7



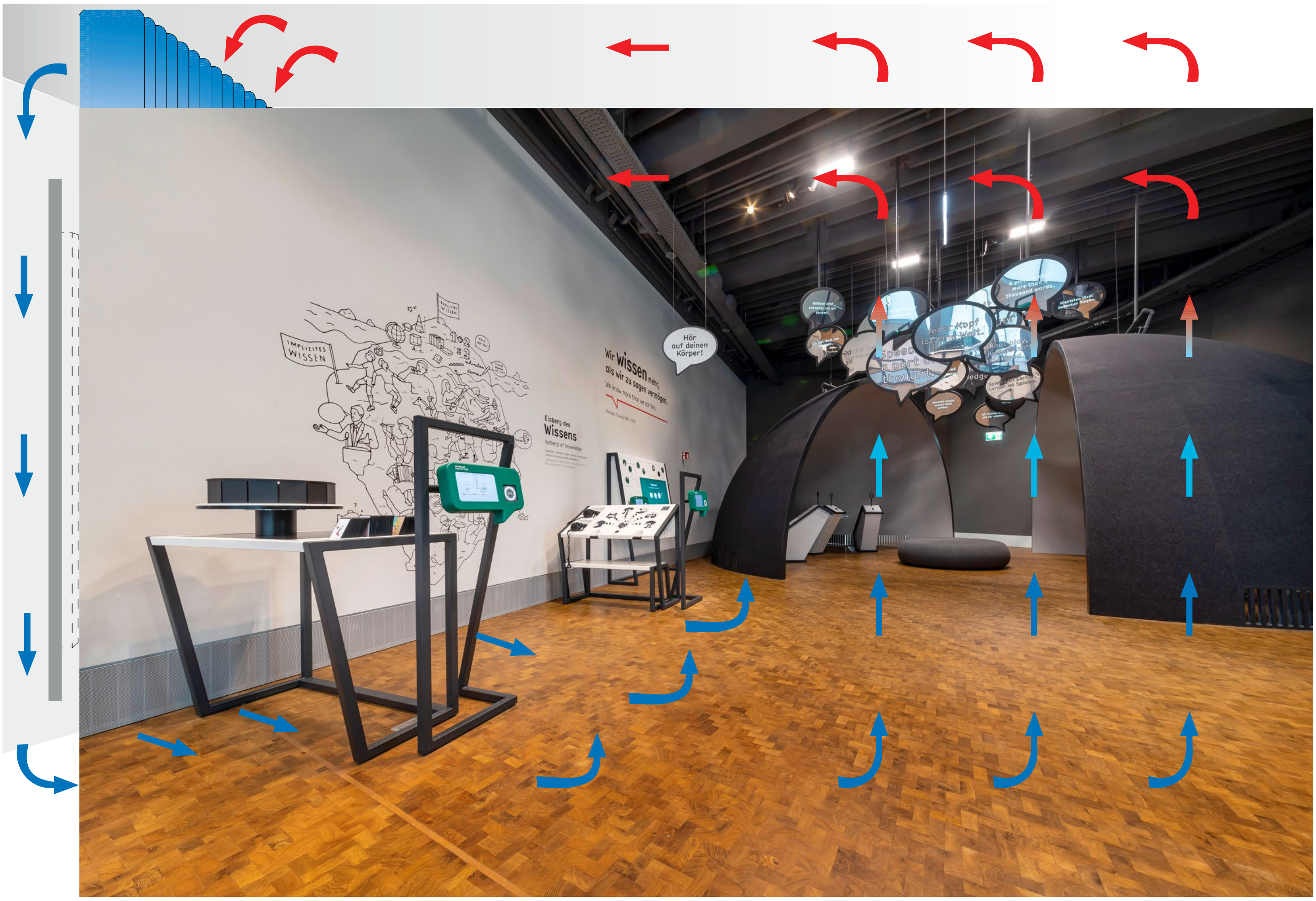
© Pictures: Tom Dachs (Theater), TTC Timmler Technology (Studio SRF)

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)

TTC Timmler Technology

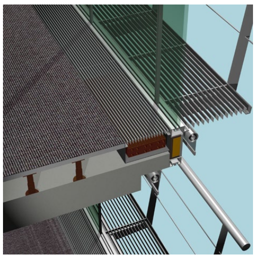
Designing innovative solutions for new buildings and redevelopment together with architects and planners

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.

EIN BEITRAG ZUM NACHHALTIGEN BAUEN · A CONTRIBUTION TO SUSTAINABLE BUILDINGS · BLUE TECH BY TTC

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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