

Ceiling Cooling and Ceiling Heating with BEKA Pre-fabricated Units

1. Generals

Modern office and business premises must be climate controlled nearly throughout the year because of their high thermal insulation and internal loads generated by computers and other office equipment. At the heating period, they have comparatively low heat consumption. The energetic cost saving solution is a BEKA heating and cooling ceiling.

With the BEKA pre-fabricated unit heating and cooling mats can easily and economically be utilised for dry-built construction. Due to the combined function of the ceiling, investment costs for heating system installations can be minimised.

2. System description

The BEKA pre-fabricated units are screwed to suspension ceiling construction according to dry-built construction instructions just like any standard dry-built panel. The pre-dimensioned connection lines are laid into the ceiling cavity. The pre-fabricated unit is connected with flexible hoses to the supply lines.

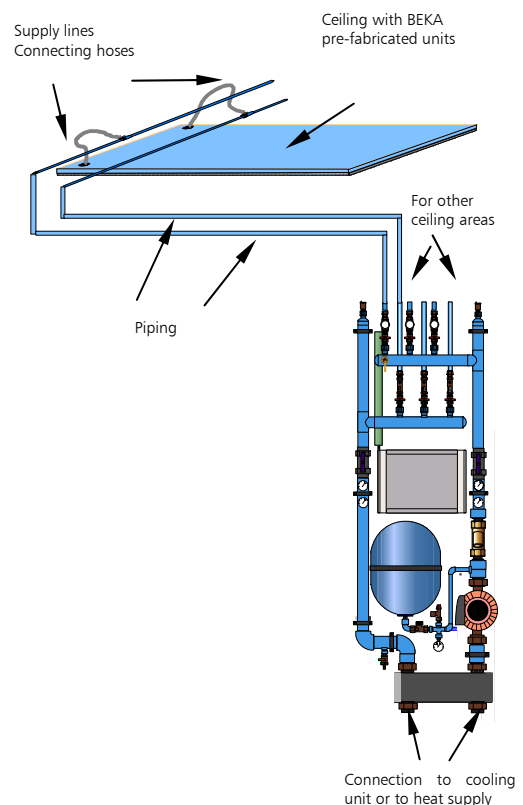
3. Cold water / heating water technology

The BEKA heating and cooling mats are tied-up in zones to the piping as a circuit and connected to the heat or cooling source. The connection by storey-distributor is recommended.

For the cold-water preparation, different techniques and systems can be utilised. The economical advantages of cooling ceilings is based on the fact that the ceiling will already provide sufficient performance even with supply temperatures, which are only slightly below the room temperature. This makes the utilisation of "alternative energy sources" such as heat pumps or open cooling and ground water possible.

For generating of heating water the same advantages are true as well. In connection with solar collector systems and even with standard technologies, a significant energy saving is already reached, because respectable heating per-

formances are achieved with considerably low supply temperatures (below 40°C).



4. Installation

In general, the standard Installation guidelines have to be observed. All materials used in the BEKA heating and cooling mat system must be non-corrosive. Materials to be used can be: plastics, stainless steel, copper, brass and red brass. Other materials in use could cause sludge and lead to a failure of the system.

5. Regulating technology

The regulating technology secures both the desired comfort and necessary system reliance.

The cooling ceiling requires: Room temperature regulation, dew point protection and control of the supply temperature for the cold water. Supply temperatures below 16°C must be avoided because of the danger that the dew point will be reached!

For the heating ceiling, room temperature control is required, which regulates the volume of heating water as function of the desired room temperature. Supply temperatures above 45°C must be avoided because of danger of excessive surface temperatures of the ceiling and to avoid that the plasterboard will dry-out!

6. System dimensioning

The cooling ceiling from BEKA pre-fabricated units is dimensioned according to the following layout table. The supply temperature determined in the water circuit, taken at the side of the cooling unit or heat generator, is regulated with the water temperature upstream to the heat exchanger.

7. Installation instructions

For the installation of the BEKA pre-fabricated unit the standards for dry-built construction and the manufacturer's recommendations must be obeyed.

It is recommended to use torsion-resistant sheet-metal profiles for the supporting construction of the suspended ceiling. The spacing and the type of anchoring of the suspended hangers to the raw ceiling must be designed for load of ≤ 30 kg/m².

The pre-fabricated unit is offered in the same dimensions as the standard building panels so that tailoring work at the building site is not necessary. Only at border areas and places where components are planned to be attached to the ceiling, inactive panels are fitted. The BEKA pre-fabricated units are delivered pre-drilled for the assembly to sub-construction

made from standard CD-profiles.

The screws may only be placed at these pre-determined positions, otherwise there is danger that the integrated capillary tube mats are damaged.

Before starting work, a ceiling pattern and installation pattern must be drawn-up. All cassettes with their sizes, installation direction and supply lines must be marked. In the ceiling pattern, also all areas must be marked, which will stay empty for the installation of partition walls, light fixtures and other components to be attached to the ceiling. Also the installation position for the BEKA dew point sensor must be marked at the ceiling pattern.

The Polypropylene piping is connected among each other by thermal welding. For the execution, the welding directions DVS 2207-11 of the Deutschen Verband für Schweißtechnik e.V. are valid. (The surrounding temperature during working must not drop below 5°C. The pre-heating, welding and setting time for the individual pipe sizes must be observed according to the relevant regulations.)

8. Tools, materials

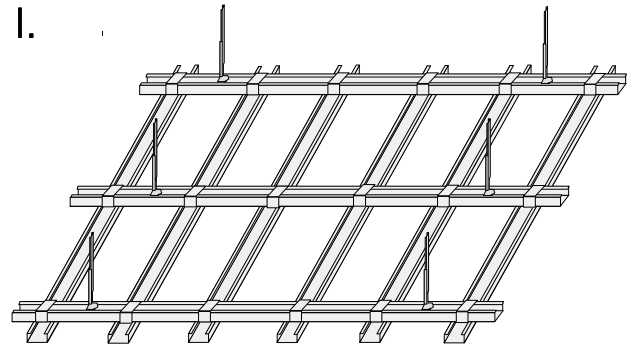
For the installation of the BEKA pre-fabricated units, standard tools and materials for the dry-built construction work are used:

- CD - profiles
- Cross links
- Nonius hangers
- Dowels and screws
- Dry-wall screw, 55 mm long
- Angle profiles
- Knife and edge planer
- Screw driver
- Smoothing spatula
- Joint filler
- Hand-held grinder

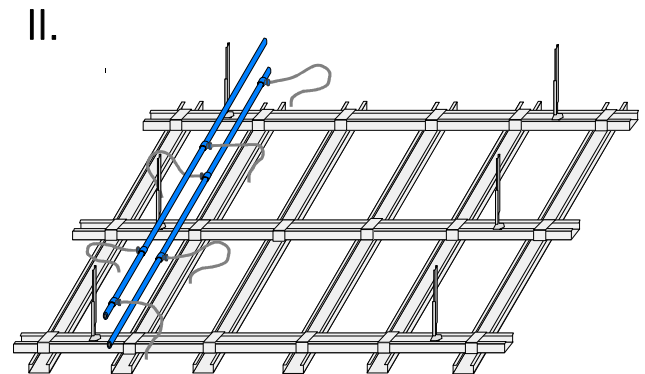
For the connection of supply lines to the cold-water circuit, a hand held welder with sleeve adapter is recommended for the plastic welding together with plastic fittings. Alternatively compression fittings can be used.

9. Installation steps at the ceiling

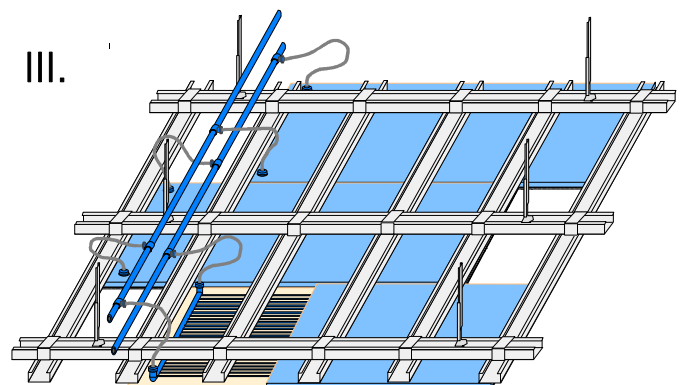
- The supporting structure is aligned and fixed at the raw ceiling with nonius hangers.
- The spacing for the supporting profiles should be 500 mm. Additional supporting profiles (also the angle profiles) at the border areas for the tailored inactive panels are positioned according to the relevant dry-built directions.



- The supply lines are laid in the ceiling cavity and connected to the main lines (connections by thermal welding or compression fittings).



- The BEKA pre-fabricated units are fixed to the subconstruction according to the ceiling-pattern.
- The flexible connecting hoses are plugged into the quick-action couplings of the supply lines.
- The pre-fabricated units are aligned at the subconstruction to the pre-drilled holes.
- The dry-wall screws are inserted through the pre-drilled holes and tightened until subconstruction is securely fixed.
- Take pretest with air pressure of 10 bar for 1 hour
- Take final test with water at 10 bar for 4 hours.
- Maintain a resting pressure of 3 bar until taken into operation.



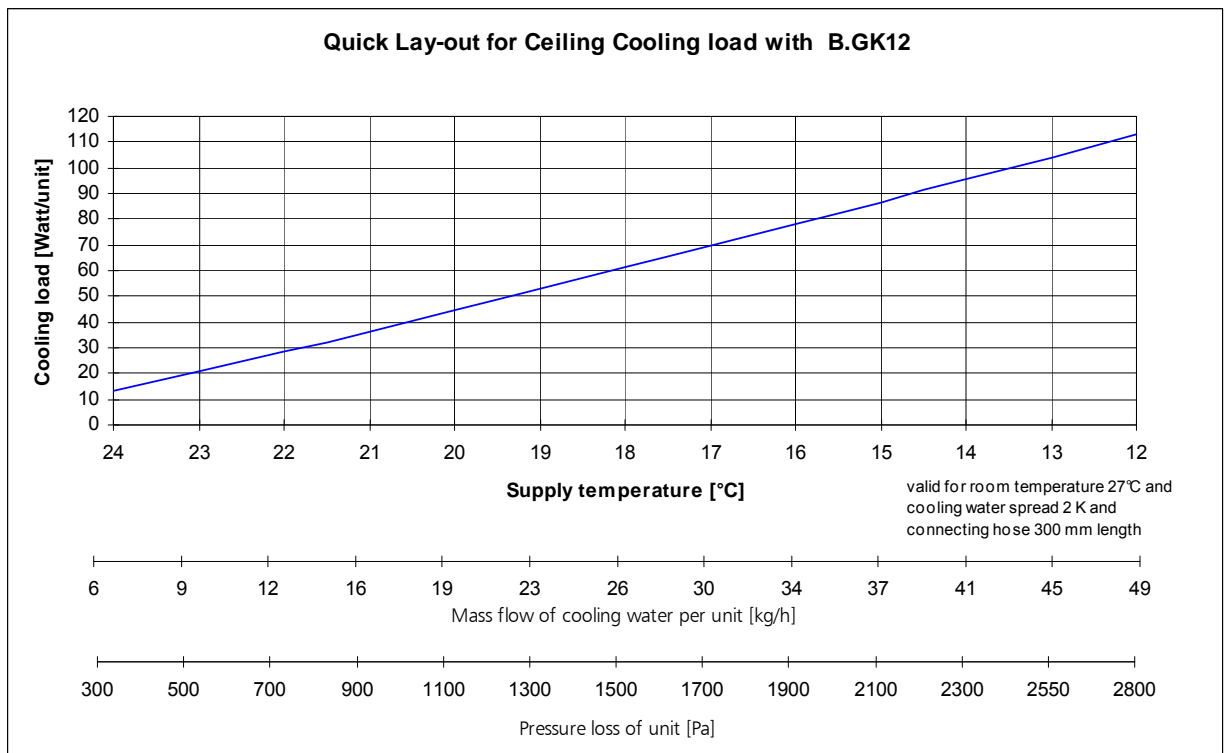
10. Lay-out of the Cooling ceiling with the BEKA Pre-fabricated Unit B.GK12

Project:	Date:
Project consultant:	Lay-out valid for 27°C - room temperature and 2 K cooling spread!

Required cooling capacity

1	Cooling load for the room	W	from calculation of planning office
2	Planned quantity of panels	qty	derive possible arrangement from room measurements
3	Required cooling capacity of unit	W	= cooling load / quantity of panels

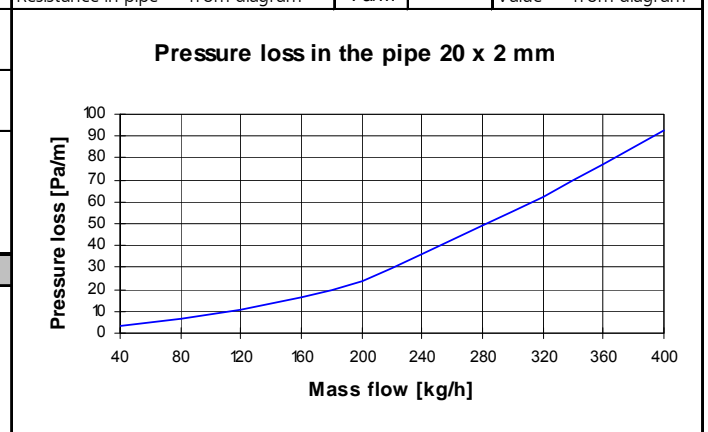
Determination of capacity



4	Supply temperature → from diagram	°C	Water volume per unit	kg/h	→ from diagram
5	Return temperature	°C	Water volume per zone	l/h	

Pressure loss determination

6	Pressure loss in the pipe = pipe length * Resistance	Pa	Length of connecting pipe	m	only one lead
			Resistance in pipe → from diagram	Pa/m	Value → from diagram
7	Pressure loss of unit → with value of line 3 from diagram	Pa			
8	Add. for pressure loss through fittings (Recomm: 30% extra for pipe)	Pa			
9	Add. for heat transfer station (Recomm: for zone valves 500 - 1000 Pa for mains regulating valves 700 - 1500 Pa for heat exchanger approx. 4000 Pa)	Pa			
10	Total pressure loss	Pa			



If BEKA transfer stations are used the determination for pressure losses can be omitted. Only the quantity of cooling circuits and total cooling capacity is required for the selection!

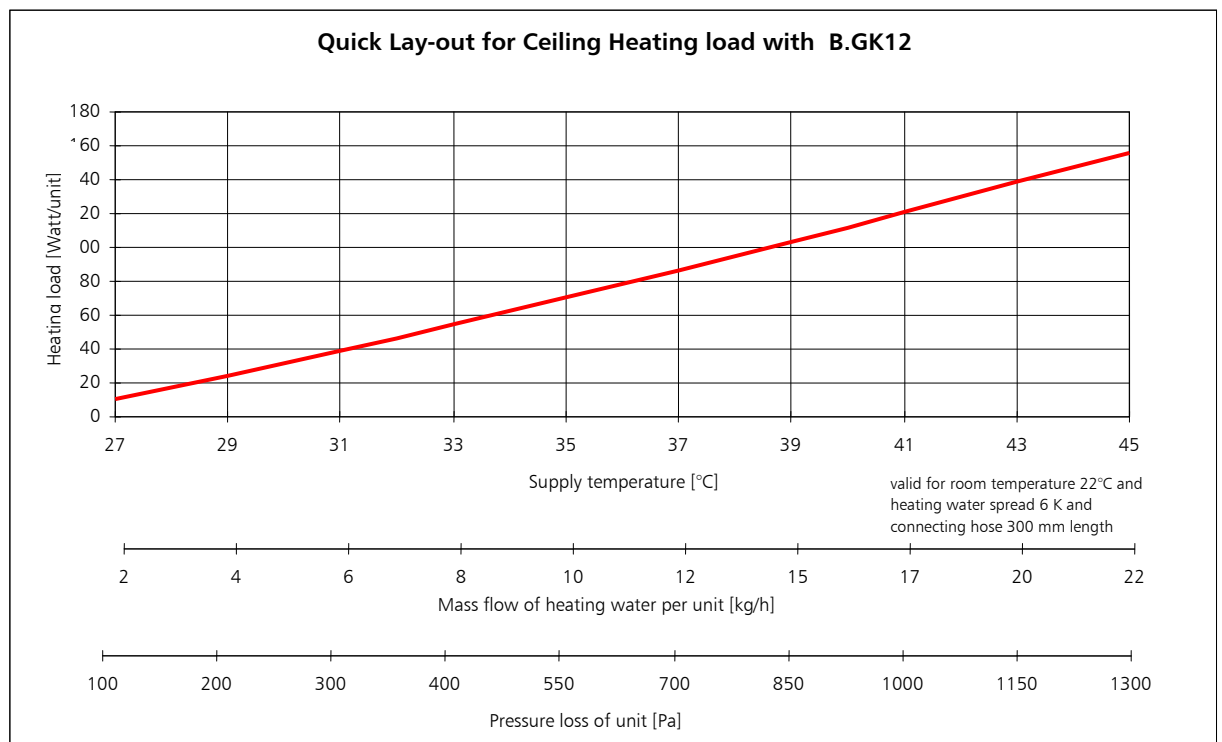
11. Layout for ceiling heating with the BEKA pre-fabricated unit B.GK12

Project:	Date :
Project consultant:	Lay-out valid for 22°C - room temperature and 6 K cooling spread!

Required heating capacity

1 Heating load for the room	W	from calculation of planning office
2 Planned quantity of panels	Stück	derive possible arrangement from room measurements
3 Required heating capacity of unit	W	= heating load / quantity of panels

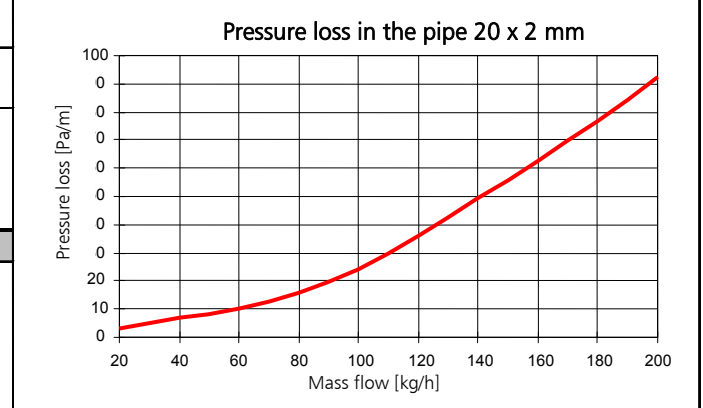
Determination of capacity



4 Supply temperature → from diagram	°C	Water volume per unit	kg/h	→ from diagram
5 Return temperature	°C	Water volume per zone	l/h	

Pressure loss determination

6 Pressure loss in the pipe = pipe length * Resistance	Pa	Length of connecting pipe	m	only one lead
7 Pressure loss of unit → with value of line 3 from diagram	Pa	Resistance in pipe → from diagram	Pa/m	Value → from diagram
8 Add. for pressure loss through fittings (Recomm: 30% extra for pipe)	Pa			
9 Add. for heat transfer station (Recomm: for zone valves 500 - 1000 Pa for mains regulating valves 700 - 1500 Pa for heat exchanger approx. 4000 Pa)	Pa			
10 Total pressure loss	Pa			



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12. Technical specification

Design:

12.5 mm Plasterboard
Capillary tube mat with capillary diameter 3.35x0.5 mm (Polypropylene)
30 mm extruded foam (thermal conductivity 0.035 W/mK; Fire rating: B1)

Masses:

11.8 kg/m² (empty)
12.5 kg/m² (filled)

Size:

Width: 600 mm
Length: 2000 mm
Pre-drilled to be screwed in 500 mm screen

Cooling capacity:

65 W/m² (DIN 4715)
=78 W/Unit

Heating capacity:

130 W/m²
= 156 W/Unit

Operating conditions:

Temperature-stable with permanent operation up to 45°C
Operating pressure 3 to 4 bar
Test pressure 10 bar over 10 hours maximum

Application / mode of installation:

Cooling and heating ceilings for dry-built constructions
Connections by BEKA quick-action coupling system
Installation according to the relevant dry-built instructions

Delivery:

Finished dry-built units are delivered laid on pallets.