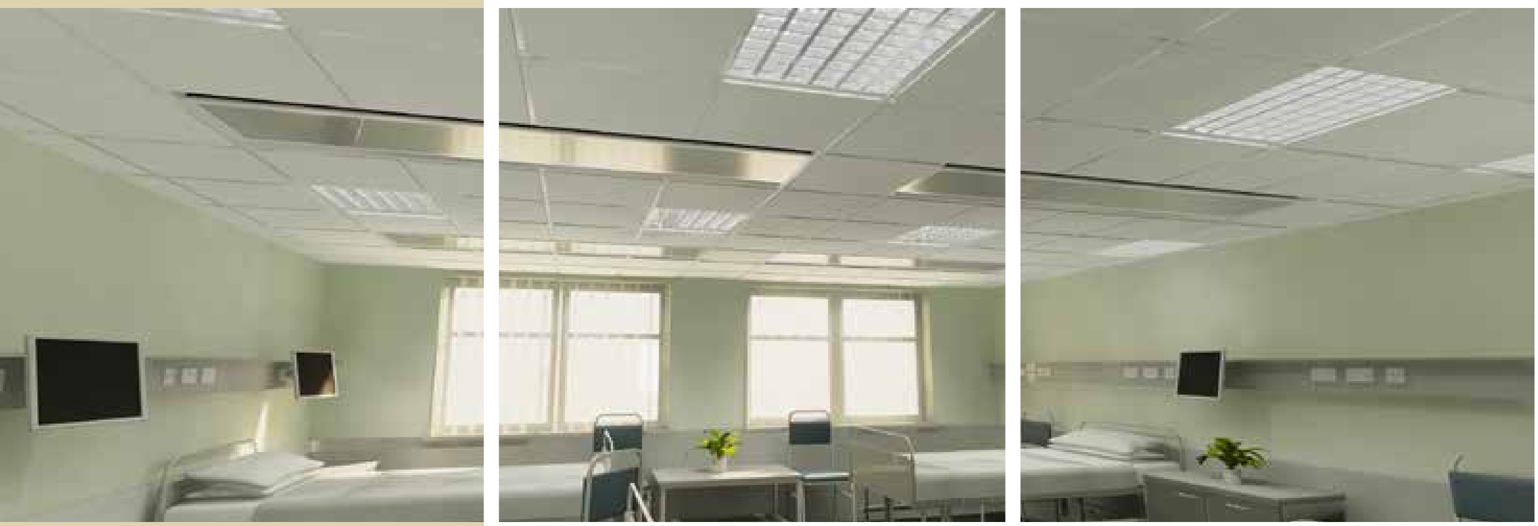
the future of space conditioning

Eco™

active chilled beam



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Product Description

Introduction

Eco™ is one if the FTF Group's latest range of high performance Chilled Beams. Energy efficiency has been a key driver for such advancements in the FTF Group's Chilled Beam Technology.

Eco is **227mm deep as standard** and can be increased to **267mm deep for higher air volumes**. Eco can achieve **1016 watts per meter total cooling** (based on 10Δtk and 25 ltrs/sec/m for a beam supplied at 16°C with a 100Pa).

The Eco beam contains a number of Patent Pending performance enhancing features and as can be expected from the FTF Group brand, the Eco beam is also 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 "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 entire length of 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 jet velocities decrease their cooling capacities / efficiencies.

Heat exchanger batteries are also fitted with extruded aluminum 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.

Eco can be used in most types of commercial building where a value engineered solution is preferred such as for ceiling integration. Eco units are finished in RAL 9010 (20% Gloss) White as standard.

Eco is available in any length from 1.2m up to 3.6m in 0.1m increments and is constructed from zinc coated mild steel for its outer casing rather than extruded aluminum which is utilised for the FTF Group's other products. This is the area where the value engineering has occurred. The cooling and heating components are the same high quality construction for Eco™ as utilised for Compact™ and Ultima™ and as such a similar cooling / heating performance.

The air chamber for Eco is the largest in the FTF Group's product range and can accommodate up to 90 ltrs/sec with its 160mm diameter single air inlet connection point.

Eco beams all have a "closed back", thus meaning 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 or recirculated air as the recirculated air does not mix with any air from the ceiling void. The induction ratio of Eco is typically 5 times that of the supply air (fresh air) rate.

In addition to Eco's high cooling performance capability of in excess of 1000 watter per meter, **Eco 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 Eco can handle air volumes up to 30 l/s/m and up to 120Pa**. Please not however that these high air volumes should be avoided wherever possible and are the absolute maximum and should not ever be exceeded. As a "rule of thumb" 25 ltrs/sec/m from a 2-way discharge beam is the maximum for occupancy comfort compliance to BS EN 7730.

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

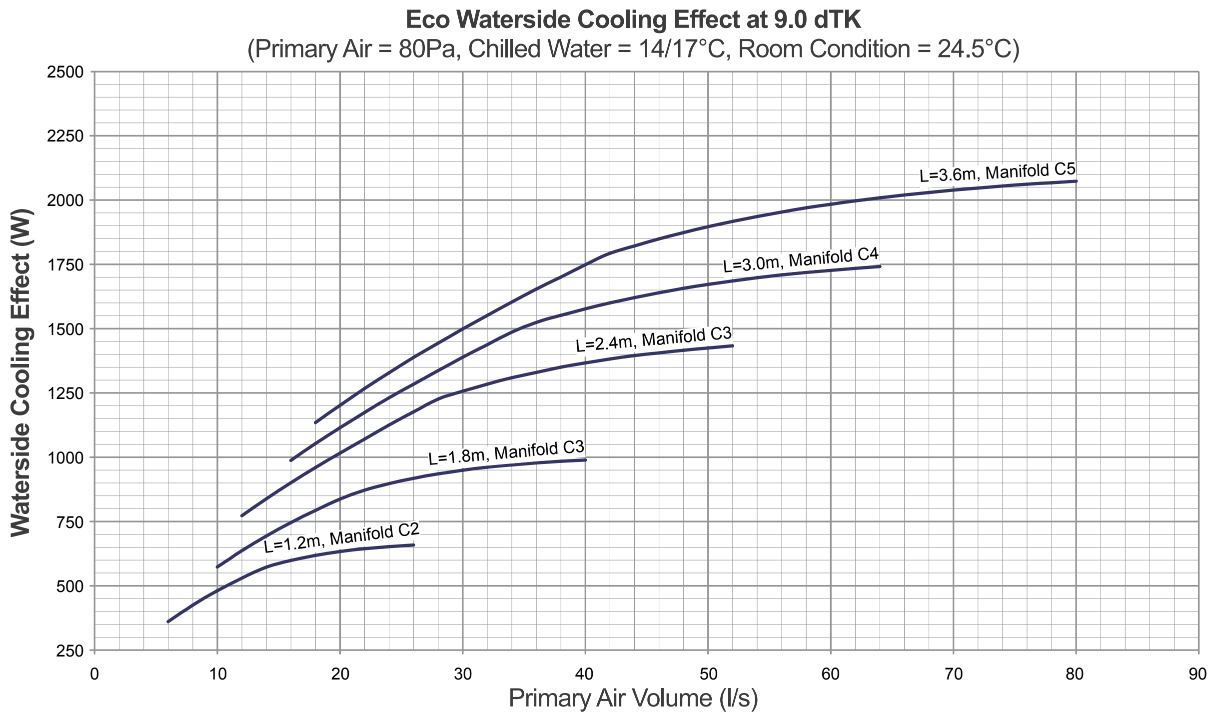
The maximum total supply air for the product is limited to 90 ltrs/sec, which equates to 25 ltrs/sec/m for a 3.6m long beam.

Eco is also available with a **drop down heat exchange battery** for easy cleaning to all 4 sides of the heat exchanger - see the FTF Group's separate **Eco-Healthcare**™ brochure.

At a glance

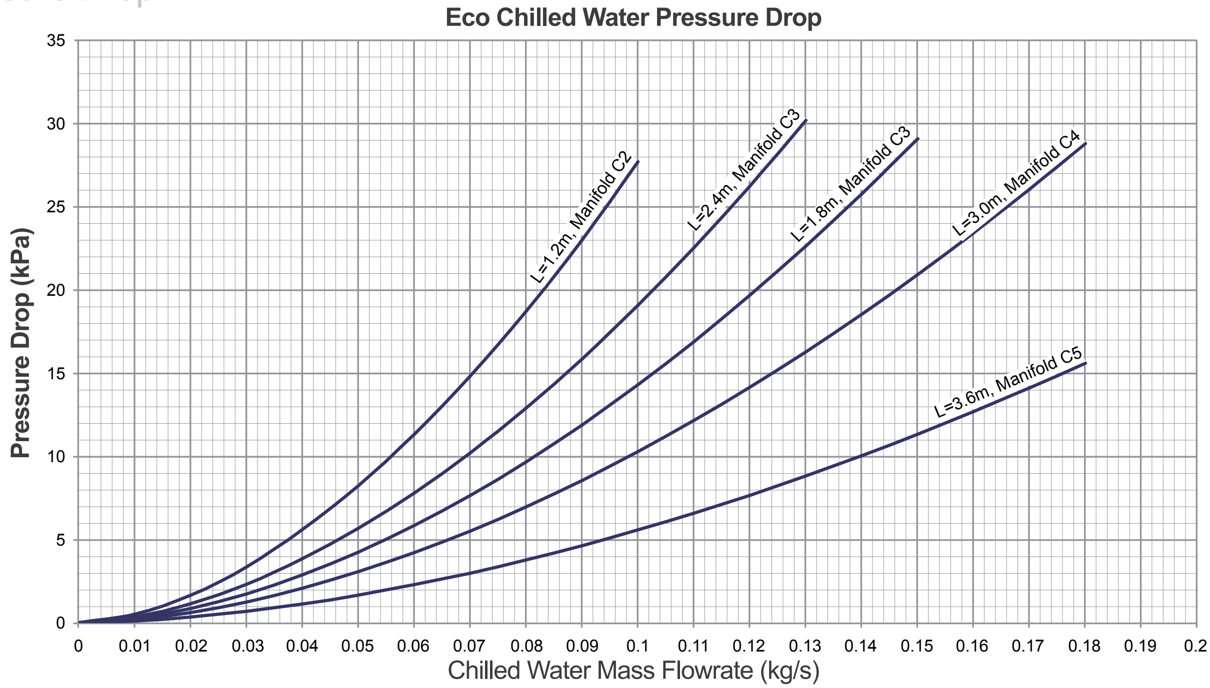
- High output **"1016 w/m"**.
- Can accommodate up to 90 ltrs/sec.
- Optimise discharge nozzle sizes and pitch factory set to best suit project requirements.
- Coanda effect is initiated within the beam.
- Discharge veins are concealed within the beam for improved aesthetics.
- **Fan shape distribution for increased occupancy comfort.**
- **Unique fast fixing of removable underplates that prevents any sagging even on long beam lenghts of 3.6m.**
- **Various different perforation patterns available for removable underaplates.**
- **Multiple manifold variants 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

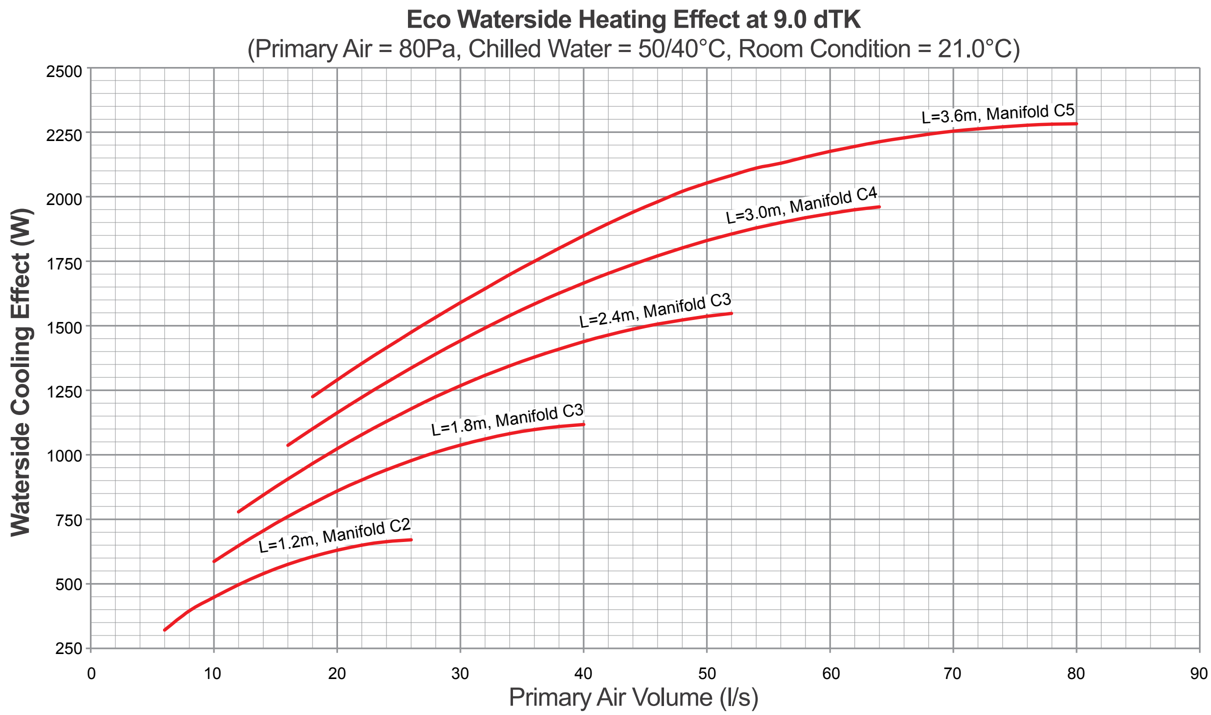


Cooling figures are based on cooling & heating beams, additional cooling is possible with a cooling only product, contact the FTF Group for more information.

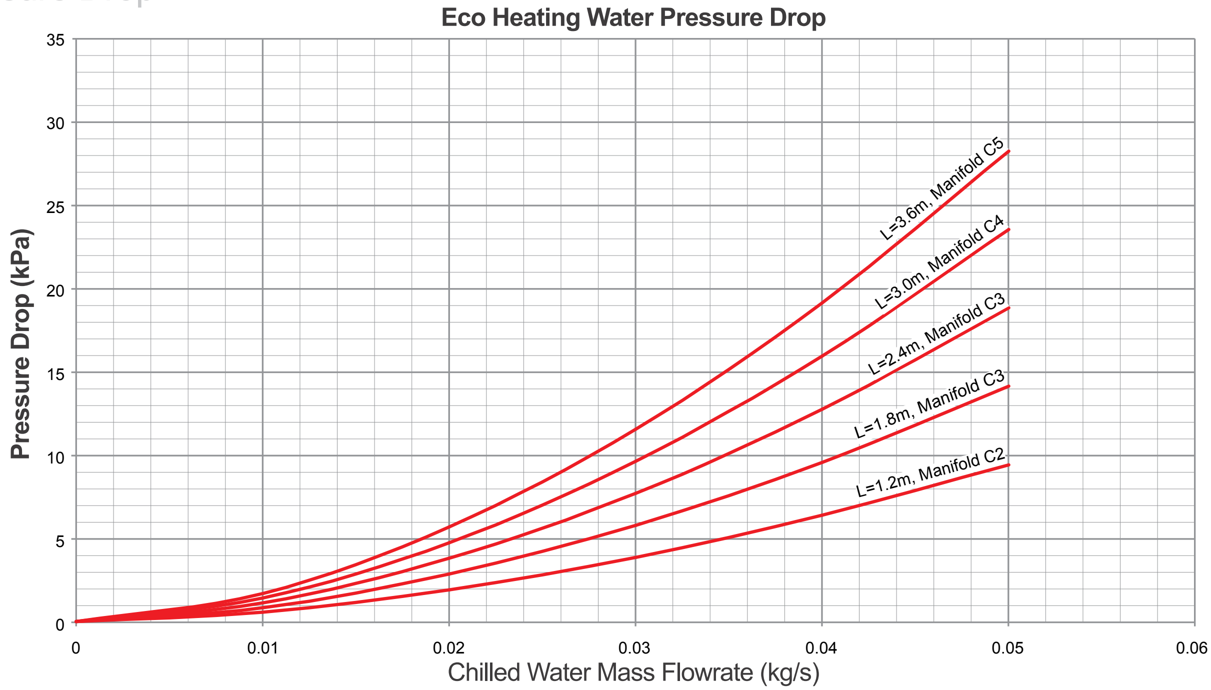
Pressure Drop



Heating Performance



Pressure Drop



Cooling Selection Tables

Cooling at 40Pa Nozzle Pressure

Nozzle Pressure 40 Pa		Water															
Q (l/s)	Eco	ΔtK - 7°C				ΔtK - 8°C				ΔtK - 9°C				ΔtK - 10°C			
	L (m)	P (w)	p(kg/s)	Mannifold	p(kPa)	P (w)	p(kg/s)	Mannifold	p(kPa)	P (w)	p(kg/s)	Mannifold	p(kPa)	P (w)	p(kg/s)	Mannifold	p(kPa)
10	1.2	295	0.024	C2	2.2	312	0.019	C2	1.5	405	0.032	C2	3.8	459	0.037	C2	4.7
	1.8	390	0.031	C2	5.2	425	0.025	C2	3.7	522	0.042	C2	8.7	589	0.047	C2	10.8
	2.4	444	0.035	C2	8.7	489	0.029	C2	6.3	593	0.047	C2	14.5	670	0.053	C2	17.9
	3.0	480	0.038	C2	12.5	530	0.032	C2	9.1	593	0.047	C3	6.4	670	0.053	C3	7.9
	3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	561	0.045	C2	9.6	614	0.037	C2	6.9	763	0.061	C2	16.2	778	0.062	C3	6.0
	2.4	720	0.057	C2	19.1	773	0.046	C2	13.8	864	0.069	C3	9.6	979	0.078	C3	11.9
	3.0	748	0.060	C3	9.3	823	0.049	C3	6.7	1006	0.080	C3	15.5	1151	0.092	C3	19.2
	3.6	827	0.066	C3	13.2	912	0.054	C3	9.6	1045	0.083	C4	8.7	1179	0.094	C4	10.8
30	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	756	0.060	C3	7.4	911	0.054	C2	18.0	1019	0.081	C3	12.6	1155	0.092	C3	15.6
	3.0	921	0.073	C3	13.1	1009	0.060	C3	9.5	1159	0.092	C4	8.6	1312	0.104	C4	10.7
	3.6	1079	0.086	C3	20.0	1159	0.069	C3	14.4	1337	0.106	C4	13.1	1534	0.122	C4	16.3
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	1013	0.081	C3	15.3	1112	0.066	C3	11.0	1277	0.102	C4	10.1	1443	0.115	C4	12.6
	3.6	1123	0.089	C4	9.6	1317	0.079	C3	17.8	1526	0.121	C4	16.2	1625	0.129	C5	10.1

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 3°C (Water in-out), nozzle pressure of 40 Pa, 1 x Ø125 air connection.
For green values, a Ø22 mannifold 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)	Eco	ΔtK - 7°C				ΔtK - 8°C				ΔtK - 9°C				ΔtK - 10°C			
	L (m)	P (w)	p(kg/s)	Mannifold	p(kPa)	P (w)	p(kg/s)	Mannifold	p(kPa)	P (w)	p(kg/s)	Mannifold	p(kPa)	P (w)	p(kg/s)	Mannifold	p(kPa)
10	1.2	316	0.025	C2	2.4	333	0.020	C2	1.7	435	0.035	C2	4.2	494	0.039	C2	5.3
	1.8	412	0.033	C2	5.7	448	0.027	C2	4.1	551	0.044	C2	9.6	619	0.049	C2	11.8
	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	438	0.035	C2	4.1	459	0.027	C2	2.8	601	0.048	C2	7.2	680	0.054	C2	9.0
	1.8	632	0.050	C2	11.7	690	0.041	C2	8.4	865	0.069	C2	19.7	875	0.070	C3	7.3
	2.4	694	0.055	C3	6.5	832	0.050	C2	15.6	931	0.074	C3	10.9	1053	0.084	C3	13.5
	3.0	791	0.063	C3	10.2	870	0.052	C3	7.4	1055	0.084	C3	16.9	1128	0.090	C4	8.3
	3.6	869	0.069	C3	14.5	963	0.058	C3	10.6	1101	0.088	C4	9.6	1239	0.099	C4	11.8
30	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	729	0.058	C2	15.1	807	0.048	C2	10.8	902	0.072	C3	7.5	1020	0.081	C3	9.4
	2.4	866	0.069	C3	9.3	939	0.056	C3	6.6	1168	0.093	C3	15.7	1332	0.106	C3	19.6
	3.0	1019	0.081	C3	15.4	1115	0.067	C3	11.1	1281	0.102	C4	10.2	1451	0.115	C4	12.6
	3.6	1068	0.085	C4	8.9	1248	0.075	C3	16.3	1436	0.114	C4	14.8	1641	0.131	C4	18.4
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	954	0.076	C3	11.0	1041	0.062	C3	7.8	1263	0.100	C3	18.4	1360	0.108	C4	9.0
	3.0	1171	0.093	C3	19.5	1282	0.077	C3	14.0	1472	0.117	C4	12.8	1668	0.133	C4	15.9
	3.6	1264	0.101	C4	11.7	1381	0.082	C4	8.4	1730	0.138	C4	19.7	1830	0.146	C5	12.3

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 3°C (Water in-out), nozzle pressure of 60 Pa, 1 x Ø125 air connection.
For green values, a Ø22 mannifold 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)	Eco	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	347	0.028	C2	2.8	364	0.022	C2	2.0	479	0.038	C2	4.9	544	0.043	C2	6.2
	1.8	469	0.037	C2	7.1	613	0.031	C2	5.1	619	0.049	C2	11.8	692	0.055	C2	14.5
	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	462	0.037	C2	4.5	486	0.029	C2	3.1	632	0.050	C2	7.8	716	0.057	C2	9.8
	1.8	683	0.054	C2	13.3	749	0.045	C2	9.5	836	0.067	C3	6.6	949	0.076	C3	8.3
	2.4	763	0.061	C3	7.6	906	0.054	C2	18.2	1015	0.081	C3	12.7	1141	0.091	C3	15.7
	3.0	877	0.070	C3	12.2	973	0.058	C3	8.9	1150	0.091	C3	20.0	1251	0.100	C4	10.0
	3.6	970	0.077	C3	17.7	1091	0.065	C3	13.1	1239	0.099	C4	11.8	1384	0.110	C4	14.5
30	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	776	0.062	C2	16.4	849	0.051	C2	11.8	948	0.075	C3	8.2	1075	0.086	C3	10.3
	2.4	931	0.074	C3	10.5	1010	0.060	C3	7.4	1256	0.100	C3	17.7	1327	0.106	C4	8.6
	3.0	1098	0.087	C3	17.7	1212	0.072	C3	12.8	1388	0.110	C4	11.7	1565	0.125	C4	14.5
	3.6	1170	0.093	C4	10.4	1359	0.081	C3	19.1	1549	0.123	C4	17.2	1686	0.134	C5	10.9
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	812	0.065	C2	17.6	884	0.053	C2	12.6	988	0.079	C3	8.8	1120	0.089	C3	11.0
	2.4	1005	0.080	C3	12.0	1095	0.065	C3	8.5	1264	0.101	C4	7.8	1433	0.114	C4	9.8
	3.0	1169	0.093	C4	8.4	1371	0.082	C3	15.7	1576	0.125	C4	14.3	1791	0.142	C4	17.8
	3.6	1367	0.109	C4	13.3	1497	0.089	C4	9.5	1748	0.139	C5	11.3	1976	0.157	C5	14.0

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 3°C (Water in-out), nozzle pressure of 80 Pa, 1 x Ø125 air connection.
For green values, a Ø22 mannifold 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)	Eco	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	369	0.029	C2	3.1	387	0.023	C2	2.2	508	0.040	C2	5.4	575	0.046	C2	6.8
	1.8	498	0.040	C2	7.9	545	0.033	C2	5.6	657	0.052	C2	13.1	735	0.058	C2	16.1
	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	504	0.040	C2	5.2	530	0.032	C2	3.5	690	0.055	C2	9.0	781	0.062	C2	11.3
	1.8	723	0.058	C2	14.7	795	0.047	C2	10.6	888	0.071	C3	7.3	1006	0.080	C3	9.2
	2.4	807	0.064	C3	8.3	957	0.057	C2	19.9	1072	0.085	C3	13.9	1204	0.096	C3	17.2
	3.0	927	0.074	C3	13.5	1030	0.062	C3	9.8	1178	0.094	C4	8.9	1323	0.105	C4	11.0
	3.6	1030	0.082	C3	19.6	1157	0.069	C3	14.5	1314	0.105	C4	13.1	1470	0.117	C4	16.1
30	1.2	536	0.043	C2	5.7	567	0.034	C2	3.9	732	0.058	C2	9.9	830	0.066	C2	12.4
	1.8	847	0.064	C2	19.0	926	0.055	C2	13.6	1034	0.082	C3	9.4	1172	0.093	C3	11.8
	2.4	994	0.079	C3	11.7	1082	0.065	C3	8.3	1336	0.106	C3	19.7	1416	0.113	C4	9.6
	3.0	1159	0.092	C3	19.5	1283	0.077	C3	14.1	1467	0.117	C4	12.9	1653	0.132	C4	15.9
	3.6	1237	0.099	C4	11.4	1364	0.081	C4	8.2	1636	0.130	C4	18.9	1781	0.142	C5	11.9
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	796	0.063	C3	5.9	973	0.058	C2	14.8	1087	0.087	C3	10.3	1232	0.098	C3	12.8
	2.4	1097	0.087	C3	13.8	1195	0.071	C3	9.7	1379	0.110	C4	9.0	1563	0.124	C4	11.3
	3.0	1256	0.100	C4	9.5	1471	0.088	C3	17.7	1690	0.134	C4	16.1	1919	0.153	C4	20.0
	3.6	1445	0.115	C4	14.7	1589	0.095	C4	10.6	1849	0.147	C5	12.4	2087	0.166	C5	15.4

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 3°C (Water in-out), nozzle pressure of100 Pa, 1 x Ø125 air connection.
For green values, a Ø22 mannifold 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											
	Eco	ΔtK - 15°C			ΔtK - 20°C			ΔtK - 25°C			ΔtK - 30°C		
Q (l/s)	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	353	0.012	0.8	442	0.012	0.8	539	0.013	0.8	670	0.016	1.1
	1.8	426	0.012	1.3	533	0.013	1.2	691	0.017	1.9	850	0.020	2.7
	2.4	462	0.012	1.4	633	0.015	2.3	814	0.020	3.4	997	0.024	4.7
	3.0	523	0.013	2.1	723	0.017	3.6	926	0.022	5.4	1131	0.027	7.4
	3.6	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	551	0.013	1.3	781	0.019	2.4	579	0.024	3.7	1243	0.030	5.2
	2.4	670	0.016	2.6	938	0.022	4.5	1205	0.029	6.8	1469	0.035	9.3
	3.0	767	0.018	4.1	1063	0.025	7.0	1357	0.033	10.5	1647	0.039	14.4
	3.6	850	0.020	5.9	1171	0.028	10.1	1489	0.036	14.9	1803	0.043	20.3
30	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	824	0.020	3.7	1149	0.028	6.4	1467	0.035	9.6	1779	0.043	13.1
	3.0	961	0.023	6.0	1326	0.032	10.4	1684	0.040	15.3	2036	0.049	20.8
	3.6	1072	0.026	8.8	1469	0.035	14.9	1858	0.045	22.0	2245	0.054	29.8
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	1095	0.026	7.6	1503	0.036	12.9	1901	0.046	19.0	2298	0.055	25.8
	3.6	1243	0.030	11.4	1694	0.041	19.2	2137	0.051	28.1	2584	0.062	38.1

Flow-adjusted waterside heating effect table. Heating circuit Δt = 10°C (Water in-out), nozzle pressure of 40 Pa, 1 x Ø125 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											
	Eco	ΔtK - 15°C			ΔtK - 20°C			ΔtK - 25°C			ΔtK - 30°C		
Q (l/s)	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	374	0.012	0.8	458	0.012	0.7	571	0.014	0.9	711	0.017	1.3
	1.8	440	0.012	1.2	567	0.014	1.4	736	0.018	2.1	906	0.022	3.0
	2.4	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	-	-	-	-	-	-	-	-	-	-	-	-
	3.6	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	450	0.012	0.8	596	0.014	1.0	797	0.019	1.6	980	0.023	2.2
	1.8	587	0.014	1.5	831	0.020	2.7	1075	0.026	4.1	1317	0.032	5.7
	2.4	711	0.017	2.8	993	0.024	5.0	1272	0.030	7.5	1547	0.037	10.2
	3.0	814	0.020	4.5	1127	0.027	7.8	1434	0.034	11.6	1737	0.042	15.8
	3.6	906	0.022	6.6	1246	0.030	11.2	1578	0.038	16.5	1907	0.046	22.4
30	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	691	0.017	2.0	980	0.023	3.6	1266	0.030	5.5	1546	0.037	7.6
	2.4	880	0.021	4.1	1223	0.029	7.1	1559	0.037	10.6	1890	0.045	14.5
	3.0	1018	0.024	6.7	1401	0.034	11.4	1775	0.043	16.8	2148	0.051	22.9
	3.6	1133	0.027	9.7	1547	0.037	16.4	1954	0.047	24.0	2362	0.057	32.6
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	-	-	-	-	-	-	-	-	-	-	-	-
	2.4	980	0.023	5.0	1360	0.033	8.6	1730	0.041	12.8	2095	0.050	17.4
	3.0	1170	0.028	8.5	1602	0.038	14.4	2027	0.049	21.2	2455	0.059	28.9
	3.6	1317	0.032	12.6	1791	0.043	21.1	2264	0.054	31.0	2741	0.066	42.3

Flow-adjusted waterside heating effect table. Heating circuit Δt = 10°C (Water in-out), nozzle pressure of 60 Pa, 1 x Ø125 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											
	Eco	ΔtK - 15°C			ΔtK - 20°C			ΔtK - 25°C			ΔtK - 30°C		
Q (l/s)	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	374	0.012	0.7	460	0.012	0.6	604	0.014	1.0	752	0.018	1.4
	1.8	454	0.012	1.2	601	0.014	1.5	782	0.019	2.4	963	0.023	3.3
	2.4	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	-	-	-	-	-	-	-	-	-	-	-	-
	3.6	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	456	0.012	0.7	648	0.016	1.1	855	0.020	1.8	1063	0.025	2.6
	1.8	624	0.015	1.7	881	0.021	3.0	1138	0.027	4.5	1391	0.033	6.3
	2.4	752	0.018	3.1	1048	0.025	5.5	1339	0.032	8.2	1625	0.039	11.2
	3.0	862	0.021	5.0	1190	0.029	8.6	1510	0.036	12.7	1825	0.044	17.2
	3.6	963	0.023	7.3	1319	0.032	12.4	1666	0.040	18.1	2008	0.048	24.5
30	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	751	0.018	2.3	1063	0.025	4.1	1371	0.033	6.3	1672	0.040	8.7
	2.4	936	0.022	4.6	1297	0.031	7.9	1652	0.040	11.8	2005	0.048	16.1
	3.0	1076	0.026	7.4	1475	0.035	12.5	1867	0.045	18.4	2262	0.054	25.0
	3.6	1194	0.029	10.6	1625	0.039	17.8	2051	0.049	26.1	2480	0.059	35.5
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	804	0.019	2.6	1146	0.027	4.7	1481	0.035	7.2	1805	0.043	9.9
	2.4	1063	0.025	5.7	1472	0.035	9.9	1871	0.045	14.6	2267	0.054	20.0
	3.0	1246	0.030	9.5	1703	0.041	16.1	2157	0.052	23.7	2617	0.063	32.3
	3.6	1391	0.033	13.9	1891	0.045	23.2	2394	0.057	34.2	2904	0.070	46.8

Flow-adjusted waterside heating effect table. Heating circuit Δt = 10°C (Water in-out), nozzle pressure of 80 Pa, 1 x Ø125 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											
	Eco	ΔtK - 15°C			ΔtK - 20°C			ΔtK - 25°C			ΔtK - 30°C		
Q (l/s)	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	378	0.012	0.7	469	0.012	0.6	616	0.015	1.0	766	0.018	1.4
	1.8	460	0.012	1.2	616	0.015	1.6	802	0.019	2.5	989	0.024	3.5
	2.4	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	-	-	-	-	-	-	-	-	-	-	-	-
	3.6	-	-	-	-	-	-	-	-	-	-	-	-
20	1.2	470	0.012	0.7	675	0.016	1.2	886	0.021	1.9	1097	0.026	2.7
	1.8	637	0.015	1.7	897	0.021	3.1	1157	0.028	4.7	1413	0.034	6.5
	2.4	766	0.018	3.2	1067	0.026	5.6	1364	0.033	8.4	1655	0.040	11.5
	3.0	881	0.021	5.2	1217	0.029	8.9	1546	0.037	13.2	1870	0.045	18.0
	3.6	989	0.024	7.7	1357	0.033	13.0	1716	0.041	19.1	2072	0.050	25.9
30	1.2	517	0.012	0.8	758	0.018	1.5	1003	0.024	2.4	1246	0.030	3.4
	1.8	780	0.019	2.5	1097	0.026	4.4	1409	0.034	6.6	1714	0.041	9.1
	2.4	955	0.023	4.7	1320	0.032	8.2	1678	0.040	12.1	2032	0.049	16.5
	3.0	1094	0.026	7.6	1498	0.036	12.8	1896	0.045	18.9	2293	0.055	25.7
	3.6	1216	0.029	11.0	1655	0.040	18.4	2089	0.050	27.0	2525	0.060	36.6
40	1.2	-	-	-	-	-	-	-	-	-	-	-	-
	1.8	861	0.021	2.9	1217	0.029	5.3	1563	0.037	7.9	1899	0.045	10.9
	2.4	1097	0.026	6.0	1511	0.036	10.4	1915	0.046	15.3	2318	0.056	20.8
	3.0	1269	0.030	9.8	1731	0.041	16.5	2187	0.052	24.2	2649	0.063	33.0
	3.6	1413	0.034	14.3	1917	0.046	23.8	2422	0.058	34.9	2933	0.070	47.6

Flow-adjusted waterside heating effect table. Heating circuit Δt = 10°C (Water in-out), nozzle pressure of 100 Pa, 1 x Ø125 air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.012 kg/s.

Air Cooling Effect

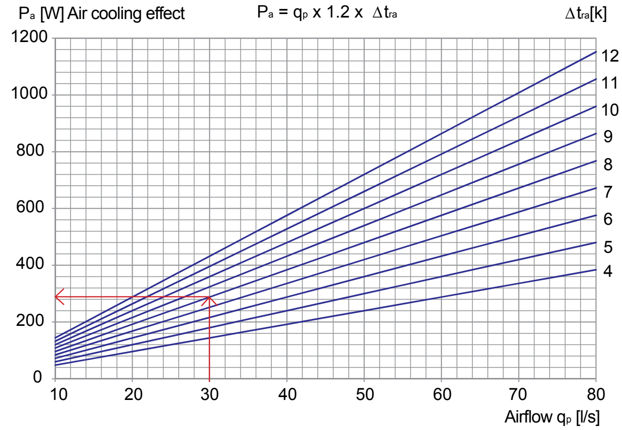
Cooling effect supplied in the ventilation air [W]

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.

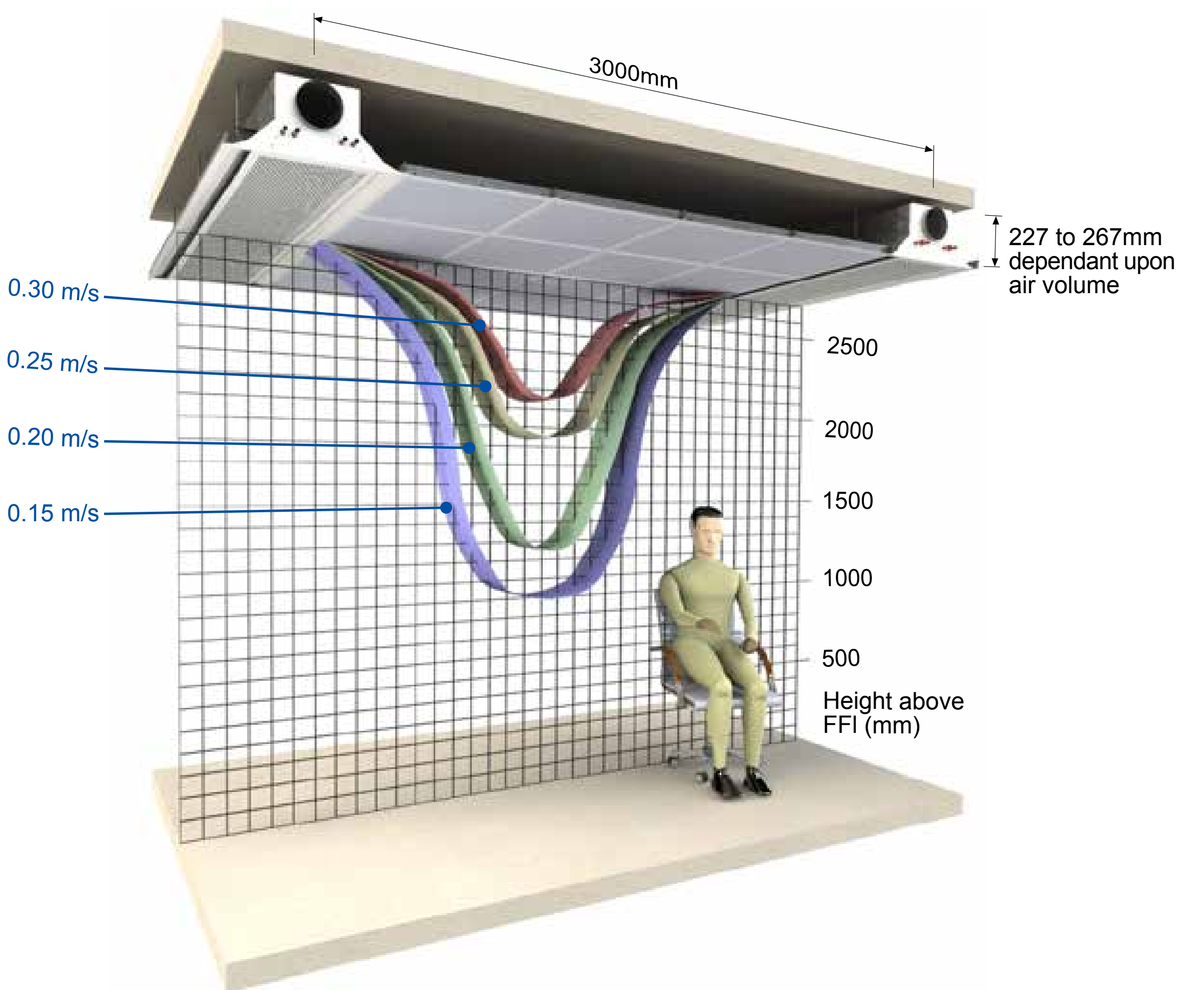
Formula for air cooling effect: $P = m \times Cp \times \Delta t$
Where:
m = mass flow [kg/s]
Cp = specific heat capacity [J(kg•K)]
qp = air flow [l/s]
Δt = the difference between the temperature of the room and the temperature of the supply air [K].
It is usually $m \times Cp \approx qp \times 1.2$



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.

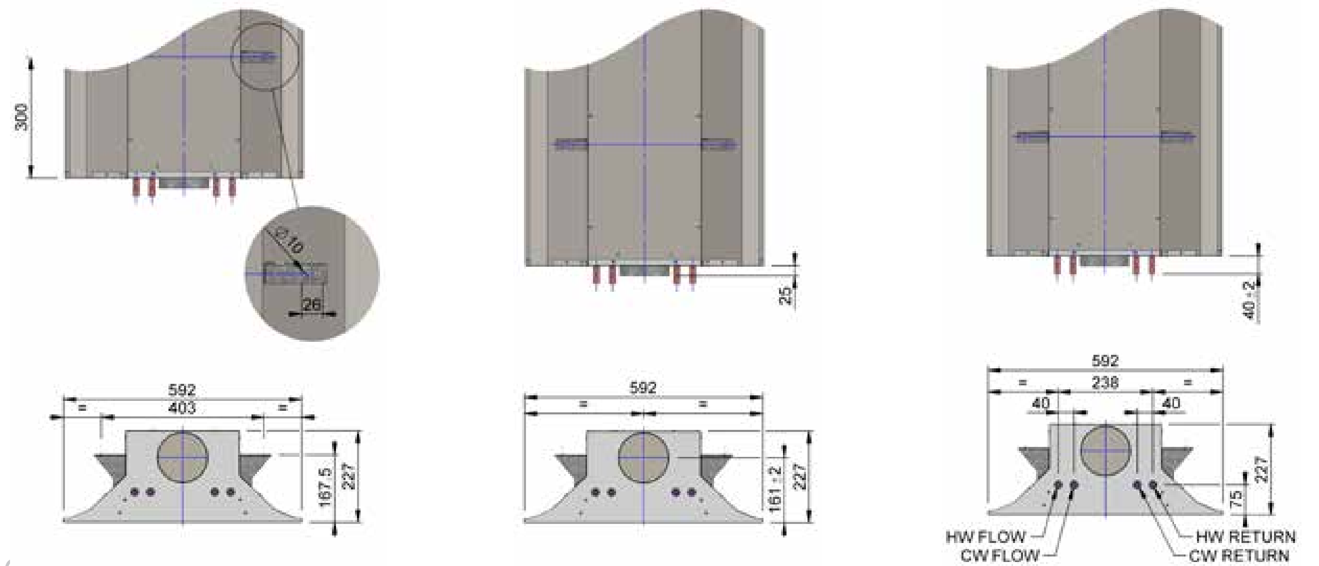
Scatter Diagram

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

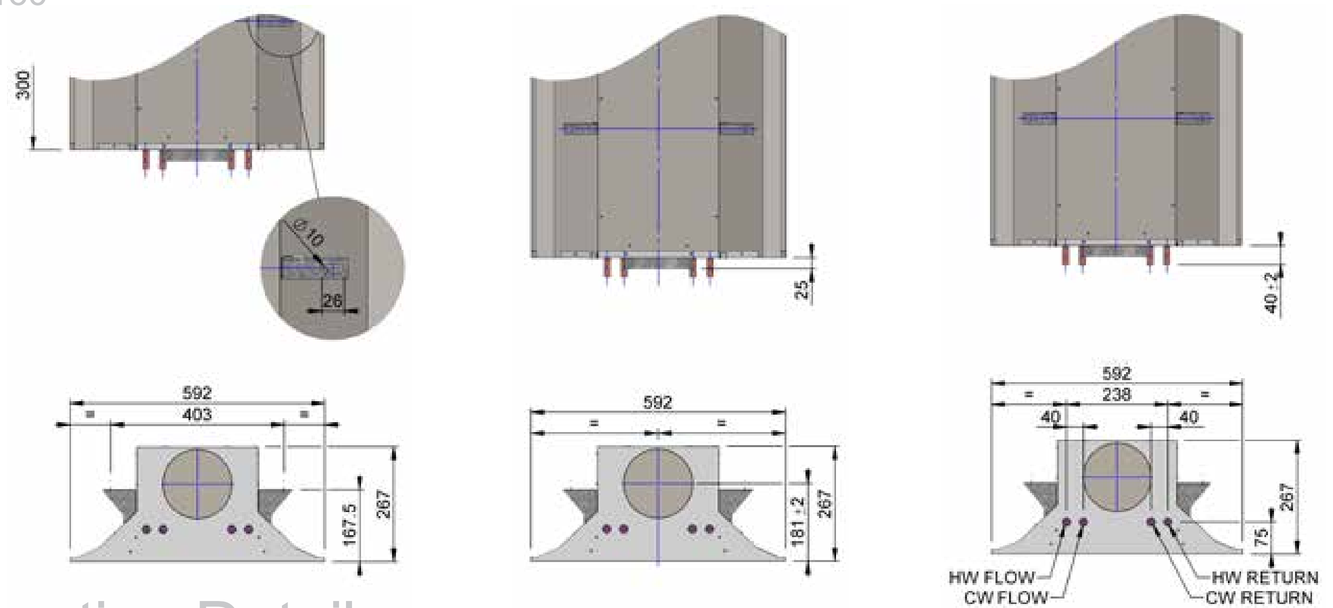


Product Dimensions

Eco 125

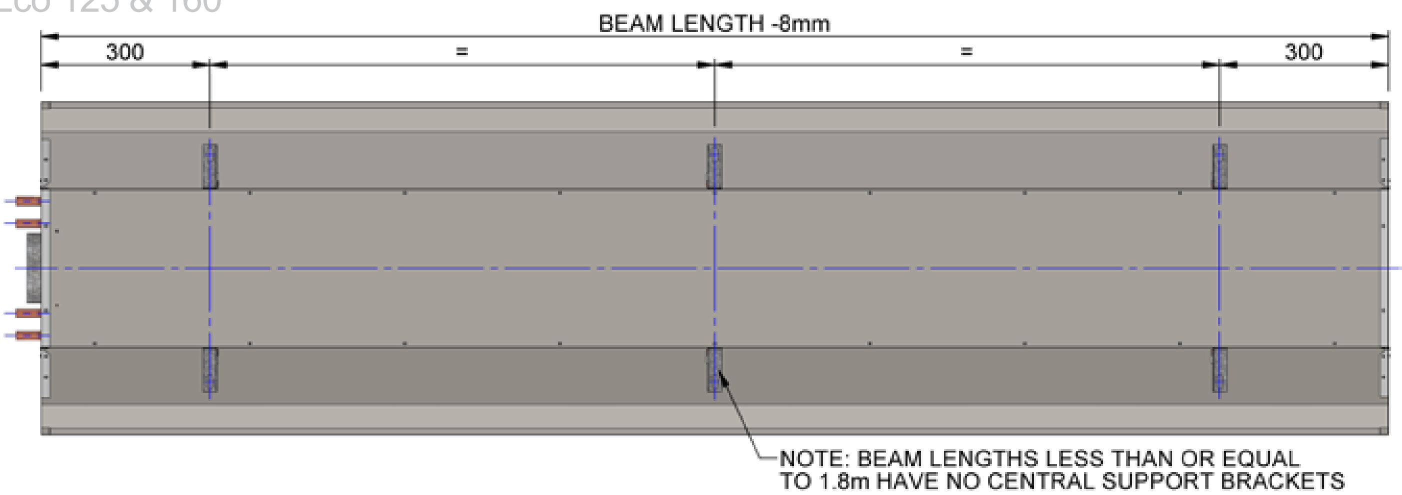


Eco 160



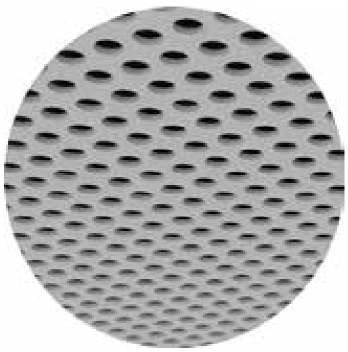
Mounting Details

Eco 125 & 160



Perforation Pattern Options

Slot Perforation
45% Free Area



Dot Perforation
33% Free Area

Double Dot Perforation
51% Free Area

Product Ordering Codes

2. Function

CO - Ceiling Int. Cooling Only

CH - Ceiling Int. Cooling & Heating

4. Underplate

7D - 7Ø & 4Ø Double Dot / 51% Free Area

4D - 4Ø Dot / 33% Free Area

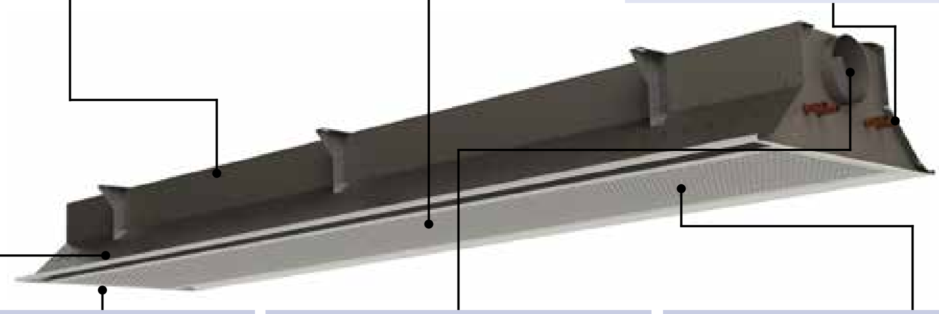
5S - 5 X 35 Slot / 45% Free Area

6. Waterside Connection

Battery Manifold Types - C1/C2/C3/C4/C5

15 C3 H — Orientation - H: Horizontal

Chilled Water Connection Size (mm) 15 / 22



1. Beam Type

EC - Eco

3. Nominal Beam Length (mm)

5. Airside Connection

Air Connection Qty

1 x 100 H — Orientation - H: Horizontal

Air Connection Spigot Size (mm) 125/160

7. Air Supply / Discharge

Air Supply Volume (l/s)

43 80 M

Air Discharge Characteristic -

L: Long Throw - No Discharge Vanes

M: Medium Thrown - 18° Discharge Vanes

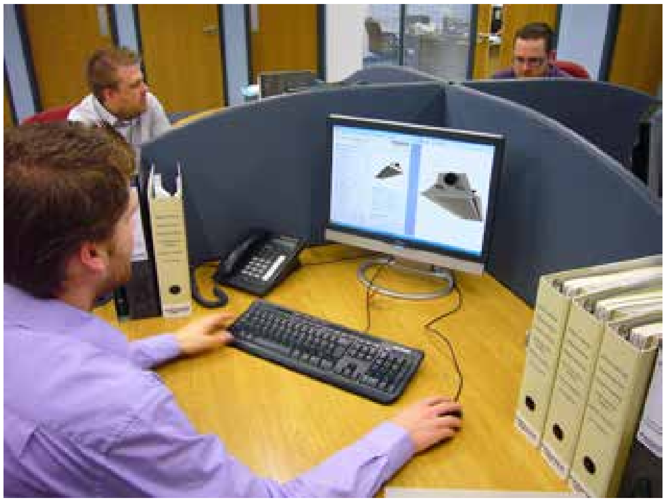
S: Short Throw - 35° Discharge Vanes

Air Supply Nozzle Pressure (Pa)

Example:

EC	CH	2400	7D	-	1 x 125H	15C4H	-	4580M
1	2	3	4		5	6		7

Calculation Programme



Eco Active Beam Data

Beam Variant	Standard	
Air Connection	1x125	mm
Product Overall Length	2.4	m
Manifold Type	C4	
Air Discharge Throw	S	
Nozzle Static Pressure	80	Pa
Fresh Air Supply Volume	25	l/s
Heating Function	Std	
Underplate Perforation Type	43% OBR	

The FTF Group's calcaultion programme for Eco 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 Perforation Type" 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	18.0	°C	21.0	°C
Average Room Condition	24.0	°C	21.0	°C
"Air On" 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.

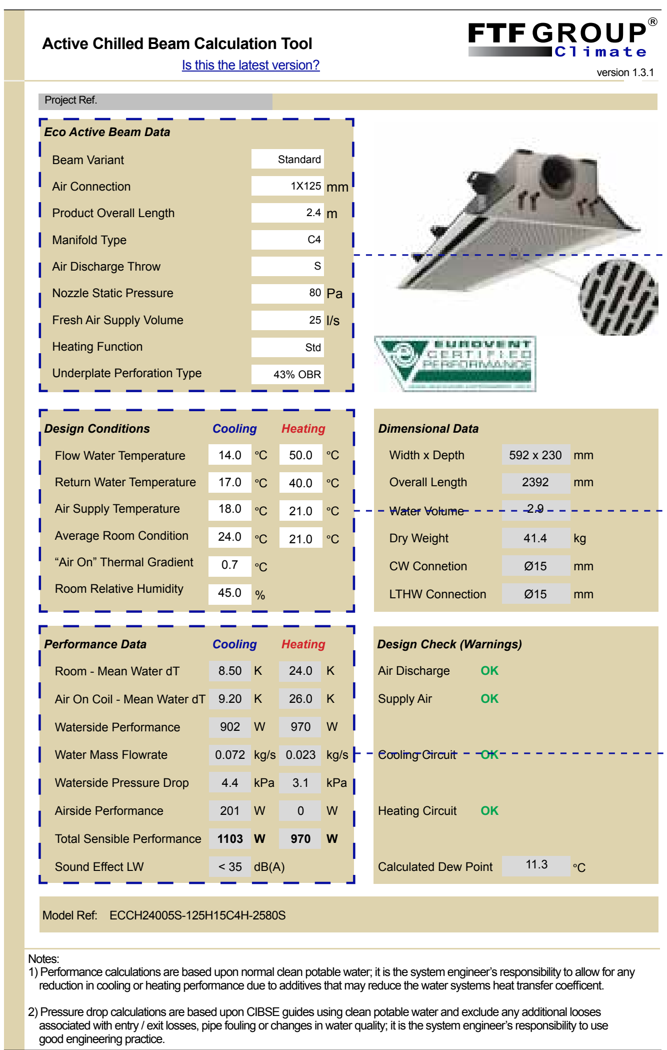
Performance Data

	Cooling		Heating	
Room - Mean Water dT	8.50	K	24.0	K
Air On Coil - Mean Water dT	9.20	K	26.0	K
Waterside Performance	902	W	970	W
Waterside Mass Flowrate	0.072	kg/s	0.023	kg/s
Waterside Pressure Drop	4.4	kPa	3.1	kPa
Airside Performance	201	W	0	W
Total Sensible Performance	**1103**	**W**	**970**	**W**
Sound Effect Lw	<35	dB(A)		

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

Finally, the "Design Check" should read "Ok" in green, or detail some warnings in red.
Calculation programmes for Eco are available upon request.

Contact out technical department or complete an application request form found at www.ftfgroup.us from the relevant link on our homepage.



Active Chilled Beam Calculation Tool
Is this the latest version?
FTF GROUP® Climate
version 1.3.1

Project Ref.

Eco Active Beam Data

Beam Variant	Standard	
Air Connection	1X125	mm
Product Overall Length	2.4	m
Manifold Type	C4	
Air Discharge Throw	S	
Nozzle Static Pressure	80	Pa
Fresh Air Supply Volume	25	l/s
Heating Function	Std	
Underplate Perforation Type	43% OBR	

EUROVENT CERTIFIED PERFORMANCE

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	18.0	°C	21.0	°C
Average Room Condition	24.0	°C	21.0	°C
"Air On" Thermal Gradient	0.7	°C		
Room Relative Humidity	45.0	%		

Dimensional Data		
Width x Depth	592 x 230	mm
Overall Length	2392	mm
Water Volume	2.9	
Dry Weight	41.4	kg
CW Connetion	Ø15	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	26.0	K
Waterside Performance	902	W	970	W
Water Mass Flowrate	0.072	kg/s	0.023	kg/s
Waterside Pressure Drop	4.4	kPa	3.1	kPa
Airside Performance	201	W	0	W
Total Sensible Performance	**1103**	**W**	**970**	**W**
Sound Effect LW	< 35	dB(A)		

Design Check (Warnings)	
Air Discharge	OK
Supply Air	OK
Cooling Circuit	OK
Heating Circuit	OK
Calculated Dew Point	11.3 °C

Model Ref: ECCH24005S-125H15C4H-2580S

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 coefficent.

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.

Project Specific Testing Facility

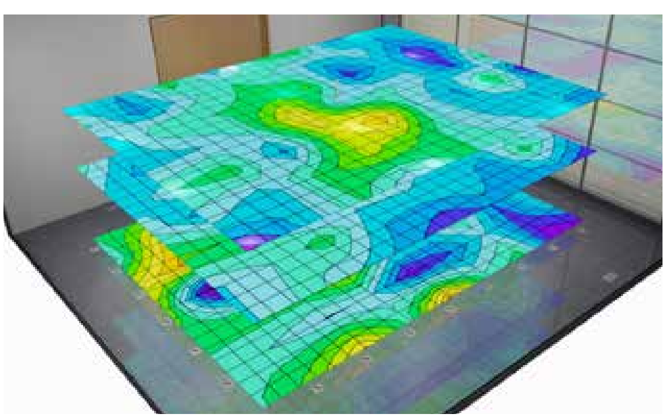
The FTF Group have 3 number state-of-the-art Climatic Testing Laboratories at one of its subsidiary companies predominantly situated at the prestigious Pride Park, Derby, UK. Each laboratory has internal dimensions of 6.3m (L) x 5.7m (W) x 3.3m (H) and includes a thermal wall so that both core and perimeter zones can be modelled. The test facilities are fixed in overall size and construction therefore simulation of buildings specific thermal mass therefore cannot be completed, it should, however be noted that a specific project can be simulated more accurately by recessing the flooe and reducing the height as necessary.

Project Specific Testing

Project Specific mock-up testing is a valuable tool which allows the Client to fully asses the proposed system and determine the resulting indoor quality and 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 enhanced.



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.

Photometric Testing Facility

The FTF Groups technical facility at Pride Park, Derby also has two Photometric test laboratories which 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 of 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 chosed then published Lamp manufacturer’s data is used to calculate actual lighting levels in a design.

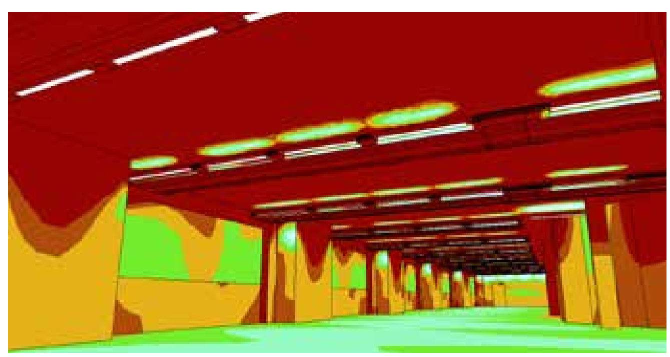
The intensity distribution is obtained by the use of a Goniophotometer to measure the intensity of light emitted from the surface of the fitting at pre-determined angles. The light intensity is measured using either a photometer with corrective spectral response filter to match the CIE standard observer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

Luminaire outputs are measured using out integrating sphere for small luminaires or our large integrator room for large fittings and Multiservice 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 all 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 suppling 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.

The FTF Groups technical facility also conducts 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 junstion temperatures.



Acoustic Testing Facility

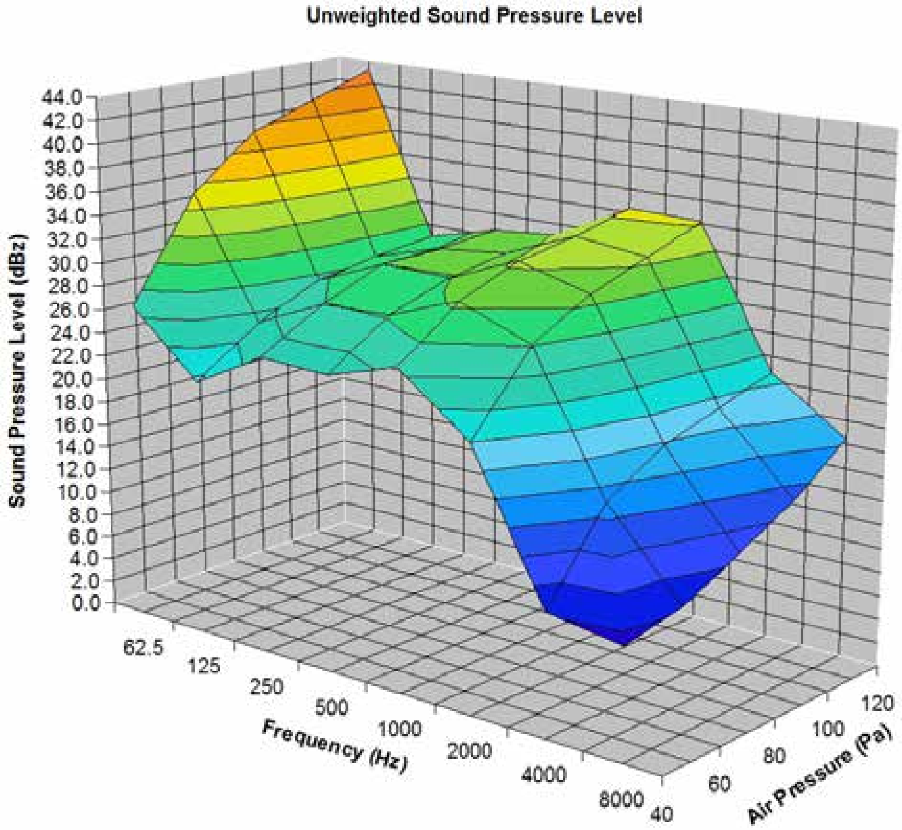
The Acoustic Test Room at the FTF Groups Technical Facility is a hemi-anechoic chamber which utilises sound absorbing acoustic foam material in the shape of wedges to provide an echo free zone for acoustic measurements; the height of the acoustic foam wedges has a direct relationship with the maximum absorbtion frequency, hence the FTF Group had the wedges specifically designed to optimise the sound absorption at the peak frequency normally found with our Active Chilled Beam products.

The use of acoustics 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 cen be accurately measured.

The acoustic facilities allow the FTF Group to provide express in-house sound evaluation to that all products, even project specific designs can be assessed and optimised.

To ensure accuracy the FTF Group 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, the FTF Group also send their new products for specialist third parts Acoustic Testing. The results of which are very close and within measurement tolerances to that of FTF Groups in-house measurement of sound.



Frenger Systems Limited (trading as FTF Group Climate participates in the ECC programme for Chilled Beams. Check the ongoing validity of certification: www.eurovent-certification.com or www.certifalsh.com

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