GB1104
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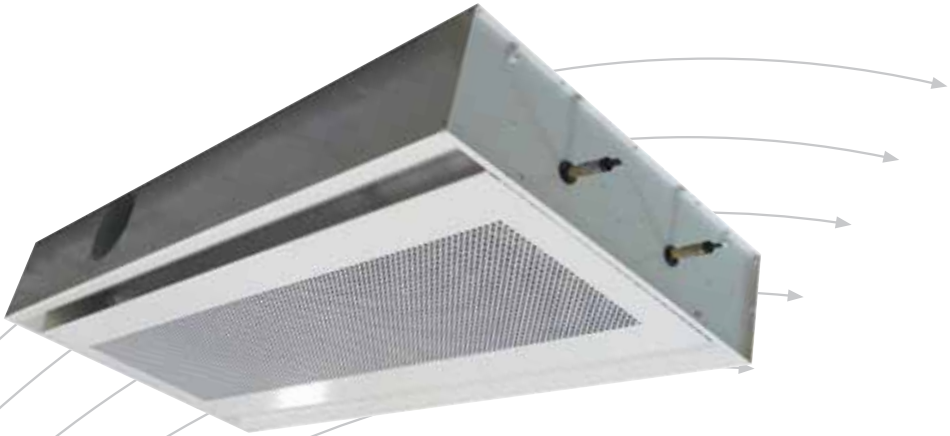
KBI

Active chilled beam



- Ceiling-integrated installation
- Low-profile design
- Available in 1.2 m to 3.6 m lengths
- Unidirectional or bidirectional air dispersion
- Coanda nozzles - set for optimum induction
- Jet Split (accessory)

TROX® TECHNIK

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KBI

APPLICATION

KBI is a hydronic cooling, heating and ventilation system for use in offices, shops, schools etc. The system is designed to provide excellent cooling effect, and a high induction level ensures a draft-free environment in the occupied zone. KBI is made for integration in a standard, 600mm module ceiling grid.

FUNCTION

Air is supplied via carefully adjusted Coanda nozzles which ensure that the air is dispersed along the ceiling in a fan-shaped flow pattern. This technique optimises the dispersion effect by providing a larger area for the supply air and indoor air to mix.
Such effective mixing of indoor air and supply air, i.e. induction, minimises the risk of draft in the occupied zone. KBI systems used for heating only, utilises the same technique for effective dispersion of heat along the ceiling. The secondary air is extracted through an opening on the unit's front-panel in order to avoid dirt accumulation on the ceiling (see fig. 1).

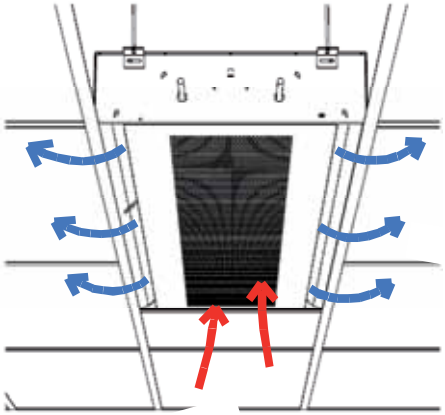

Fig. 1: Supply air and secondary air

QUICK SELECTION

Total cooling effect, P_{tot}, from the chilled beam can be calculated by adding the cooling effect of the primary air, P_p (diagram 1), to the cooling effect of the hydronic system, P_k (table 1).

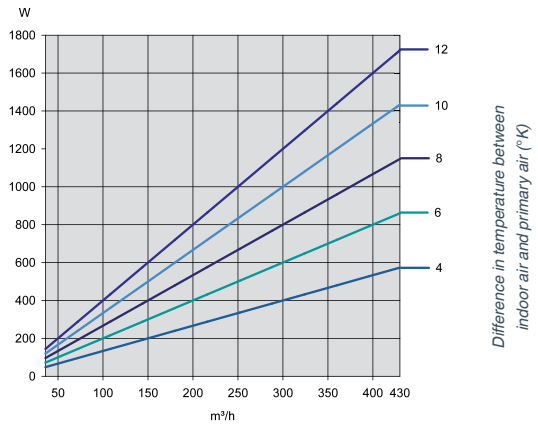

Diagram 1: Primary-air cooling effect

The quick selection tables show the cooling effect of the hydronic system at a difference in temperature between secondary air (indoor air) and water (medium temperature) of 7.5K/8.5K/9.5K and at a water supply of 0.06 l/s.
Sound level provided is A-weighted sound power level in the reverberation chamber at a room attenuation equivalent to 10 m^2 Sabine.

Technical data on acoustics and dimensions are available on pages 6-7.

KBI

KBI-1200															
Δt_K (K)		7,5				8,5				9,5				L_{PA}	L_{PA}
Air pressure (Pa)		60		90		60		90		60		90		[dB(A)]	[dB(A)]
Coil type		KB	HBK	KB	HBK	KB	HBK	KB	HBK	KB	HBK	KB	HBK	60Pa	90 Pa
Air supply (m³/h)	36	242	252	-	-	274	285	-	-	307	319	-	-	≤25	-
	54	288	328	310	353	327	372	352	400	365	415	393	447	≤25	26
	72	317	383	341	413	359	434	387	467	402	486	433	523	26	28
	90	337	422	355	453	383	478	403	513	428	534	450	574	27	30
	108	356	427	371	480	407	517	427	554	455	577	478	619	≤25	32

KBI-1800															
Δt_K (K)		7,5				8,5				9,5				L_{PA}	L_{PA}
Air pressure (Pa)		60		90		60		90		60		90		[dB(A)]	[dB(A)]
Coil type		KB	HBK	KB	HBK	KB	HBK	KB	HBK	KB	HBK	KB	HBK	60Pa	90 Pa
Air supply (m³/h)	72	487	541	537	596	553	613	609	676	617	685	680	755	≤25	<25
	90	501	583	551	641	568	661	625	727	635	739	698	813	≤25	<25
	108	521	629	569	688	590	713	645	780	660	797	721	871	≤25	<25
	126	507	657	542	709	598	745	644	803	668	833	720	898	<25	28
	144	542	693	583	746	614	785	661	845	686	878	739	945	≤25	30

KBI-2400															
Δt_K (K)		7,5				8,5				9,5				L_{PA}	L_{PA}
Air pressure (Pa)		60		90		60		90		60		90		[dB(A)]	[dB(A)]
Coil type		KB	HBK	KB	HBK	KB	HBK	KB	HBK	KB	HBK	KB	HBK	60Pa	90 Pa
Air supply (m³/h)	72	575	638	-	-	650	721	-	-	727	807	-	-	≤25	-
	90	620	715	666	780	703	811	755	884	786	906	843	987	≤25	<25
	108	654	770	700	839	741	874	793	952	829	976	887	1063	≤25	<25
	126	677	820	739	909	767	929	838	1031	858	1038	936	1151	≤25	<25
	144	692	849	753	941	784	963	853	1066	876	1076	954	1192	26	26

KBI-3000															
Δt_K (K)		7,5				8,5				9,5				L_{PA}	L_{PA}
Air pressure (Pa)		60		90		60		90		60		90		[dB(A)]	[dB(A)]
Coil type		KB	HBK	KB	HBK	KB	HBK	KB	HBK	KB	HBK	KB	HBK	60Pa	90 Pa
Air supply (m³/h)	90	733	803	-	-	833	911	-	-	932	1018	-	-	≤25	-
	108	759	865	824	938	861	980	934	1064	962	1095	1044	1189	≤25	26
	126	791	930	855	1005	896	1054	969	1139	1002	1178	1083	1273	≤25	27
	144	813	981	871	1052	921	1113	987	1193	1029	1243	1103	1333	≤25	27
	162	838	1036	898	1110	949	1174	1017	1258	1061	1313	1136	1406	26	29

KBI-3600															
Δt_K (K)		7,5				8,5				9,5				L_{PA}	L_{PA}
Air pressure (Pa)		60		90		60		90		60		90		[dB(A)]	[dB(A)]
Coil type		KB	HBK	KB	HBK	KB	HBK	KB	HBK	KB	HBK	KB	HBK	60Pa	90 Pa
Air supply (m³/h)	108	811	879	-	-	919	993	-	-	1028	1115	-	-	≤25	-
	126	849	952	-	-	962	1079	-	-	1075	1206	-	-	≤25	-
	144	880	1016	959	1107	998	1152	1088	1255	1115	1287	1216	1402	≤25	<25
	162	907	1073	986	1166	1028	1216	1117	1321	1149	1360	1248	1477	≤25	<25
	180	930	1123	1023	1236	1053	1273	1159	1400	1177	1422	1296	1565	≤25	<25

Table 1: Quick selection, hydronic cooling effect

KBI

DESIGN

- Nozzle configuration for the chilled beam, i.e. desired air supply and pressure, is specified at time of order.
- KBI is delivered with integrated measuring point.
- The front panel, with integrated grille for secondary air, can be folded down for inspection and cleaning.
- KBI is available in installation lengths of 1200, 1800, 2400, 3000 and 3600 mm.
- Coil types: KB = cooling (standard), HKB = cooling (high-power) and VKB = cooling and heating (cooling effect as for KB)
- Dispersion options: 50/50 (bidirectional), 60/40, 80/20 or 100/0 (unidirectional)
- Connection to air: KBI installation lengths 1.2 m, 1.8 m and 2.4 m are equipped with spiro connection Ø125 mm (spigot dimension). KBI installation lengths 3.0 m and 3.6 m are equipped with 2 spiro connections. For positioning options, please see fig. 2 and under Order Code.
- Connection to water, cooling: Cu Ø15x1.0 mm. For positioning options, please see fig. 2 and 4 and under Order Code.
- Connection to water, heating: Cu Ø10x1.0 mm. For positioning options, please see fig. 3 and 4 and under Order Code.
- Available with Jet Split system (see fig. 3).

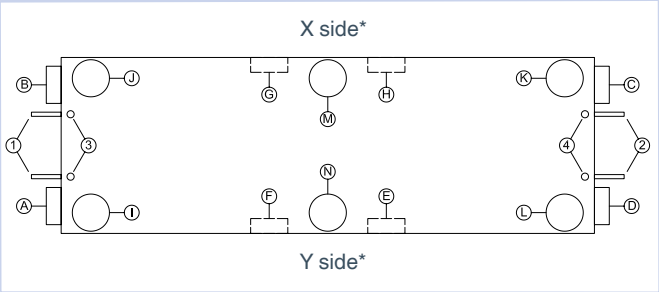

Fig. 2: Connection options for air and water
** See dispersion type*

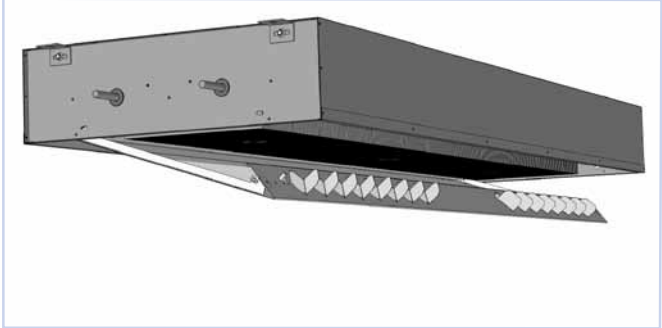

Fig. 3: Jet Split system for individual adjustment of air jets.

The following KBI designs are available on request:

- Blanked for future increase in air supply.
- Ultra-low profile = 146 mm with Ø100 spigot for supply up to approx. 20 l/s.
- Freely suspended (see separate data sheet for KBF chilled beam)
- Integrated room controller, temperature control unit. Pre-set and pre-connected from factory (see also under Accessories).
- Alternative front panels.
- Outlet connection pre-installed.

Please contact TROX Auranor for further information on the above designs.

MATERIALS AND SURFACE COATING

Casing in a galvanised, steel-plated finish. Delivered in a powdered enamel finish (white RAL 9010) as standard. Copper-tube coils with aluminium lamellae.

ACCESSORIES

- Control valv e: MMA FVR (see separate data sheet)
- Thermal setting: EasyTermo (see separate data sheet)
- Room controller: EasyTemp (see separate data sheet)
- Transformer: EasyTrafo 75 VA (see separate data sheet)
- Transformer: EasyTrafo 105 VA (see separate data sheet)

ORDER CODE

KBI - 1800 - KB - 30 - 50/50 - G - 3 / 0 - JS / 0

Product
Length: 1200, 1800, 2400, 3000 or 3600 mm
Coil type:
KB = cooling, standard design
HKB = cooling, high-capacity
VKB = cooling and heating
Nozzle configuration: :
10 - 50
Dispersion type X/Y [%]:
50/50 (standard design),
60/40, 70/30, 80/20, 90/10,100/0
Connection to air:
Lengths 1.2 m to 2.4 m: A to N
Lengths 3.0 m to 3.6 m: A to N,
(two connections), see fig. 2.
Connection to water:
1, 2, 3 or 4 (see fig. 2 and 4)
S = with damper DRS-K Ø125
JS = with Jet Split
SL = special finish, on request

DIMENSIONS AND WEIGHT

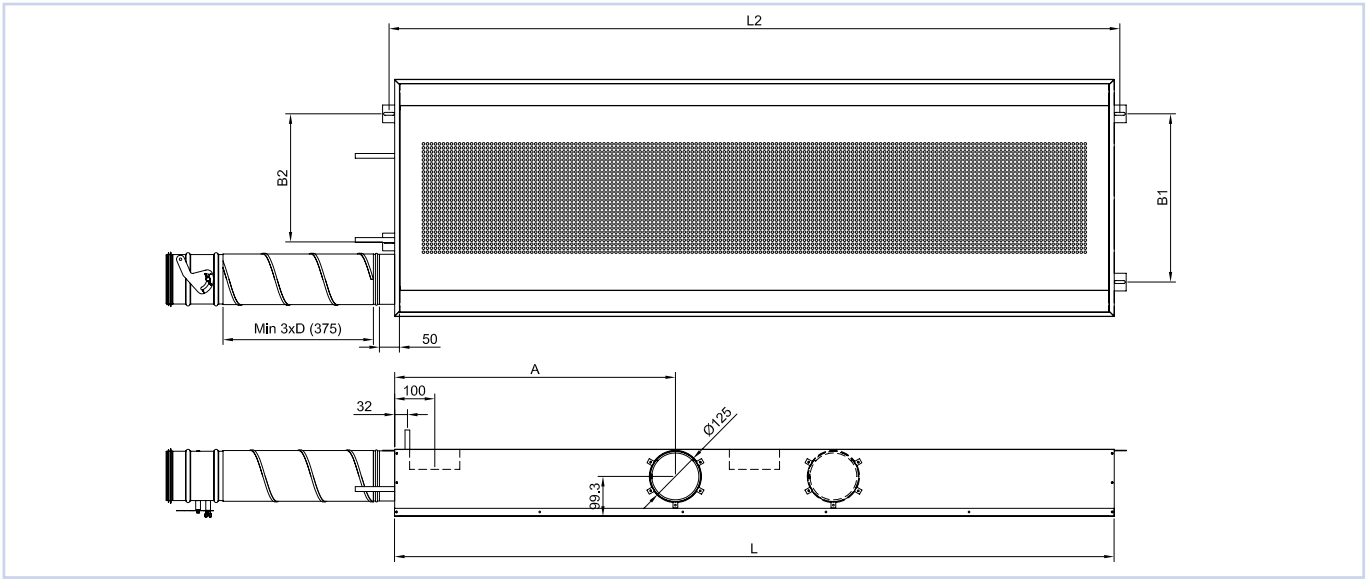

Fig. 4: Dimensions

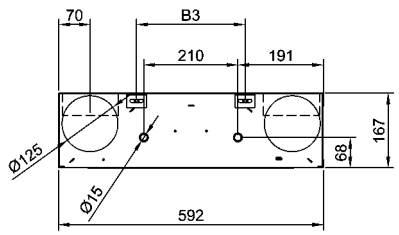

Fig. 5
KB cooling coil
(standard)

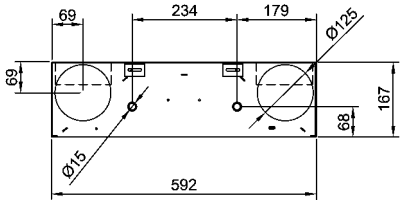

Fig. 6
HBK coil
(high-power)

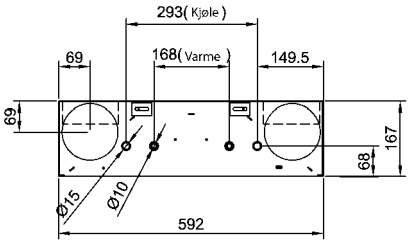

Fig. 7: VBK coil
(cooling and heating)

Mounting pitch (c/c)	B1 (mm)	B2 (mm)	B3 (mm)
Side connection	420		
Gable connection (L≤ 2,4)		320	
Gable connection (L> 2,4)			220

Table 2: C-C spacing, installation

Length (mm)	A (mm)	L (mm)	L2 (mm)	Weight(kg)
1200	400	1194	1222	22
1800	700	1794	1822	33
2400	1000	2394	2422	43
3000	1000	2994	3022	54
3600	1200	3594	3622	64

Table 3: Dimensions and weight (including water)

ACOUSTIC DATA

Approx. noise level generated by the chilled beam is shown in the diagrams below (values with safety margin). For accurate dimensioning, please use our product selection software Auracool available for download at our website: www.auranor.no

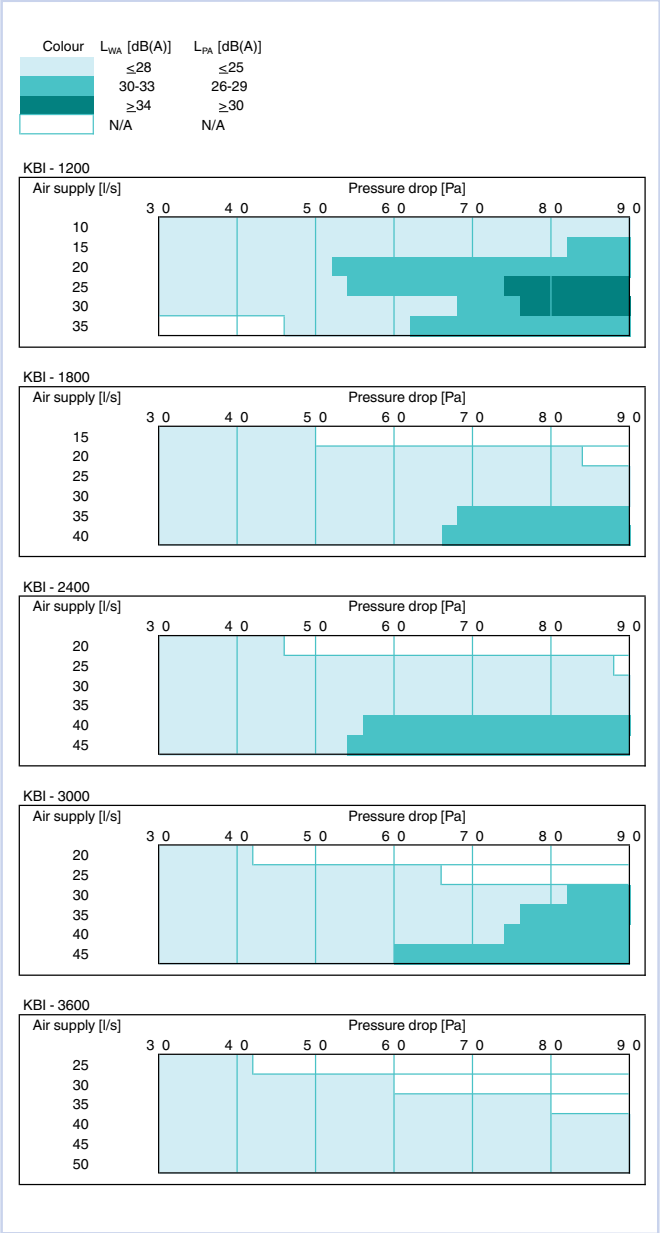

Diagram 2: KBI in standard design, with pressure and supply as well as sound power level and sound pressure level at 4 dB room attenuation.

Noise generated by DRS-K damper (accessory) is calculated as follows: Diagram 12 shows total decrease in pressure over the DRS-K damper as a function of air supply and duct velocity. The graphs represent A-weighted sound pressure level in the reverberation chamber at 10 m^2 Sabine room attenuation generated by the damper, reduced by end-reflection for open duct end.

When using the Auracool software, technical data for each chilled beam in a project are provided. This includes correction factors for calculation of sound power level at the respective frequencies for each chilled beam.

The acoustic data are displayed as sound pressure level at 10 m^2 Sabine in the reverberation chamber. Acoustic properties have been measured in a 200 m^3 reverberation room, and measurement methods utilised are ISO 5135 and ISO 7235 (for self-generated noise and attenuation).

CALCULATION DIAGRAMS

For accurate dimensioning, please use the Auracool software available for download at our website www.auranor.no.
The software enables selection of the optimum chilled beam for the prevailing conditions.
Among the factors calculated in Auracool are:

- Cooling effect
- Heating effect
- Sound pressure level
- Internal attenuation
- Pressure drop air/water
- Appropriate positioning

The following technical data can be used for quick selection and estimates. Unless otherwise stated, the KBI unit can be assumed to be of standard design.

Symbols:

q	= Air supply, primary air [l/s]
pt	= Total air pressure, Pa
tp	= Primary-air temperature, °C
ts	= Secondary-air temperature (indoor air), °C
ΔtL	= Difference in temperature between indoor air and primary air, K
Ptot	= Total cooling effect
Pp	= Cooling effect of primary air
Pk	= Cooling effect of water side, W
Pv	= Heating effect of water side, W
Δtk	= Difference in temperature between secondary air (indoor air) and water (medium temperature), cooling, K
Δtv	= Difference in temperature between secondary air (indoor air) and water (medium temperature), heating, K
qv	= Water supply [l/s]
Δpw	= Pressure drop water, kPa
twf	= Supply-water temperature, °C
twr	= Return-water temperature, °C
Δtw	= Difference in temperature between supply water and return water, K
LPA dB(A)	= Sound pressure level in room with 10 m2 absorption,
LWA	= Sound power level, dB(A)

Cooling effects have been measured in accordance with the Nordtest method NT VVS 078.

Cooling effect:
The primary air cooling effect Pp can be obtained from diagram 1 or calculated by using the formula:

$Pp \approx q \times 1.2 \times \Delta tL$

Total cooling effect P_{tot} is calculated by adding the hydronic cooling effect from the coil. Diagrams 3 to 7 show the cooling-effect gradient $P_k/\Delta_t k$ for the various chilled-beam lengths at a water supply of 0.06 l/s. Please see diagram 13 for correction in terms of water supply level. The cooling effect P_k is calculated by multiplying the gradient with the difference in temperature between secondary air (indoor air) and the medium temperature of the water Δt_k. In all diagrams, Δt_k is assumed to be below 6-12 K. Diagram 8 shows how the effect alters with changes in the water supply.

Example:
Chilled-beam length = 1800 mm
Air supply q = 40 l/s
Total air pressure pt = 60 Pa
Δt_k = 8.5 K
Primary-air temperature t_p = 18°C Indoor-air temperature = 24°C

According to diagram 4, the cooling-effect gradient $P_k/\Delta tk$ for standard coil = 73 W/K at a water supply of qv = 0,06 l/s. Cooling effect on the water side P_k can be calculated as follows: 73*8.5 = 620 W. The increase in water temperature can be calculated by using the formula $\Delta t_k = P_k / (qv*4200)$, i.e. 620 / (0.06*4200) = 2.5 K. Primary-air cooling effect is calculated as follows: $P_p \approx q \times 1.2 \times \Delta t_L = 40 \times 1.2 \times (24 - 18)$ = 289 W
Total cooling effect for the chilled beam:
$P_{tot} = P_p + P_k = 289 + 620 = 908$ W

Varmeffekt:
Kombibatteriets varmeeffekt beregnes som følger:
$P_v / \Delta t_v = 0,5 \times P_K/\Delta t_k$

Eksempel:
Ved en temperaturforskjell mellom rom og vann på 30 K, blir varmeeffekten for baffelen i eksempelet:
$P_v / \Delta t_v = 0,5 \times 620/8,5 = 36,5$ W/K x 30K = 1095 W

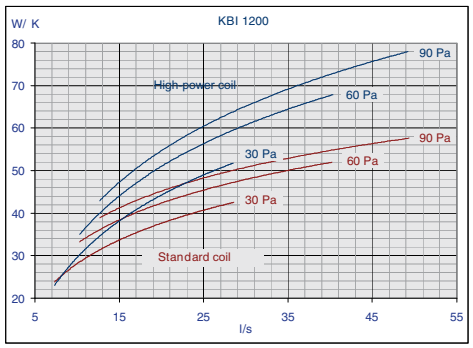

Diagram 3, KBI 1200
Cooling-effect gradient P_k /Δt for installation length 1200 mm

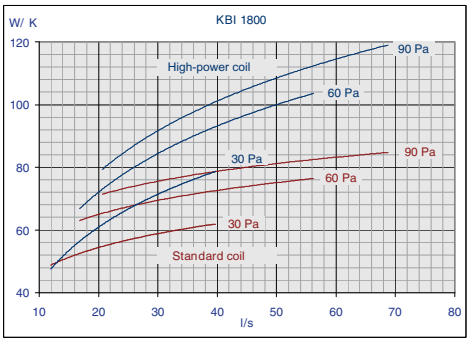

Diagram 4, KBI 1800
Cooling-effect gradient P_k /Δt for installation length 1800 mm

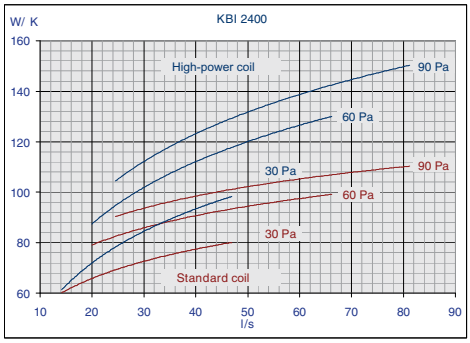

Diagram 5, KBI 2400
Cooling-effect gradient P_k /Δt for installation length 2400 m

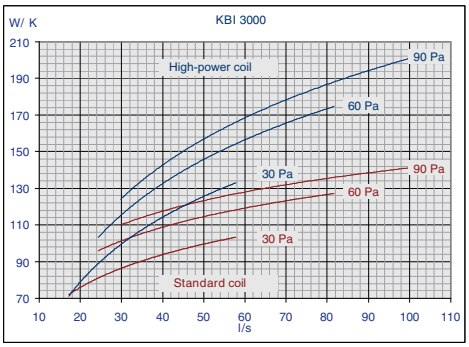

Diagram 6, KBI 3000
Cooling-effect gradient P_k /Δt for installation length 3000 mm

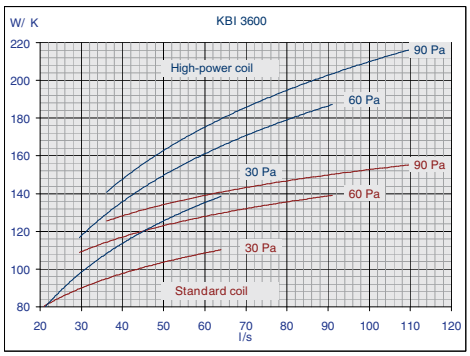

Diagram 7, KBI 3600
Cooling-effect gradient P_k /Δt for installation length 3600 mm

CORRECTION FACTOR

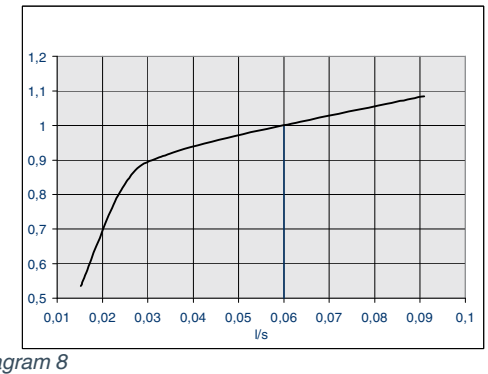

Diagram 8
Correction factor for cooling effect (relative nominal water supply 0.06 l/s)

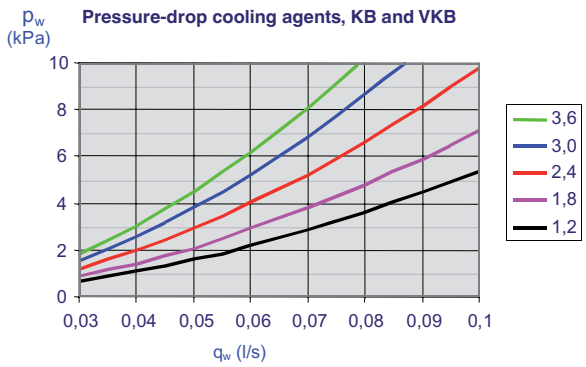

Diagram 9
Pressure-drop cooling agents (water) Δpw for standard coil KB and combined coil VKB

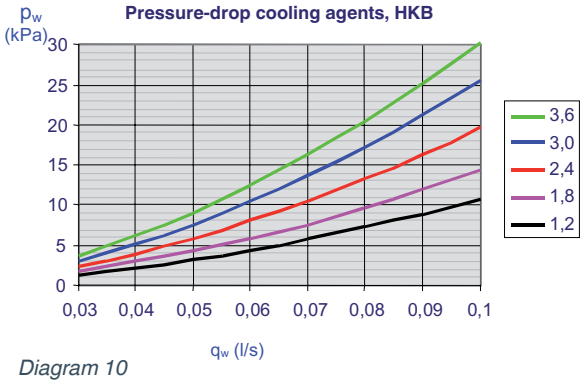

Diagram 10
Pressure-drop cooling agents (water) Δpw for high-power coil HKB

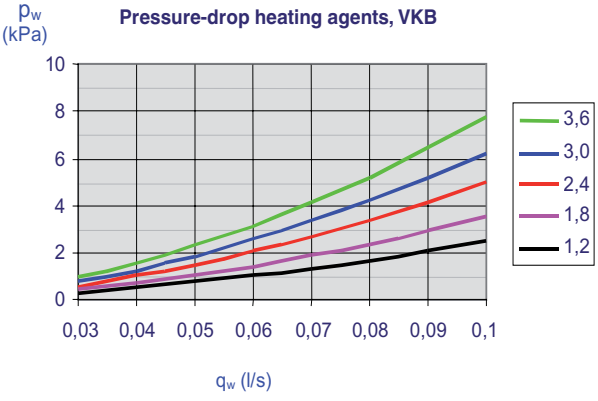

Diagram 11
Pressure-drop heating agents (water) Δp_w for combined coil VKB

TECHNICAL DATA FOR COMMISSIONING DAMPER DRS-K.

Diagram 12 shows total pressure drop over the damper alone as a function of air flow rate and duct velocity. The graphs represent A-weighted sound pressure level in the reverberation chamber at 10 m^2 Sabine room attenuation.

Table 4 provides the correction factor [KO] for conversion into sound power level for the DRS-K damper at the various frequency bands. Correction factors shown in the diagram are for open damper (right/lower line) and closed damper (left/upper line). Open is equivalent to a damper angle of approx. 25º. The correction factors for intermediate points are interpolated between these. Sound power level is calculated using the formula: $L_{WA} = L_{Pa} + KO$, where L_{Pa} is sound pressure level obtained from diagram 12.

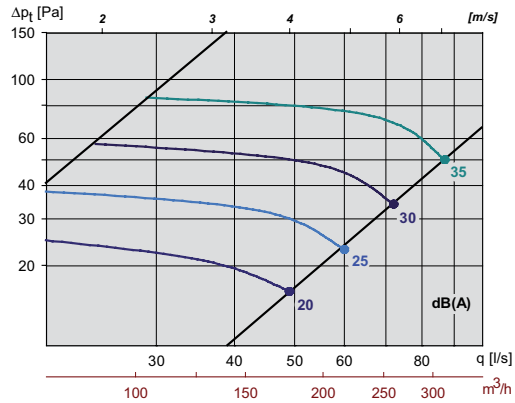

Diagram 12
Pressure drop and sound pressure level for commissioning damper DRS-K

Correction factor [KO], DRS-K

	Octave band (Hz)							
DRS-K	63	125	250	5e 00	1k	2k	4k	8k
Damper open	31	17	10	5	0	1	-10	-14
Damper closed	28	15	9	8	3	-6	-11	-15

Table 4: Correction factors for conversion to sound power level

KBI

THROW LENGTHS
Appropriate positioning in terms of throw lengths is calculated by using the product selection software Auracool available for download via our website www.auranor.no.

FLOW PATTERN

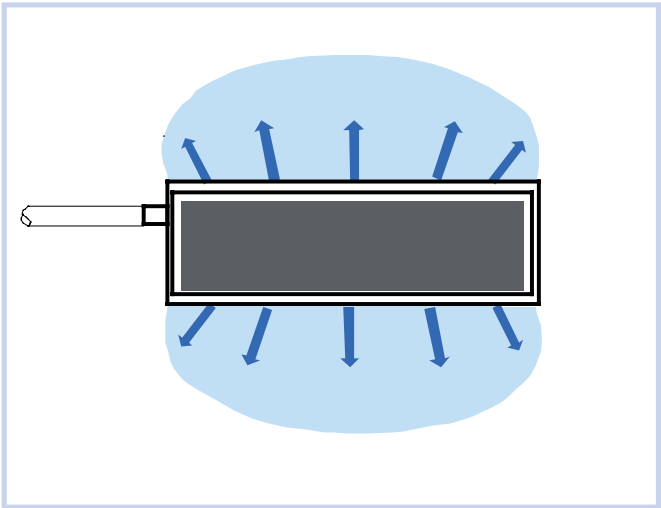

Fig. 8: Flow pattern (angled Coanda nozzles)

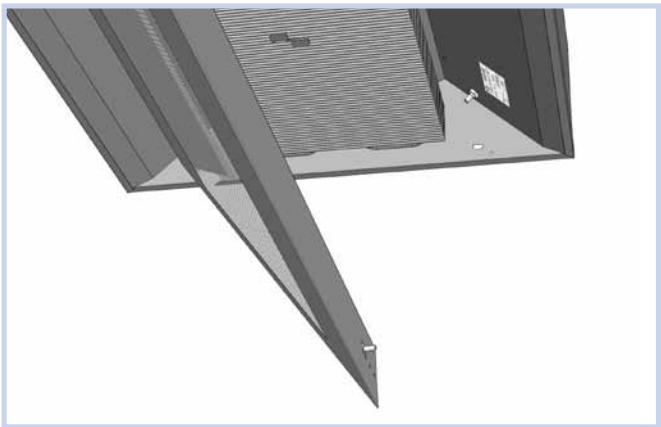

Fig. 9

INSTALLATION
KBI is delivered with 4 support brackets to be attached to the short ends of the chilled beam, and this will allow for +/- 10 mm adjustment in both directions horizontally as well as vertically by means of a threaded rod. Use of anchor or similar is recommended when mounting on a concrete base.

COMMISSIONING
The chilled beam features an integrated pressure outlet for commissioning of air flow rate, and this can be accessed by folding down the front panel and connecting up by means of nipple Ø6 by rear gable wall as shown in fig. 9.

MAINTENANCE
Full access to the coil is achieved by folding down the front panel as shown in fig. 9 - 11. Vacuuming and, if required, using a damp cloth to clean the unit is recommended.

ENVIRONMENT
Enquiries regarding product declaration can be directed to our sales team, or information can be found at our website: www.auranor.no

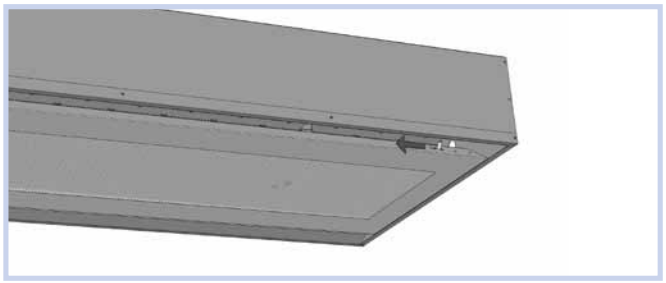

Fig. 10

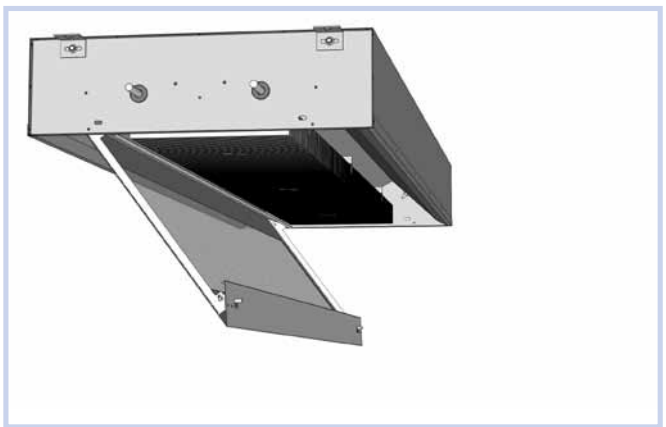

Fig. 11

KBI is developed and manufactured by:

The company reserves the right to make amendments without prior notice.

TROX® TECHNIK
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