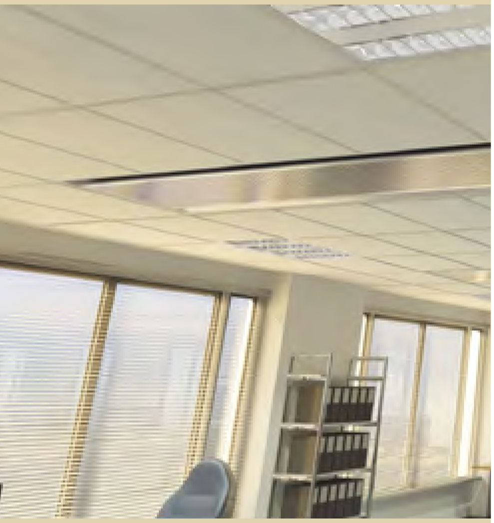
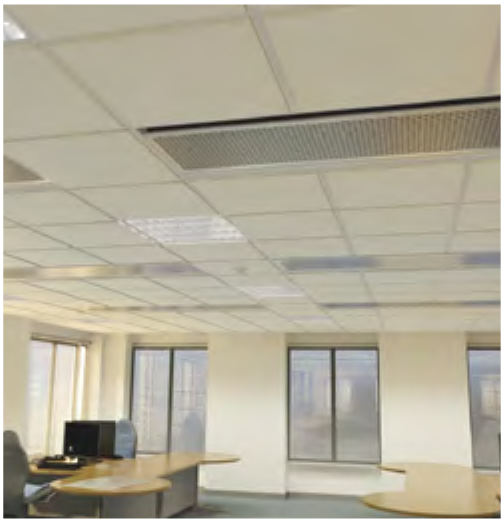
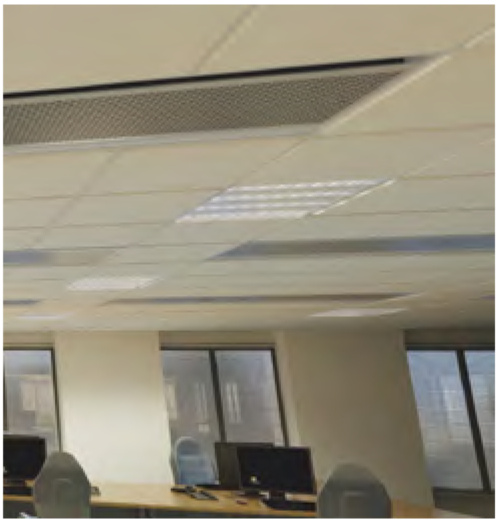
the future of space conditioning

Compact®

active chilled beam

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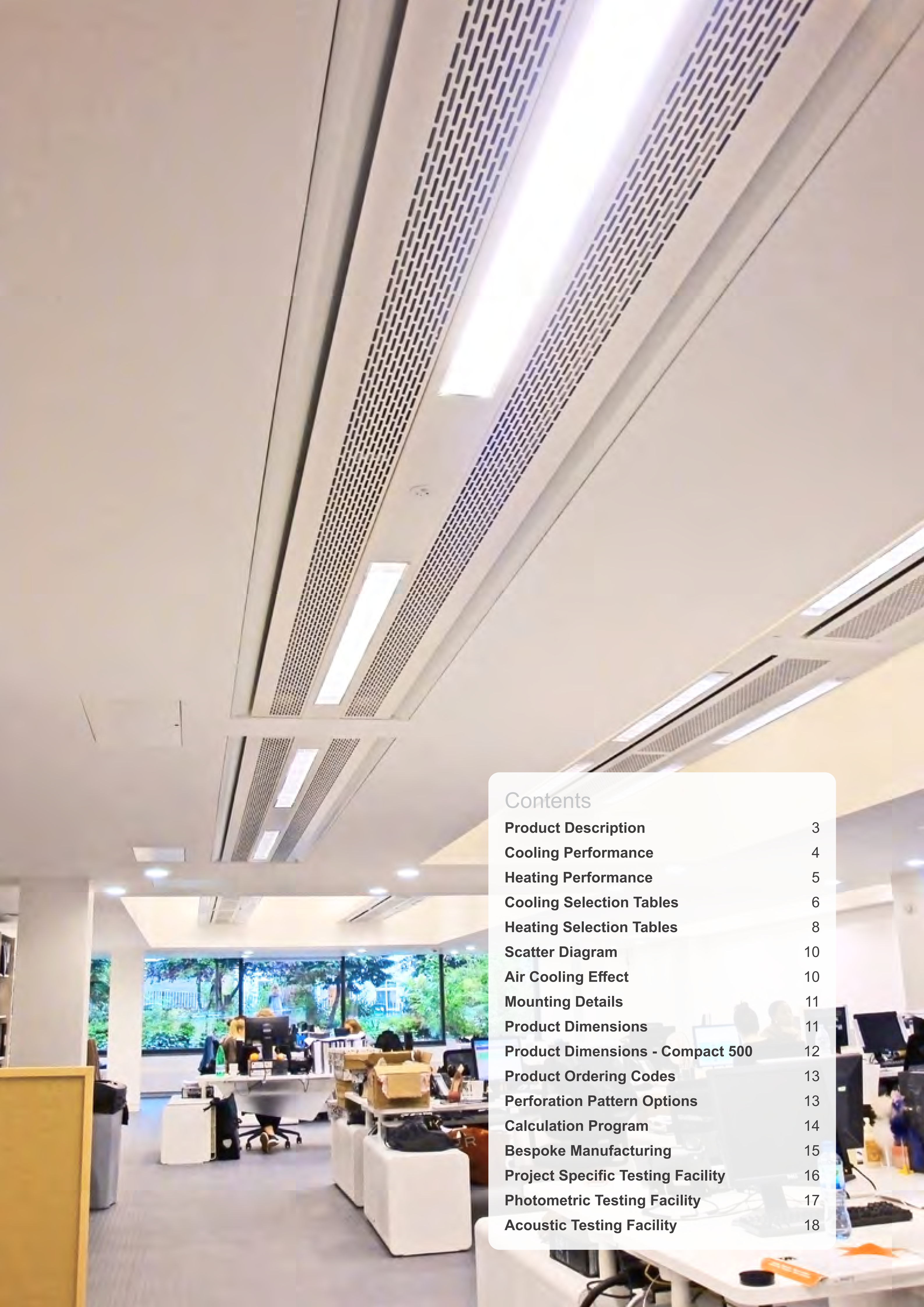
FRENGER® systems



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Product Description

Compact is one of Frenger's latest range of high performance Chilled Beams. Energy efficiency has been a key driver for such advancements in Frenger's Chilled Beam Technology.

Compact is only **133mm deep** and can achieve up to **1092 watts per meter total cooling** (based on 10∆tk and 26 ltrs/sec/m for a 1.8m long beam, supplied at 16°C with a 100Pa).

The Compact beam contains a number of **Frenger's patented performance enhancing features** and as can be expected from the Frenger brand, the Compact beam is designed to be easily tailored to suit the unique parameters of individual project sites, for the optimum product / system efficiencies. This is partly achieved by Frenger's "burst nozzle" arrangement that not only encourages induction, but also reduces noise. Given the size and amount of burst nozzles being appropriately quantified for each project, this provides consistent jet velocities, equal distribution of the air discharge and continuous induction through the heat exchanger (battery). There are no dead spots due to plugging back nozzles from a standard pitch or having to adjust the pressure in the system to suit the amount of open standard nozzle sizes as associated with many competitors' active beams as dead spots and / or reduced yet velocities decrease their cooling capacities / efficiencies.

Frenger's heat exchanger batteries are also fitted with extruded aluminium profiles to not only enhance performance but also provide a continuous clip on facility for the underplates. This arrangement keeps the underplates true and flat for long lengths, even up to 3.6m.

Compact beams all have a "closed back", this means that all induced air (recirculated room air) is induced through the underplate within the room space to avoid any need for perimeter flash gaps and / or openings in the ceiling system. This also provides for a better quality of recirculated air as the recirculated air does not mix with any air from the ceiling void. The induction ratio of Compact is typically 4-5 times that of the supply ait (fresh air) rate.

The Compact Chilled Beam outer casing is constructed from extruded aluminium and zintec pressed steel. The casing facilitates an aluminium burst nozzle strip (project specific) and a high performance heat exchange battery constructed from copper and aluminium. Beams are available in lengths from 0.6m up to 0.1m increments. Typically 0.6m wide (0.5m wide is also available).

In addition to Compact's high cooling performance capability of in excess of 1000 watts per meter, **Compact can operate well and induce at low air volumes, as little as 3 l/s/m and even with a low static pressure of just 40Pa. Likewise Compact can handle high air volumes up to 30 l/s/m and up to 120Pa.** Please note however that these high air volumes should be avoided wherever possible and are the absolute maxiumum and should not ever be exceeded. As a "rule of thumb" 25 ltrs/s/m from a 2 way discharge beam is the maximum for occupancy comfort compliance to BS EN 7730.

Compact can have integrated heating with separate connections (2 pipe connections for cooling and 2 pipes for heating).

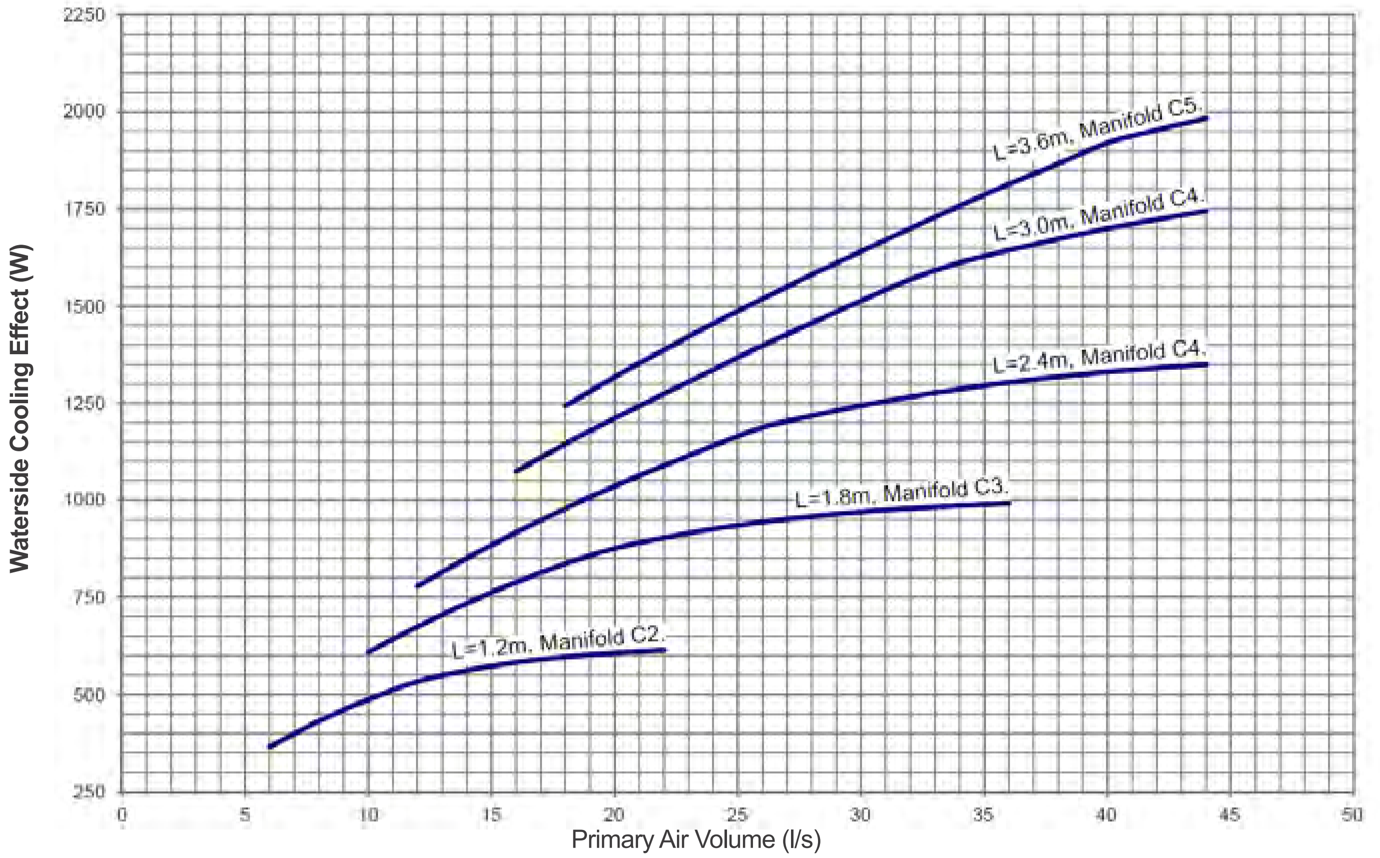
The maximum total supply of air for the product is limited to 50 ltrs/sec. If the total air volume is more that 50 ltrs/sec or if you require increased heating performance, refer to the Ultima active chilled beams by Frenger. Visually both units appear identical from the underside.

At a glance

- Shallow Depth **(only 133mm)**.
- High output **"1092 W/m".**
- Optimise discharge nozzle sizes and pitch factory set to best suit project requirements.
- Coanda effect is initiated within the beam.
- Smooth curved discharged slot as opposed to traditional faceted discharge slots for improves aesthetics.
- Discharge veins are concealed within the beam for improved aesthetics.
- **Fan shape distribution for increased occupancy comfort.**
- Unique fast fixing of removable underplates that prevents any sagging even on long beam lengths of 3.6m.
- Various different perforation patterns available for removable underplates.
- Multiple manifold variant to enable **reduced chilled** (and LTHW, if applicable) **water mass flow rates** to be facilitated for **increased energy efficiencies.**
- Operates well at **"Low Pressure"** and **"Low Air Volume" for increased energy efficiencies.**
- Provides indoor climate **in accordance with BS EN ISO 7730**.

Cooling Performance

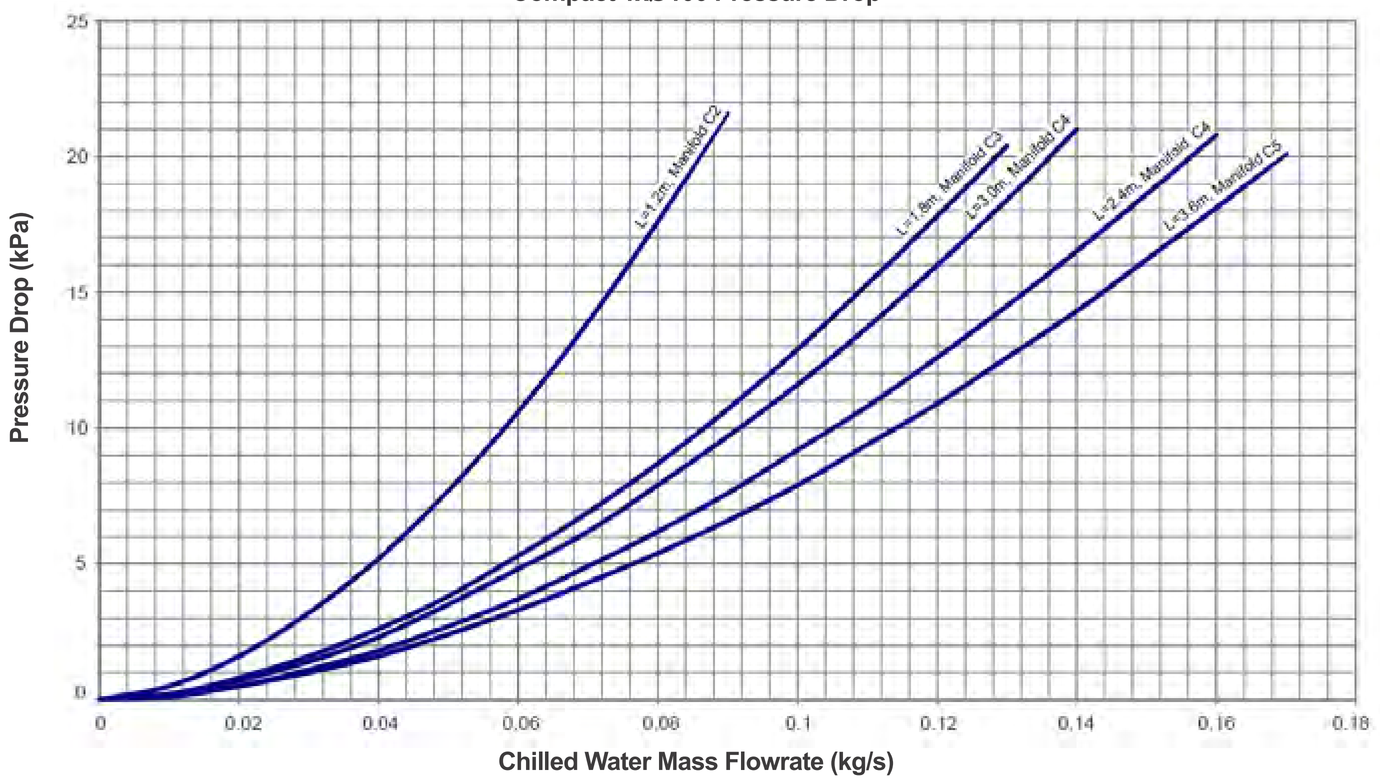
Compact 1xØ100 Waterside Cooling Effect at 9.0 dTK
(Primary Air = 80Pa, Chilled Water = 14/17°C, Room Condition = 24.5°C)



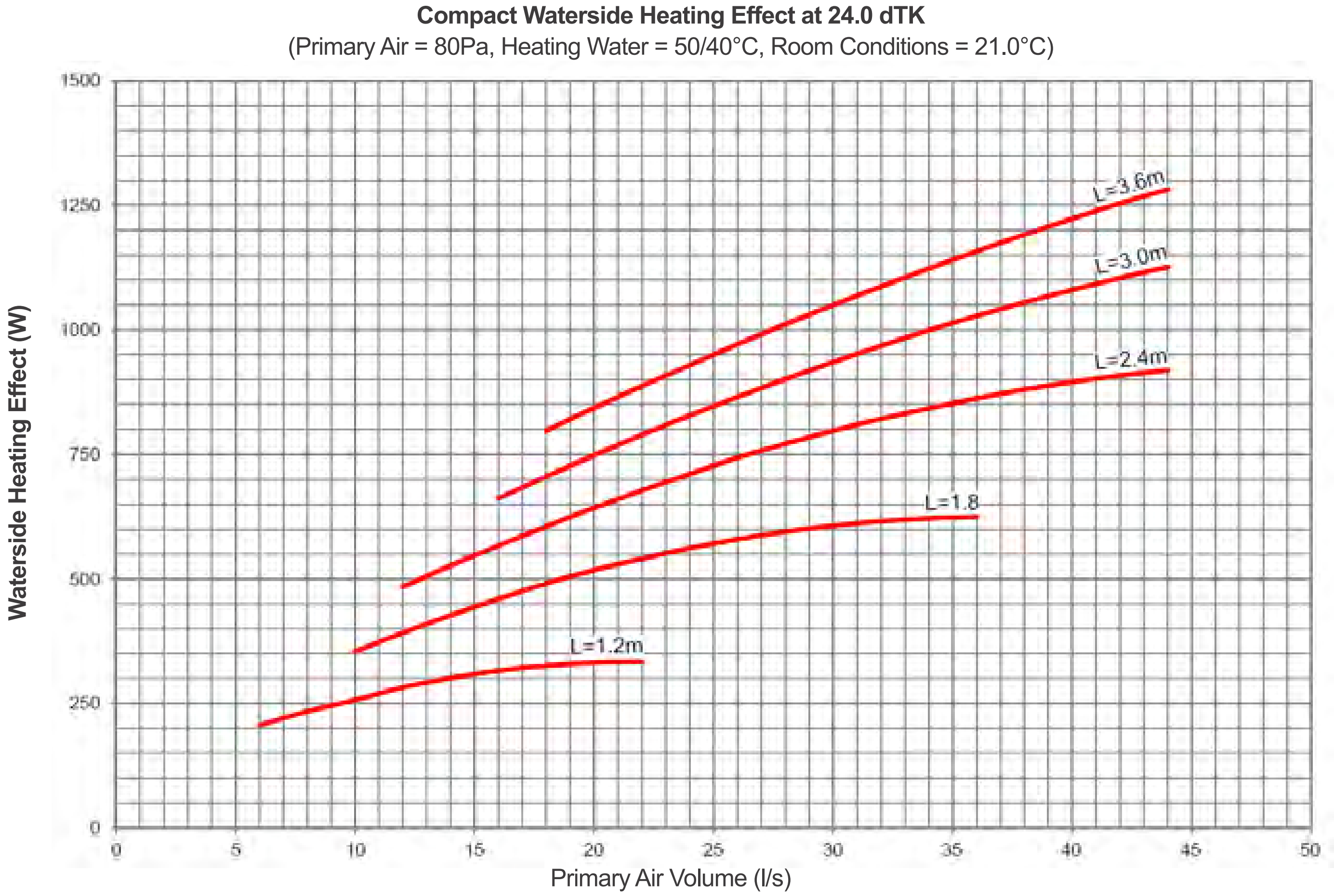
Cooling figures are based on cooling & heating beams, additional cooling is possible with a cooling only product - contact Frenger for more information.

Pressure Drop

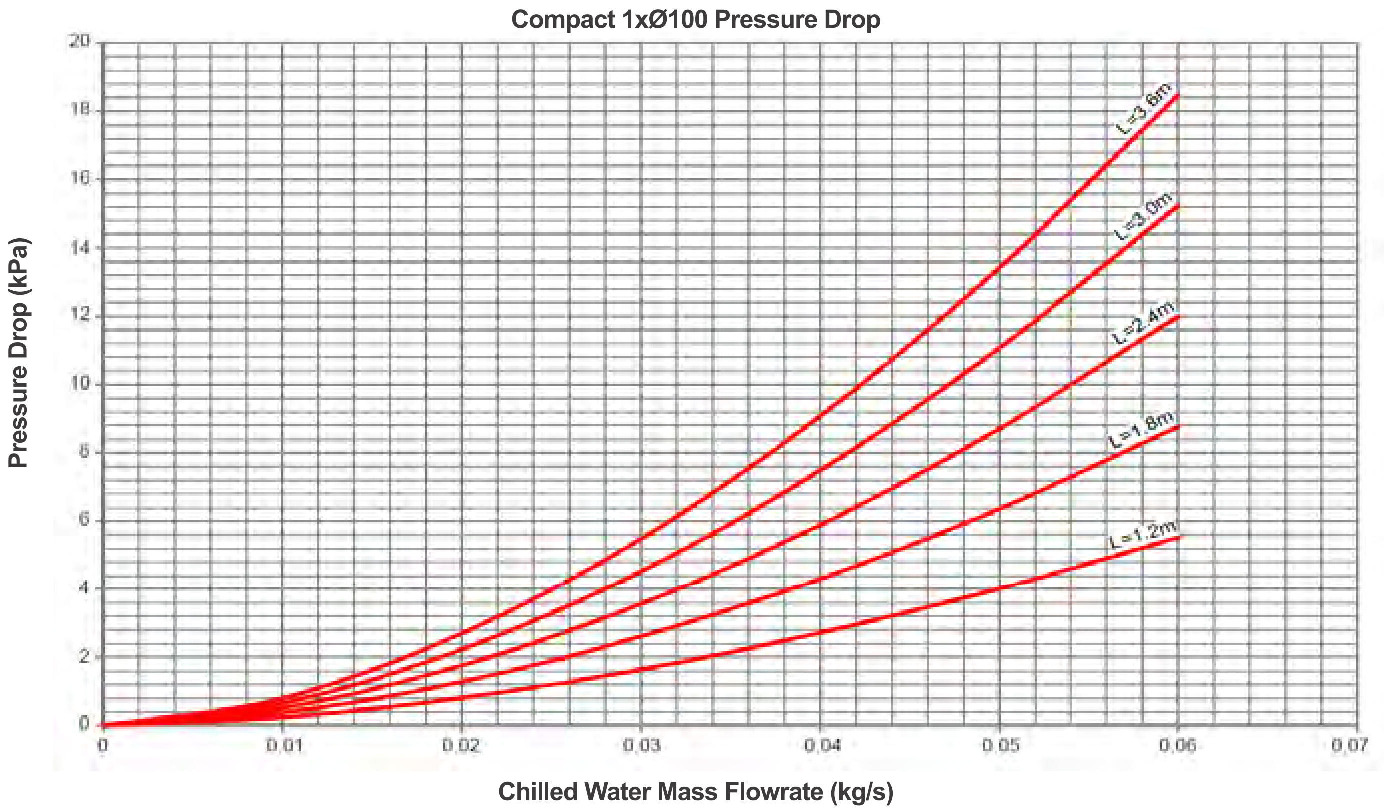
Compact 1xØ100 Pressure Drop



Heating Performance



Pressure Drop



Cooling Selection Tables

Cooling at 40Pa Nozzle Pressure

Nozzle Pressure 40 Pa		Water															
Q (l/s)	Compact	ΔtK - 7°C				ΔtK - 8°C				ΔtK - 9°C				ΔtK - 10°C			
	L (m)	P (w)	p(kg/s)	Manifold	p(kPa)	P (w)	p(kg/s)	Manifold	p(kPa)	P (w)	p(kg/s)	Manifold	p(kPa)	P (w)	p(kg/s)	Manifold	p(kPa)
	1.2	258	0.021	C2	1.5	268	0.016	C2	1.0	362	0.029	C2	2.6	414	0.033	C2	3.3
	1.8	402	0.032	C2	5.1	437	0.026	C2	3.6	538	0.043	C2	8.5	608	0.048	C2	10.5
10	2.4	478	0.038	C2	9.6	527	0.031	C2	6.9	639	0.051	C2	15.9	725	0.058	C2	19.7
	3.0	526	0.042	C2	14.5	582	0.035	C2	10.6	651	0.052	C3	6.7	734	0.058	C3	8.3
	3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	544	0.043	C2	8.3	590	0.035	C2	5.9	657	0.052	C2	14.1	828	0.066	C2	17.5
20	2.4	747	0.060	C2	19.4	798	0.048	C2	14.0	892	0.071	C3	8.9	1012	0.081	C3	11.0
	3.0	797	0.063	C3	9.3	877	0.052	C3	6.8	1082	0.086	C3	15.6	1253	0.100	C3	19.5
	3.6	899	0.072	C3	14.0	990	0.059	C3	10.2	1134	0.090	C4	11.1	1281	0.102	C4	13.7
	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	2.4	760	0.061	C3	6.5	913	0.055	C2	17.5	1022	0.081	C3	11.1	1151	0.092	C3	13.8
	3.0	963	0.077	C3	12.7	1053	0.063	C3	9.2	1210	0.096	C4	10.0	1372	0.109	C4	12.5
	3.6	1058	0.084	C4	9.7	1240	0.074	C3	14.8	1440	0.115	C4	16.2	1530	0.122	C5	10.5
	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	1037	0.083	C3	14.5	1146	0.068	C3	10.4	1314	0.105	C4	11.5	1479	0.118	C4	14.3
	3.6	1185	0.094	C4	11.6	1390	0.083	C3	17.9	1611	0.128	C4	19.5	1715	0.136	C5	12.7

Flow-adjusted waterside cooling effect table. Cooling circuit ∆t = 3°C (Water in-out), nozzle pressure of 40 Pa, 1 x Ø100 air connection.
For green values, a Ø22 manifold connection size is required.
Please refer to Frenger Technical Department for selections not covered within these tables.

Cooling at 60Pa Nozzle Pressure

Nozzle Pressure 60 Pa		Water															
Q (l/s)	Compact	ΔtK - 7°C				ΔtK - 8°C				ΔtK - 9°C				ΔtK - 10°C			
	L (m)	P (w)	p(kg/s)	Manifold	p(kPa)	P (w)	p(kg/s)	Manifold	p(kPa)	P (w)	p(kg/s)	Manifold	p(kPa)	P (w)	p(kg/s)	Manifold	p(kPa)
	1.2	289	0.023	C2	1.8	298	0.018	C2	1.2	406	0.032	C2	3.1	464	0.037	C2	3.9
	1.8	425	0.034	C2	5.5	460	0.027	C2	3.9	569	0.045	C2	9.3	641	0.051	C2	11.5
10	2.4	507	0.040	C2	10.6	560	0.033	C2	7.7	671	0.053	C2	17.4	709	0.056	C3	6.1
	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	627	0.050	C2	10.6	683	0.041	C2	7.5	846	0.067	C2	17.8	867	0.069	C3	6.0
20	2.4	727	0.058	C3	6.1	875	0.052	C2	16.3	978	0.078	C3	10.3	1109	0.088	C3	12.8
	3.0	847	0.067	C3	10.3	933	0.056	C3	7.5	1139	0.091	C3	17.2	1208	0.096	C4	10.2
	3.6	942	0.075	C3	15.2	1044	0.062	C3	11.2	1193	0.095	C4	12.1	1343	0.107	C4	15.0
	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	2.4	885	0.070	C3	8.5	959	0.057	C3	6.0	1186	0.094	C3	14.3	1343	0.107	C3	17.7
	3.0	1085	0.086	C3	15.4	1184	0.071	C3	11.1	1362	0.108	C4	12.2	1546	0.123	C4	15.1
	3.6	1152	0.092	C4	11.1	1350	0.081	C3	17.1	1565	0.125	C4	18.6	1666	0.133	C5	12.1
	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	2.4	949	0.076	C3	9.6	1034	0.062	C3	6.7	1256	0.100	C3	16.0	1412	0.112	C3	19.8
	3.0	1210	0.096	C3	18.8	1335	0.080	C3	13.6	1675	0.133	C4	14.9	1724	0.137	C4	18.4
	3.6	1352	0.108	C4	14.4	1478	0.088	C4	10.3	1728	0.138	C5	12.7	1960	0.156	C5	15.8

Flow-adjusted waterside cooling effect table. Cooling circuit ∆t = 3°C (Water in-out), nozzle pressure of 60 Pa, 1 x Ø100 air connection.
For green values, a Ø22 manifold connection size is required.
Please refer to Frenger Technical Department for selections not covered within these tables.

Cooling at 80Pa Nozzle Pressure

Nozzle Pressure 80 Pa		Water															
Q (l/s)	Compact	ΔtK - 7°C				ΔtK - 8°C				ΔtK - 9°C				ΔtK - 10°C			
	L (m)	P (w)	p(kg/s)	Manifold	p(kPa)	P (w)	p(kg/s)	Manifold	p(kPa)	P (w)	p(kg/s)	Manifold	p(kPa)	P (w)	p(kg/s)	Manifold	p(kPa)
10	1.2	311	0.025	C2	2.0	319	0.019	C2	1.3	440	0.035	C2	3.5	503	0.040	C2	4.5
	1.8	475	0.038	C2	6.7	517	0.031	C2	4.8	630	0.050	C2	11.2	706	0.056	C2	13.8
	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	376	0.030	C2	2.7	388	0.023	C2	1.8	526	0.042	C2	4.7	600	0.048	C2	6.0
	1.8	671	0.053	C2	11.9	731	0.044	C2	8.4	909	0.072	C2	20.0	928	0.074	C3	6.7
	2.4	793	0.063	C3	7.1	946	0.057	C2	18.8	1060	0.074	C3	11.9	1194	0.095	C3	14.7
	3.0	930	0.074	C3	12.2	1033	0.062	C3	8.9	1225	0.098	C3	20.0	1327	0.106	C4	12.0
	3.6	1038	0.083	C3	18.3	1169	0.070	C3	13.6	1326	0.106	C4	14.7	1482	0.118	C4	18.0
30	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	732	0.058	C2	13.7	799	0.048	C2	9.8	892	0.071	C3	6.2	1013	0.081	C3	7.8
	2.4	941	0.075	C3	9.4	1020	0.061	C3	6.6	1270	0.101	C3	15.8	1450	0.115	C3	19.7
	3.0	1168	0.093	C3	17.6	1283	0.077	C3	12.7	1472	0.117	C4	13.9	1665	0.132	C4	17.3
	3.6	1255	0.100	C4	12.9	1459	0.087	C3	19.7	1607	0.128	C5	11.3	1808	0.144	C5	14.1
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	999	0.080	C3	10.4	1086	0.065	C3	7.3	1357	0.108	C3	17.5	1423	0.113	C4	10.2
	3.0	1209	0.096	C4	9.7	1417	0.085	C3	15.0	1630	0.130	C4	16.4	1750	0.139	C5	10.6
	3.6	1457	0.116	C4	16.4	1596	0.095	C4	11.7	1863	0.148	C5	14.4	2110	0.168	C5	17.9

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 3°C (Water in-out), nozzle pressure of 80 Pa, 1 x Ø100 air connection.
For green values, a Ø22 manifold connection size is required.
Please refer to Frenger Technical Department for selections not covered within these tables.

Cooling at 100Pa Nozzle Pressure

Nozzle Pressure 100 Pa		Water															
Q (l/s)	Compact	ΔtK - 7°C				ΔtK - 8°C				ΔtK - 9°C				ΔtK - 10°C			
	L (m)	P (w)	p(kg/s)	Manifold	p(kPa)	P (w)	p(kg/s)	Manifold	p(kPa)	P (w)	p(kg/s)	Manifold	p(kPa)	P (w)	p(kg/s)	Mannfold	p(kPa)
10	1.2	333	0.027	C2	2.2	343	0.020	C2	1.5	469	0.037	C2	3.9	536	0.043	C2	4.9
	1.8	503	0.040	C2	7.4	548	0.033	C2	5.3	666	0.053	C2	12.3	746	0.059	C2	15.1
	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	415	0.033	C2	3.1	428	0.026	C2	2.1	580	0.048	C2	5.5	661	0.053	C2	7.0
	1.8	719	0.057	C2	13.3	786	0.047	C2	9.5	877	0.070	C3	6.0	997	0.079	C3	7.5
	2.4	840	0.067	C3	7.8	912	0.054	C3	5.5	1119	0.089	C3	13.1	1260	0.100	C3	16.2
	3.0	983	0.078	C3	13.4	1094	0.065	C3	9.8	1249	0.099	C4	10.7	1402	0.112	C4	13.2
	3.6	1068	0.085	C4	9.8	1237	0.074	C3	15.0	1403	0.112	C4	16.2	1570	0.125	C4	19.8
30	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	803	0.064	C2	16.0	877	0.052	C2	11.4	979	0.078	C3	7.2	1111	0.088	C3	9.0
	2.4	1017	0.081	C3	10.7	1104	0.066	C3	7.5	1372	0.109	C3	18.0	1449	0.115	C4	10.4
	3.0	1233	0.098	C3	19.3	1358	0.081	C3	14.0	1556	0.124	C4	15.3	1758	0.140	C4	19.0
	3.6	1326	0.106	C4	14.2	1465	0.087	C4	10.2	1698	0.135	C5	12.5	1910	0.152	C5	15.5
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	1094	0.087	C3	12.0	1191	0.071	C3	8.5	1375	0.109	C4	9.4	1559	0.124	C4	11.8
	3.0	1312	0.104	C4	11.0	1538	0.092	C3	17.1	1770	0.141	C4	18.8	1899	0.151	C5	12.1
	3.6	1546	0.123	C4	18.1	1698	0.101	C4	13.0	1976	0.157	C5	15.9	2236	0.178	C5	19.8

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 3°C (Water in-out), nozzle pressure of 100 Pa, 1 x Ø100 air connection.
For green values, a Ø22 manifold connection size is required.
Please refer to Frenger Technical Department for selections not covered within these tables.

Heating Selection Tables

Heating at 40Pa Nozzle Pressure

Nozzle Pressure 40 Pa		Water											
Q (l/s)	Compact	ΔtK - 20°C			ΔtK - 25°C			ΔtK - 30°C			ΔtK - 35°C		
	L (m)	P (w)	p(kg/s)	p(kPa)	P (w)	p(kg/s)	p(kPa)	P (w)	p(kg/s)	p(kPa)	P (w)	p(kg/s)	p(kPa)
10	1.2	236	0.012	0.3	278	0.012	0.3	326	0.012	0.3	372	0.012	0.3
	1.8	297	0.012	0.4	357	0.012	0.4	427	0.012	0.5	478	0.012	0.4
	2.4	348	0.012	0.6	427	0.012	0.7	490	0.012	0.6	586	0.014	0.9
	3.0	392	0.012	0.9	464	0.012	0.8	571	0.014	1.1	680	0.016	1.4
	3.6	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	383	0.012	0.5	457	0.012	0.4	563	0.013	0.6	682	0.016	0.8
	2.4	450	0.012	0.6	580	0.012	0.9	723	0.017	1.3	866	0.021	1.7
	3.0	523	0.013	1.0	682	0.012	1.5	843	0.020	2.1	1004	0.024	2.8
	3.6	590	0.014	1.5	767	0.012	2.3	943	0.023	3.2	1119	0.027	4.2
30	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	528	0.013	0.8	697	0.017	1.2	869	0.021	1.8	1040	0.025	2.3
	3.0	650	0.016	1.4	849	0.020	2.2	1048	0.025	3.1	1245	0.030	4.1
	3.6	743	0.018	2.2	964	0.023	3.4	1184	0.028	4.7	1402	0.034	6.2
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	729	0.017	1.7	952	0.023	2.7	1173	0.028	3.8	1390	0.033	5.0
	3.6	860	0.021	2.8	1112	0.027	4.4	1361	0.033	6.0	1605	0.038	7.9

Flow-adjusted waterside heating effect table. Heating circuit Δt = 10°C (Water in-out), nozzle pressure of 40 Pa, 1 x Ø100 air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.012 kg/s.

Heating at 60Pa Nozzle Pressure

Nozzle Pressure 60 Pa		Water											
Q (l/s)	Compact	ΔtK - 20°C			ΔtK - 25°C			ΔtK - 30°C			ΔtK - 35°C		
	L (m)	P (w)	p(kg/s)	p(kPa)	P (w)	p(kg/s)	p(kPa)	P (w)	p(kg/s)	p(kPa)	P (w)	p(kg/s)	p(kPa)
10	1.2	242	0.012	0.3	297	0.012	0.3	342	0.012	0.3	391	0.012	0.3
	1.8	314	0.012	0.5	374	0.012	0.5	444	0.012	0.5	506	0.012	0.5
	2.4	363	0.012	0.6	445	0.012	0.7	522	0.013	0.7	626	0.015	1.0
	3.0	-	-	-	-	-	-	-	-	-	-	-	-
	3.6	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	417	0.012	0.6	481	0.012	0.5	605	0.014	0.7	731	0.017	0.9
	2.4	469	0.012	0.6	616	0.015	1.0	767	0.018	1.4	918	0.022	1.9
	3.0	554	0.013	1.1	723	0.017	1.7	893	0.021	2.4	1063	0.025	3.1
	3.6	629	0.015	1.6	815	0.020	2.5	1002	0.024	3.5	1188	0.028	4.7
30	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	569	0.014	0.9	751	0.018	1.4	934	0.022	2.0	1116	0.027	2.7
	3.0	692	0.017	1.6	902	0.022	2.5	1112	0.027	3.5	1319	0.032	4.6
	3.6	789	0.019	2.4	1021	0.024	3.7	1251	0.030	5.2	1478	0.035	6.8
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	613	0.015	1.0	811	0.019	1.6	1010	0.024	2.3	1207	0.029	3.0
	3.0	787	0.019	2.0	1025	0.025	3.1	1261	0.030	4.3	1493	0.036	5.7
	3.6	917	0.022	3.2	1183	0.028	4.8	1445	0.035	6.7	1703	0.041	8.7

Flow-adjusted waterside heating effect table. Heating circuit Δt = 10°C (Water in-out), nozzle pressure of 60 Pa, 1 x Ø100 air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.012 kg/s.

Heating at 80Pa Nozzle Pressure

Nozzle Pressure 80 Pa		Water											
Q (l/s)	Compact	ΔtK - 20°C			ΔtK - 25°C			ΔtK - 30°C			ΔtK - 35°C		
	L (m)	P (w)	p(kg/s)	p(kPa)	P (w)	p(kg/s)	p(kPa)	P (w)	p(kg/s)	p(kPa)	P (w)	p(kg/s)	p(kPa)
10	1.2	255	0.012	0.3	315	0.012	0.3	352	0.012	0.3	418	0.012	0.3
	1.8	332	0.012	0.5	391	0.012	0.5	451	0.012	0.4	535	0.013	0.5
	2.4	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	-	-	-	-	-	-	-	-	-	-	-	-
	3.6	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	294	0.012	0.3	352	0.012	0.3	431	0.012	0.3	476	0.012	0.3
	1.8	431	0.012	0.5	514	0.012	0.5	646	0.015	0.7	780	0.019	1.0
	2.4	497	0.012	0.7	653	0.016	1.1	811	0.019	1.6	970	0.023	2.1
	3.0	586	0.014	1.2	765	0.018	1.8	944	0.023	2.6	1122	0.027	3.4
	3.6	666	0.016	1.8	865	0.021	2.8	1062	0.025	3.9	1257	0.030	5.1
30	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	450	0.012	0.4	591	0.014	0.7	749	0.018	1.0	908	0.022	1.3
	2.4	611	0.015	1.0	804	0.019	1.6	999	0.024	2.2	1193	0.029	3.0
	3.0	735	0.018	1.8	956	0.023	2.7	1175	0.028	3.8	1392	0.033	5.0
	3.6	834	0.020	2.7	1077	0.026	4.1	1317	0.032	5.7	1553	0.037	7.4
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	677	0.016	1.2	896	0.021	1.9	1115	0.027	2.7	1331	0.032	3.6
	3.0	846	0.020	2.3	1099	0.026	3.5	1350	0.032	4.9	1597	0.038	6.4
	3.6	974	0.023	3.5	1254	0.030	5.4	1529	0.037	7.4	1803	0.043	9.6

Flow-adjusted waterside heating effect table. Heating circuit Δt = 10°C (Water in-out), nozzle pressure of 80 Pa, 1 x Ø100 air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.012 kg/s.

Heating at 100Pa Nozzle Pressure

Nozzle Pressure 100 Pa		Water											
Q (l/s)	Compact	ΔtK - 20°C			ΔtK - 25°C			ΔtK - 30°C			ΔtK - 35°C		
	L (m)	P (w)	p(kg/s)	p(kPa)	P (w)	p(kg/s)	p(kPa)	P (w)	p(kg/s)	p(kPa)	P (w)	p(kg/s)	p(kPa)
10	1.2	256	0.012	0.3	309	0.012	0.3	360	0.012	0.3	423	0.012	0.3
	1.8	339	0.012	0.6	397	0.012	0.5	461	0.012	0.4	546	0.013	0.5
	2.4	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	-	-	-	-	-	-	-	-	-	-	-	-
	3.6	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	319	0.012	0.3	377	0.012	0.3	449	0.012	0.3	515	0.012	0.3
	1.8	438	0.012	0.5	531	0.013	0.5	664	0.016	0.8	800	0.019	1.1
	2.4	507	0.012	0.7	665	0.016	1.1	826	0.020	1.6	987	0.024	2.1
	3.0	597	0.014	1.2	780	0.019	1.9	963	0.023	2.7	1145	0.027	3.6
	3.6	682	0.016	1.9	885	0.021	2.9	1089	0.026	4.1	1289	0.031	5.4
30	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	470	0.012	0.5	628	0.015	0.7	791	0.019	1.1	955	0.023	1.4
	2.4	631	0.015	1.1	827	0.020	1.7	1024	0.025	2.3	1219	0.029	3.1
	3.0	749	0.018	1.8	973	0.023	2.8	1195	0.029	3.9	1415	0.034	5.2
	3.6	849	0.020	2.8	1096	0.026	4.2	1340	0.032	5.9	1580	0.038	7.7
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	713	0.017	1.3	938	0.022	2.1	1161	0.028	2.9	1382	0.033	3.9
	3.0	870	0.021	2.4	1126	0.027	3.6	1379	0.033	5.1	1628	0.039	6.6
	3.6	992	0.024	3.7	1275	0.031	5.5	1553	0.037	7.6	1829	0.044	9.9

Flow-adjusted waterside heating effect table. Heating circuit Δt = 10°C (Water in-out), nozzle pressure of 100 Pa, 1 x Ø100 air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.012 kg/s.

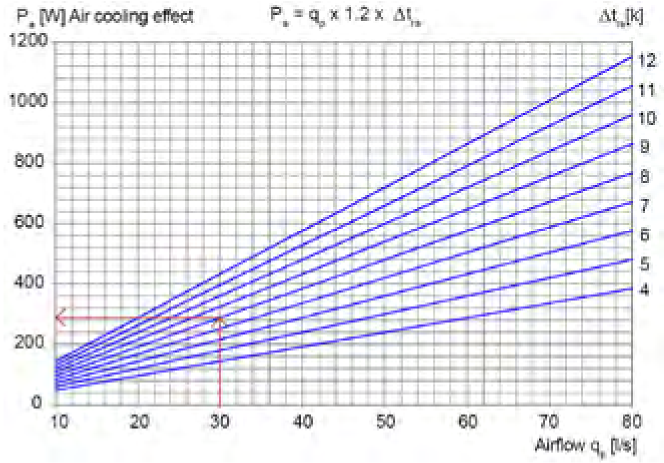
Air Cooling Effect

Cooling effect supplied in the ventilation air [W]

1. Start by calculating the required cooling effect that has to be supplied to the room in order to provide a certain temperature.
2. Calculate any cooling effect that is provided by the ventilation air.
3. The remaining cooling effect has to be supplied by the beam.

Formula for air cooling effect: $P = m \times Cp \times \Delta t$
Where:
m = mass flow [kg/s]
Cp = specific heat capacity [J/(kg-K)]
qp = air flow [l/s]
Δt = the difference between the temperature of the room and the temperature of the supply air [K]

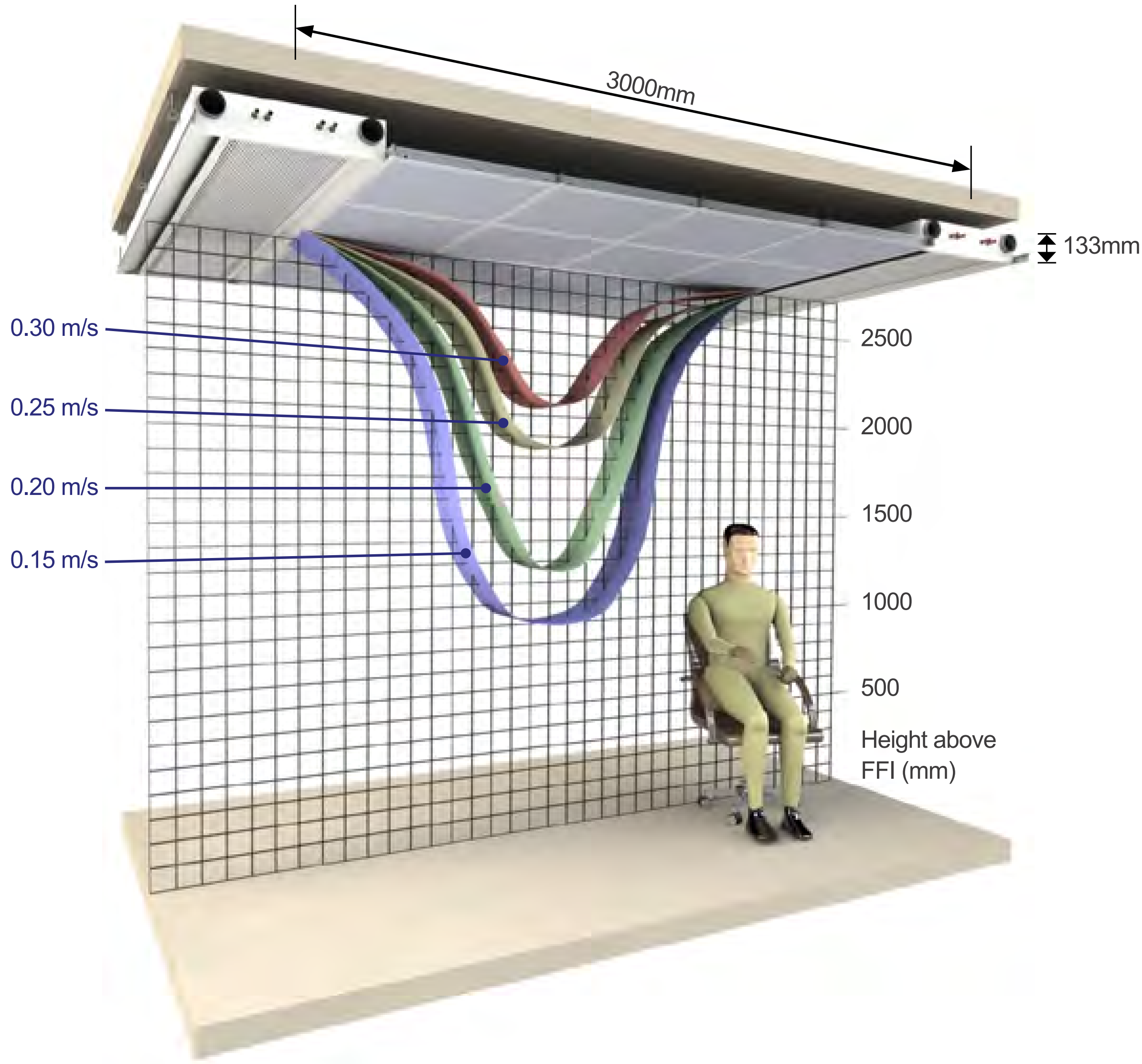
It is usually $m \times Cp \approx qp \times 1.2$



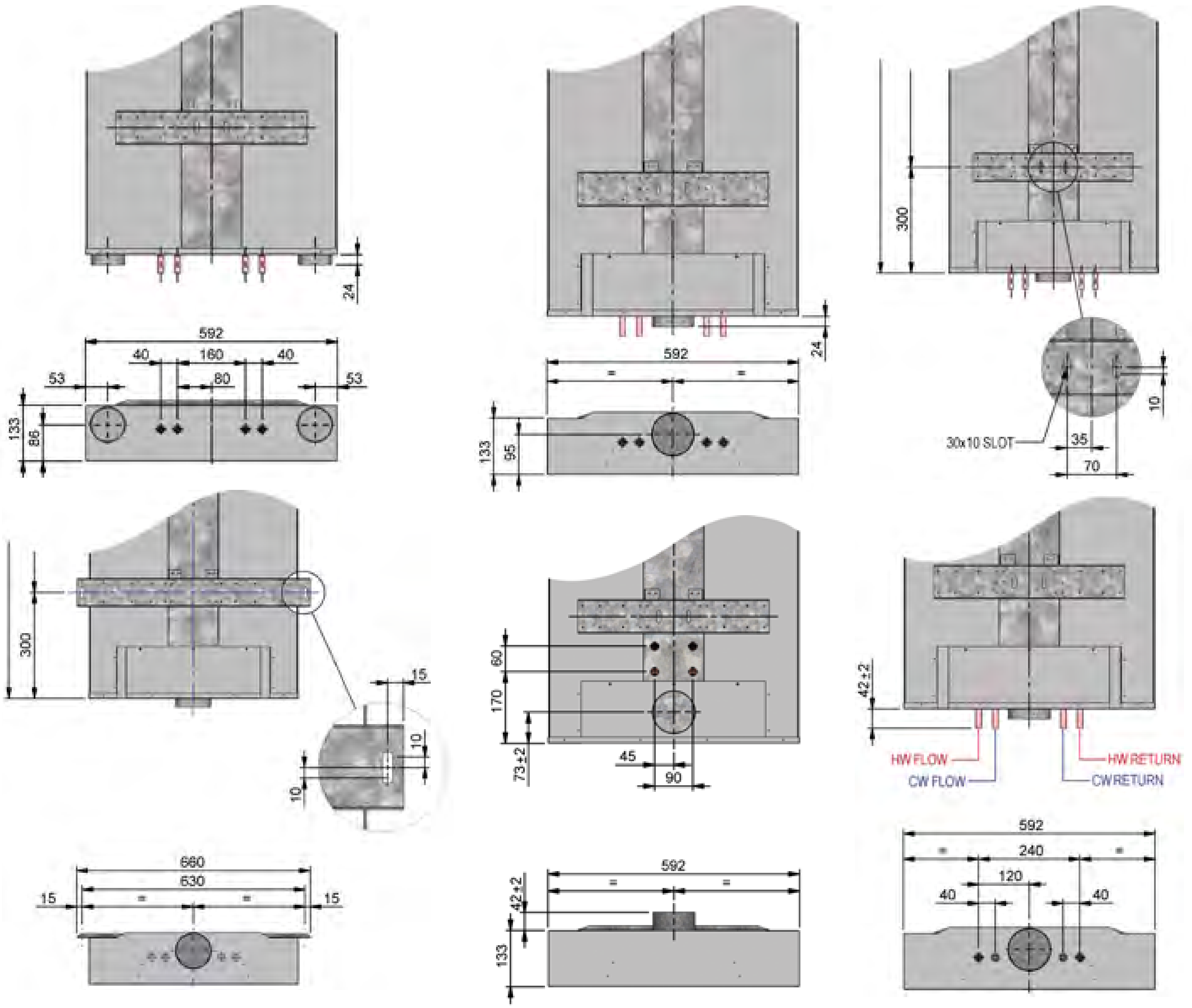
Air cooling effect as a function of airflow. For example, if the air flow is 30 l/s and the under-temperature of the supply air is Δt_{ra} = 8k, the cooling effect from the graph is 290W.

Scatter Diagram

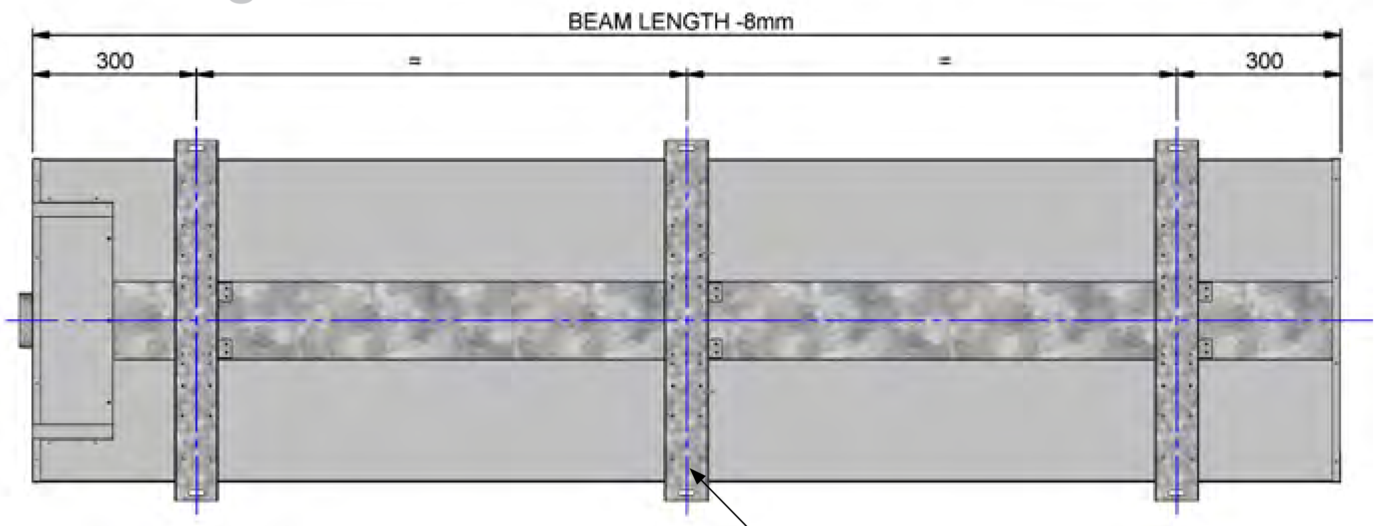
Fresh Air Volume 22 l/s / Active m @ 80 Pa



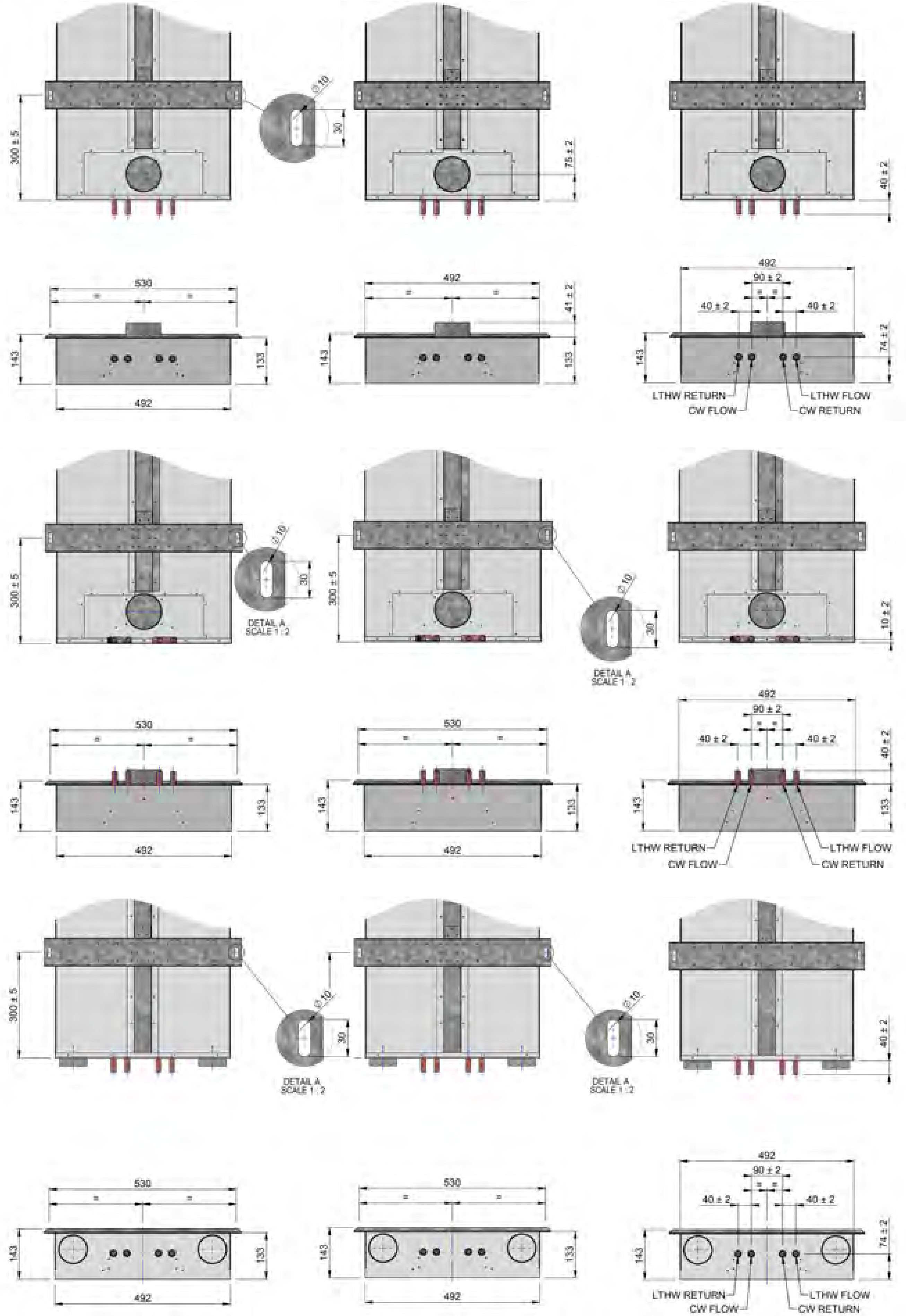
Product Dimensions



Mounting Details

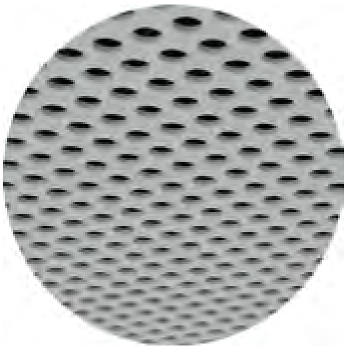


Note: Beam lengths less than or equal
to 1.8m have no central support bracket.


300 ± 5
Ø 10
30
75 ± 2
40 ± 2
530
492
41 ± 2
90 ± 2
40 ± 2
74 ± 2
143
133
LTHW RETURN
CW FLOW
LTHW FLOW
CW RETURN
DETAIL A
SCALE 1 : 2
10 ± 2

Perforation Pattern Options

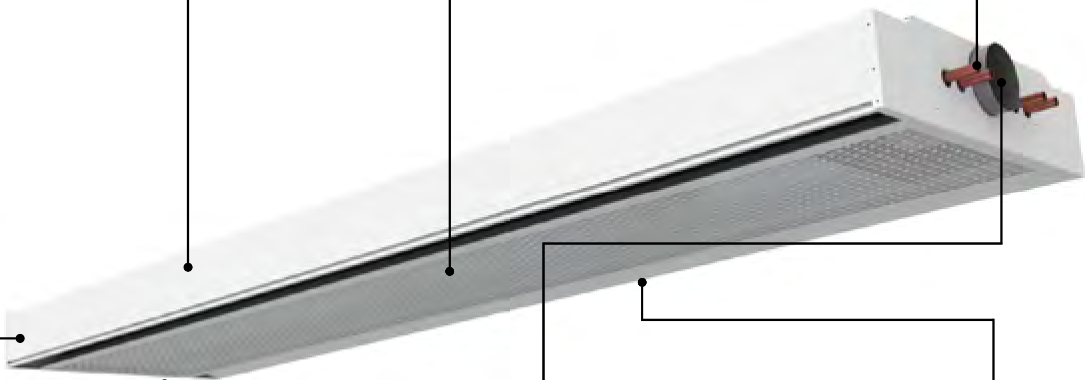
Slot Perforation
45% Free Area



Dot Perforation
33% Free Area

Double Dot Perforation
50% Free Area

Product Ordering Codes



1. Beam Type
- **CO** - Compact
- **CO5** - Compact 500

2. Function
- **CO** - Ceiling Int. Cooling Only
- **CH** - Ceiling Int. Cooling & Heating
- **MO** - Multiservice Cooling Only
- **MH** - Multiservice Cooling & Heating

3. Nominal Beam Length (mm)

4. Underplate
- **7D** - 7Ø & 4Ø Double Dot / 50% Free Area
- **4D** - 4Ø Dot / 33% Free Area
- **5S** - 5 X 35 Slot / 45% Free Area

5. Airside Connection

1 x 100 H
- Air Connection Qty
- Orientation - H: Horizontal / V: Vertical
- Air Connection Spigot Size (mm) 80/100/125

6. Waterside Connection

15 C3 H
- Battery Manifold Types - C1/C2/C3/C4/C5
- Orientation - H: Horizontal / V: Vertical
- Chilled Water Connection Size (mm) 15 / 22

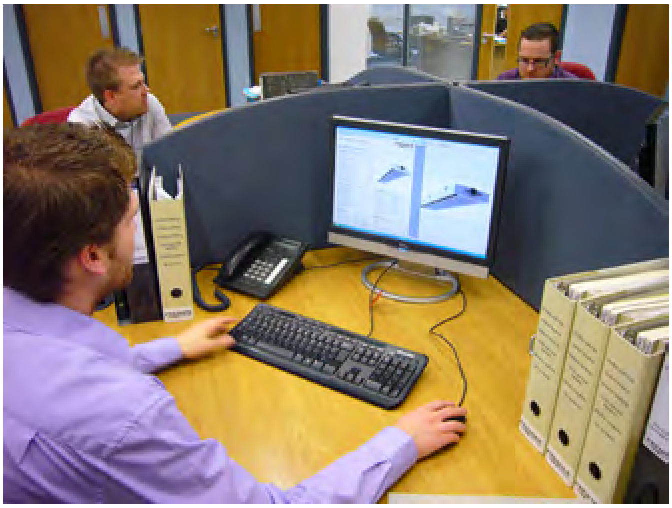
7. Air Supply / Discharge

15 80 L
- Air Supply Volume (l/s)
- Air Discharge Characteristic -
  - L: Long Throw - No Discharge Vanes
  - M: Medium Thrown - 18° Discharge Vanes
  - S: Short Throw - 35° Discharge Vanes
- Air Supply Nozzle Pressure (Pa)

Example: CO | CH | 1300 | 7D - 1 x 100H | 15C3H - 1580L

CO	CH	1300	7D	1 x 100H	15C3H	1580L
1	2	3	4	5	6	7

Calculation Program



Compact Active Beam Data

Air Connection	1x100	mm
Product Overall Length	3.6	m
Manifold Type	C4	
Air Discharge Throw	L	
Nozzle Static Pressure	80	Pa
Fresh Air Supply Volume	40	l/s
Heating Function	Yes	
Underplate Perforation Type	43% OBR	

Frenger's calculation program for Compact is extremely user friendly.

Simply select from the drop down menu the "Air Connection" configuration. Air volumes in excess of 40 ltrs/sec and up to 50 ltrs/sec should be 2 x 80 diameter.

"Manifold types" can be changed in the drop down menu for increased waterside cooling effect, however attention needs to be taken regarding resultant pressure drops (hydraulic resistance). If pressure drops need reducing, choose a higher numbered manifold (C5 being the highest and C2 being the lowest).

"Discharge Throw" can be S (short), M (medium) or L (long).

"Underplate Perforated" options can be found on page 12.

Design Conditions	Cooling		Heating	
Flow Water Temperature	14.0	°C	50.0	°C
Return Water Temperature	17.0	°C	40.0	°C
Air Supply Temperature	16.0	°C	19.0	°C
Average Room Condition	24.0	°C	21.0	°C
Thermal Gradient	0.7	°C		
Room Relative Humidity	45.0	%		

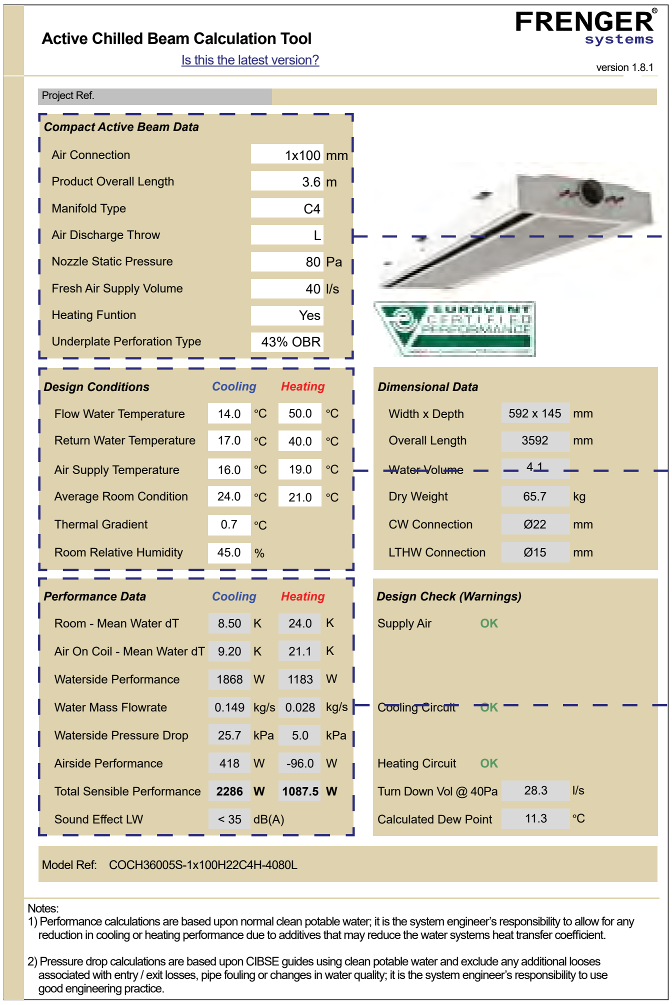
Complete your project data in the "Design Conditions" section. Please note that the "Air On" Thermal Gradient should not be used in normal instances.

Performance Data	Cooling		Heating	
Room - Mean Water dT	8.50	K	24.0	K
Air On Coil - Mean Water dT	9.20	K	21.1	K
Waterside Performance	1868	W	1183	W
Waterside Mass Flowrate	0.149	kg/s	0.028	kg/s
Waterside Pressure Drop	25.7	kPa	5.0	kPa
Airside Performance	418	W	-96.0	W
Total Sensible Performance	**2286**	**W**	**1087.5**	**W**
Sound Effect Lw	<35	dB(A)		

"Performance Data" will then automatically be calculated. Likewise "Dimensional Date" will be also automatically calculated.

Finally, the "Design Check" should read "OK" in green, or detail some warning in red.
Calculation programs for Compact are available upon request.

Contact our technical department or complete an application request form from www.frenger.co.uk from the relevant link on our home page.



Active Chilled Beam Calculation Tool

Is this the latest version?

FRENGER systems

version 1.8.1

Project Ref.

Compact Active Beam Data		
Air Connection	1x100	mm
Product Overall Length	3.6	m
Manifold Type	C4	
Air Discharge Throw	L	
Nozzle Static Pressure	80	Pa
Fresh Air Supply Volume	40	l/s
Heating Funtion	Yes	
Underplate Perforation Type	43% OBR	

Design Conditions	Cooling		Heating	
Flow Water Temperature	14.0	°C	50.0	°C
Return Water Temperature	17.0	°C	40.0	°C
Air Supply Temperature	16.0	°C	19.0	°C
Average Room Condition	24.0	°C	21.0	°C
Thermal Gradient	0.7	°C		
Room Relative Humidity	45.0	%		

Dimensional Data		
Width x Depth	592 x 145	mm
Overall Length	3592	mm
Water Volume	4.1	
Dry Weight	65.7	kg
CW Connection	Ø22	mm
LTHW Connection	Ø15	mm

Performance Data	Cooling		Heating	
Room - Mean Water dT	8.50	K	24.0	K
Air On Coil - Mean Water dT	9.20	K	21.1	K
Waterside Performance	1868	W	1183	W
Water Mass Flowrate	0.149	kg/s	0.028	kg/s
Waterside Pressure Drop	25.7	kPa	5.0	kPa
Airside Performance	418	W	-96.0	W
Total Sensible Performance	**2286**	**W**	**1087.5**	**W**
Sound Effect LW	< 35	dB(A)		

Design Check (Warnings)		
Supply Air	OK	
Cooling Circuit	OK	
Heating Circuit	OK	
Turn Down Vol @ 40Pa	28.3	l/s
Calculated Dew Point	11.3	°C

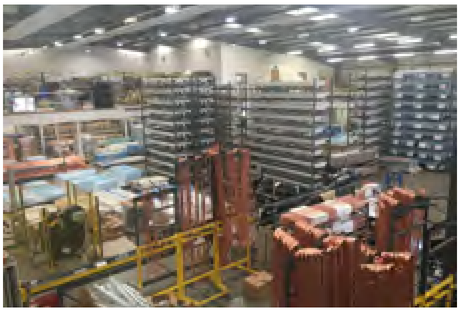
Model Ref: COCH36005S-1x100H22C4H-4080L

Notes:
1) Performance calculations are based upon normal clean potable water; it is the system engineer's responsibility to allow for any reduction in cooling or heating performance due to additives that may reduce the water systems heat transfer coefficient.

2) Pressure drop calculations are based upon CIBSE guides using clean potable water and exclude any additional looses associated with entry / exit losses, pipe fouling or changes in water quality; it is the system engineer's responsibility to use good engineering practice.

Bespoke Manufacturing

Frenger has the manufacturing capability required to deliver the most complex of bespoke solutions. Facilities include the latest full CNC machine centers, together with a dedicated powder-coat paint plant to paint all of the components of the products and project specific in-house testing laboratories.















Project Specific Testing Facility

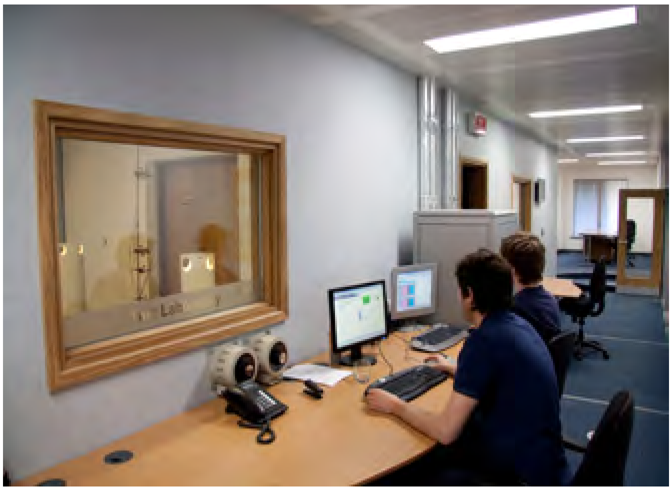
The 3 number state-of-the-art Climatic Testing Laboratories at Frenger's technical facility in Derby (UK) have internal dimensions of 6.3m (L) x 5.7m (W) x 3.3m (H) high and includes a thermal wall so that both internal and perimeter zones can be simulated. Project specific testing validates product / solution performance (outputs) and resultant Room Comfort Conditions for compliance category grading in accordance with BS EN ISO 7730. All of Frenger's chilled beams have also been independently tested and certified by Eurovent in terms of product performance (output), as Eurovent can not test for thermal comfort; hence the need for Frenger's own laboratories.

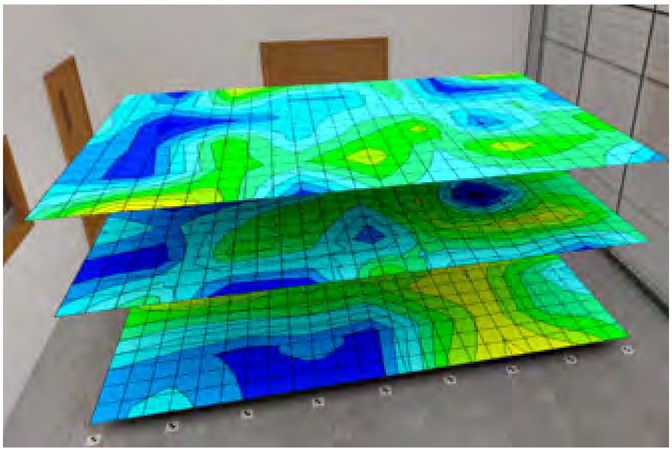
Project Specific Testing

Project specific mock-up testing is a valuable tool which allows the Client to fully assess the proposed system and determine the resulting room occupancy Thermal Comfort conditions. The physical modelling is achieved by installing a full scale representation of a building zone complete with internal & external heat gains (Lighting, Small Power, Occupancy & Solar Gains).

The installed mock-up enables the client to verify the following:

- Product performance under project specific conditions.
- Spatial air temperature distribution.
- Spatial air velocities.
- Experience thermal comfort.
- Project specific aesthetics.
- Experience lighting levels (where relevant).
- Investigate the specific design and allow the system to be optimised.





The project-specific installation and test is normally conducted to verify:

- Product capacity under design conditions.
- Comfort levels - air temperature distribution.
  - thermal stratification.
  - draft risk.
  - radiant temperature analysis.
- Smoke test video illustrating air movement.
- Live Thermal Imaging

Photometric Testing Facility

The in-house Photometric test laboratories at Frenger are used to evaluate the performance of luminaires. To measure the performance, it is necessary to obtain values of light intensity distribution from the luminaire. These light intensity distributions are used to mathematically model the lighting distribution envelope of a particular luminaire. This distribution along with the luminaires efficacy allows for the generation of a digital distribution that is the basis of the usual industry standard electronic file format. In order to assess the efficacy of the luminaire it is a requirement to compare the performance of the luminaire against either a calibrated light source for absolute output or against the “bare” light source for a relative performance ratio.

The industry uses both methods. Generally absolute lumen outputs are used for solid state lighting sources and relative lighting output ratios (LOR) are used for the more traditional sources. Where the LOR method is chosen then published Lamp manufacturer’s data is used to calculate actual lighting levels in a scheme and for LED light source the integration chamber is used to measure LED luminance efficacy.

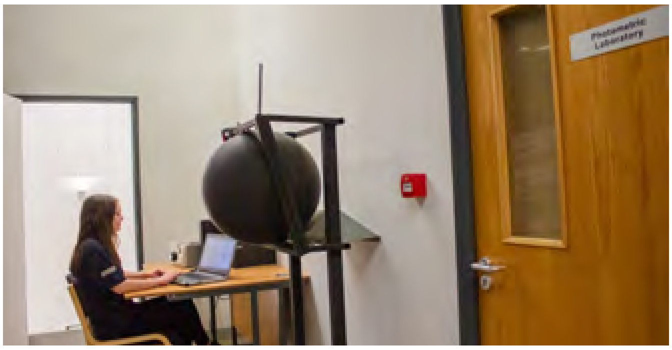
The intensity distribution is obtained by the use of a Goniophotometer to measure the intensity of light emitted from the surface of the fitting at pre-determined angles. The light intensity is measured using either a photometer with a corrective spectral response filter to match the CIE standard observer curves or our spectrometer for LED sources.

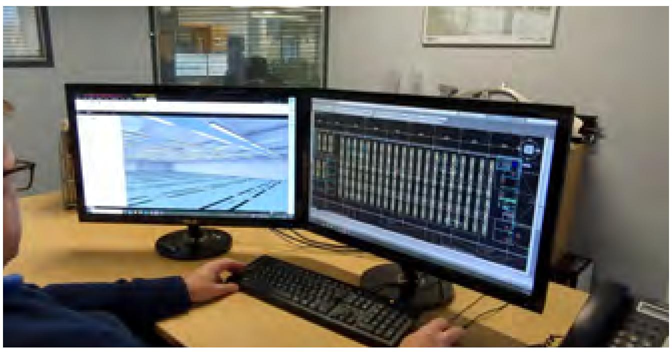
Luminaire outputs are measured using our integrating sphere for smaller luminaires or our large integrator room for large fittings and Multi Service Chilled Beams. For both methods we can use traceable calibrated radiant flux standards for absolute comparisons.

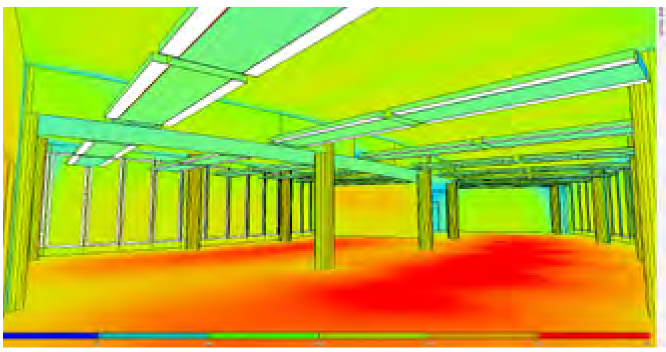
All tests use appropriate equipment to measure and control the characteristics of the luminaire and include air temperature measurements, luminaire supply voltage, luminaire current and power. Thermal characteristics of luminaire components can be recorded during the testing process as required.

A full test report is compiled and supplied in “locked” PDF format. Data is collected and correlated using applicable software and is presented electronically to suit, usually in Eulumdat, CIBSE TM14 or IESN standard file format.

Frenger conduct photometric tests in accordance with CIE 127:2007 and BS EN 13032-1 and sound engineering practice as applicable. During the course of these tests suitable temperature measurements of parts of LED’s can be recorded. These recorded and plotted temperature distributions can be used to provide feedback and help optimise the light output of solid state light source based luminaires which are often found to be sensitive to junction temperatures.







Acoustic Testing Facility

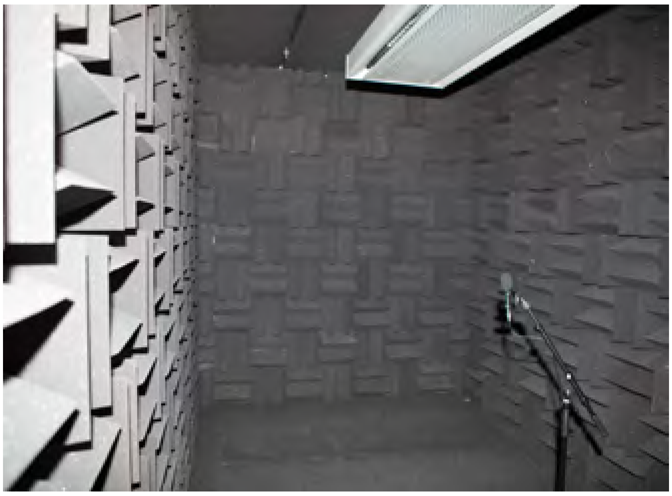
The Acoustic Test Room at Frenger is a hemi-anechoic chamber which utilises sound absorbing acoustic foam material in the shape of wedges to provide an echo free zone for acoustic measurements; the height of the acoustic foam wedge has a direct relationship with the maximum absorption frequency, hence Frenger had the acoustic wedges specifically designed to optimise the sound absorption at the peak frequency normally found with our active chilled beam products.

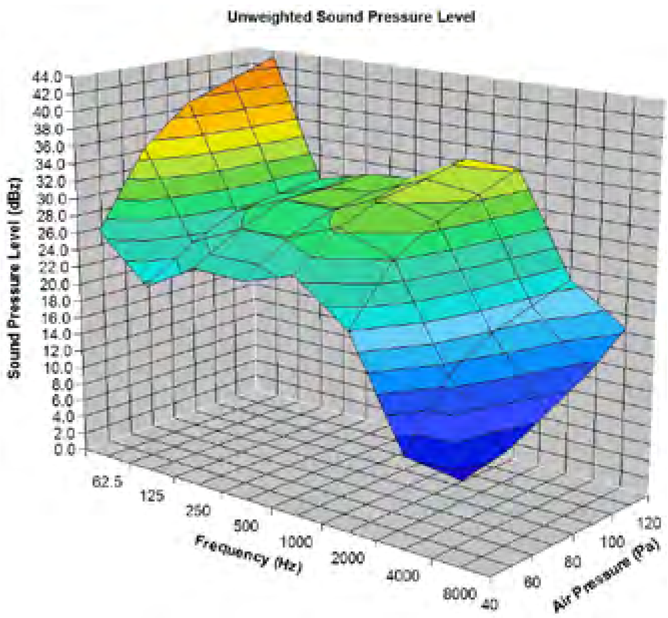
The use of acoustic absorbing material within the test room provides the simulation of a quiet open space without “reflections” which helps to ensure sound measurements from the sound source are accurate, in addition the acoustic material also helps reduce external noise entering the test room meaning that relatively low levels of sound can be accurately measured.

The acoustic facilities allow Frenger to provide express in-house sound evaluation so that all products, even project specific designs can be quickly and easily assessed and optimised.

To ensure accuracy, Frenger only use Class 1 measurement equipment which allows sound level measurements to be taken at 11 different ⅓ octave bands between 16 Hz to 16 kHz, with A, C and Z (un-weighted) simultaneous weightings.

In addition to the above, Frenger also send their new products to specialist third party Acoustic Testing. The results of which are very close and within measurement tolerances to that of Frenger’s in-house measurement of sound.





Frenger Systems participates in the ECC program for Chilled Beams.
Check ongoing validity of certificate:
www.eurovent-certification.com or
www.certiflash.com

FRENGER® systems

UK Head Office

Frenger System Ltd
Riverside Road
Pride Park
Derby
DE24 8HY

tel: +44 0 1332 295 678
sales@frenger.co.uk
www.frenger.co.uk

Australian Office

Frenger
Level 20
Tower 2
201 Sussex Street
Sydney
NSW 2000
Australia

tel: +61 2 9006 1147
sales@frenger.com.au
www.frenger.com.au

American Office

FTF Group Climate
Bryant Park
104 W40th Street
Suite 400 & 500
New York
NY 10018
United States of America

tel: +00 1 (646) 571-2151
sales@ftfgroup.us
www.ftfgroup.us

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Registered No. 646 6229 20

www.frenger.co.uk