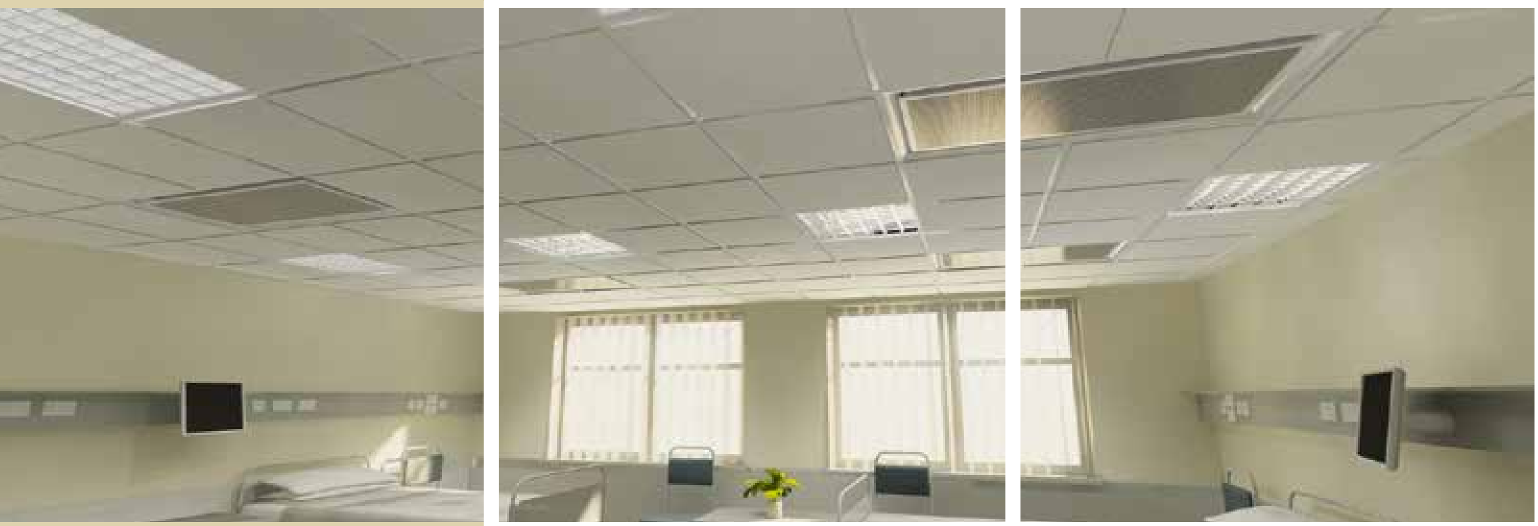
the future of space conditioning

Halo™

active chilled beam



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FTF GROUP® Climate

Contents

Product Description

Introduction

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

Halo is only **230mm deep** and can achieve upto **1463 watts total cooling** (based on a 1.2m long beam with 10∆tk between room and mean water temperature and 44 ltrs/sec of air supplied at 16°C with a 100Pa).

The Halo beam contains a number of **Patent Pending performance enhancing features** and **Registered Designs** for aesthetic enhancement, all as can be expected from the FTF Group brand.

These high-capacity Active Chilled Beams have a small footprint and as such have become increasingly popular as they can free up ceiling area whilst still handling significant heat gains and heat losses. However, the challenge has been to meet these demands whilst still delivering high levels of occupancy comfort. The FTF Group's Halo Active Chilled Beam meets these challenges with its unique 360° air discharge characteristics with concealed air discharge veins.

The latest-generation of 360° Active Chilled Beam combines cooling and optional heating function with a revolutionary air discharge system and pattern. By introducing the air with set back air deflector veins further up into the point of discharge rather than being mounted on the underplates like earlier models, this not only improves the 360° diffusion pattern it also vastly improves the products aesthetics. This latest development is a Registered Design in addition the the Patent Pending performance enhancing items by the FTF Group. When compared to traditional 2-way or 4-way discharge pattern by others, Halo can deliver a reduction in air velocities of up to 35%.

This optimal method of spreading the air in all directions means the shortest possible air throws are created, resulting in optimal levels of comfort to building occupants.

At a glance

- Halo is only 230mm deep and can achieve up to 1463 watts total cooling.
- High-capacity Active Chilled Beams with a small footprint.
- True 360° air discharge characteristics.
- Concealed air discharge veins.
- Spreading the air in all directions means the shortest possible air throws are created.
- Halo is offered in 3 standard models; "I", "C", amd "F":
    - Halo "I" models are for integrated ceiling installation.
    - Halo "C"-60 and Halo "C"-120 are designed for integration into metal clip-in ceiling systems.
    - Halo "F"-60 is designed for free-hanging exposed applications.
- Providing a comfortable environment, compliant to BS EN ISO 7730.

Construction

Halo is offered in 3 standard models: “I”, “C” and “F”.

Halo “I” models are for integrated ceiling installations in standard 15 or 24mm exposed tee bar grids (Lay-in grid systems) replacing 600 x 600mm or 1200 x 600mm tile modules and can be used for integration with either “mineral fibre” tiles or plaster board ceilings.

Halo “C”-60 and Halo “C”-120 are designed for integration into metal clip-in ceiling systems.

Halo “F”-60 is designed for free-hanging exposed applications. This is a standard model with an additional factory fitted architectural frame enhancement kit that can be finished in white to match the Halo beam, or provided as a different colour to make a feature of the extruded aluminum outer frame.

Halo™ Active Chilled Beam 1200 x 600 Module.

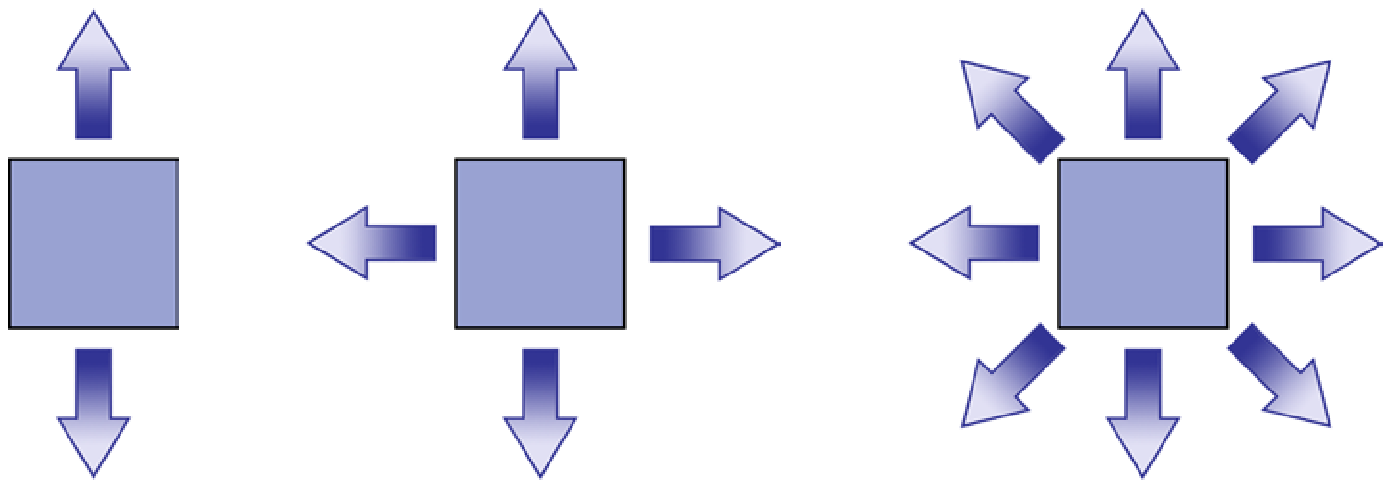
Optimum Diffusion Pattern

In addition to the flexibility offered by a modular designed small unit, Halo has been designed to deliver the most comfortable environment at any given air volume. Traditional Active Chilled Beams with 1-way or 2-way throw have the potential to throw air at high velocities over long distances, however this may result in low comfort levels - particularly where the air streams from adjacent beams meet and fall downwards into the occupied zone or where beams are located close to walls or partitions.

Beams wit ha 4-way throw help to alleviate this problem, however the FTF Group’s Halo beam takes the concept to the next level with its “true” 360° diffusion pattern.

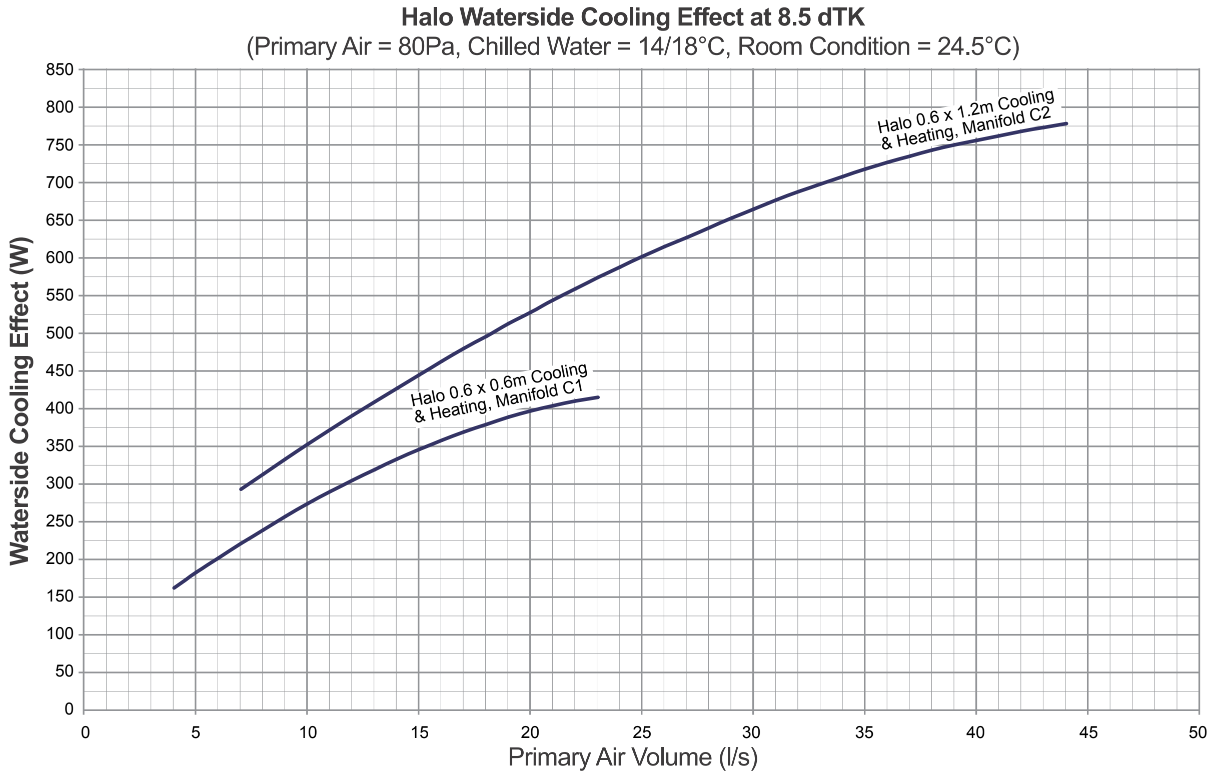
The substiantially shorter air discharge throws (35%) offered by Halo can enable more Chilled Beams to be positioned into a given room space for higher total heat gains to be offset whilst still avoiding draughts and providing a comfortable environment, compliant to BS EN ISO 7730.

Halo™ Active Chilled Beam 1200 x 600 Module fitted with architectural frame enhancement kit.



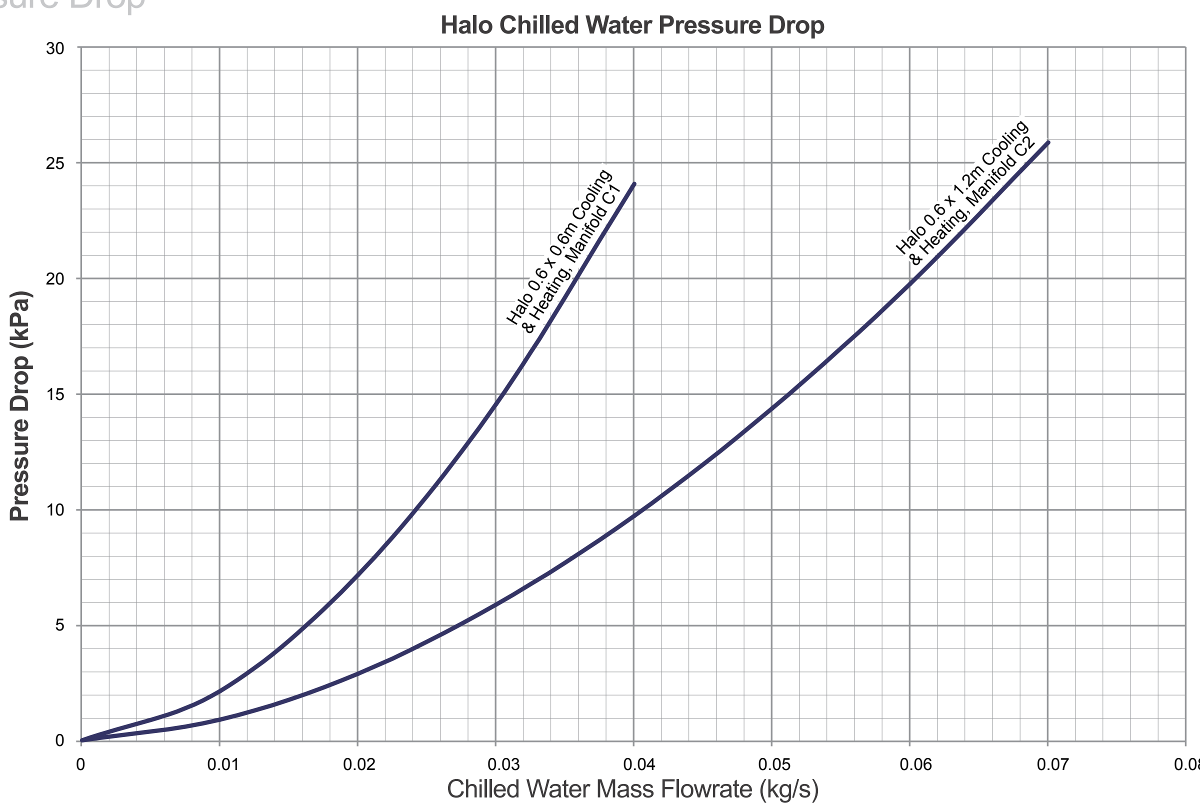
Halo distributes air in a 360° pattern for shorter air throws and optimum comfort.

Cooling Performance

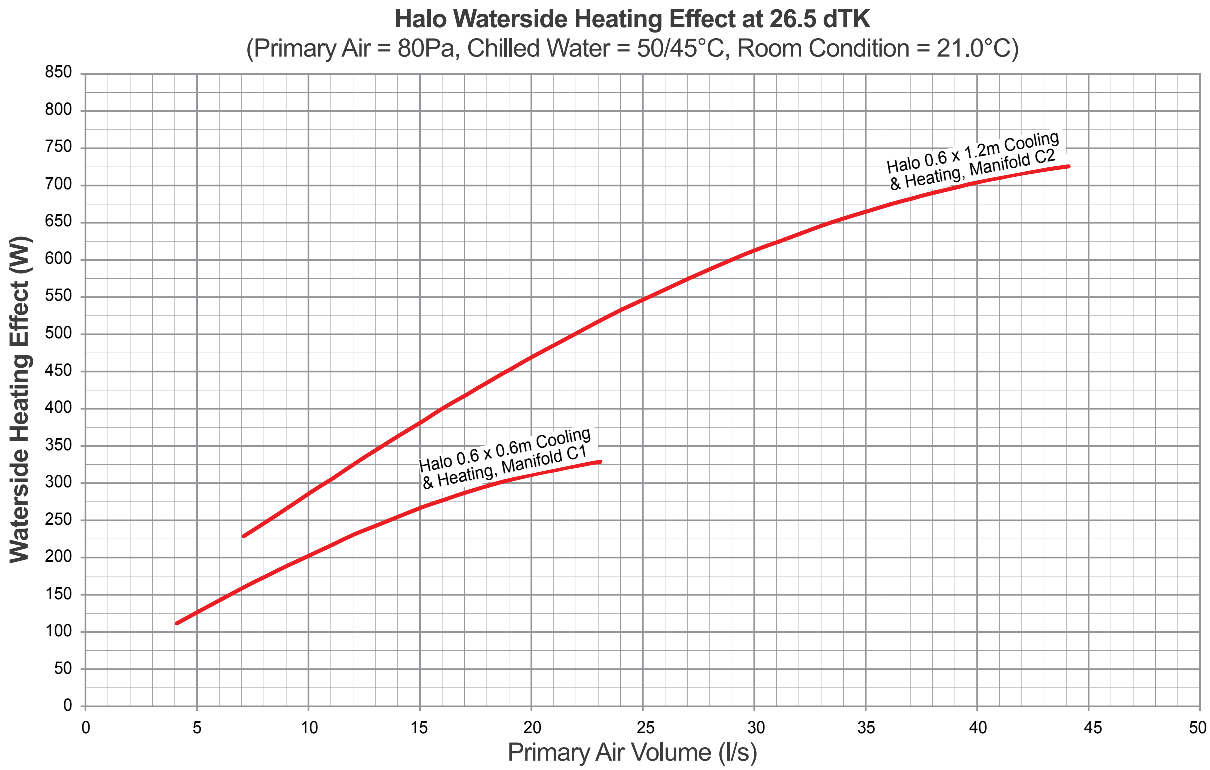


Cooling figures are based on cooling & heating beams, additional cooling is possible with a cooling only product, contact the FTF Group for more information.

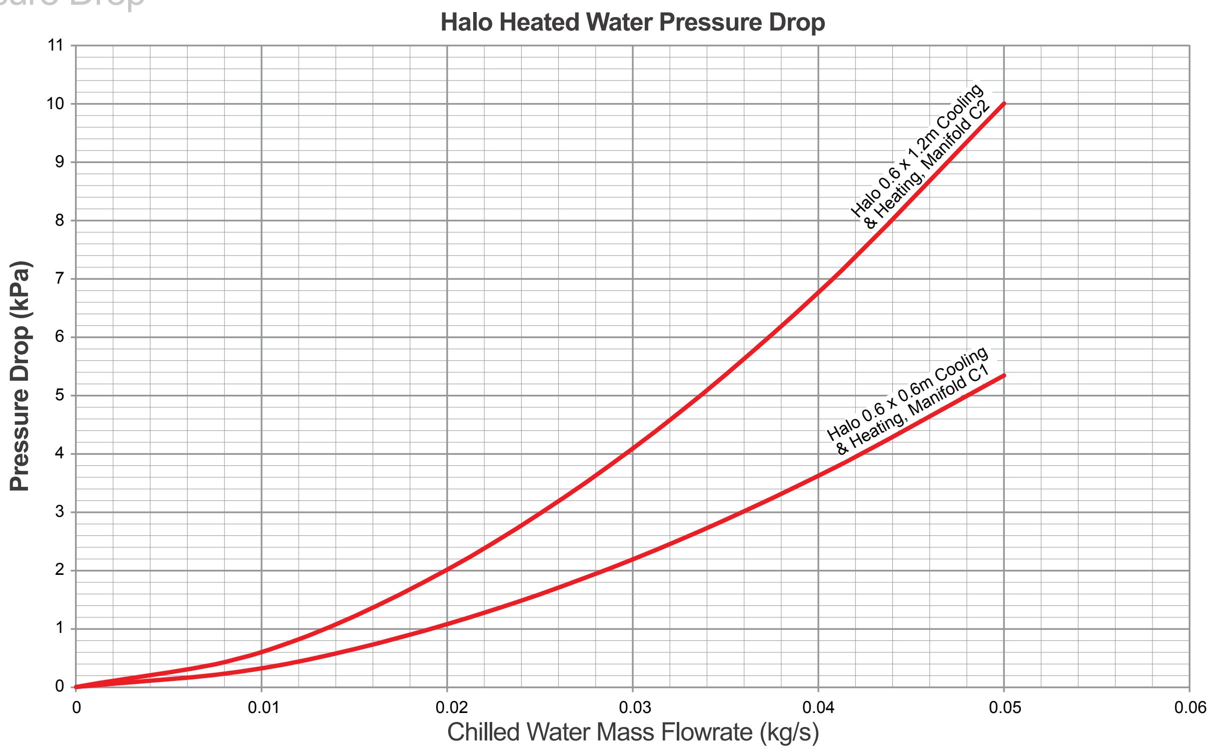
Pressure Drop



Heating Performance



Pressure Drop



Cooling Selection Tables

Cooling at 40Pa Nozzle Pressure

Nozzle Pressure 40 Pa		Water															
Q (l/s)	Halo	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)
5	0.6	215	0.017	C1	5.4	243	0.015	C1	4.1	280	0.022	C1	8.6	312	0.025	C1	10.5
	1.2	376	0.030	C2	5.8	425	0.025	C2	4.4	488	0.039	C2	9.2	544	0.043	C2	11.2
10	0.6	231	0.018	C1	6.1	259	0.015	C1	4.6	300	0.024	C1	9.7	334	0.027	C1	11.8
	1.2	391	0.031	C2	6.2	441	0.026	C2	4.7	509	0.040	C2	9.9	567	0.045	C2	12.1
15	0.6	240	0.019	C1	6.6	264	0.016	C1	4.8	317	0.025	C1	10.7	354	0.028	C1	13.1
	1.2	405	0.032	C2	6.6	455	0.027	C2	4.9	528	0.042	C2	10.6	589	0.047	C2	12.9
20	0.6	251	0.020	C1	7.1	274	0.016	C1	5.1	333	0.027	C1	11.7	372	0.030	C1	14.3
	1.2	418	0.033	C2	7.0	467	0.028	C2	5.2	546	0.043	C2	11.2	610	0.049	C2	13.7
25	0.6	263	0.021	C1	7.7	287	0.017	C1	5.5	347	0.028	C1	12.5	387	0.031	C1	15.3
	1.2	424	0.034	C2	7.2	469	0.028	C2	5.3	561	0.045	C2	11.8	628	0.050	C2	14.4
30	0.6	272	0.022	C1	8.1	298	0.018	C1	5.9	357	0.028	C1	13.2	398	0.032	C1	16.1
	1.2	430	0.034	C2	7.4	468	0.028	C2	5.3	575	0.046	C2	12.3	646	0.051	C2	15.2
35	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	440	0.035	C2	7.7	476	0.028	C2	5.5	591	0.047	C2	12.9	663	0.053	C2	15.9
40	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	452	0.036	C2	8.1	490	0.029	C2	5.8	606	0.048	C2	13.5	680	0.054	C2	16.5
45	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	463	0.037	C2	8.4	502	0.030	C2	6.0	619	0.049	C2	14.0	694	0.055	C2	17.2
50	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	473	0.038	C2	8.7	514	0.031	C2	6.3	631	0.050	C2	14.5	707	0.056	C2	17.7

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 3°C (Water in-out), nozzle pressure of 40 Pa, 1 x Ø125 air connection.
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)	Halo	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)
5	0.6	238	0.019	C1	6.4	269	0.016	C1	4.9	309	0.025	C1	10.2	343	0.027	C1	12.4
	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	0.6	254	0.020	C1	7.2	286	0.017	C1	5.4	330	0.026	C1	11.5	367	0.029	C1	14.0
	1.2	433	0.034	C2	7.4	488	0.029	C2	5.6	562	0.045	C2	11.8	626	0.050	C2	14.3
15	0.6	267	0.021	C1	7.9	296	0.018	C1	5.8	349	0.028	C1	12.7	388	0.031	C1	15.4
	1.2	447	0.036	C2	7.8	503	0.030	C2	5.9	582	0.046	C2	12.5	649	0.052	C2	15.3
20	0.6	280	0.022	C1	8.6	311	0.019	C1	6.3	365	0.029	C1	13.8	407	0.032	C1	16.7
	1.2	461	0.037	C2	8.3	516	0.031	C2	6.1	601	0.048	C2	13.3	671	0.053	C2	16.2
25	0.6	292	0.023	C1	9.2	321	0.019	C1	6.8	379	0.030	C1	14.7	421	0.034	C1	17.8
	1.2	472	0.038	C2	8.6	523	0.031	C2	6.3	619	0.049	C2	14.0	691	0.055	C2	17.0
30	0.6	301	0.024	C1	9.7	335	0.020	C1	7.2	390	0.031	C1	15.4	433	0.034	C1	18.6
	1.2	483	0.038	C2	9.0	532	0.032	C2	6.6	637	0.051	C2	14.7	711	0.057	C2	17.9
35	0.6	307	0.024	C1	10.0	343	0.021	C1	7.5	398	0.032	C1	16.0	442	0.035	C1	19.3
	1.2	496	0.039	C2	9.4	544	0.033	C2	6.9	653	0.052	C2	15.4	729	0.058	C2	18.7
40	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	508	0.040	C2	9.8	559	0.033	C2	7.1	669	0.053	C2	16.0	746	0.059	C2	19.5
45	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	520	0.041	C2	10.2	572	0.034	C2	7.4	682	0.054	C2	16.6	724	0.058	C3	6.3
50	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	530	0.042	C2	10.5	584	0.035	C2	7.7	694	0.055	C2	17.1	739	0.059	C3	6.5

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 3°C (Water in-out), nozzle pressure of 60 Pa, 1 x Ø125 air connection.
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)	Halo	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)
5	0.6	241	0.019	C1	6.6	273	0.016	C1	5.0	312	0.025	C1	10.5	347	0.025	C1	12.7
	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	0.6	276	0.022	C1	8.3	311	0.019	C1	6.2	357	0.025	C1	13.2	397	0.032	C1	16.0
	1.2	441	0.035	C2	7.6	497	0.030	C2	5.7	572	0.046	C2	12.2	637	0.051	C2	14.8
15	0.6	307	0.024	C1	10.0	345	0.021	C1	7.5	397	0.032	C1	15.9	442	0.035	C1	19.3
	1.2	474	0.038	C2	8.7	532	0.032	C2	6.5	616	0.049	C2	13.8	686	0.055	C2	16.8
20	0.6	335	0.027	C1	11.7	379	0.023	C1	8.8	431	0.034	C1	18.4	459	0.036	C2	3.1
	1.2	506	0.040	C2	9.7	566	0.034	C2	7.2	658	0.052	C2	15.5	732	0.058	C2	18.8
25	0.6	358	0.029	C1	13.1	408	0.024	C1	10.0	440	0.035	C2	2.9	496	0.039	C2	3.5
	1.2	536	0.043	C2	10.7	599	0.036	C2	8.0	697	0.055	C2	17.2	755	0.060	C3	6.7
30	0.6	377	0.030	C1	14.3	430	0.026	C1	11.0	467	0.037	C2	3.2	527	0.042	C2	3.9
	1.2	566	0.045	C2	11.8	633	0.038	C2	8.8	734	0.058	C2	18.8	797	0.063	C3	7.4
35	0.6	391	0.031	C1	15.3	447	0.027	C1	11.8	489	0.039	C2	3.4	550	0.044	C2	4.2
	1.2	594	0.047	C2	12.8	667	0.040	C2	9.6	747	0.059	C3	6.5	839	0.067	C3	8.0
40	0.6	402	0.032	C1	16.1	460	0.027	C1	12.4	505	0.040	C2	3.6	567	0.045	C2	4.4
	1.2	620	0.049	C2	13.8	698	0.042	C2	10.4	783	0.062	C3	7.1	878	0.070	C3	8.7
45	0.6	409	0.033	C1	16.6	468	0.028	C1	12.7	515	0.041	C2	3.7	578	0.046	C2	4.6
	1.2	643	0.051	C2	14.8	726	0.043	C2	11.1	815	0.065	C3	7.6	913	0.073	C3	9.3
50	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	663	0.053	C2	15.6	751	0.045	C2	11.8	843	0.067	C3	8.0	943	0.075	C3	9.8

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 3°C (Water in-out), nozzle pressure of 80 Pa, 1 x Ø125 air connection.
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)	Halo	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)
5	0.6	248	0.020	C1	6.9	280	0.017	C1	5.2	321	0.026	C1	10.9	356	0.028	C1	13.3
	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	0.6	288	0.023	C1	9.0	325	0.019	C1	6.7	372	0.030	C1	14.2	414	0.033	C1	17.2
	1.2	453	0.036	C2	8.0	509	0.030	C2	6.0	588	0.048	C2	12.8	654	0.052	C2	15.5
15	0.6	324	0.026	C1	11.0	366	0.022	C1	8.3	418	0.033	C1	17.4	442	0.035	C2	2.9
	1.2	492	0.039	C2	9.2	553	0.033	C2	6.9	639	0.051	C2	14.8	711	0.057	C2	17.9
20	0.6	355	0.028	C1	12.9	403	0.024	C1	9.8	434	0.035	C2	2.8	490	0.039C	C2	3.5
	1.2	529	0.042	C2	10.5	594	0.035	C2	7.8	687	0.055	C2	16.8	747	0.059	C3	6.6
25	0.6	382	0.030	C1	14.7	435	0.026	C1	11.2	471	0.038	C2	3.2	531	0.042	C2	4.0
	1.2	565	0.045	C2	11.8	634	0.038	C2	8.8	732	0.058	C2	18.7	798	0.053	C3	7.4
30	0.6	404	0.032	C1	16.2	460	0.027	C1	12.4	502	0.040	C2	3.6	565	0.045	C2	4.4
	1.2	598	0.048	C2	13.0	672	0.040	C2	9.7	754	0.060	C3	6.6	846	0.067	C3	8.2
35	0.6	421	0.034	C1	17.4	480	0.029	C1	13.3	527	0.042	C2	3.9	591	0.074	C2	4.8
	1.2	630	0.050	C2	14.2	710	0.042	C2	10.7	796	0.063	C3	7.3	892	0.0.71	C3	8.9
40	0.6	435	0.035	C1	18.4	494	0.029	C1	14.0	544	0.043	C2	4.1	610	0.049	C2	5.1
	1.2	658	0.052	C2	15.4	744	0.044	C2	11.6	835	0.066	C3	7.9	934	0.074	C3	9.7
45	0.6	443	0.035	C1	19.0	503	0.030	C1	14.4	555	0.044	C2	4.3	622	0.049	C2	5.2
	1.2	684	0.055	C2	16.4	775	0.046	C2	12.4	870	0.069	C3	8.5	973	0.077	C3	10.4
50	0.6	446	0.036	C1	19.3	506	0.030	C1	14.6	559	0.045	C2	4.3	627	0.050	C2	5.3
	1.2	707	0.056	C2	17.4	803	0.048	C2	13.2	901	0.072	C3	9.0	1007	0.080	C3	11.0

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 3°C (Water in-out), nozzle pressure of 100 Pa, 1 x Ø125 air connection.
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)	Halo	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)
5	0.6	181	0.012	0.4	224	0.012	0.5	267	0.012	0.4	301	0.012	0.4
	1.2	266	0.012	0.8	328	0.012	0.8	389	0.012	0.8	443	0.012	0.7
10	0.6	225	0.012	0.4	269	0.012	0.4	324	0.012	0.4	373	0.012	0.4
	1.2	317	0.012	0.8	383	0.012	0.8	450	0.012	0.7	548	0.013	0.9
15	0.6	250	0.012	0.4	303	0.012	0.4	360	0.012	0.4	429	0.012	0.5
	1.2	350	0.012	0.8	438	0.012	0.9	522	0.012	0.9	650	0.016	1.3
20	0.6	261	0.012	0.4	316	0.012	0.4	382	0.012	0.4	448	0.012	0.4
	1.2	383	0.012	0.8	467	0.012	0.8	591	0.014	1.1	738	0.018	1.6
25	0.6	260	0.012	0.4	315	0.012	0.4	381	0.012	0.4	447	0.012	0.4
	1.2	407	0.012	0.8	501	0.012	0.8	648	0.016	1.3	808	0.019	1.8
30	0.6	247	0.012	0.4	312	0.012	0.5	355	0.012	0.4	426	0.012	0.5
	1.2	434	0.012	0.9	534	0.013	0.9	691	0.017	1.4	861	0.021	2.1
35	0.6	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	443	0.012	0.9	555	0.013	1.0	718	0.017	1.5	896	0.021	2.2
40	0.6	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	447	0.012	0.9	564	0.014	1.0	731	0.017	1.6	911	0.022	2.3
45	0.6	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	446	0.012	0.9	562	0.013	1.0	727	0.017	1.6	907	0.022	2.3
50	0.6	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	440	0.012	0.9	548	0.013	1.0	709	0.017	1.5	884	0.021	2.2

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											
Q (l/s)	Halo	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)
5	0.6	192	0.012	0.4	235	0.012	0.4	278	0.012	0.4	320	0.012	0.4
	1.2	-	-	-	-	-	-	-	-	-	-	-	-
10	0.6	237	0.012	0.5	285	0.012	0.4	337	0.012	0.4	391	0.012	0.4
	1.2	344	0.012	1.0	420	0.012	1.0	479	0.012	0.8	596	0.014	1.1
15	0.6	256	0.012	0.4	312	0.012	0.4	375	0.012	0.4	442	0.012	0.4
	1.2	364	0.012	0.8	455	0.012	0.9	557	0.013	1.0	694	0.017	1.4
20	0.6	274	0.012	0.4	335	0.012	0.4	395	0.012	0.4	457	0.012	0.4
	1.2	396	0.012	0.8	483	0.012	0.8	625	0.015	1.2	779	0.019	1.7
25	0.6	276	0.012	0.4	338	0.012	0.4	399	0.012	0.4	463	0.012	0.4
	1.2	431	0.012	0.9	526	0.013	0.9	681	0.016	1.4	850	0.020	2.0
30	0.6	265	0.012	0.4	327	0.012	0.4	387	0.012	0.4	441	0.012	0.4
	1.2	445	0.012	0.9	560	0.013	1.0	725	0.017	1.6	904	0.022	2.2
35	0.6	246	0.012	0.4	307	0.012	0.5	357	0.012	0.4	422	0.012	0.5
	1.2	455	0.012	0.9	584	0.014	1.1	756	0.018	1.7	943	0.023	2.4
40	0.6	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	448	0.012	0.8	597	0.014	1.1	774	0.019	1.8	965	0.023	2.5
45	0.6	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	450	0.012	0.8	601	0.014	1.2	778	0.019	1.8	970	0.023	2.5
50	0.6	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	445	0.012	0.7	593	0.014	1.1	769	0.018	1.7	958	0.023	2.5

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												
Q (l/s)	Halo	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)
5	0.6	210	0.012	0.5	249	0.012	0.4	298	0.012	0.4	343	0.012	0.4
	1.2	-	-	-	-	-	-	-	-	-	-	-	-
10	0.6	239	0.012	0.4	300	0.012	0.5	352	0.012	0.4	417	0.012	0.5
	1.2	348	0.012	0.8	436	0.012	0.9	518	0.012	0.9	645	0.015	1.2
15	0.6	267	0.012	0.4	328	0.012	0.4	386	0.012	0.4	444	0.012	0.4
	1.2	383	0.012	0.8	467	0.012	0.8	592	0.014	1.1	739	0.018	1.6
20	0.6	285	0.012	0.4	346	0.012	0.4	425	0.012	0.5	471	0.012	0.4
	1.2	427	0.012	1.0	509	0.012	0.9	658	0.016	1.3	821	0.020	1.9
25	0.6	291	0.012	0.4	353	0.012	0.4	427	0.012	0.5	485	0.012	0.4
	1.2	526	0.012	2.3	552	0.013	1.0	714	0.017	1.5	891	0.021	2.2
30	0.6	287	0.012	0.4	348	0.012	0.4	426	0.012	0.5	475	0.012	0.4
	1.2	457	0.012	0.9	587	0.014	1.1	760	0.018	1.7	948	0.023	2.4
35	0.6	270	0.012	0.4	331	0.012	0.4	391	0.012	0.4	441	0.012	0.3
	1.2	459	0.012	0.8	613	0.014	1.2	795	0.019	1.8	990	0.024	2.6
40	0.6	244	0.012	0.4	308	0.012	0.5	359	0.012	0.4	423	0.012	0.5
	1.2	464	0.012	0.8	631	0.015	1.3	818	0.020	1.9	1019	0.024	2.8
45	0.6	211	0.012	0.4	257	0.012	0.4	306	0.012	0.4	354	0.012	0.4
	1.2	470	0.012	0.8	631	0.015	1.3	829	0.020	2.0	1033	0.025	2.8
50	0.6	-	-	-	-	-	-	-	-	-	-	-	-
	1.2	470	0.012	0.8	640	0.015	1.3	829	0.020	2.0	1033	0.025	2.8

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		W0.ater												
Q (l/s)	Halo	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)
5	0.6	214	0.012	0.4	261	0.012	0.4	310	0.012	0.4	353	0.012	0.4
	1.2	-	-	-	-	-	-	-	-	-	-	-	-
10	0.6	246	0.012	0.4	311	0.012	0.5	355	0.012	0.4	425	0.012	0.5
	1.2	360	0.012	0.8	451	0.012	0.9	548	0.013	1.0	683	0.016	1.4
15	0.6	272	0.012	0.4	334	0.012	0.4	394	0.012	0.4	455	0.012	0.4
	1.2	393	0.012	0.8	478	0.012	0.8	618	0.015	1.2	771	0.018	1.7
20	0.6	291	0.012	0.4	353	0.012	0.4	427	0.012	0.5	484	0.012	0.4
	1.2	430	0.012	0.9	526	0.013	0.9	680	0.016	1.4	848	0.020	2.0
25	0.6	307	0.012	0.5	356	0.012	0.4	436	0.012	0.5	503	0.012	0.4
	1.2	448	0.012	0.9	567	0.014	1.0	734	0.018	1.6	915	0.022	2.3
30	0.6	307	0.012	0.5	356	0.012	0.4	436	0.012	0.5	502	0.012	0.4
	1.2	451	0.012	0.8	601	0.014	1.2	779	0.019	1.8	971	0.023	2.5
35	0.6	290	0.012	0.4	351	0.012	0.4	426	0.012	0.5	481	0.012	0.4
	1.2	462	0.012	0.7	629	0.015	1.3	815	0.020	1.9	1016	0.024	2.8
40	0.6	270	0.012	0.4	331	0.012	0.4	391	0.012	0.4	451	0.012	0.4
	1.2	477	0.012	0.8	649	0.016	1.3	842	0.020	2.0	1048	0.025	2.9
45	0.6	243	0.012	0.4	306	0.012	0.5	357	0.012	0.4	421	0.013	0.5
	1.2	486	0.012	0.8	662	0.016	1.4	858	0.021	2.1	1069	0.026	3.0
50	0.6	207	0.012	0.4	256	0.012	0.4	305	0.012	0.4	353	0.012	0.4
	1.2	490	0.012	0.8	668	0.016	1.4	865	0.021	2.1	1077	0.026	3.1

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

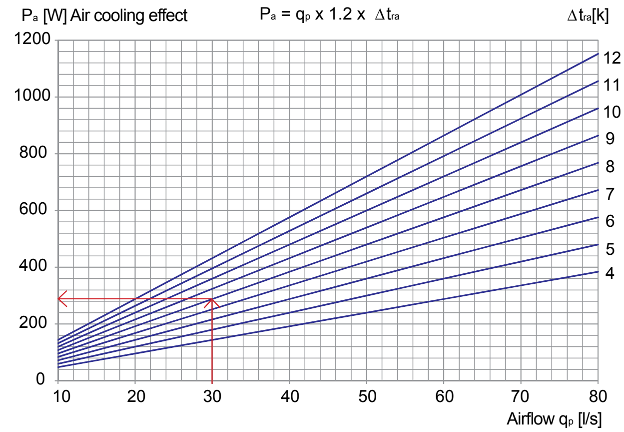
Cooling effect supplied in the ventilation air [W]

1. Start by calculating the required cooling effect that has to be supplied to the room in order to provide a certain temperautre.

2. Calculate any cooling effect that is provided by the ventilation air.

3. The remaining cooling effect has to be supplied by the beam.

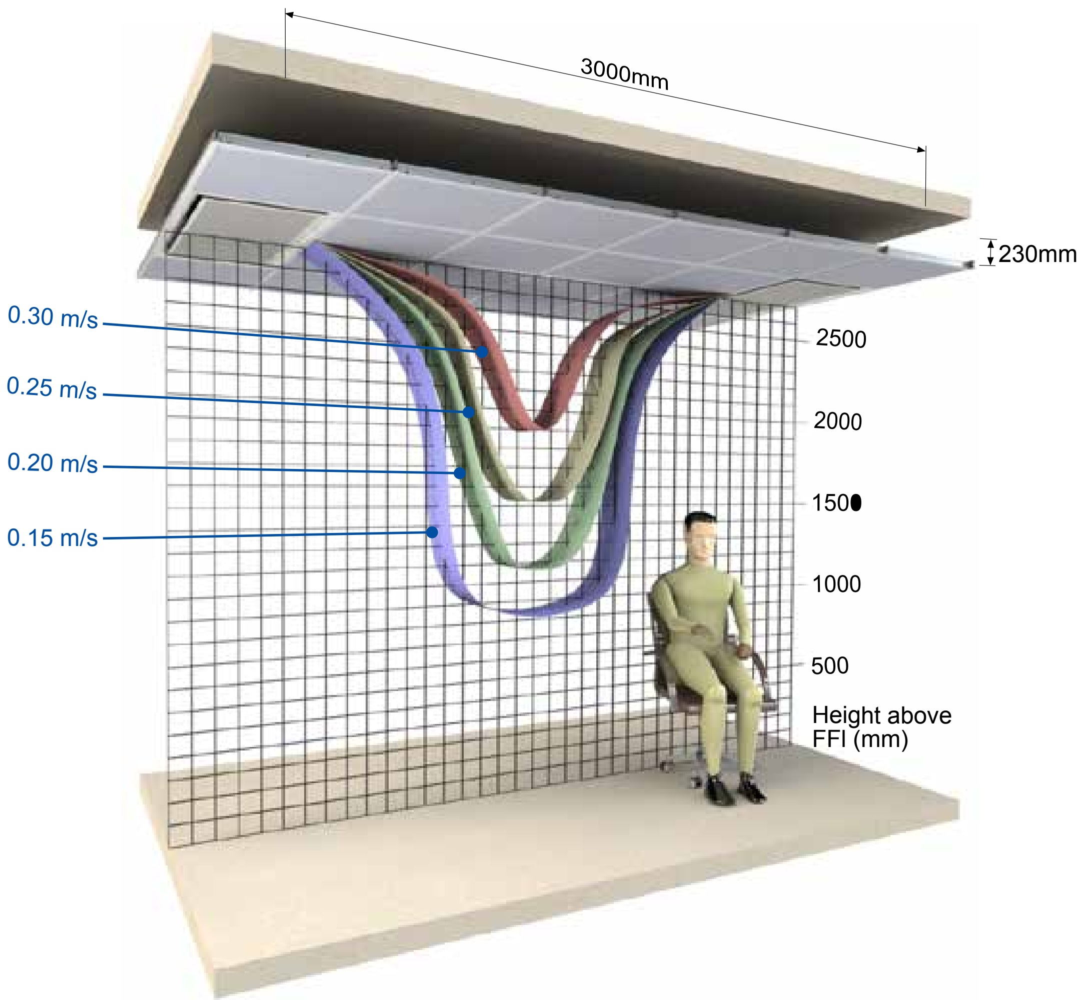
Formula for air cooling effect: $P = m \times Cp \times \Delta t$
Where:
m = mass flow [kg/s]
Cp = specific heat capacity [J/(kg•K)]
qp = air flow [l/s]
Δt = the difference between the temperature of the room and the temperature of the supply air [K]
It is usually $m \times Cp \approx qp \times 1.2$



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.

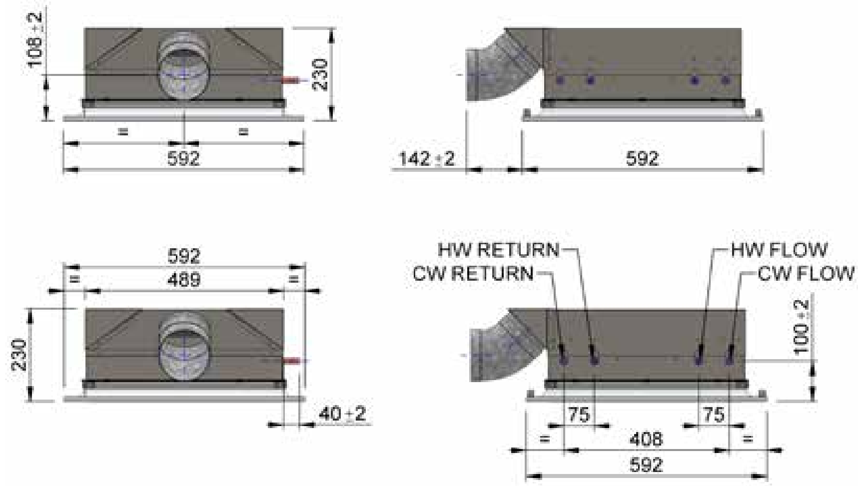
Scatter Diagram

Fresh Air Volume 35 l/s per beam @ 80Pa

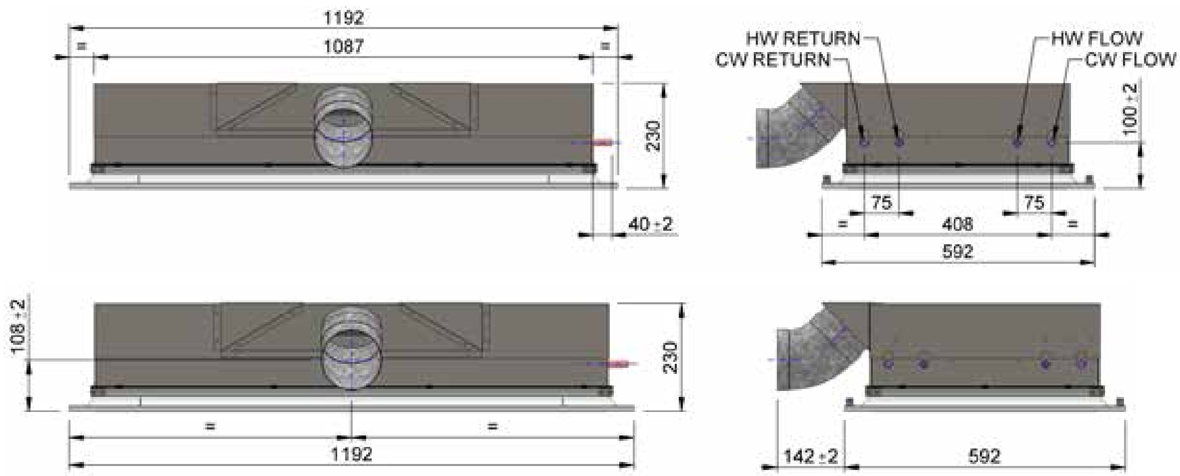


Product Dimensions

600 x 600

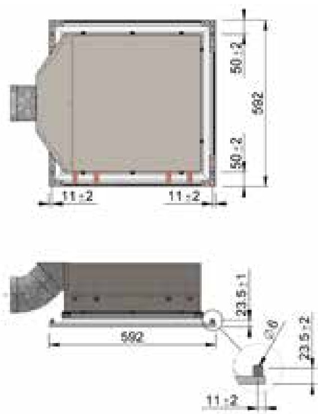


1200 x 600

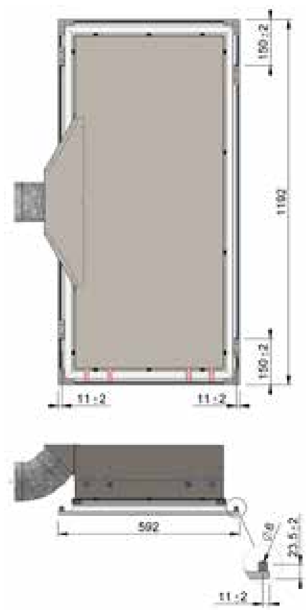


Mounting Details

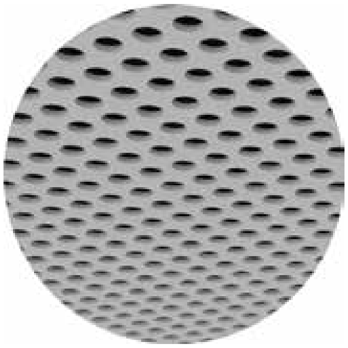
600 x 600



1200 x 600



Perforation Pattern Options



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

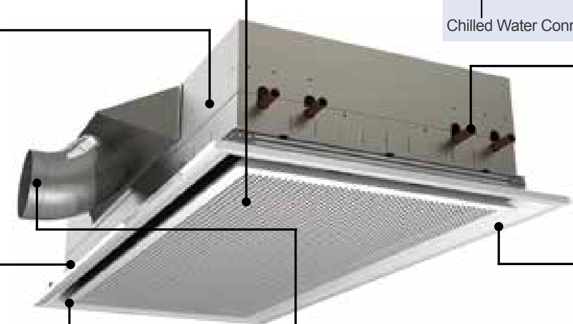
6. Waterside Connection

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

15 C3 H

Orientation - H: Horizontal

Chilled Water Connection Size (mm) 15 / 22



1. Beam Type

HAI - Halo "Integrated"

HAC - Halo "Clip In"

HAF - Halo "Free Hanging"

3. Nominal Beam Length (mm)

5. Airside Connection

Air Connection Qty

1 x 125 H

Orientation - H: Horizontal / V: Vertical

Air Connection Spigot Size (mm) 125

7. Air Supply / Discharge

Air Supply Volume (l/s)

21 80 L

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:

HAI	CH	0.6	7D	-	1 x 125H	H15C2H	-	2180L
1	2	3	4		5	6		7

Calculation Programme

Active Chilled Beam Calculation Tool

FTF GROUP® Climate

Is this the latest version?

Project Ref.

Halo Active Beam Data

Air Connection	1x125H	mm
Product Length	1.2	m
Manifold Type	C3	
Air Discharge Throw	L	
Nozzle Static Pressure	50	Pa
Fresh Air Supply Volume	10	l/s
Heating Funtion	Yes	
Ceiling System	Lay In Grid	

Design Conditions — *Heating*

Flow Water Temperature	14.0	°C	50.0	°C
Return Water Temperature	17.0	°C	47.1	°C
Air Supply Temperature	16.0	°C	19.0	°C
Average Room Condition	24.0	°C	21.0	°C
"Air On" Thermal Gradient	0.0	°C		
Room Relative Humidity	50.0	%		

Dimensional Data

Width x Depth	592 x 230	mm
Overall Length	1192	mm
Water Volume	2.5	
Dry Weight	30.3	kg
CW Connetion	Ø15	mm
LTHW Connection	Ø15	mm

Performance Data — *Heating*

Room - Mean Water dT	8.50	K	27.6	K
Waterside Performance	490	W	564	W
Water Mass Flowrate	0.039	kg/s	0.047	kg/s
Waterside Pressure Drop	3.1	kPa	8.8	kPa
Airside Performance	96	W	-24	W
Total Sensible Performance	**586**	**W**	**1087.5**	**W**
Sound Effect LW	< 35	dB(A)		

Design Check (Warnings)

Supply Air	OK	
Cooling Circuit	OK	
Heating Circuit	OK	
Calculated Dew Point	12.9	°C

Model Ref: HA-I-1.2CH-1x125HH15C3H-1050L

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.

Halo Active Beam Data

Air Connection	1x125H	mm
Product Length	1.2	m
Manifold Type	C3	
Air Discharge Throw	L	
Nozzle Static Pressure	50	Pa
Fresh Air Supply Volume	10	l/s
Heating Function	Yes	
Ceiling System	Lay In Grid	

The FTF Group's calculation programme for Halo is extremely user friendly.

"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 beinf 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 13. Note: Smaller perforation (Ref 4D) has slight reduced heating and cooling performance.

Design Conditions — *Heating*

Flow Water Temperature	14.0	°C	50.0	°C
Return Water Temperature	17.0	°C	47.1	°C
Air Supply Temperature	16.0	°C	19.0	°C
Average Room Condition	24.0	°C	21.0	°C
"Air On" Thermal Gradient	0.0	°C		
Room Relative Humidity	50.0	%		

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

Performance Data — *Heating*

Room - Mean Water dT	8.50	K	24.0	K
Waterside Performance	490	W	1183	W
Waterside Mass Flowrate	0.039	kg/s	0.028	kg/s
Waterside Pressure Drop	3.1	kPa	5.0	kPa
Airside Performance	96	W	-96.0	W
Total Sensible Performance	**586**	**W**	**1087.5**	**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 Halo are available upon request.

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

Project Specific Testing Facility

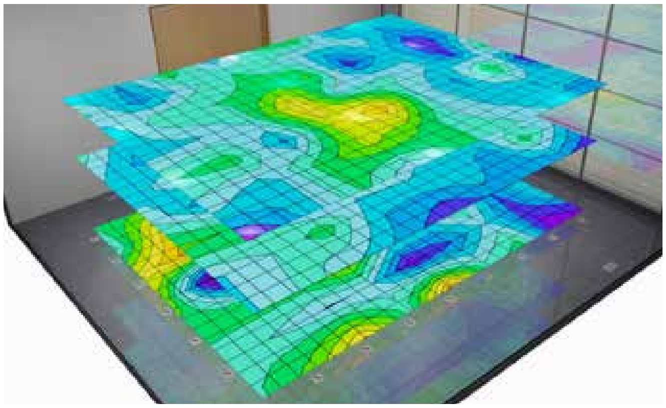
The FTF Group have 3 number state-of-the-art Climatic Testing Laboratories at one of its subsidiary companies predominantly situated at the prestigious Pride Park, Derby, UK. Each laboratory has internal dimensions of 6.3m (L) x 5.7m (W) x 3.3m (H) and includes a thermal wall so that both core and perimeter 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.

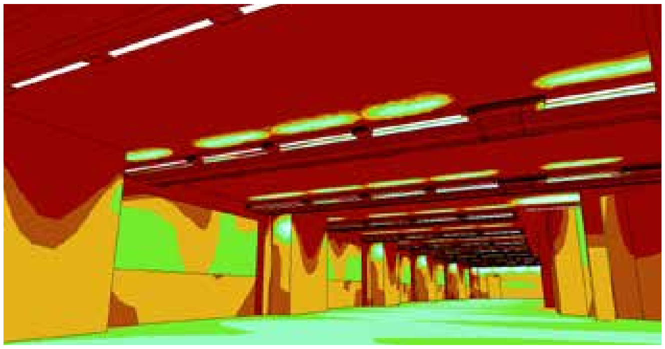
The intensity distribution is obtained by the use of a Goniophotometer to measure the intensity of light emitted from the surface of the fitting at pre-determined angles. The light intensity is measured using either a photometer with corrective spectral response filter to match the CIE standard observer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

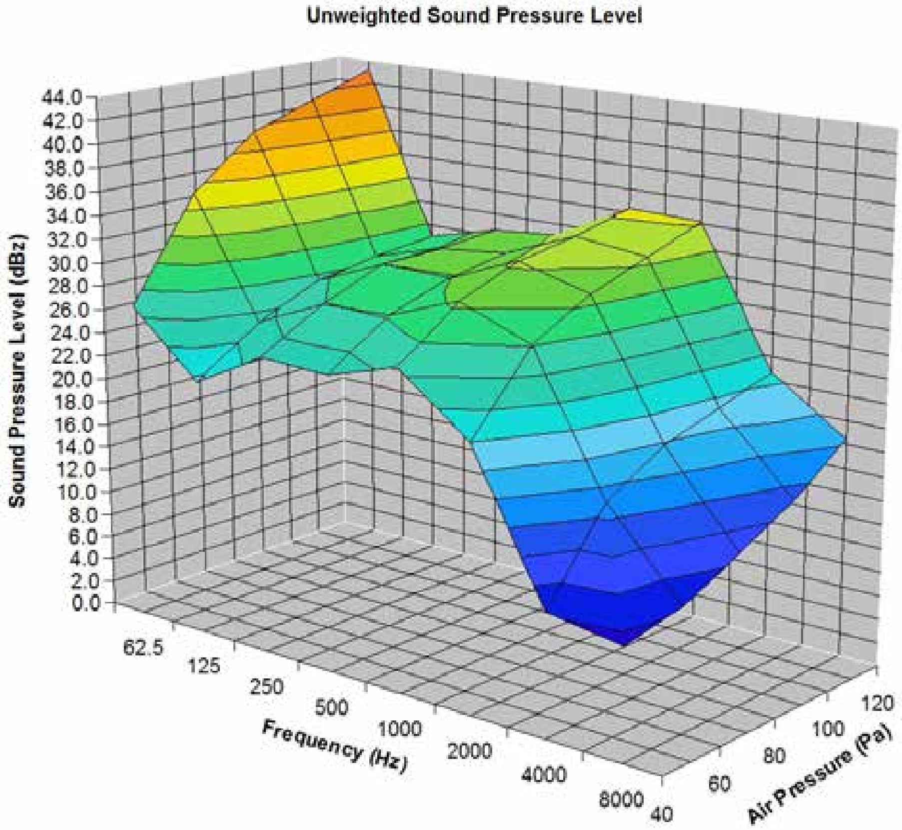
The Acoustic Test Room at the FTF Groups Technical Facility is a hemi-anechoic chamber which utilises sound absorbing acoustic foam material in the shape of wedges to provide an echo free zone for acoustic measurements; the height of the acoustic foam wedges has a direct relationship with the maximum 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.



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