

Ceiling Cooling and Ceiling Heating with BEKA Pre-fabricated Unit

1. General

Modern office- and business premises must be climate controlled nearly all year long because of their high thermal insulation and their internal loads coming from computers and other office appliances. 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 the dry-built construction. Through the combined function of the ceiling investment costs for heating system installations can be minimised.

2. System Description

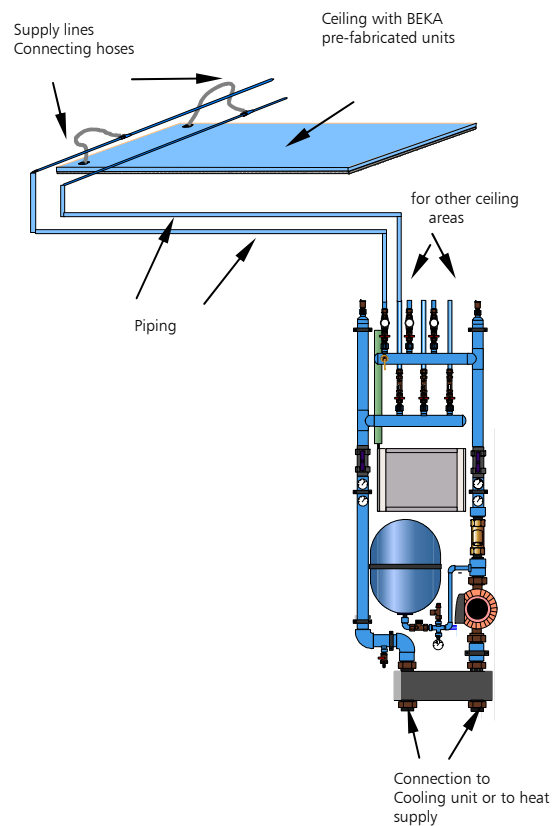
The BEKA pre-fabricated units are screwed to suspend ceiling construction according dry-build construction instructions just like any standard dry-build panel. The pre-dimensioned connection lines are laid into the ceiling cavity. The pre-fabricated unit is connected with flexible hoses to the supply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

3. Cold Water- / Heating Water Technique

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

For the cold-water preparation different techniques and systems can be utilised. The economical advantages of cooling ceiling exist because the ceiling will provide already 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. In connection with solar

collector systems and even with standard techniques a significant energy saving is already reached, because respectable heating performances are achieved with considerable low supply temperatures (below 40°C).



4. Installation

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

5. Regulating Technique

The regulating technique secures, first the desired comfort, second the necessary system reliance.

The cooling ceiling requires : a room temperature regulation, a dew point guard and a 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 a room temperature control is required, which regulates the volume of heating water in dependence to the desired room temperature. Supply temperatures above 45°C must be avoided because of the danger of excessive surface temperatures of the ceiling and to avoid that the plaster-board will dry !

6. Dimensioning of the System

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 before the heat exchanger.

7. Installation Instructions

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

It is recommended to use twist-free sheet metal profiles for the supporting construction of the suspended ceiling. The distances and the type of anchoring of the suspended verniers to the raw ceiling must be for a load of $\leq 30 \text{ kg/m}^2$.

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 at places where ceiling build-ins are planned, in-

active panels are fitted in. The BEKA pre-fabricated units are delivered pre-drilled for the connection to sub-construction made from standard CD-profiles.

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

Before starting work a ceiling pattern and an installation pattern must be drawn-up. All cassettes with their measurements, the installation direction and the 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 ceiling in-fills. Also the installation position for the BEKA dew point sensor must be marked at the ceiling pattern.

The connection of the Polypropylene piping is done 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 be below 5°C. The pre-heating, welding and setting time must be according to regulations.)

8. Tools, Materials

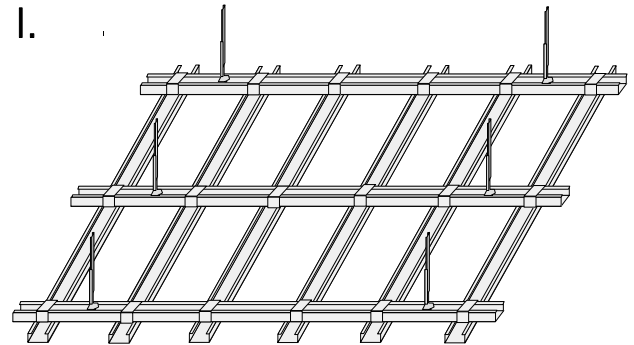
For the installation of the BEKA pre-fabricated unit standard tools and materials for the dry-build construction work is used:

- CD - profile
- Cross connector
- Vernier suspension bar
- Dowel and screws
- Rapid-build screws, 55 mm length
- Perimeter angles
- Blade-knife and edge planer
- Screw-driver
- Smoothing spatula
- Joint filler
- Hand grinder

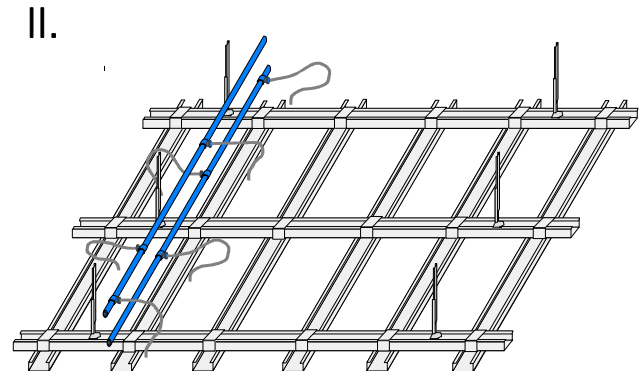
For the connection of supply lines to the cold-water circuit a hand held welder with sleeve adapter is recommended for the plastic welding together with plastic fittings. Alternatively sealing ring connectors can be used.

9. Installation Steps at the Ceiling

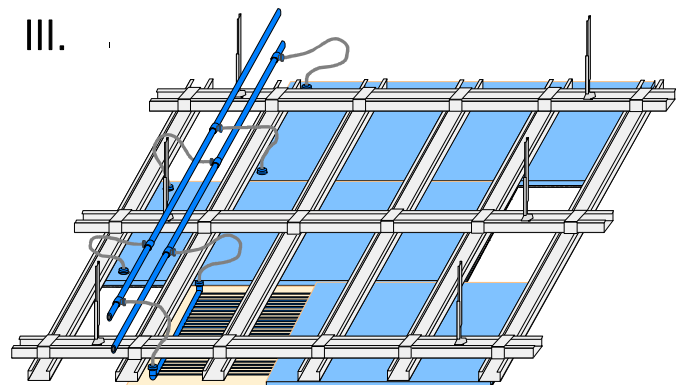
- The bearing structure is aligned and fixed at the raw ceiling with vernier suspension bars.
- The distances for the bearing profiles should be 500 mm. Additional bearing profiles (also the perimeter angle) at the border areas for the inactive tailored panels are positioned according to dry-build directions.



- The supply lines are laid in the ceiling cavity and are connected to the main lines (connections done by thermal welding or with sealing ring connectors).



- The BEKA pre-fabricated unit is fixed to the sub-construction according to the ceiling-pattern.
- The flexible connecting hoses are plugged into the quick-action couplings of the supply lines.
- The pre-fabricated unit aligned at the sub-construction to the pre-drilled holes.
- The rapid-build screws inserted through the pre-drilled holes and screwed tight until secure fixing to the sub-construction is achieved.
- Pre-test with air pressure of 10 bar for 1 hour
- Main test with water at 10 bar for 4 hours.
- Maintain a resting pressure of 3 bar until taken into operation.



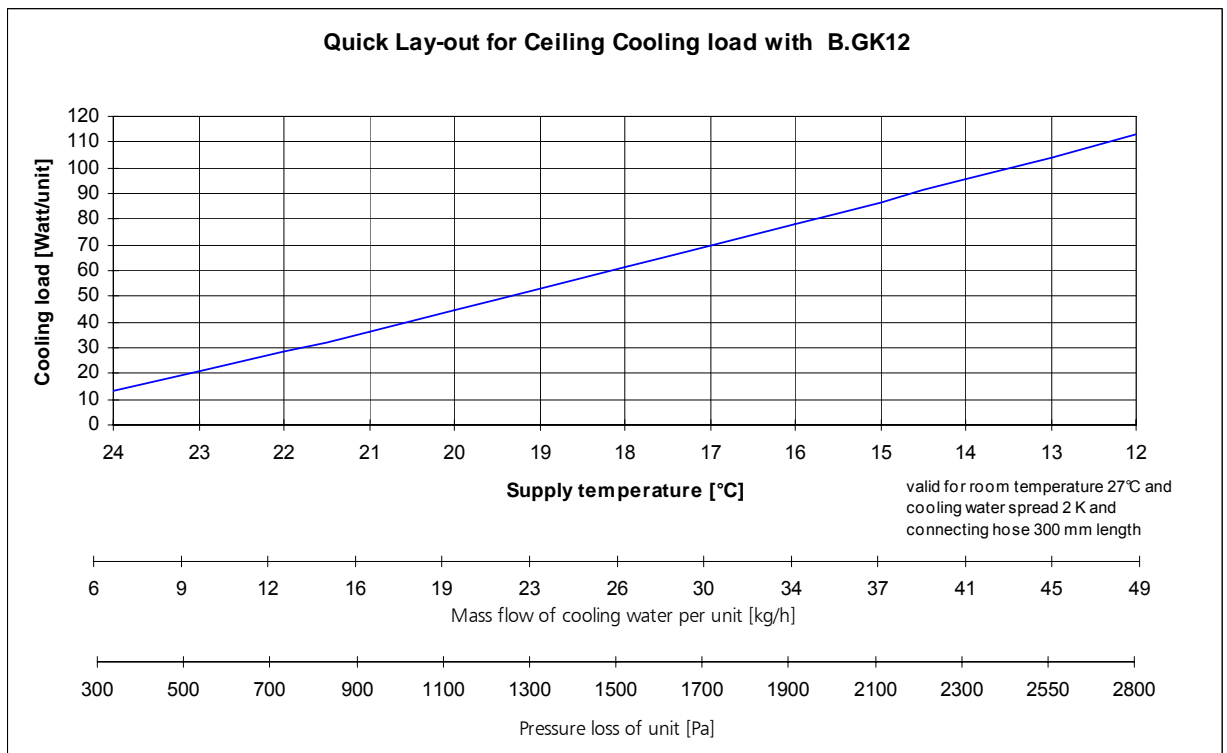
10. Lay-out of the Cooling ceiling with the BEKA Pre-fabricated Unit B.GK12

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

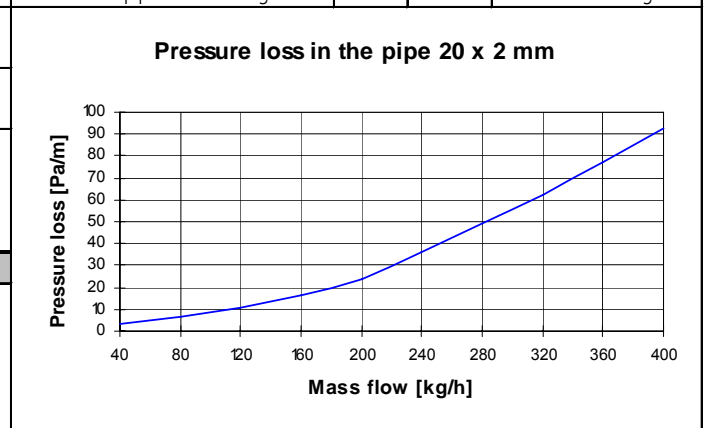


4	Supply temperature → from diagram	°C	Water volume per unit	kg/h	→ from diagram
5	Return temperature	°C	Water volume per zone	l/h	

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. Lay-out for Ceiling heating with the BEKA Pre-fabricated Unit B.GK12

12. Technical Data

Construction

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)

Weight

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 grid

Cooling capacity :

64 W/m² (DIN 4715)
=76 W/Unit

Heating capacity:

130 W/m²
= 155 W/Unit

Conditions for operation:

Temperature persistent at continues use up to 45°C
Operation pressure 3 to 4 bar
Test pressure 10 bar max. 10 hours

Place of application /Type of installation:

Cooling- and heating ceilings for Dry-built construction
Connections with BEKA quick-action-coupling system
Installation according to Dry-built instructions

Type of delivery:

Finished dry-built units are delivered laid on pallets.