Cooling and heating systems

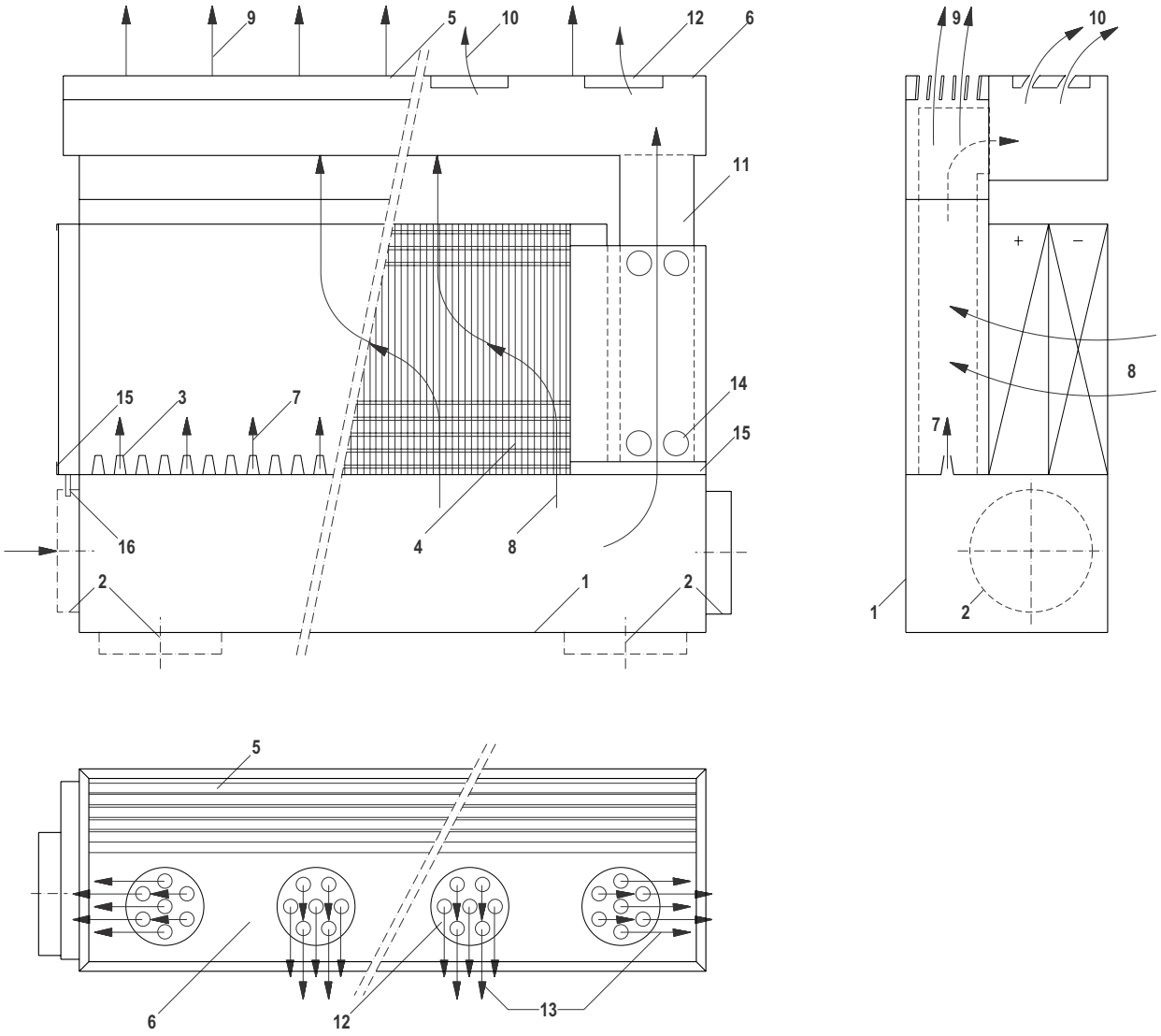
8.1 Combijet parapet unit BG-K

DS 4088 E 01.2001

KOMPONENTEN ®

Applied system solutions

Combijet parapet unit



Key:

1 primary air connection box
2 primary air spigot
3 primary air jet nozzles
4 air/water heat exchanger
5 linear bar outlet
6 multiplex outlet
7 primary air
8 secondary air (indoor air)
9 supply air from the linear bar outlet
10 supply air from the multiplex outlet
11 primary air connection duct
12 jet element
13 jet bundle
14 heat exchanger connections
15 condensate pan
16 drain (½")

Figure 1: Construction of combijet parapet unit

Combijet parapet unit

Preliminary remarks

Air/water systems have been in use in administrative buildings for some decades. These include cooling ceiling systems with mechanical ventilation, which have come into far greater use in the last ten years. In these systems water cooling and possibly heating pipes are laid in the ceiling with the requisite heat transfer elements (cooling elements). The supply air can be discharged into the room at various points.

In even longer use are air/water systems where the water cooling and heating pipes are laid at the window sill along with the heat transfer elements and the supply air pipes. Such systems are called high-pressure induction plants. Built into the induction unit are the primary air connection, the air/water heat exchanger and the discharge grille. These systems produce pronounced tangential air patterns with higher air velocities in the air downflow. Added to this are frequent noise problems because of the high pressure of approx. 300 Pa or even more on the primary air side. High pressures also mean higher energy consumption.

In recent years displacement induction units have also been used in buildings. Instead of the typical tangential air patterns with high-pressure induction units, the supply air here is discharged over the floor at low momentum. A type of displacement ventilation is generated with the usual narrow application parameters: minimum discharge temperature, vertical thermal stratification and maximum removable specific room cooling load.

KRANTZ KOMPONENTEN now provides the combijet parapet unit which avoids the disadvantages of the high-pressure induction unit and the narrow application parameters of the displacement induction unit.

The combijet parapet unit is eminently suitable for cooling, heating and fresh air supply where all the pipework in air/water systems is laid at the facade. The unit is very well suited for use in new buildings and for refurbishing existing high-pressure induction plants or fan-coil systems with primary air connection.

Construction and function

The main components of the combijet parapet unit are the primary air connection box **1** with connection spigot **2**, the primary air jet nozzles **3**, the air/water heat exchanger **4** and the air outlet system with two separate air outlets **5** and **6**. The air outlet system is fitted onto the premounted housing through the parapet opening.

A part of the primary air **7** flows at high momentum through the primary air jet nozzles **3** and induces the indoor air (secondary air) **8** via the compact heat exchanger **4** with separate water circuits for heating and cooling operation. Warm or cold water is circulated past the heat exchanger, as required. The induced secondary air therefore performs either the heating or cooling function.

The water-side connections (½") are situated at the front side of the unit on the right. Under the heat exchanger is a condensate pan **15** fitted with a drain socket (½") **16**.

The supply air **9**, consisting of a primary air portion **7** and secondary air **8**, is discharged into the room through the linear bar outlet **5**.

The rest of the primary air **10** flows through the connection duct **11** to the multiplex outlet **6**. The multiplex outlet[1)] consists of single, manually rotatable jet elements **12**. In the jet elements jet bundles **13** are formed with adjustable discharge directions and outside air

1) See Technical Selection DS 4064

quality. This enables the occupant to individually adjust the intensity of air flow at his/her workplace. The jet elements only need rotating. Each single element is rotatable through 360°. The supply air of the multiplex outlet is of high quality as it consists of pure outside air. An individually adjustable intensity of air flow at consistent high quality is thus available at the workplace.

The supply air from the linear bar outlet is reduced by the primary air from the multiplex outlet. This diminishes the momentum and the penetration depth of the supply air jet **9** discharged at a steep upward incline. No pronounced tangential air pattern forms with the disadvantages mentioned above. The supply air jet **9**, with its steep upflow along the window, removes the facade heat in summer (due to secondary air cooling in the heat exchanger); in winter (due to secondary air warming in the heat exchanger) it prevents a cold air drop at the facade.

Thanks to the combined spread of the entire supply air into several jets, a diffuse, three-dimensional indoor air flow is produced with excellent flushing of the whole occupied zone. An even temperature gradient is obtained in the room with low indoor air velocities at the same time. The maximum vertical and horizontal thermal stratification in the occupied zone amounts to ± 0.5 K. Indoor air velocities keep below 0.2 m/s.

If a brief, intensive air breeze is desired, higher air velocities can be obtained at the workplace by rotating the individual jet elements.

The combijet parapet unit is also well suited for heating. The primary air from the multiplex outlets can still be directed to the personnel. Ventilation efficiency and hence the high air quality at the workplace is therefore not impaired when heating. The supply air jet **9** screens off the window facade, offsets the transmission heat losses and then escapes into the ceiling zone.

Above the floor, comfortable air temperatures and low indoor air velocities prevail in all load situations.

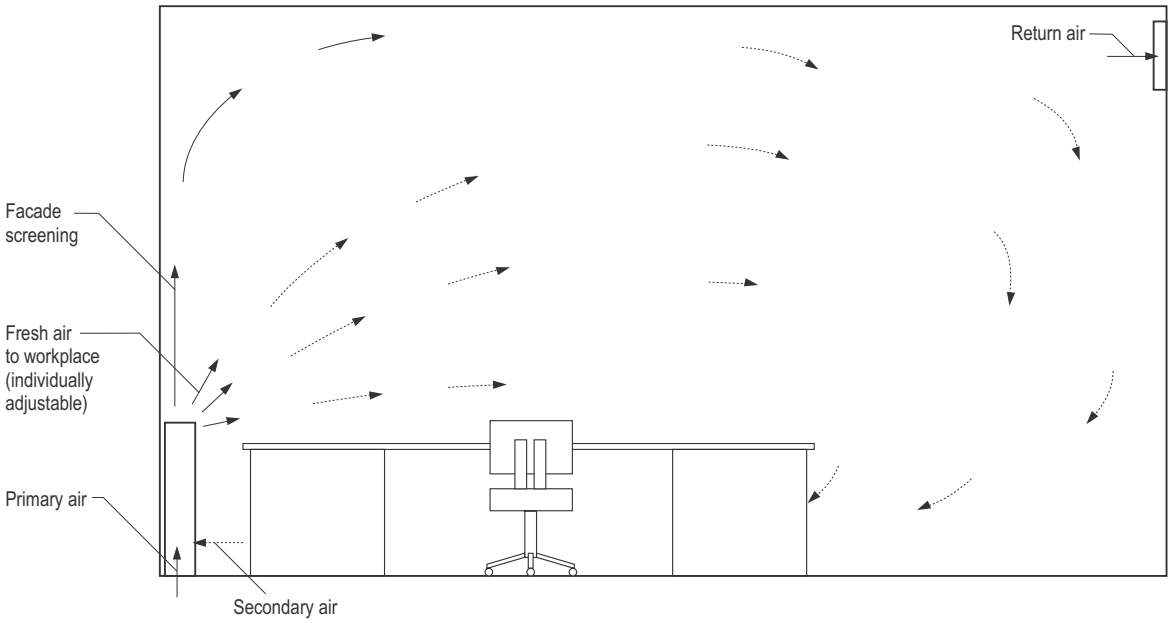


Figure 2: Air flow pattern

Combijet parapet unit

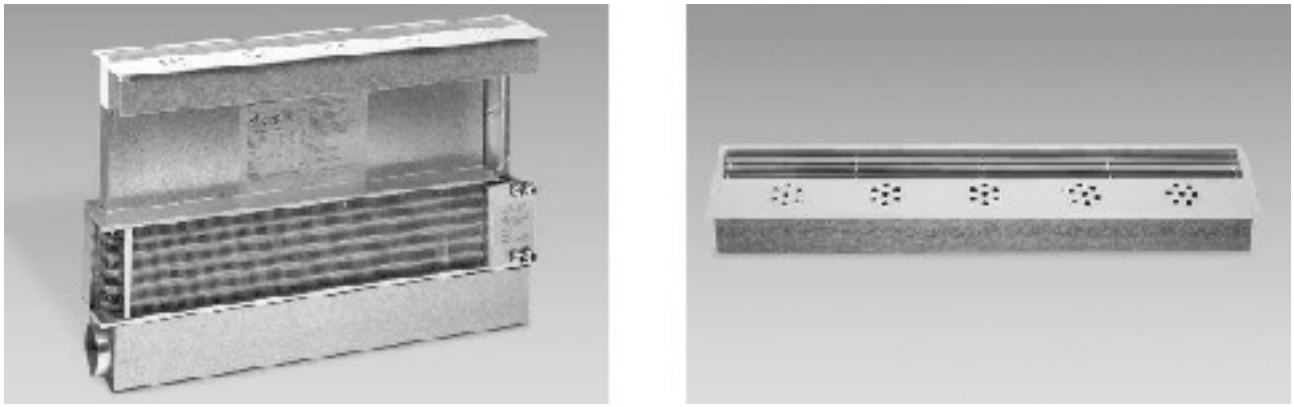


Figure 3: Photograph of combijet parapet unit
Left: Complete unit (type with extended spigot for cable ducts at customer's expense)
Right: Air outlet system

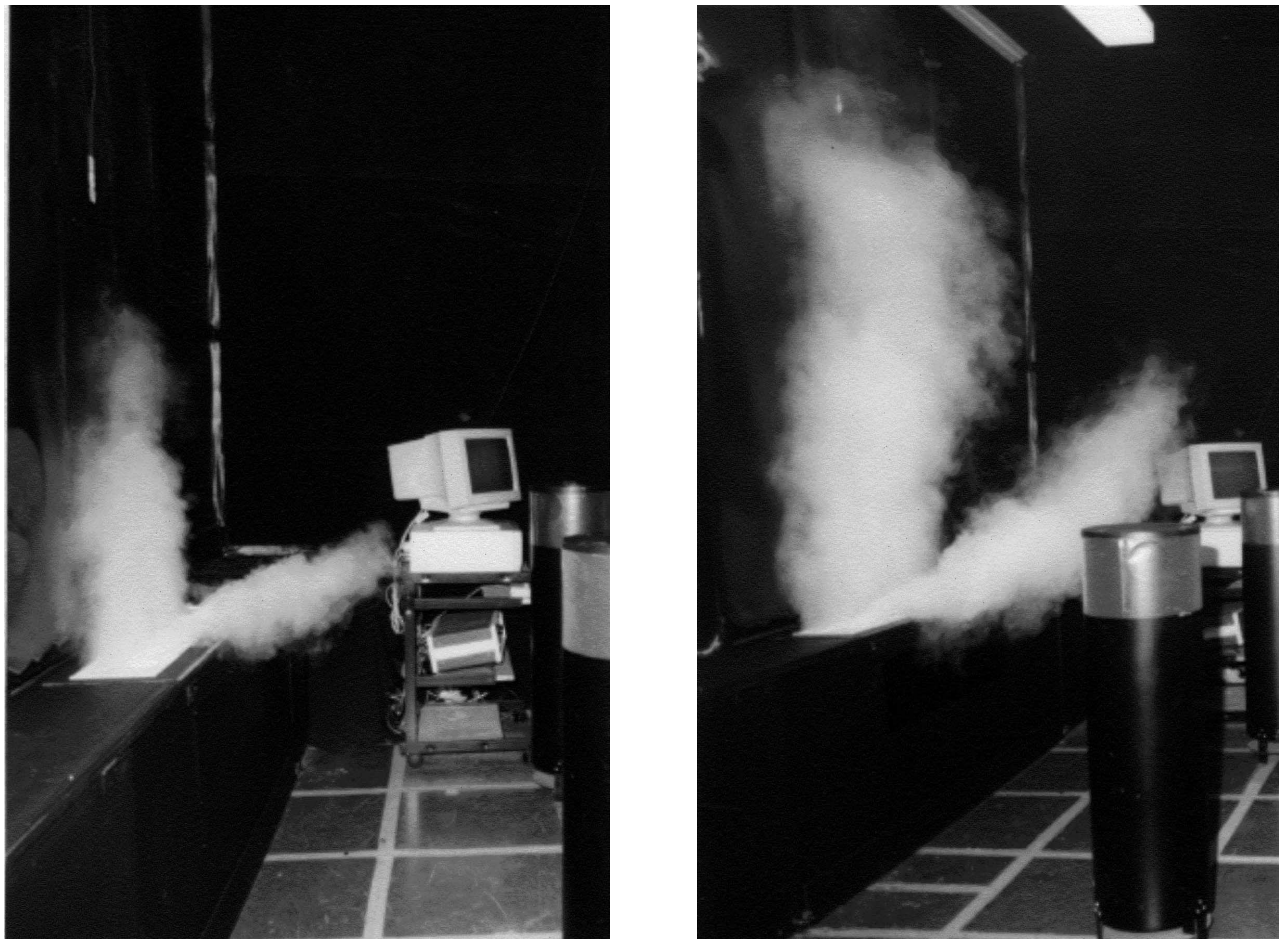


Figure 4: Jet pattern made visible with smoke tracer
Left: Flat primary air jet
Right: Steeper primary air jet

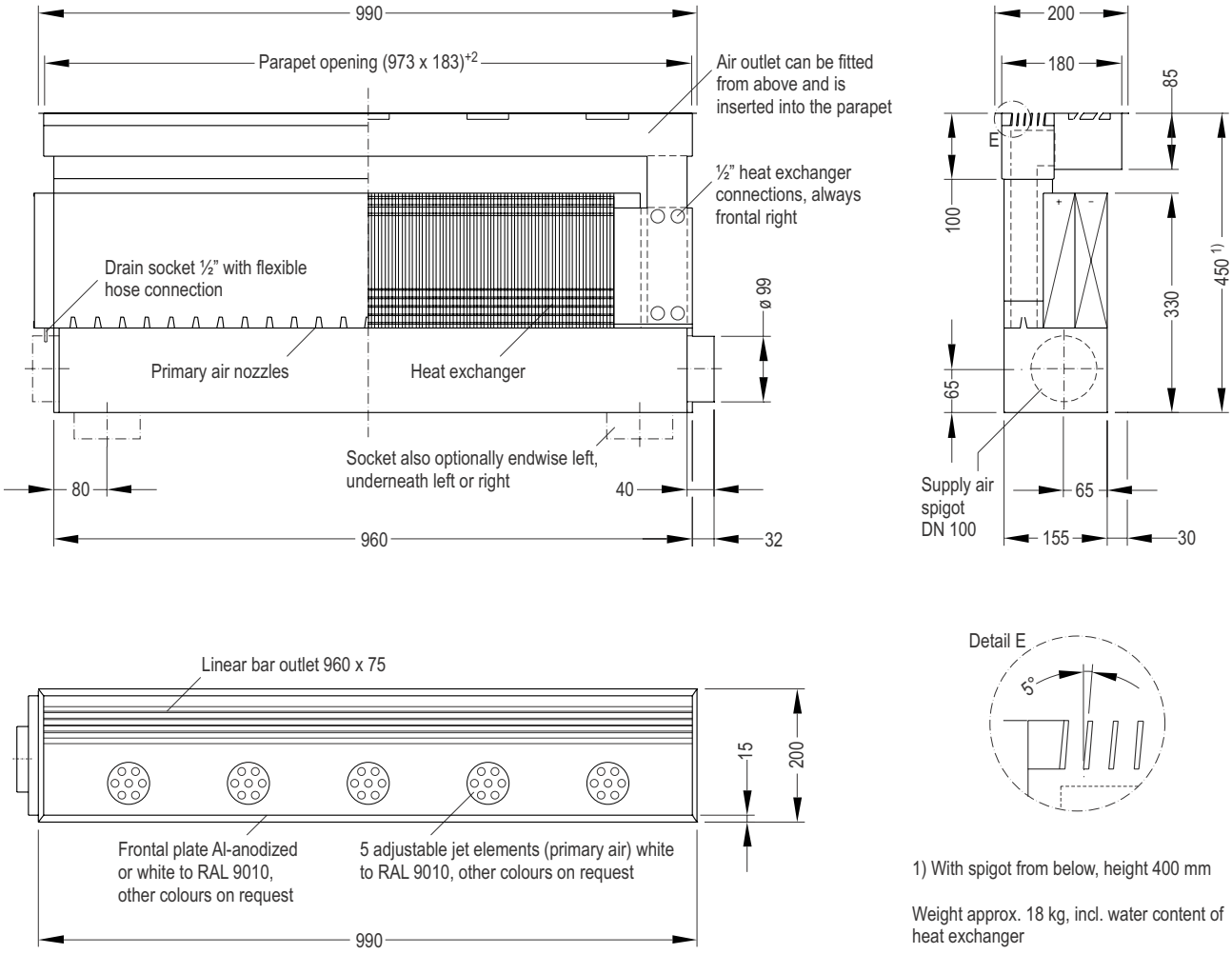


Figure 5: Dimensions of combijet parapet unit

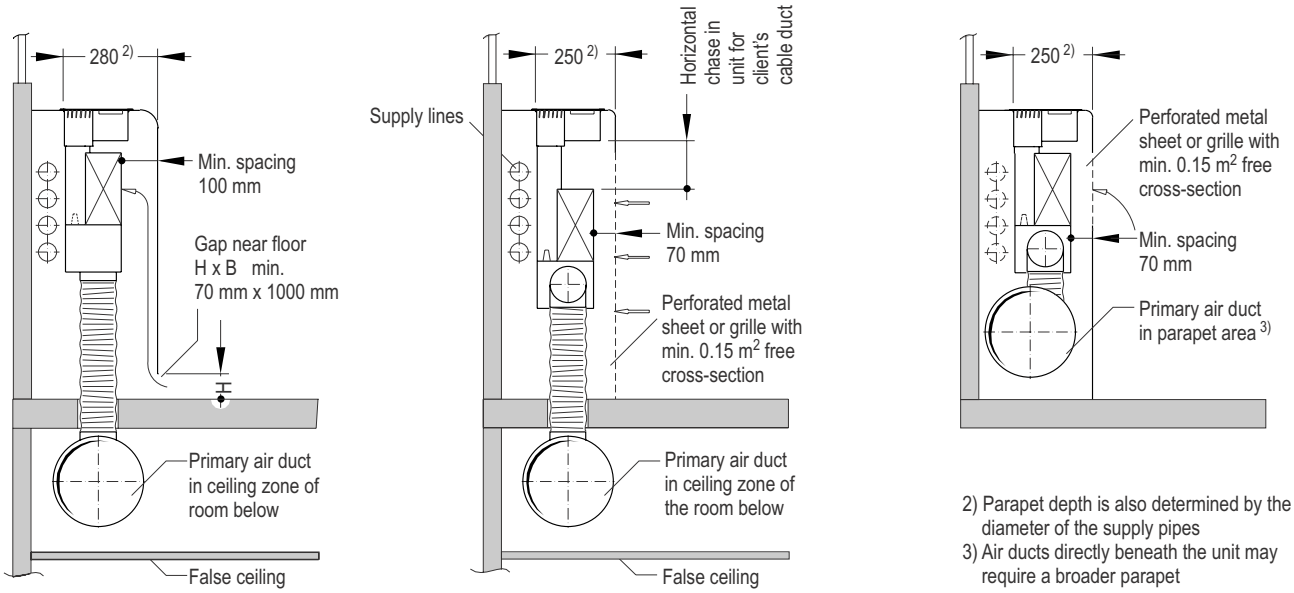


Figure 6: Examples of exhaust air openings in the building-side parapet covering, as:
Left: Gap near floor;
Centre: Full-surface grille or perforated metal sheet
Right: Horizontal grille or perforated metal sheet directly in front of the unit heat exchanger

Combijet parapet unit

Installation directions

The combijet parapet unit is installed behind the client's parapet covering. A cutout measuring 973 mm x 183 mm has to be made in the upper, horizontal segment of the covering for the air outlet system.

The outlet system **5** and **6** is delivered as a separate component for easier mounting. The housing **1** is best fastened to two brackets adjustable in 2 planes for adjustment to permissible constructional deviations. After fastening the parapet covering the air outlet component with sealing is fitted onto the housing through the covering cutout.

A sufficient gap must be left in the vertical area of the covering for unobstructed inflow of the secondary air to the heat exchanger. There are various ways of doing this (see also page 6, below):

- The parapet covering is not extended to the floor; a gap of at least 70 mm high and approx. 1 m long must be maintained. The minimum horizontal distance between the covering and the parapet unit amounts to 100 mm.
- The whole frontal plate of the parapet covering is perforated. The minimum free cross-section amounts to 0.15 m^2, the horizontal distance between the covering and the parapet unit to at least 70 mm.
- Equilevel with the heat exchanger, the frontal plate of the parapet covering has an open cross-section of at least 0.15 m^2 (in the shape of perforated metal sheeting, slots or a grille). The minimum horizontal distance between the covering and the parapet unit amounts to 70 mm.

The primary air connection can be made endwise on the right or left or from below on the right or left. The desired connection type must be specified in the order.

The height of the complete parapet unit amounts to 450 mm for lateral air connection and 400 mm for connection from below.

Depending on building layout, the client's control valves can be placed laterally, behind the unit or – due to the low unit height – under the unit for easy access.

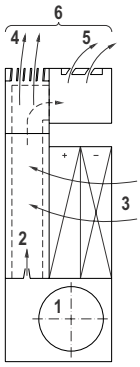
We recommend:

- connecting the supply and return pipes of the heat exchanger with flexible tubing
- connecting each unit on the water side with a shut-off mechanism
- dimensioning the connection duct cross-section on not the primary air side smaller than the connection spigot at the unit
- for parallel connection of several units selecting an air velocity in the joint supply air duct of ≤ 5 m/s

Technical data

Primary air volume flow rate

The primary air volume flow rate is best kept within a range of 14 and 22 l/s (50 and 80 m^3/h). Depending on this, the following volume flow rates are produced at the unit intake and exit:



	Air volume flow rates $\dot{V}$					
	①	②	③	④	⑤	⑥
	Pimary volume flow rate	Nozzle volume flow rate	Secondary volume flow rate	Linear bar outlet volume flow rate	Multiplex outlet volume flow rate	Total supply air volume flow rate
l/s	13.9	8.3	41.1	49.4	5.6	55.0
m^3/h	50	30	148	178	20	198
l/s	18	11.1	53.3	64.4	6.9	71.3
m^3/h	65	40	192	232	25	257
l/s	22.2	13.9	65.5	79.4	8.3	87.7
m^3/h	80	50	236	286	30	316

Cooling capacity

The cooling capacity is preselected from **Table 1** in correlation with primary air volume flow rate and the appropriate recommended water flow rate.

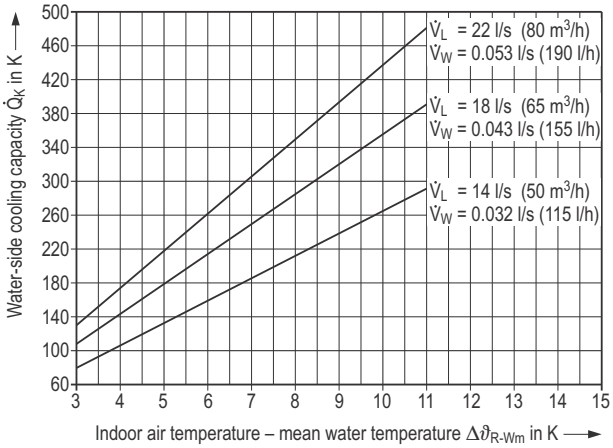
Table 1: Preselection for cooling

Primary air volume flow rate		Water flow rate	Cooling capacity[1] of secondary air (water side)	Cooling capacity[2] of primary air	Total cooling capacity	Spec. total cooling capacity [3]
l/s	m^3/h	l/h	W	W	W	W/m^2
13.9	50	115	265	135	400	54
18.0	65	155	360	175	535	80
22.2	80	190	450	215	665	90

1) Flow/Return temperature 15/17°C, room temperature 26°C
2) Primary air temperature 18°C, indoor air temperature 26°C
3) Related to room axis 1.35 m x 5.5 m ≙ 7.4 m^2 floor area

Cooling capacity for other layout conditions can be read off **Figure 7**. The influence of the water volume flow rate on cooling capacity is shown in **Figure 8**.

Water-side cooling capacity



Air-side cooling capacity in Watts

Primary air volume flow rate $\dot{V}_L$		Temperature difference primary air – indoor air $\Delta\vartheta_{P\text{-}R}$ in K		
l/s	m³/h	-6	-8	-10
13.9	50	101	135	168
18.0	65	131	175	218
22.2	80	161	215	268

Figure 7: Cooling capacity

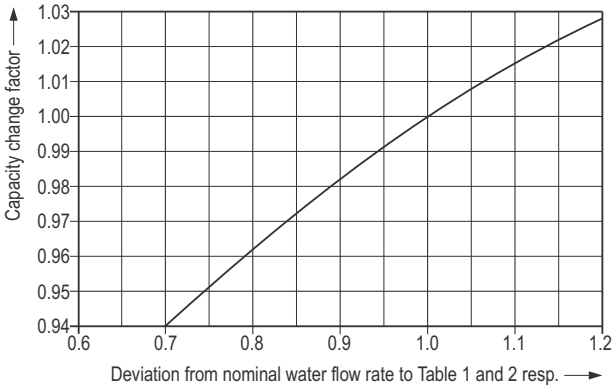


Figure 8: Influence of water volume flow rate on cooling and heating capacity

Total cooling capacities per unit of 400 to 650 W are easily achieved. For an area of 1.35 m x 5.5 m the unit can remove specific indoor cooling loads of up to 90 W/m2. Thermal comfort is maintained, i.e. there are no draughts and thermal stratification is extremely low.

Indoor air velocities in the occupied zone are < 0.20 m/s (unless a fresh air breeze is set individually at the workplace). Vertical thermal stratification is < 1 K/m, horizontal temperature differences in the occupied zone equal < 1 K. An example of the velocity and temperature gradient in the occupied zone is given in **Figures 9 and 10**.

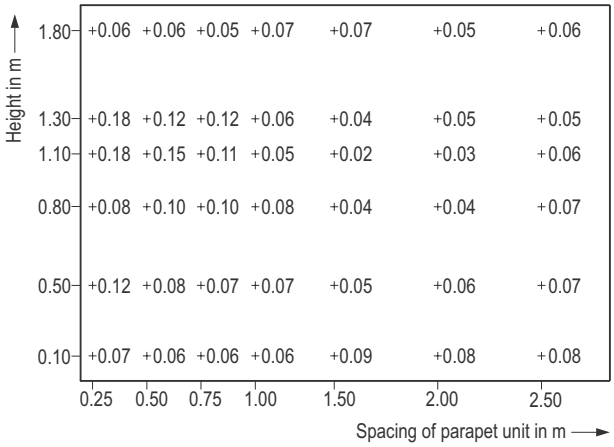


Figure 9: Mean average air velocity in m/s; $\dot{V}_L$ = 22.2 l/s (80 m³/h), ϑ_L = 18°C; example

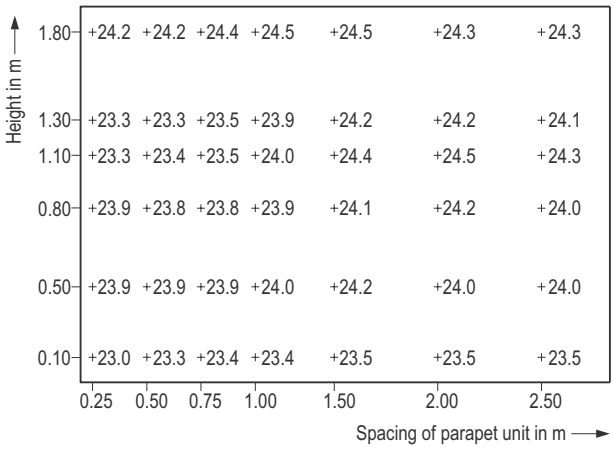


Figure 10: Indoor air temperature in °C ; $\dot{V}_L$ = 22.2 l/s (80 m³/h), ϑ_L = 18°C; example

The water flow temperature should be selected to exceed the dewpoint temperature of the indoor air. If under unfavourable conditions (e.g. open window with high outside air humidity) condensate briefly forms in the heat exchanger, it is collected in the condensate pan **15**, can evaporate there or can be removed via a client's drain.

Heating capacity

Heating capacity is preselected using **Table 2**.

Primary air volume flow rate		Water volume flow rate	Heating capacity[1] of secondary air (water side)	Spec. heating capacity[2]
l/s	m^3/h	l/h	W	W/m^2
—	—	80	380	50
13.9	50	80	660	90
18.0	65	100	880	120
22.2	80	120	1100	148

1) Flow/Return temperature 50/40°C, room temperature 22°C
2) Related to room axis 1.35 m x 5.5 m ≙ 7.4 m^2 floor area

A detailed layout can be specified from Figure 11. The influence of the water volume flow rate on heating capacity is shown in **Figure 8**.

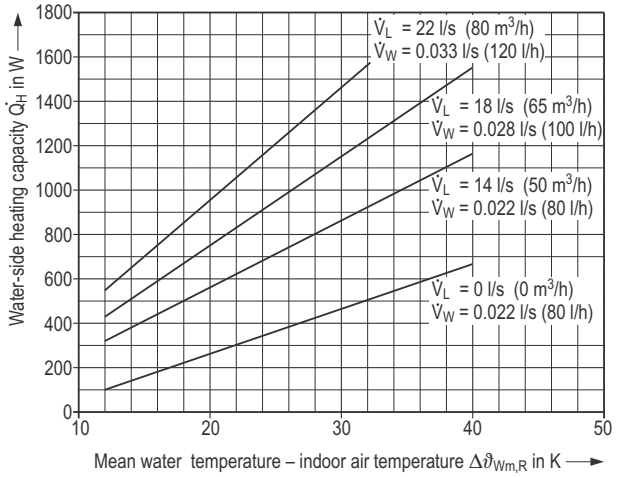


Figure 11: Water-side heating capacity in Watts

The heating capacity of the primary air is not indicated, since the primary air in winter is not usually discharged at a higher temperature than the indoor air. The primary air can generally be heated to up to 28°C with no difficulty. In this case an additional air-side heating capacity is available. This increased heating capacity is not usually required.

The combijet parapet unit guarantees a substantial heating capacity also without primary air supply. This is particularly advantageous at night or at the weekend and saves energy. Heating capacities without primary air supply of about 350 W per unit are possible. This corresponds for a room area of 7.4 m^2 per unit to a specific heating capacity of approx. 48 W/m^2. In modern or thermically refurbished buildings, this is enough to meet room heating requirements.

With primary air connection the heating capacity increases to 650 – 1100 W per unit.

Sound power level and pressure loss

The sound power level and the air-side pressure loss are low and depend only on the primary air volume flow rate. According to **Figure 12**, the A-rated sound power level amounts for 13.9 l/s (50 m^3/h) primary air volume flow rate to 24 dB(A) ref. 10^{-12} W, for 22 l/s (80 m^3/h), to 36 dB(A) ref. 10^{-12} W. The corresponding total pressure equals 90 and 230 Pa resp.

$\dot{V}_L$		Sound power level in dB ref. 10^{-12} W							
		L_{WA}	Octave band centre frequency in Hz						
l/h	m^3/h	dB(A)	125	250	500	1 K	2 K	4 K	8 K
13.9	50	24	33	25	22	16	9	12	9
18.0	65	30	36	28	27	24	19	22	17
22.2	80	36	41	32	32	30	28	24	21

Insertion loss D in dB ref. 10^{-12} W								
Octave band centre frequency in Hz								
63	125	250	500	1 K	2 K	4 K	8 K	$\bar{D}$
28	28	30	32	34	31	31	34	31

Water-side pressure loss of the heat exchanger can be read off **Figure 13** and amounts for example in cooling operation at 120 l/h to 1.9 kPa, at 180 l/h to 4.2 kPa.

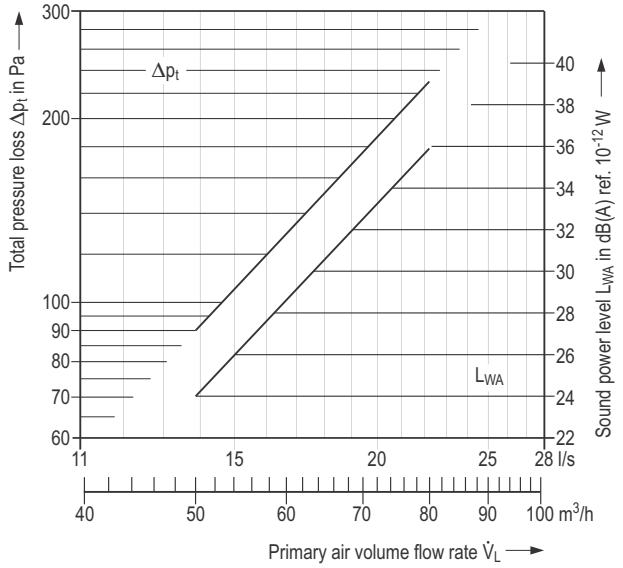


Figure 12: Sound power level and air-side pressure loss

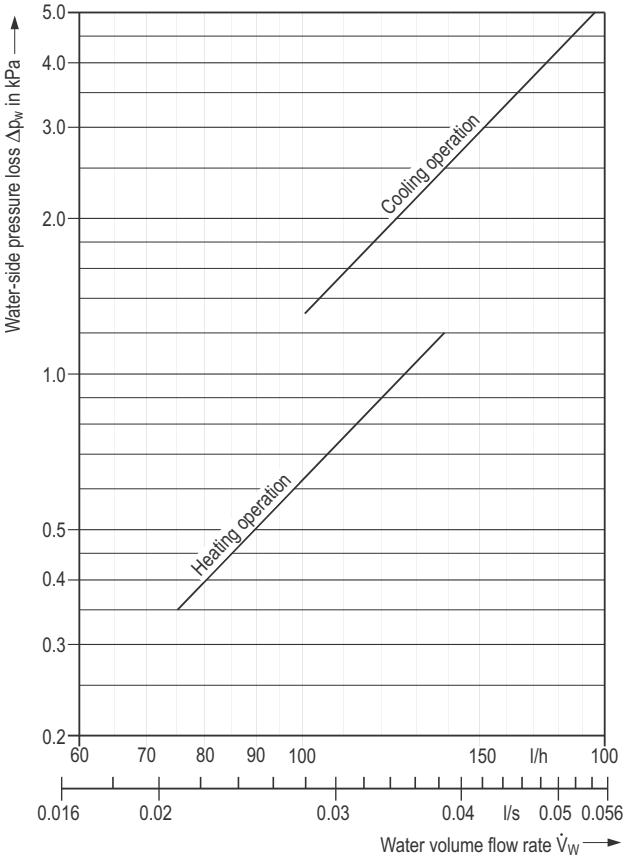


Figure 13: Water-side pressure loss of heat exchanger

Features

- Cooling, heating and fresh air supply from the window sill while retaining high thermal comfort
- Spread of the supply air flow by combining several air jets with fast velocity reduction, thus eliminating tangential air patterns
- Individually adjustable intensity of air flow at workplace near the facade by manual adjustment of discharge direction
- Improved indoor air flow by separating fresh air supply to the workplaces and facade screening
- Cooling capacity of up to about 650 W, i.e. approx. 90 W/m² floor area under conditions of thermal comfort
- Primary air volume flow rate of 14 to 22 l/s (50 to 80 m³/h)
- Low vertical thermal stratification (< 1 K/m)
- No impairment of ventilation efficiency in heating operation
- Low air velocities and comfortable temperatures in floor zone
- Low pressure loss (90 – 230 Pa), resulting in energy-saving operation
- Heating also possible without primary air operation, resulting in energy savings in heating operation at night and at the weekend
- Low sound power level
- Low height of 450 and 400 mm resp.
- Housing and air outlet component delivered separately → easier installation
- Heat exchanger cleanable from the front and from behind (to VDI 6022). Wide blade spacing for easy cleaning makes filter superfluous
- Suitable for new buildings and refurbishments as a substitute for high-pressure induction units
- Condensate pan under heat exchanger, including drain socket with ½" hose connection

DS 4088 E Bl. 10 01.2001

Combijet parapet unit

Type code

BK – K – __

Parapet unit ----------
Combijet ----------
Air connection ----------

Air connection
(View to front of unit)
L = Left
R = Right
LU = Underneath left
RU = Underneath right

Tender text

..... Unit
Combijet parapet unit for cooling, heating and fresh air supply from window sill

Supply air flow spread in individually adjustable fresh air (primary air) supply to workplaces and thermal screening of the facade with a mixture of primary and secondary air,

Item 1
Unit with primary air connection, built-in primary air jet nozzles, consisting of:

Water heat exchanger made of copper piping with mounted aluminium blades and separate circulation for heating and cooling operation as well as wide blade spacing for easy cleaning from the front and back,

Condensate pan including drain socket with hose connection ½",

Primary air connection (View to front of unit)

☐ left, ☐ right,
☐ underneath left, ☐ underneath right

Water connection at front, right,

☐ with control valves,

☐ brackets for fastening the unit, adjustable in two planes

Item 2
Combined air outlet system with
Linear bar outlet for thermic screening of window facade in cooling and heating operation, rapid drop in jet velocity without producing thermal discomfort due to tangential air patterns,

Multiplex outlet with round jet elements, each manually rotatable through 360° for required spread of primary air flow directed to workplace, thus enabling individual adjustment of air flow intensity at workplace.

Technical data
Primary air volume flow rate: .....l/s (m^3/h)
Permissible sound power level: .....dB(A) ref.10^{-12}W
Air-side pressure loss[1]: ..... Pa

Cooling operation[2]
Total cooling capacity: .....W
Water flow temperature: ..... °C
Water volume flow rate: ..... l/h (l/s)
Water-side pressure loss: ..... kPa

Heating operation[3]
Heating capacity (secondary): ..... W
Water flow temperature: ..... °C
Water volume flow rate: ..... l/h (l/s)
Water-side pressure loss:[4] ..... kPa

Material
– Housing: Galvanized steel
– Linear bar outlet: Aluminium
☐ anodized natural colour
☐ painted to RAL 9010, pure white [5]
– Jet elements:
acryl butadiene styrol ABS
coloured pure white, similar to RAL 9010 [5]
– Heat exchanger: Copper/Aluminium

Dimensions
– Length: 990 mm
– Width:
Housing: 155 mm
Air outlet: 200 mm
– Height [6]: 450 mm
Perm. operating pressure of heat exchanger[7]: 16 bar
Weight: approx. 15 kg

Make: KRANTZ KOMPONENTEN

Type: BG-K-__

Subject to technical alterations!

Details: 1) Figure 12
2) Table 1
3) Table 2
4) Figure 13
5) Other colours on request
6) For air connection from below 400 mm
7) Higher pressures on request

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Applied system solutions

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