Cooling and heating systems

Active chilled beam DK-LIG/Z

DS 4108 E 05.2012

Active chilled beam DK-LIG/Z

Preliminary remarks

To cool the indoor air KRANTZ KOMPONENTEN provides not only large-surface cooling ceiling systems, but also passive and active chilled beams. While the passive DK-F chilled beam operates without supply air (primary air) simply as a recirculated air cooler using gravity, the active DK-LIG/Z also has a ventilation function thanks to primary air connection. This way the requisite outdoor air flow rate for the occupants can be delivered to the room.
The active chilled beam DK-LIG/Z can be used for cooling and heating.

Construction design

The main components of the active chilled beam DK-LIG/Z are the top-closed housing **1** with air connection spigot **1a**, the built-in heat exchanger **2** with pipe ends **2a** for 2-pipe or 4-pipe systems, the nozzle plate **3** with the primary air nozzles **3a**, and the perforated screen **4**.

The screen **4** is positioned between the two air shafts **5**; various screen perforation patterns are available on enquiry.

Depending on the application, the connection spigot **1a** can be placed to the left or right along the housing length (viewed from connection side of heat exchanger) or endwise. The standard width of the endwise angle flange for ceiling connection **1b** is 15 mm. If needed, angle flanges of other dimensions can be provided for dimensional adjustment to the ceiling system; information on enquiry.

Mode of operation

The primary air is discharged at high momentum through the nozzles **3a** and induces indoor air (secondary air) that is reflowing from below through the heat exchanger. Primary and secondary air mix intensively and the resulting supply air is delivered to the room via the air shafts **5**.

The DK-LIG/Z can be flush mounted into a suspended ceiling or freely suspended from the concrete ceiling. In flush mounting, the supply air glides along the suspended ceiling and flows horizontally and evenly at low velocity into the room.

If the DK-LIG/Z is freely suspended, this effect is obtained with narrow wings **6**.

The DK-LIG/Z has a built-in reflow surface area for secondary air (perforated screen **4**). The screen is easy to remove to give access to the heat exchanger.

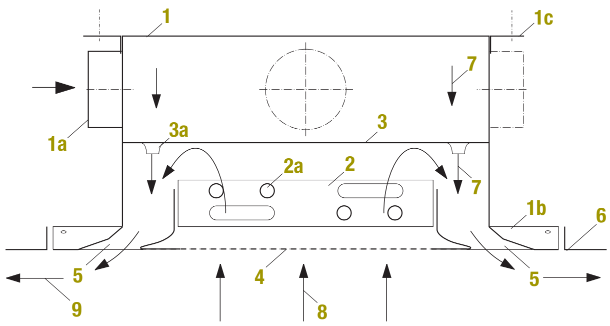


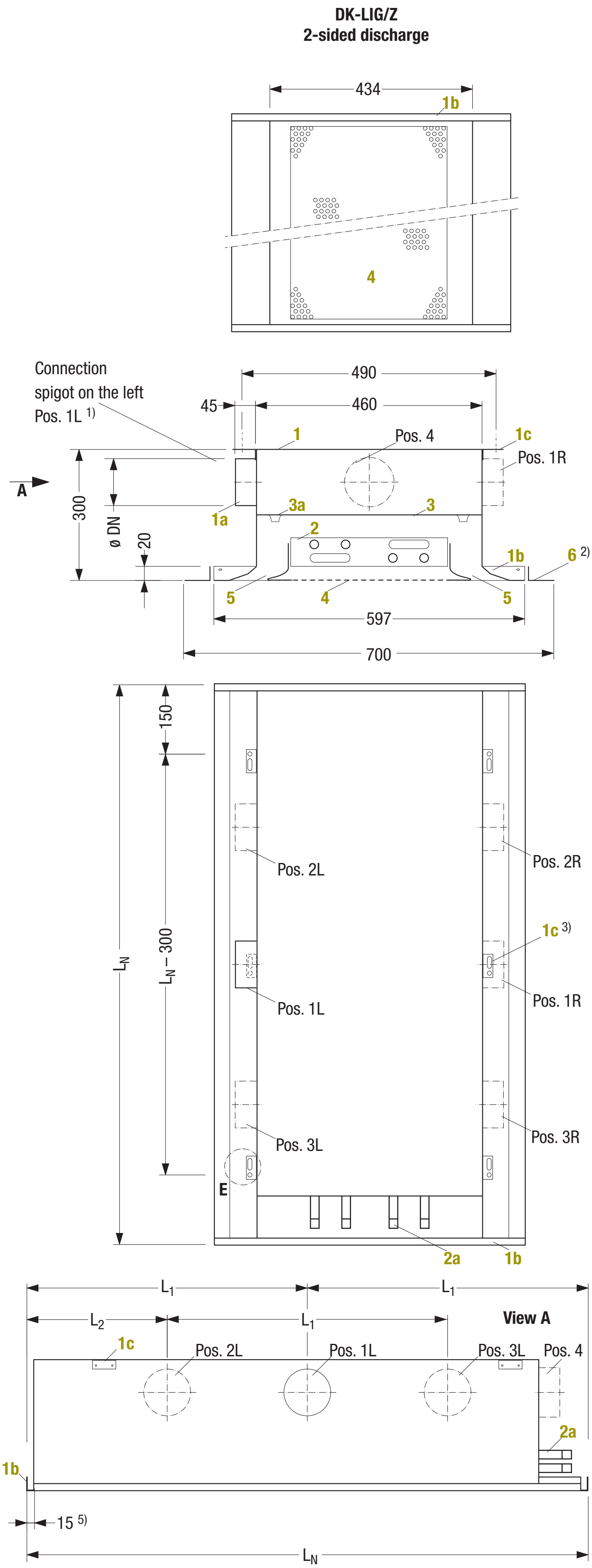
Figure 1: Construction design and function of the DK-LIG/Z

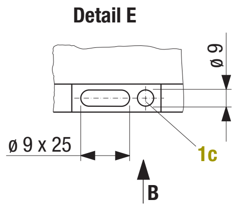
Key:

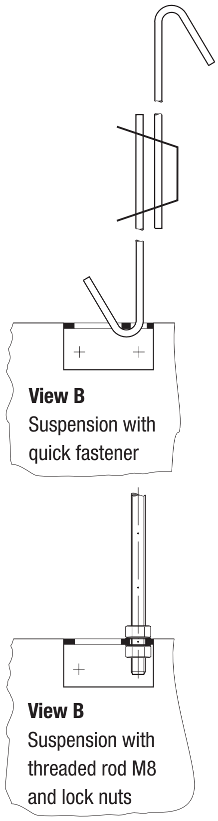
1	Housing	**2**	Heat exchanger	**5**	Air shaft
1a	Connection spigot	**2a**	Pipe ends	**6**	Wing
1b	Angle flange for ceiling connection	**3**	Nozzle plate	**7**	Primary air
		3a	Primary air nozzles	**8**	Secondary air
1c	L-fastener	**4**	Perforated screen	**9**	Supply air

Active chilled beam DK-LIG/Z

Dimensions







Lengths and weights

L_N mm	L_1 mm	L_2 mm	W kg
1,200	600	300	28
1,500	750	375	35
1,800	900	450	40
2,100	1,050	525	47
2,400	1,200	600	53
2,700	1,350	675	60
3,000	1,500	750	65

Standard water connection at calibrated pipe ends, ø 15 mm

Standard connection spigot ø DN [4]

Position	ø DN
Pos. 1L / 1R	100 / 125
Pos. 2L / 2R	100 / 125
Pos. 3L / 3R	100 / 125
Pos. 4	100 / 125 / 150

[1] Viewed from connection side of heat exchanger

[2] With flush mounting

[3] Additional fastener required for $L_N \geq$ 2,400 mm

[4] Smaller ø DN and several connection spigots possible

[5] Other widths possible on request

Figure 2: Dimensions of DK-LIG/Z

Active chilled beam DK-LIG/Z

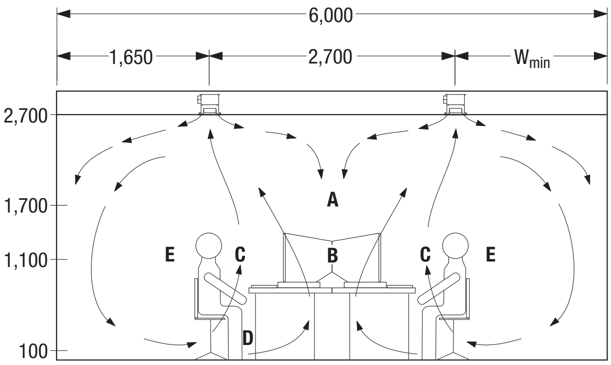
Design and layout specifications

In many cases the chilled beams are installed perpendicular to the facade, in the middle of the facade axis. Sometimes placement parallel to the facade is required, e.g. as a continuous strip of beams or in the form of single units spaced in a row.

Maximum indoor air velocities depend on the spacing between the chilled beams and their distance from the wall as well as on the primary air flow rate. Figure 3 shows some velocities at different points of the room. For example, at a primary air flow rate of 11 l/(s·m) [40 m^3/ (h·m)], maximum indoor air velocities are 0.14 – 0.18 m/s, with the total cooling capacity amounting to 400 W/m.

To obtain low indoor air velocities (for office applications) with a centre distance of only 1,350 mm (Figure 4), a primary air flow rate of about 8 l/(s·m) [30 m^3/(h·m)] should be selected.

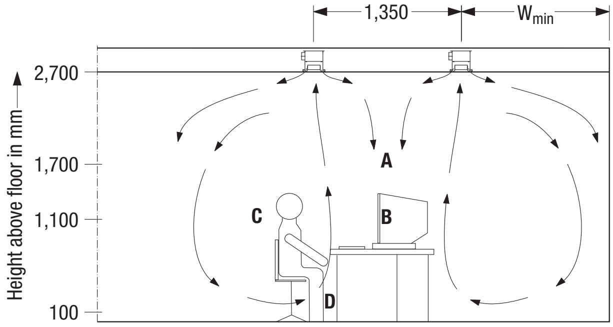
For other distances, an interpolation between 1,350 and 2,700 mm can be made.



	Primary air flow rate in l/(s·m) [m^3/(h·m)]				
	25 [90]	19.5 [70]	14 [50]	11 [40]	8 [30]
W_{min} in mm	1,600	1,300	1,000	800	600
Zone	Total cooling capacity in W/m (air $\Delta\vartheta_{Z-R}$ = –8 K and water $\Delta\vartheta_{W-R}$ = –10 K)				
A	0.34	0.31	0.28	0.18	0.16
B	0.29	0.27	0.25	0.16	0.14
C	0.20	0.17	0.15	0.14	0.13
D	0.22	0.20	0.18	0.14	0.13
E	0.22	0.18	0.16	0.14	0.12

Figure 3: Indoor air velocities in m/s in the occupied zone for arrangement with broader centre distance

Note: For room lighting we recommend to use recessed lighting or pendant lighting at minimum 20 cm from the ceiling. Surface-mounted lighting is not suitable because it would deflect the air jet from the ceiling, resulting in an early descent of the supply air and thus in higher air velocities.



	Primary air flow rate in l/(s·m) [m^3/(h·m)]			
	19.5 [70]	14 [50]	11 [40]	8 [30]
W_{min} in mm	1,300	1,000	800	600
Zone	Total cooling capacity in W/m (air $\Delta\vartheta_{Z-R}$ = –8 K and water $\Delta\vartheta_{W-R}$ = –10 K)			
A	0.32	0.28	0.24	0.22
B	0.29	0.26	0.23	0.20
C	0.20	0.18	0.18	0.18
D	0.25	0.22	0.20	0.18

Figure 4: Indoor air velocities in m/s in the occupied zone for arrangement with small centre distance

In general: The vertical temperature gradient in all cases is ≤ 1 K/m for floor-to-ceiling heights up to 3.5 m.

Key for all tables:

$\Delta\vartheta_{Z-R}$ = Temperature difference supply air to indoor air in K

$\Delta\vartheta_{W-R}$ = Difference mean water temperature to indoor air temperature in K

Figure 5: Active chilled beam DK-LIG/Z

Active chilled beam DK-LIG/Z

Layout

The chilled beam layout depends among other things on the diameter of the primary air nozzles. The nozzle diameter is determined in relation to the primary air flow rate, see Table 1.

Table 1: Recommended nozzle diameter related to primary air flow rate

Primary air flow rate l/(s•m) [m³/(h•m)] [1]	Nozzle ø mm
3 to 6 [10 to 20]	3
4 to 8 [15 to 30]	4
4 to 11 [25 to 40]	5
8 to 15 [30 to 55]	6
11 to 19.5 [40 to 70]	7
16.5 to 25 [60 to 90]	8

[1] Related to chilled beam length L_N

Tables 2 and 3 show preselected values for cooling and heating capacity; specific case layout subject to enquiry.

Table 2: Cooling capacity [$\Delta\vartheta_{W-R}$ = –10 K, $\Delta\vartheta_{Z-R}$ = –8 K]

Nom. length L_N mm	Nozzle ø mm	Primary air flow rate l/(s·m)	Primary air flow rate m³/(h·m)	Waterside cooling capacity W	Airside cooling capacity W	Total cooling capacity W	Specific total cooling capacity W/m
1,200	3	4.2	15.0	387	48	435	363
	4	6.3	22.5	436	73	509	424
	5	9.0	32.5	487	105	592	493
	6	11.9	42.5	506	137	643	536
	7	15.3	55.0	537	177	714	595
	8	19.4	70.0	565	226	791	659
	8	25.0	90.0	685	290	975	813
2,100	3	4.2	15.0	683	85	768	366
	4	6.3	22.5	777	127	904	430
	5	9.0	32.5	861	184	1,045	498
	6	11.9	42.5	903	240	1,143	544
	7	15.3	55.0	955	311	1,266	603
	8	19.4	70.0	1,008	395	1,403	668
	8	25.0	90.0	1,218	508	1,726	822
3,000	3	4.2	15.0	978	121	1,099	366
	4	6.3	22.5	1,118	181	1,299	433
	5	9.0	32.5	1,235	262	1,497	499
	6	11.9	42.5	1,300	343	1,643	548
	7	15.3	55.0	1,374	444	1,818	606
	8	19.4	70.0	1,451	565	2,016	672
	8	25.0	90.0	1,751	726	2,477	826

Table 3: Heating capacity [$\Delta\vartheta_{W-R}$ = 15 K, $\Delta\vartheta_{Z-R}$ = 0 K]

Nom. length L_N mm	Nozzle ø mm	Primary air flow rate l/(s·m)	Primary air flow rate m³/(h·m)	Total heating capacity W	Specific total heating capacity W/m
1,200	3	4.2	15.0	205	171
	4	6.3	22.5	238	198
	5	9.0	32.5	277	231
	6	11.9	42.5	291	243
	7	15.3	55.0	314	262
	8	19.4	70.0	340	283
	8	25.0	90.0	414	345
2,100	3	4.2	15.0	370	176
	4	6.3	22.5	429	204
	5	9.0	32.5	495	236
	6	11.9	42.5	522	249
	7	15.3	55.0	562	268
	8	19.4	70.0	605	288
	8	25.0	90.0	736	350
3,000	3	4.2	15.0	535	178
	4	6.3	22.5	619	206
	5	9.0	32.5	713	238
	6	11.9	42.5	754	251
	7	15.3	55.0	810	270
	8	19.4	70.0	871	290
	8	25.0	90.0	1,057	352

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Preventing temperature drop below dew point

The dew point temperature of the indoor air must always be lower than the surface temperature of the beam's supply pipe. This is a reliable way of preventing condensation. To enhance reliability, we recommend using dew point sensors. These shall be fitted at the coldest or most suitable points on the chilled water supply pipes. They serve to signal the start of local condensation at an early stage and trigger an increase in water supply temperature or a chilled water supply shutoff, for example.

If chilled beams operate in conjunction with a central air handling system, a sufficient dehumidification is usually ensured by the cooling coil and the dew point temperature stays below the recommended supply temperature.

We basically recommend using dew point sensors to monitor the dew point, especially if the building has openable windows.

For more details please read our publication DS 4076 e "Cooling ceiling system description".

Features

- Active chilled beam with primary air connection for supplying the requisite outdoor air flow rate for the occupants
- For placement parallel and/or perpendicular to the facade
- Compact unit with high capacity for cooling and heating
  - cooling capacity up to 826 W/m,
  - heating capacity up to 352 W/m
- Horizontal air discharge for low indoor air velocities in the occupied zone
- Suitable for flush ceiling installation or freely suspended
- Housing closed at sides and top
- Primary air connection positioned lengthwise or endwise
- Built-in reflow surface area for secondary air intake
- Heat exchanger easily accessible from room for cleaning
- Several screen design options available
- Thanks to low height well suited for low storeys in new or refurbished buildings

Active chilled beam DK-LIG/Z

Type code

DK – LIG/Z – ___ – ___ – ___

Chilled beam — Kind/Function — Heat exchanger — Length — Width

Kind/Function

LIG = Active chilled beam with ventilation function and induction device in closed housing

Z = 2-sided discharge

Heat exchanger

2 = two-pipe system

4 = four-pipe system

Length: 1,200, 1,500, 1,800, 2,100, 2,400, 2,700, 3,000 [mm]

Width: 600 mm

Tender text

.... units

Active chilled beam for cooling and heating indoor air with simultaneous fresh air supply (centrally conditioned primary air), particularly suitable for installation in closed suspended ceilings instead of a standard ceiling tile,

consisting of:

- a rectangular housing with primary air spigot,
- primary air nozzles in a row above each of the supply air shafts for horizontal air discharge,
- a perforated screen at the housing underside for reflow of indoor air (secondary air),
- a built-in air-to-water heat exchanger with horizontal copper pipes and aluminium fins,
- L-fasteners at the housing top side for fastening to ceiling.

Technical data

Specific waterside cooling capacity: (related to nominal length)	.... W/m
Chilled water supply temperature:	......................................°C
Chilled water return temperature:	......................................°C
Chilled water flow rate:	.... l/h
Waterside pressure drop:	.... Pa
Max. operating pressure:	standard 6 bars [1)]
Water quality:	mains water
Indoor air temperature:	......................................°C
Primary air temperature:	......................................°C
Primary air flow rate:	.... l/s [m³/h]
Airside cooling capacity:	.... W
Sound power level:	.... dB(A) ref-10¹²W
Pressure drop:	.... Pa

Dimensions / Type

Installation type:	☐ flush with ceiling (standard)
	☐ freely suspended (with wings)
Nominal length:	...... mm
Nominal width:	597 mm
Nominal height:	300 mm
Heat exchanger:	☐ two-pipe system (standard)
	☐ four-pipe system (optional)
Water connection:	☐ push-in fitting, ø 15 mm
	☐ pipe end for pressing, ø 15 mm
Connection spigot ø:	DN ....; .... pieces
Position of connection spigots	
	☐ left, Pos. ......
	☐ right, Pos. .....
	☐ endwise, Pos. 4
Screen for 2-sided discharge	
Perforation pattern:	standard Rv 8/9.6
	optional ....
	($A_0 \geq 63\%$ required)
Material:	galvanized sheet metal
	powder-coated or wet painted
Colour:	☐ to RAL 9010 (standard)
	☐ to RAL ....

Make: KRANTZ KOMPONENTEN

Type: DK – LIG/Z – ___ – ___ – ___

Subject to technical alterations.

[1)] Higher operating pressure on request

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Applied system solutions

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