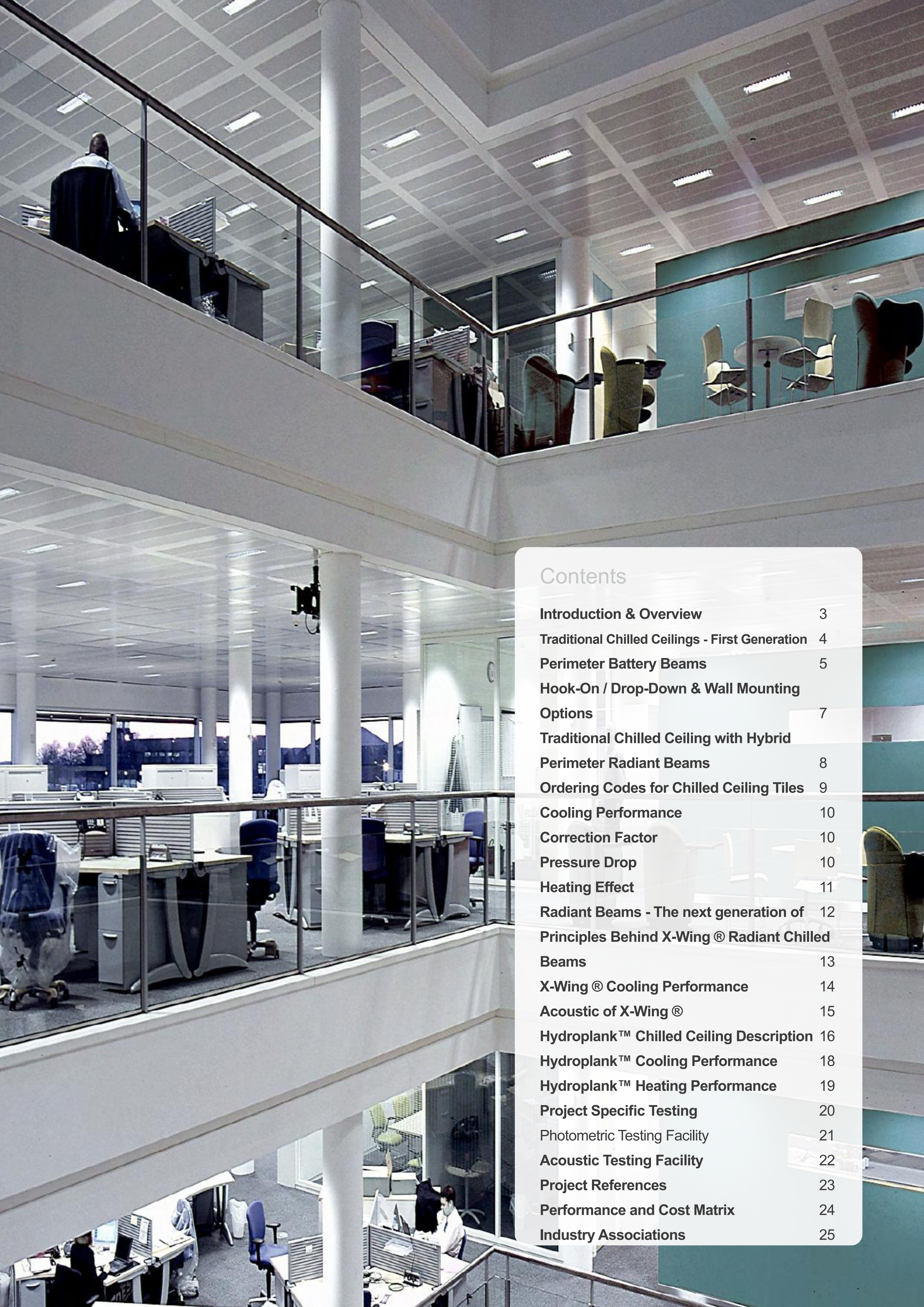
the future of space conditioning

Chilled Ceiling Solutions



www.frenger.co.uk
an FTF Group Company

FRENGER® systems



Contents

Introduction & Overview

Technical Advancements of Chilled Ceilings

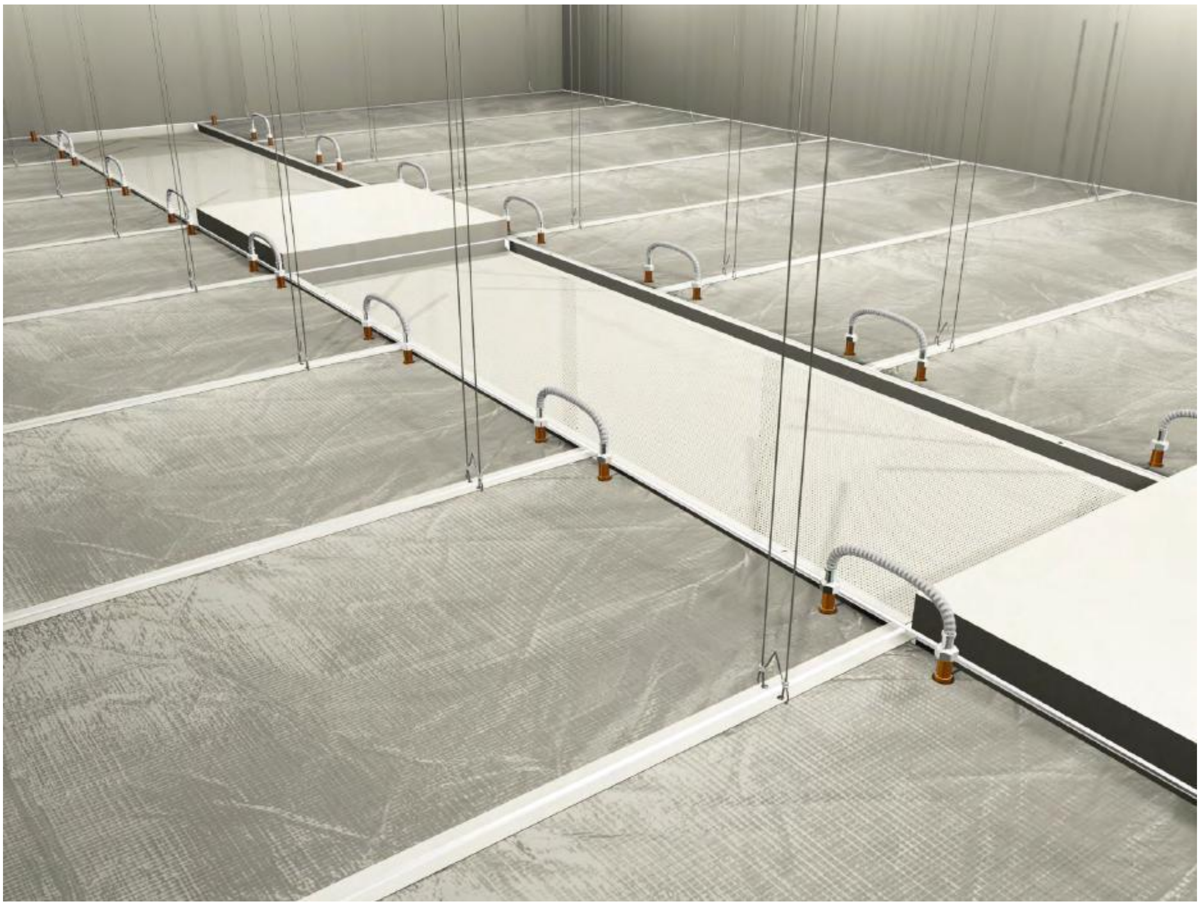
Static cooling systems (chilled ceilings) have, over the past 40 years, proven themselves capable of delivering high levels of occupancy comfort at reduced running costs. Frenger designed, supplied and installed the “Worlds Largest Radiant Chilled Ceiling” system in 1962; the 175,000 square meter, 27 stories high, Shell Oil Headquarters, situated on the River Thames in London. This building was also the first fully sealed air conditioned building in Europe and was revolutionary at its time as this Frenger Chilled Ceiling used the River Thames’ water to cool the building down. This was achieved by pumping in cool water from upstream to a secondary heat exchanger which in turn cooled (took heat out of the building by “Radiant” absorption) the building down, then depositing the warmer return water from the secondary heat exchanger down stream. This installation is still operating after over 50 years and is a testament to the integrity of the product and to Frenger’s design capabilities.

Since this time the cooling requirements for a typical office environment have increased considerably; improved insulation, higher occupancy densities and a much higher usage of IT equipment have all fueled this increase. It became apparent in the mid 1990’s that the cooling capacity of a traditional chilled ceiling was not sufficient to meet these increased heat-gains, and consequently higher-capacity Passive Chilled Beam fin coil batteries were introduced into perimeter zones to offset the solar load generated at the building façade.

Although fin coil batteries provided the extra cooling at lower cost in £ / watt than the radiant ceiling, the perimeter aesthetics suffered due to the fin coil batteries requiring large size perforations and percentage open area to allow air (“convection”) to circulate and this also reduced occupancy comfort, due to higher air velocities.

Frenger however saw the opportunity to take all the benefits from a traditional chilled ceiling for radiant cooling, and to develop a “hybrid” product solution that also has the cooling performance of Passive Beams coupled with “Radiant Cooling” to yield the same aesthetics as associated with the traditional Radiant Chilled Ceilings and in turn low air velocities for compliance to ISO 7730 European Standard for “Indoor Air Comfort Conditions” given that Frenger’s “hybrid” Chilled Beams have a 40% “Radiant” quotient.

Shell Centre - London - 1962



Traditional Chilled Ceiling System

Traditional Chilled Ceilings - First Generation

These attractive high quality ceiling systems provide the best in occupancy comfort given their high "Radiant" quotient. Approximately 70% of the total cooling is by radiant absorption and the remaining 30% by convection if the back of the tiles are insulated, and circa 55% Radiation and 45% Convection if the cooling tiles are uninsulated.

The cooling tiles are constructed from zinc coated steel which is polyester powdercoated to whatever the project colour requirements are.

Aluminium extruded heat exchange "pipeseats" are powdercoated black and are bonded to the back of the perforated metal tile. The tiles can be any size and as large as 1.35m x 1.35m, these are known as "Mega Tiles". The tiles are usually insulated with black tissue faces mineral wool pads with a class "O" foil backing for increased "Radiant" component (70% Radiation / 30% Convection).

There is however a limiting factor of approximately 80w/m² of activated ceiling tiles if insulated. Up to 90w/m² of activated ceiling tiles is possible if ceiling tiles are uninsulated, however the Radiant component is approximately 55% and the rest of the cooling is by 45% Convection-element.

The above listed cooling effects are based on 8.5°C difference between "mean water temperature" (MWT) and the "design room temperature", known as dT(k). See the cooling performance graphs on page 10.

Traditional
Chilled Ceiling

Please not however that not all of the ceiling can be activated with cooling coils, such as the ceiling grid.

In some instances, the ceiling grid (Tartan Grid as shown in the picture below can be represented circa 20% of the overall ceiling if the grid was 1.5m x 1.5m and each plain grid was 150mm wide). An allowance of approximately 8% of the total ceiling area being taken up by light fittings should also be made, and as such the rule of thumb is that circa 72% of the total ceiling are (room size) is to be activated by cooling coils. As such 80 watts/m² netts out at 57.6 watts/m² on the floor (insulated tiles) and 90 watts/m² netts out at 64.8 watts/m² on the floor (uninsulated tiles) at 8.5 (dtK).

Perimeter Battery Beams

Traditional Chilled Ceilings are suitable for most core areas where total heat gains are less than 60 watts/m². Around the perimeter zones where solar gains exceeds the cooling capabilities of Traditional Chilled Ceilings, fin coil batteries were adopted by other companies (not Frenger) to supplement the overall cooling requirements.

The solar gains can represent a large proportion of the total cooling requirement, as these gains are usually the first 4 meters into the building from the façade.

For example in a 20 metre wide building with glazed façades, the solar gain area would represent 40 percent of the floor plate and probably more than half of the total cooling requirements.

The fin coil batteries did counter these heat gains in a very cost-effective way, however the aesthetics of the overall ceiling system suffered, as the perimeter zones had to have 50% open area with 5mm holes to enable convection (fin coil batteries are over 95% convective) and as such the fin coils were visible through the large open area, even the side casing was painted black.

The other down side was high air velocities directly below the fin coil batteries given that they are predominantly convective-only. The Percentage People Dissatisfied (PPD) due to high air velocities would exceed a RD (Draft Risk) Rating of 25 to 35 for the fin coils in this application.

Frenger however saw this as and opportunity to develop a "Hybrid" by taking all the benefits associated with "Radiant" Chilled Tiles and the high levels of cooling performance of "Convective" Chilled Beams without the need for large holes or percentage open area, and more importantly maintaining low air velocities for good occupancy comfort across the entire floor plate (Occupied Zone).

Project Vauxhall - Nottinghamshire
Core zone cooled via Radiant Cooling Elements bonded to micro perforated metal tiles (traditional).
Perimeter zones cooled by Radiant Chilled Beam concealed above the micro-perforated metal ceiling.

Hook-On / Drop-Down & Wall Mounting Options

Chilled Ceiling tiles can be factory fitted with hook-on brackets, to allow the tiles to be moved into a "dropped-down" position, giving access behind the tile.

Notes:

1) Flexible hoses (supplied by others) are required to allow the tile to drop down and hook onto the ceiling beam grid while still being connected to the mains water supply.

2) Safety cords can be supplied as an optional extra.

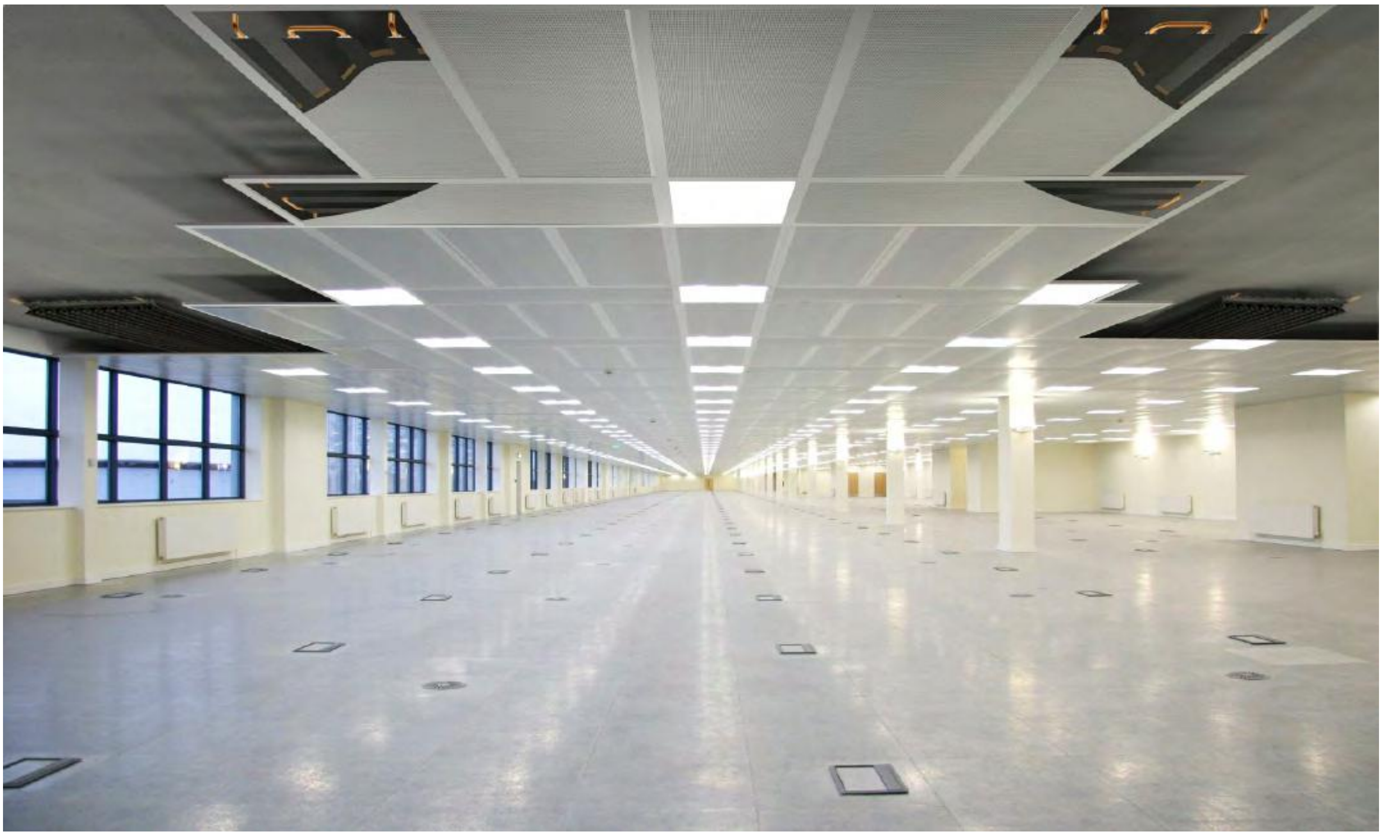
Hook-on Chilled Ceiling Tile Installation

If required wall mounting brackets for Chilled Ceiling Tiles can be supplied loose for fitment on site. These brackets convert the tiles into Chilled Wall Mounted Tiles. See page 10 for Chilled Wall Mounted Tiles cooling performance data.

Chilled Wall Mounted Tile. (Perforated version available)

Wall Mounted Chilled Tile Installation

Traditional Chilled Ceiling with Hybrid Perimeter Radiant Beams



Concealed Radiant Chilled Beams
Note: The perimeter ceiling tile perforations are the same size and percentage open areas as (Micro perf) the core zones with traditional chilled ceiling tiles.

Ordering Codes for Chilled Ceiling Tiles

Length in centimetres	CT xxx
Tile width in centimetres	CT xxx / xxx
Hole pitch of perforations, “S” Square or “D” Diagonal	CT xxx / xxx D
Hole size 1.5mm or 2.2mm	CT xxx / xxx - D24
Percentage open area 22% or 30%	CT xxx / xxx - D2428
Plain border “PB” around edge of the chilled tile, 10mm or 15mm	CT xxx / xx - D2428-PB15
Insulated “I” or Uninsulated “UI”	CT xxx / xxx - D2428-PB15-I
Tiles to suit lay on grid “LG” or beam grid “BG”	CT xxx / xx - D2428-PB15-I-BG

Example:

CT 135 / 135 - D2428 - PB15 - I - BG
This example is the ordering code for Chilled Ceiling Tile 1.35m x 1.35m with Diagonal Pitch Perforation holes (2.2mm diameter) representing 30% open area with 15mm Plain Border around each tile. All Chilled Tiles to be insulated and suitable for fitment with a Beam Grid (Tartan Grid effect).

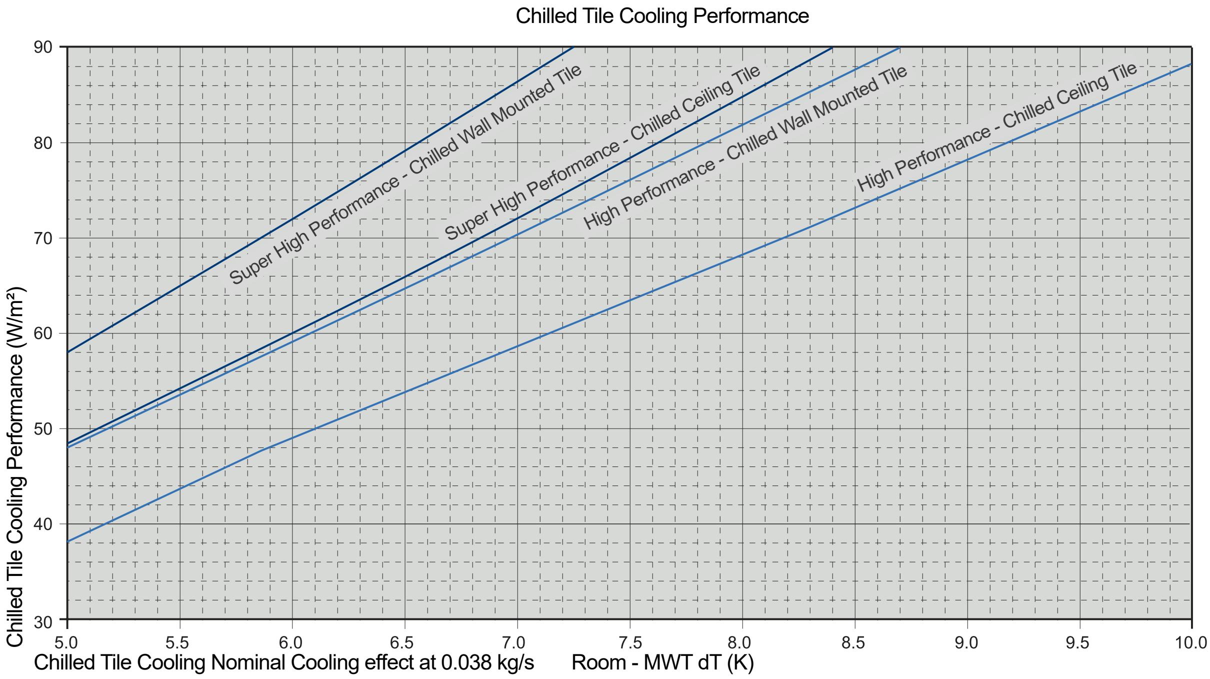
Example:

CT 1800 / 600 - D2428 - PB15 - I - LG
This example is the ordering code for Chilled Ceiling Tiles 1.8m x 0.6m with Diagonal Pitch Perforation holes (2.2mm diameter) representing 30% open area with 15mm Plain Border around each tile. All Chilled Tiles to be insulated and suitable for fitment with a Lay on Grid (exposed tee bar).

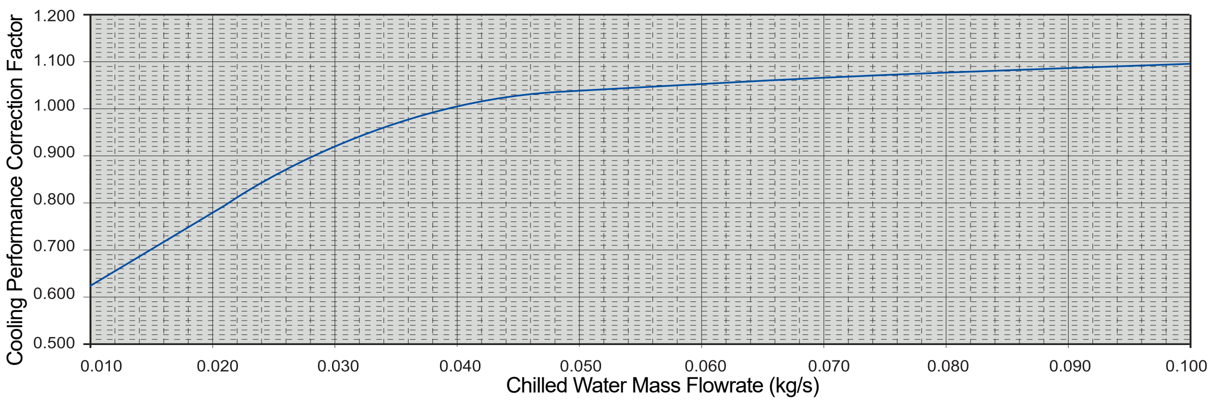
Cooling Performance

Note: Cooling performance should be multiplied by the “correction factor” table below dependant upon how many chilled tiles linked together in series for chilled water mass flow rate.

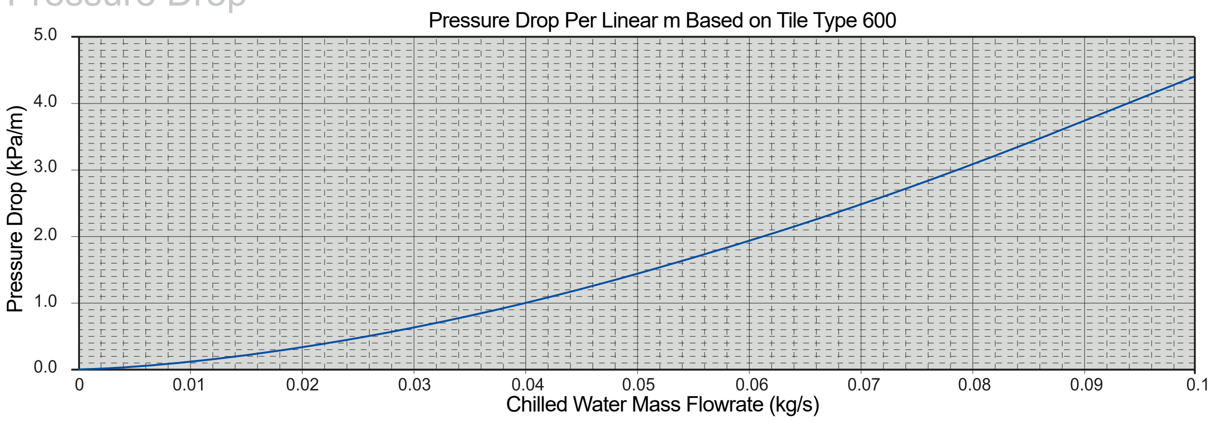
Cooling Performance Details



Correction Factor



Pressure Drop

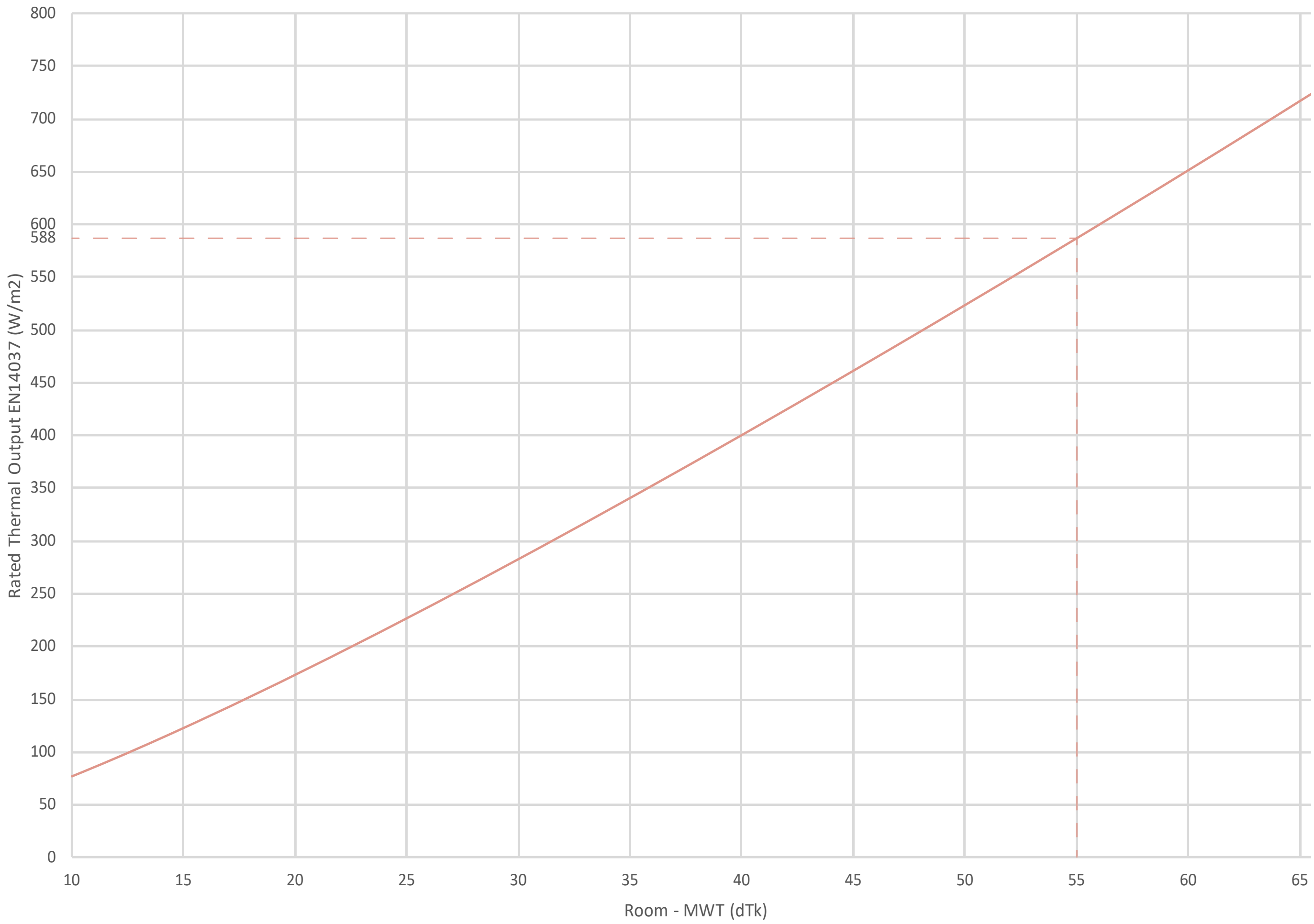


Heating Effect

		ΔtK (Mean water Temperature less room temperature (°C))																	
Panel Dimensions		48		50		52		54		55		56		58		60		62	
Width (m)	Length (m)	Q(w)	ṁ (l/s)	Q(w)	ṁ (l/s)	Q(w)	ṁ (l/s)	Q(w)	ṁ (l/s)	Q(w)	ṁ (l/s)	Q(w)	ṁ (l/s)	Q(w)	ṁ (l/s)	Q(w)	ṁ (l/s)	Q(w)	ṁ (l/s)
0.6	0.6	180	0.012	189	0.012	198	0.012	207	0.012	212	0.012	216	0.012	226	0.012	235	0.012	244	0.012
	1.2	360	0.012	378	0.012	396	0.012	414	0.012	423	0.012	433	0.012	451	0.012	470	0.012	489	0.012
	1.8	540	0.012	567	0.012	594	0.013	621	0.014	635	0.014	649	0.014	677	0.015	705	0.015	733	0.016
	2.4	720	0.016	756	0.016	792	0.017	829	0.018	847	0.018	865	0.019	902	0.020	940	0.020	977	0.021
	3.0	900	0.020	945	0.021	990	0.022	1036	0.023	1059	0.023	1082	0.024	1128	0.025	1175	0.026	1222	0.027
0.9	0.6	270	0.012	283	0.012	297	0.012	311	0.012	318	0.012	325	0.012	338	0.012	352	0.012	366	0.012
	1.2	540	0.012	567	0.012	594	0.013	621	0.014	635	0.014	649	0.014	677	0.015	705	0.015	733	0.016
	1.8	810	0.018	850	0.019	891	0.019	932	0.020	953	0.021	974	0.021	1015	0.022	1057	0.023	1099	0.024
	2.4	1080	0.024	1134	0.025	1188	0.026	1243	0.027	1270	0.028	1298	0.028	1354	0.029	1410	0.031	1466	0.032
	3.0	1350	0.029	1417	0.031	1485	0.032	1554	0.034	1588	0.035	1623	0.035	1692	0.037	1762	0.038	1832	0.040

Above stated radiant flow rates based on 82°C Flow and 72°C return with a room temperature of 21.5°C.

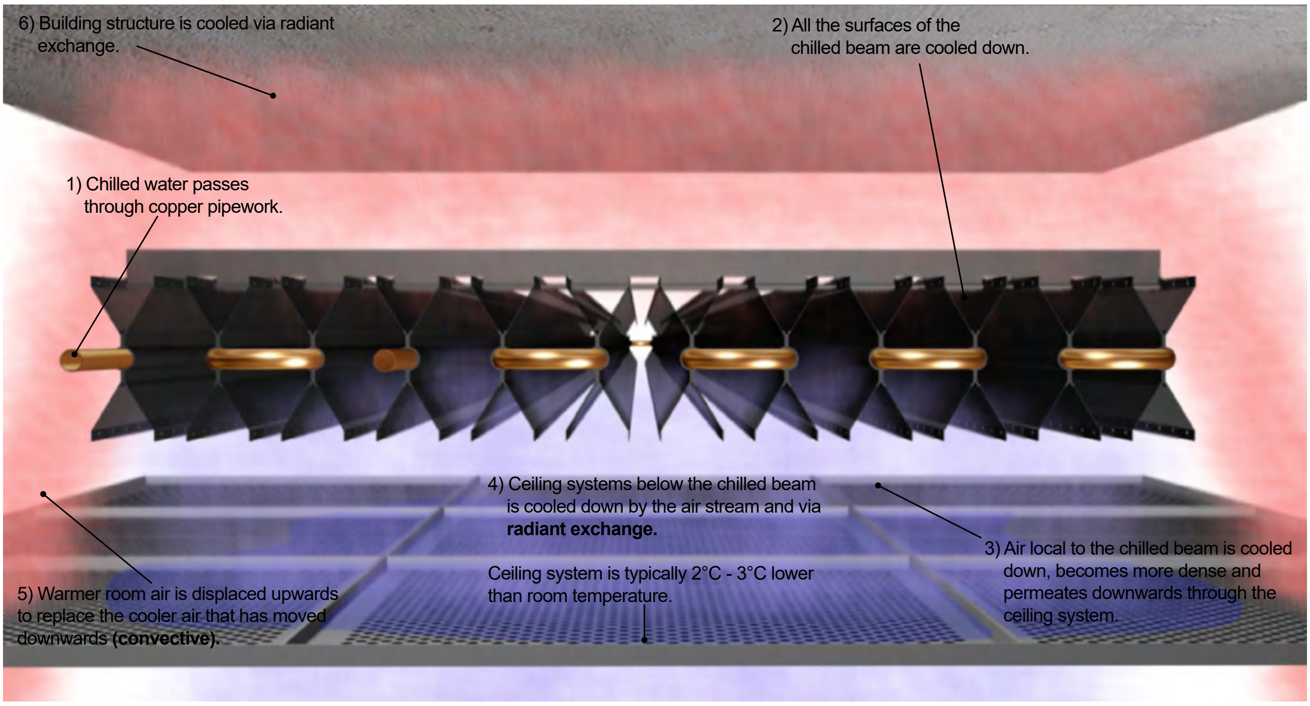
For red values the flow rate has been adjusted to the recommended minimum flow of 0.012 kg/s.



Radiant Beams -
The next generation of Chilled Ceilings

Former British Telecoms UK Headquarters in Leavesden Park, Watford

Principles Behind X-Wing ® Radiant Chilled Beams



The principles behind Radiant Chilled Beams.

The exchange of Radiation creates no air movement

As cold water passes through the chilled beam the warmer room air is cooled against the beam's cooler surfaces. This cooled air which is heavier due to its higher density, then streams through the punched louvres in the beam and percolates through the small ceiling perforations into the room space below. In this way air is circulated within the room, with warm air from the room being continually replaced by cooled air.

In addition to this convective cooling process, the cold surfaces of the beam also absorb heat radiation from the building occupants and the warmer surrounding surfaces. The radiation quotient is approximately 40% of the total cooling effect (the other 60% of cooling being generated by the convective cooling effect described above).

The efficiency of the convection process, coupled with the ability of the product to exchange energy by way of long-wave radiation, means that they retain a high cooling effect even when the air temperature in the room is relatively low (e.g. at night or when the building is unoccupied). In this way large amounts of cold energy can be stored in the building structure during low load periods, and used to offset heat gains when the need arises.

Radiant Beams deliver a more comfortable environment.

The radiant cooling properties provide significant advantages when it comes to occupancy comfort. This hybrid between a radiant / chilled ceiling and a convective "battery" beam provides the high cooling capacities up to 300 w/lm (135w/m²) on the floor if required. Cooling by radiation is generally considered to be preferable to cooling by convection alone; perceived temperatures will be lower and air velocities will also be lower. Radiant beams deliver the comfort levels associated with chilled ceilings at the higher performance as associated with chilled beams.

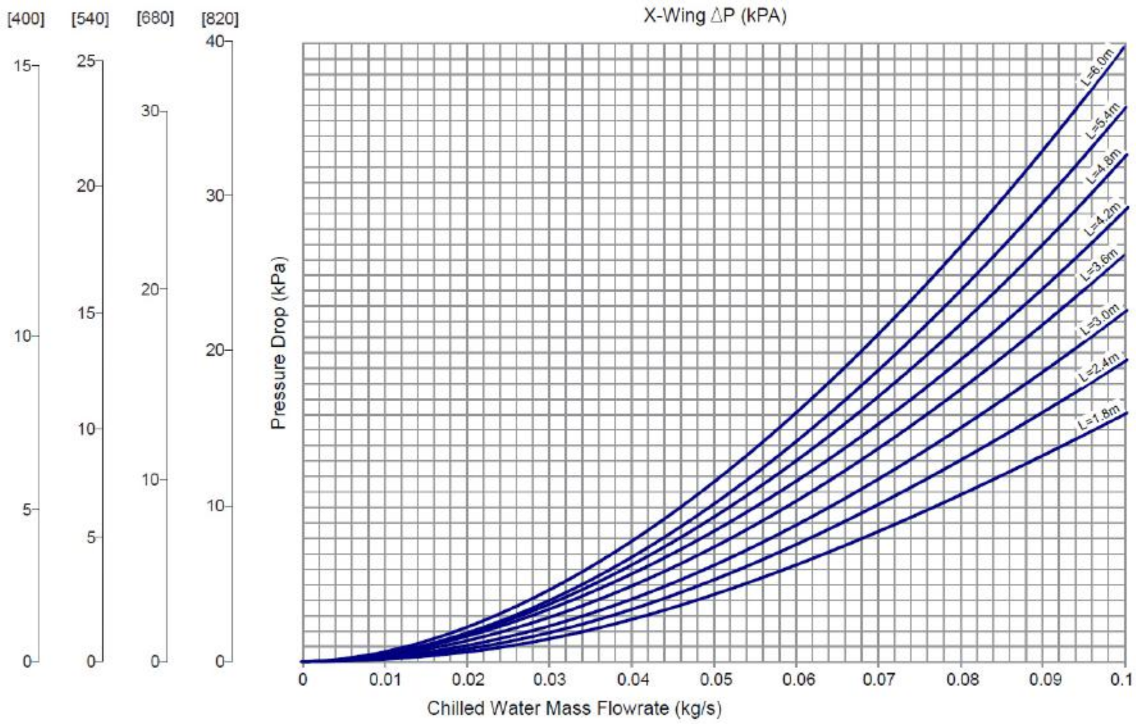
25 Year life expectancy

The patent pending technologies employed in the manufacture of these Radiant Beams eliminates the use of any joints and given that there are no moving parts Frenger has no hesitation in advising a technical life for the product in excess of 25 years (minimum water quality applies).

X-Wing Cooling Performance

Perforation Pattern	X-Wing Output (W / m / K)				Max Ceiling Output (W / m² / °C)
	XW 400-15	XW 540-15	XW 680-15	XW 820-15	
Exposed	17.7	24.1	30.8	34.4	-
S5050	17.5	22.6	27.6	32.4	17.2
S5046	17.4	22.6	27.6	32.1	17.0
D4033	16.6	21.4	25.8	29.8	12.8
D3534	16.5	21.1	25.5	29.3	12.7
D3022	15.2	19.1	22.8	25.9	9.3
S2426	15.2	19.1	22.8	25.9	10.0

Pressure Drop



Ordering Codes for X-Wing ® Radiant Chilled Beam

3. Waterside Connection

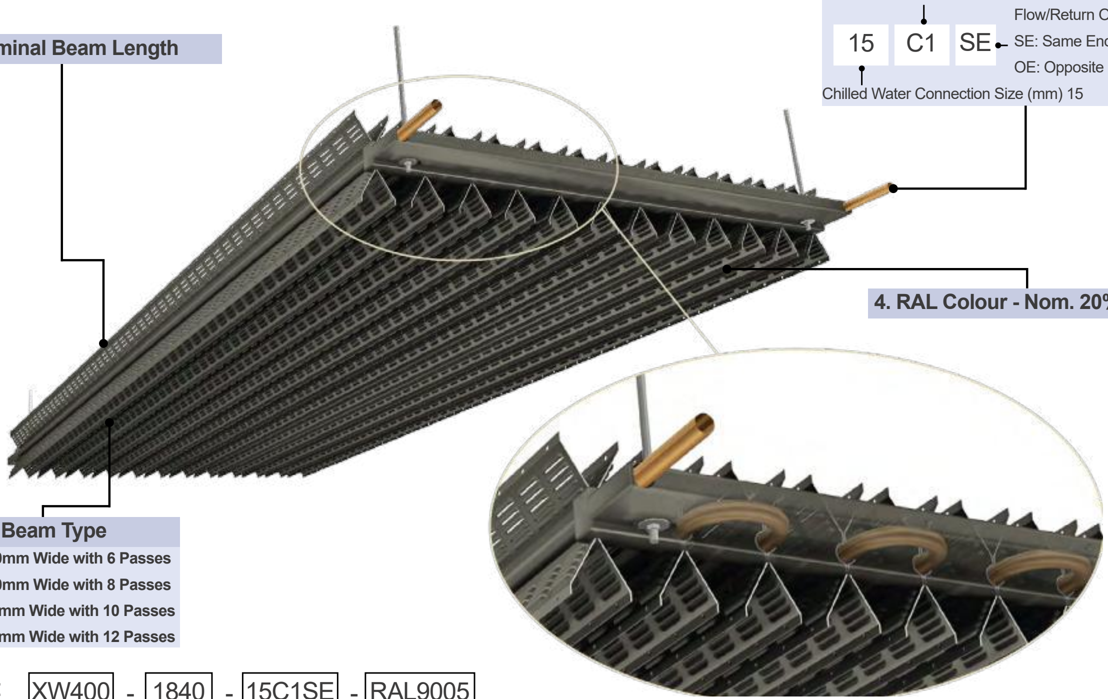
Battery Manifold Types - C1/C1.1/C2/C2.2

15 | C1 | SE

Flow/Return Orientation
SE: Same End
OE: Opposite End

Chilled Water Connection Size (mm) 15

2. Nominal Beam Length



4. RAL Colour - Nom. 20% Gloss

1. Beam Type

XW400 - 400mm Wide with 6 Passes
XW540 - 540mm Wide with 8 Passes
XW680 - 680mm Wide with 10 Passes
XW820 - 820mm Wide with 12 Passes

Example: XW400 - 1840 - 15C1SE - RAL9005

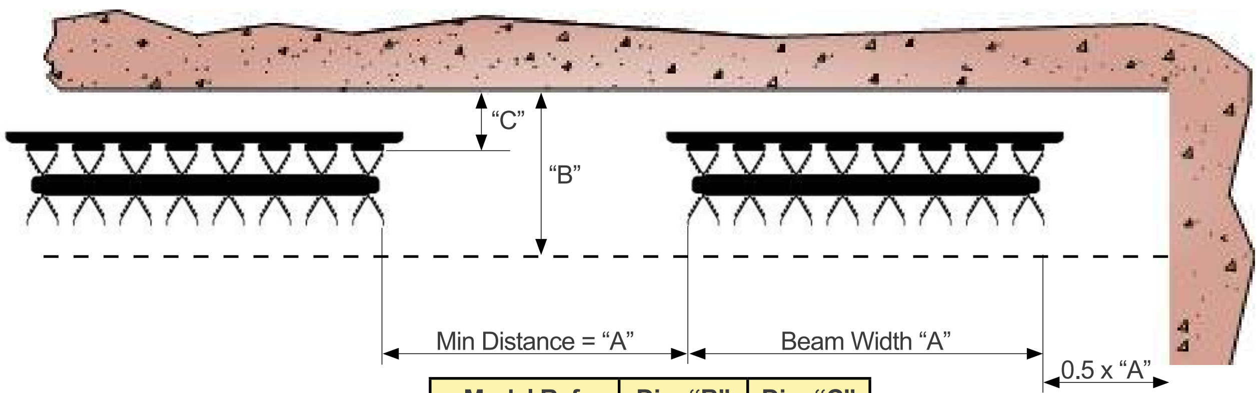
(1) XW400 - (2) 1840 - (3) 15C1SE - (4) RAL9005

Acoustics of X-Wing ®

Sound absorbing material can be fitted directly to the roof slab "if" sound reduction is required. It is usual to design the layout of chilled beams such that they allow for future cellularisation along gridlines for partition offices. However, it is sometimes the case that future fit-out requirements may determine that an acoustic partition needs to pass through a previously installed beam. Where this is the case then Frenger can offer a purpose-designed acoustic baffle that nestles perfectly around the geometry of the beam to provide excellent room-to-room attenuation.

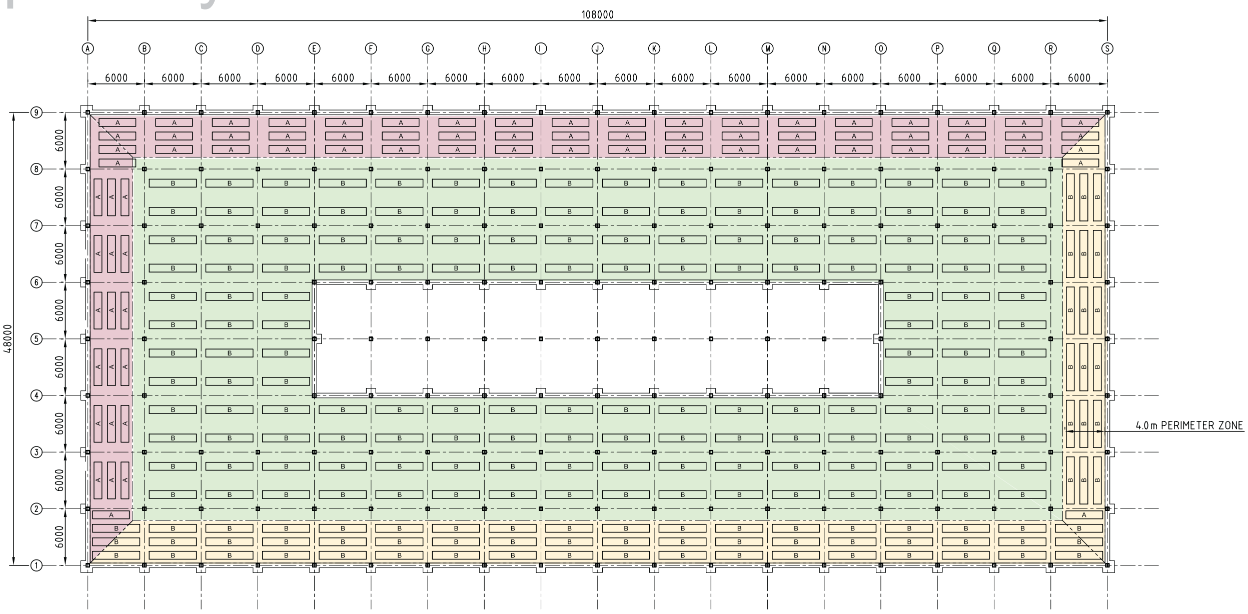
With this arrangement - a beam straddling two offices- individual room control is of course not possible however the beam will self-regulate to a large extent; offering more cooling to the office with the greater heat gain.

Cross sectional heights



Model Ref.	Dim "B"	Dim "C"
XW 400-15	252mm	65mm
XW 540-15	267mm	80mm
XW 680-15	302mm	100mm
XW 820-15	322mm	120mm

Typical layouts



Hydroplank™ Chilled Ceiling Rafts

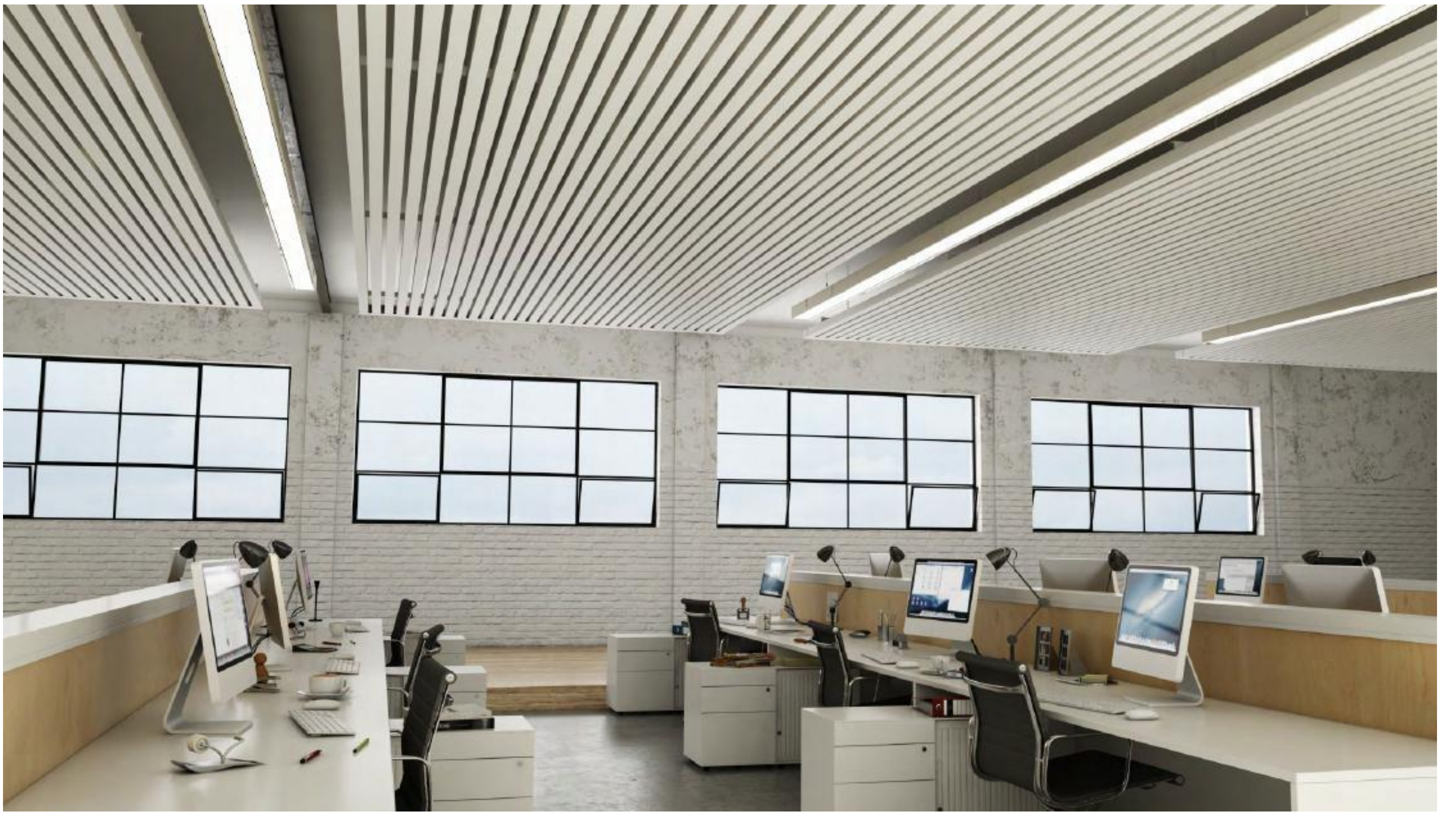
Frenger's ® extruded Hydroplank™ Chilled Ceiling solutions, allow large portions of the roof soffit to be activated to provide uniform cooling and heating into the occupied space, with minimal air movement and therefore exceptional thermal comfort with the highest performance possibilities on the market for such raft and/or ceiling systems. When a full ('wall to wall') plank ceiling aesthetic is required, the activated raft sections are fully factory assembled by Frenger ® and delivered as complete units. The 'wall to wall' dummy sections are also delivered in factory assembled sections complete with key slot mounting brackets to enable easy removal should you wish to access the ceiling void at the sides and ends of the activated raft sections.

Hydroplank™
Chilled Ceiling

Activated raft sections can be fully cooling or fully heating if a 2 pipe system is desired and appropriate switch over control valve from CHW to LTHW is utilised. Alternatively a 4 pipe system can be adopted for each raft where approximately 70% of the waterways are a closed cooling circuit with its own flow and return tails (2 pipe connections for Cooling) and approximately 30% of the waterways are a closed Heating circuit with its own flow and return tails (2 pipe connections for Heating). The Hydroplank™ Chilled Ceiling uses copper tube from Frenger's ® in-house full CNC automated "State of the art" serpentine bending machine, which produces seamless sinusoidal copper coils with no risk of leaks as there are no joints whatsoever as each serpentine coil comes straight off one thousand metre drums of copper as shown in the photograph to the right. The copper tubes fit directly into the pipe seat of the extruded aluminium "Planks" which have been designed to give optimal metal-to-metal contact to ensure maximum heat transfer.

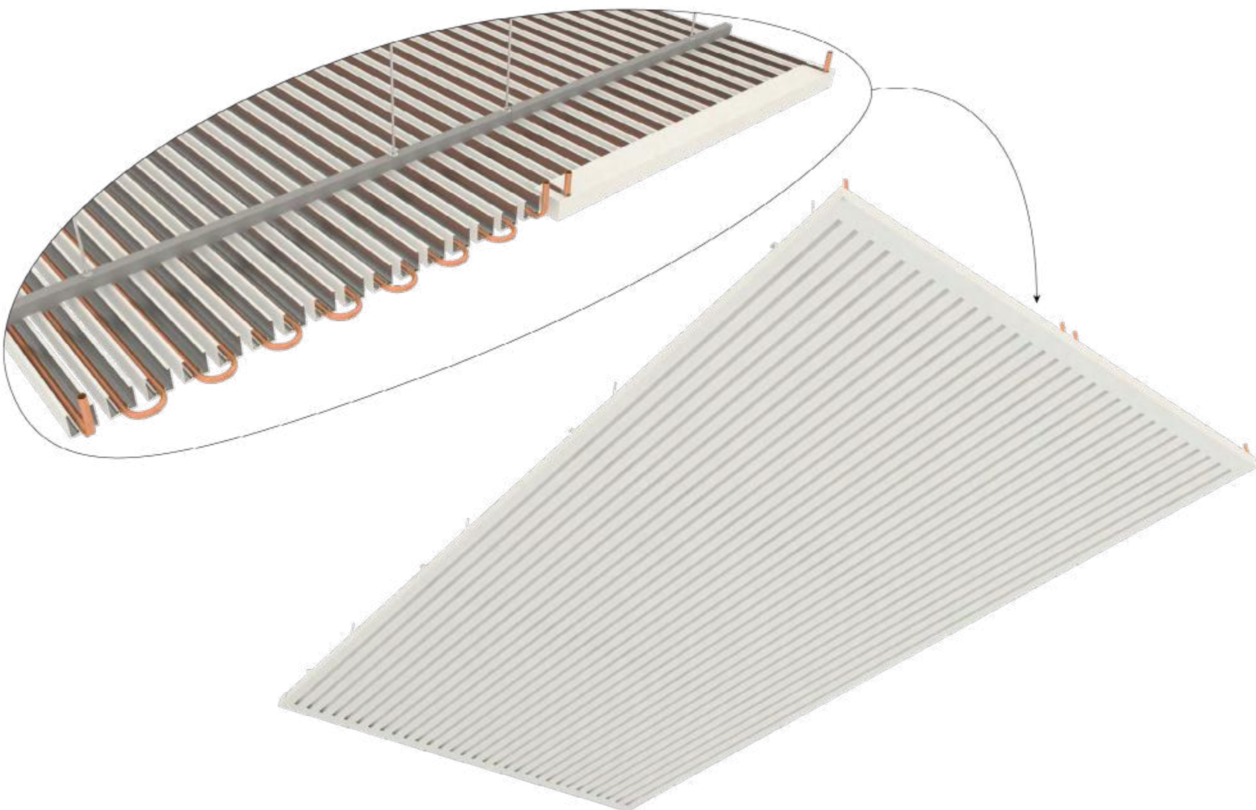
Office space installed with ceiling integrated Hydroplank™ solution

Hydroplank™ Chilled Ceiling



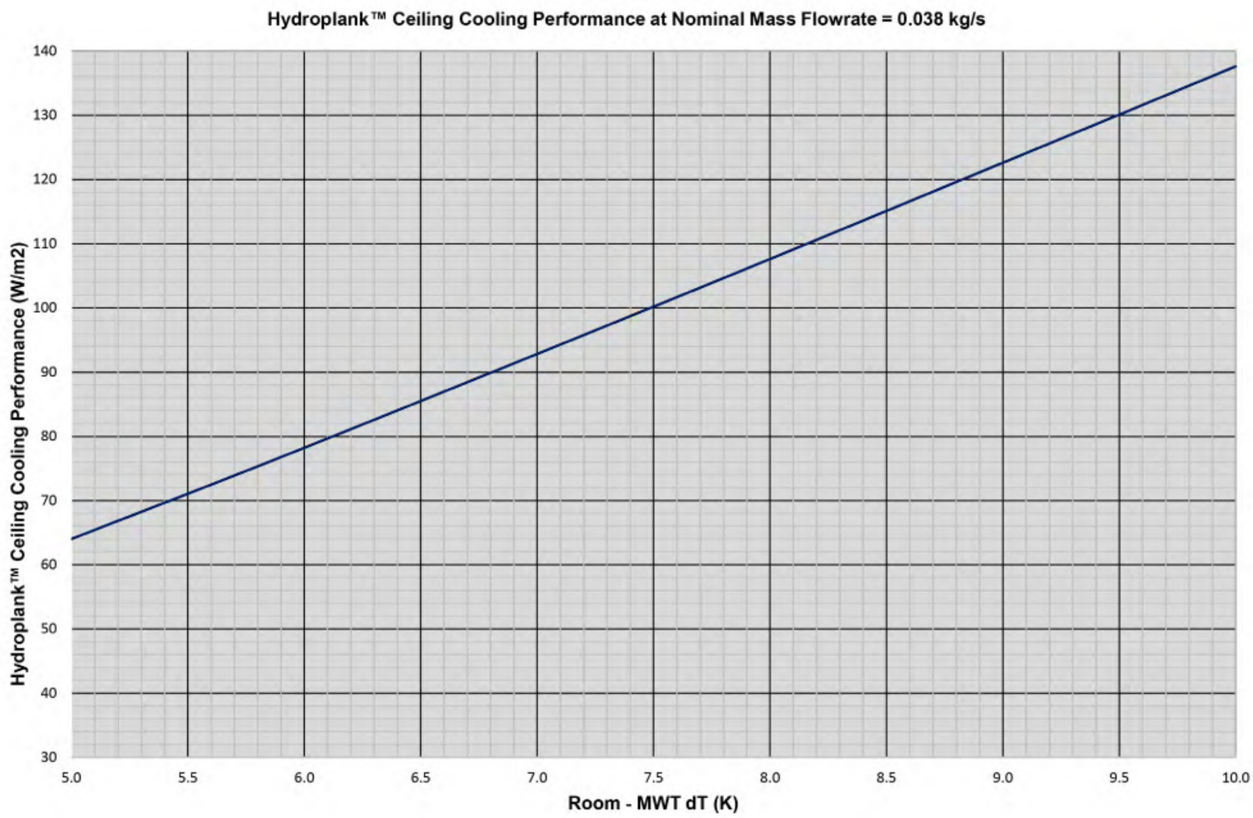
Ceiling Mounted Hydroplank™ Chilled Ceiling inside an office setting

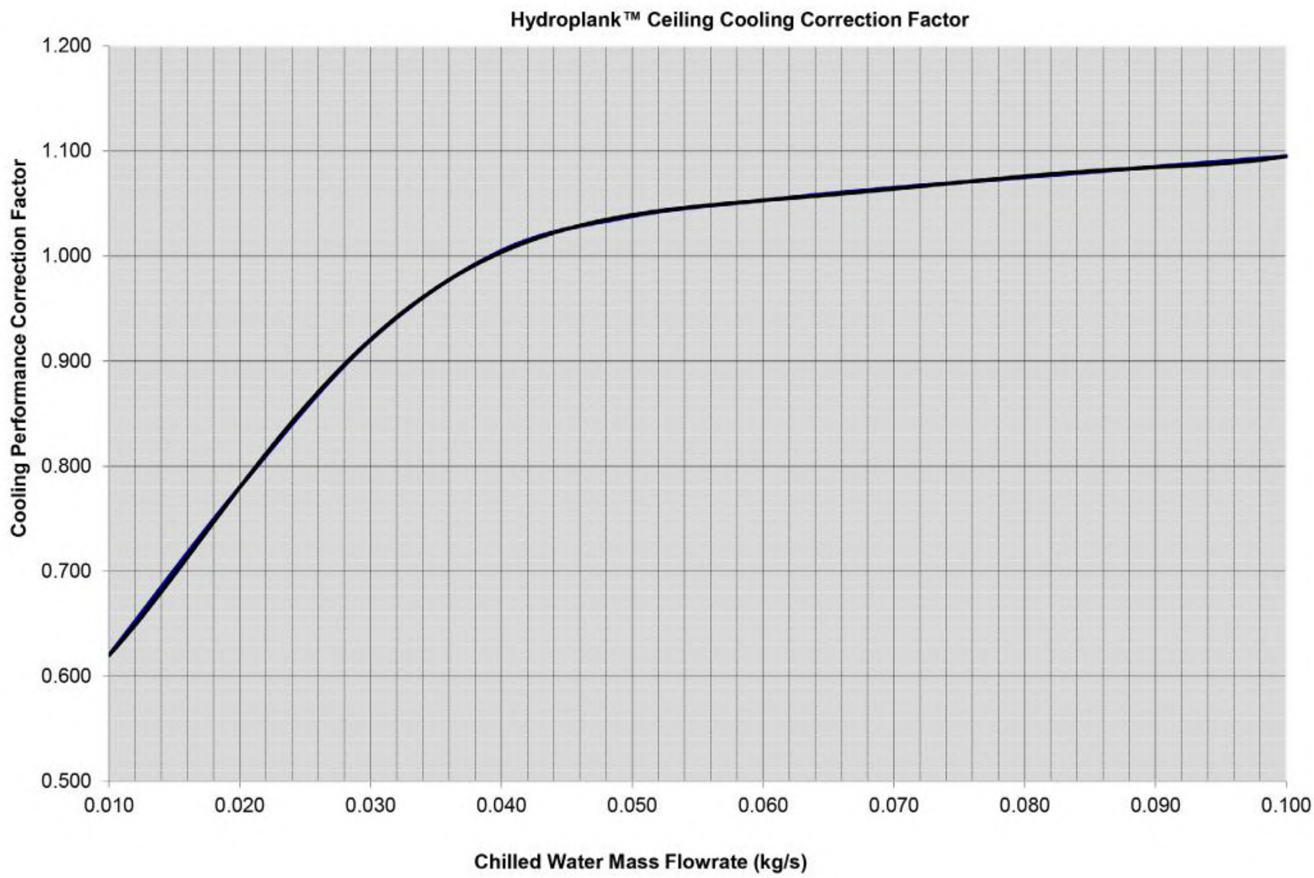
Frenger's ® Hydroplank™ Ceiling solutions can be supplied as stand-alone rafts or integrated into our full ceiling solution for a clean visual aesthetic. Frenger ® also offer their LED luminaries which are designed to seamlessly integrate into their heating and/or cooling Hydroplank™ ceiling rafts. Frenger ® have made use of their MSCB (Multi-Service Chilled Beam) extruded polycarbonate lighting technology to develop a slimline LED luminare to operate with an extruded polycarbonate diffuser optic that is the same profile as their extruded aluminium heating and/or cooling plank sections. With the approach clients and/or professional teams can choose alternative lighting solutions.



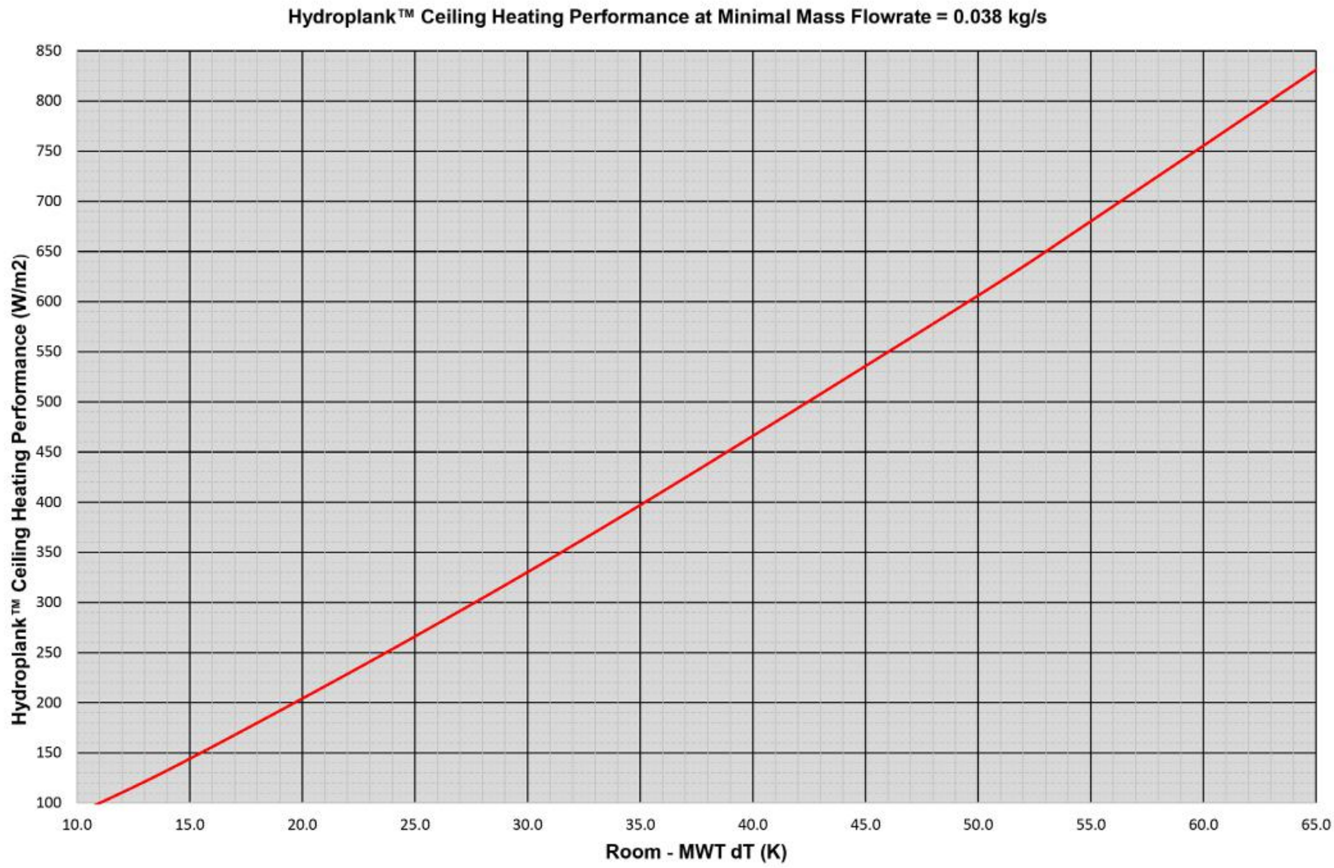
Hydroplank™ Cooling Performance

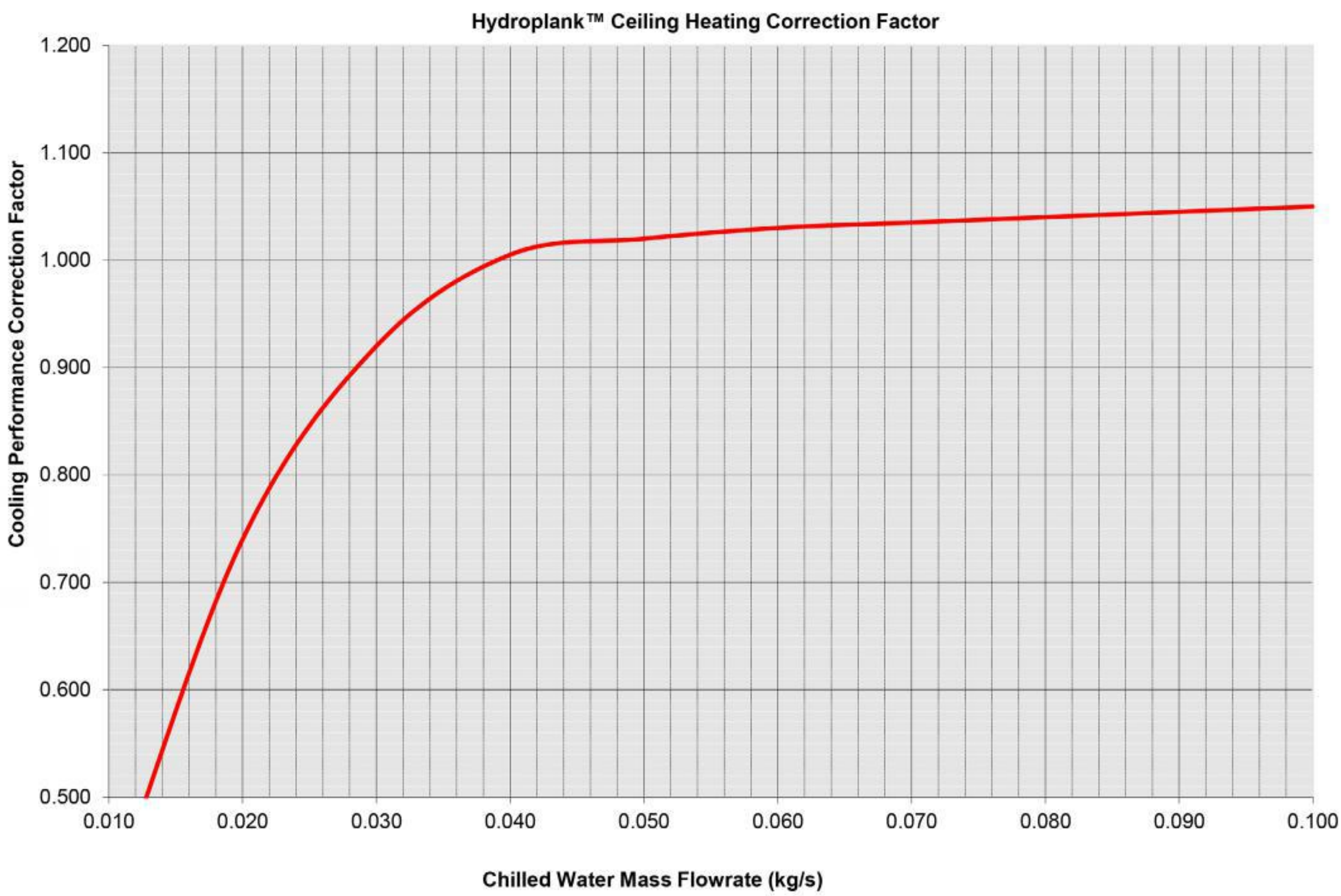
Below is a Hydroplank™ chilled ceiling Cooling and Heating performance graph, as well as a cooling and heating correction graph. Note: Cooling and heating performance should be multiplied by the "correction factor" table below dependant upon how many chilled raft sections are linked together in series for total chilled water mass flow rate.





Hydroplank™ Heating Performance





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

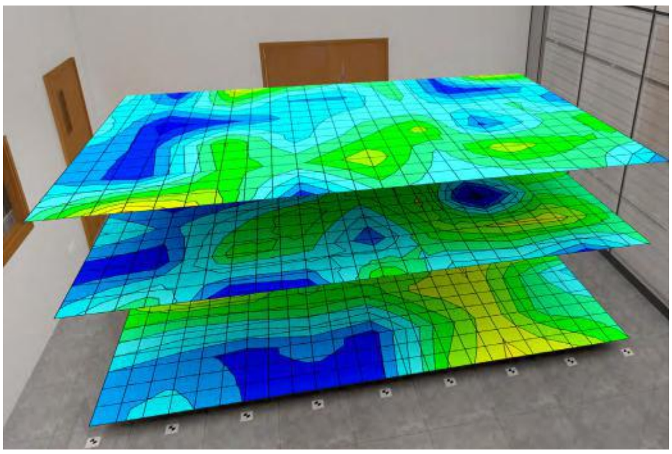
Project specific mock-up testing is a valuable tool which allows the Client to fully assess the proposed system and determine the resulting room occupancy Thermal Comfort conditions. The physical modelling is achieved by installing a full scale representation of a building zone complete with internal & 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 optmised.

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 intergration chamber is used to measure LED luminance efficacy.

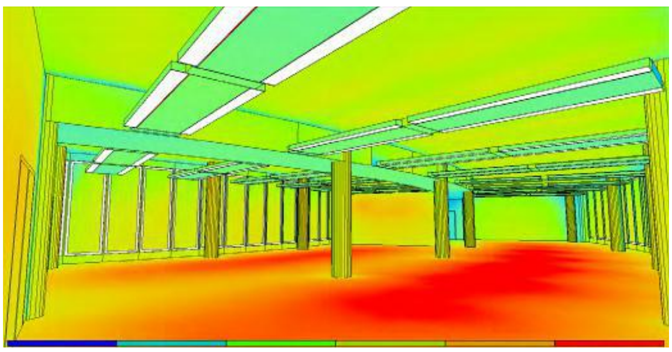
The intensity distribution is obtained by the use of a Goniophotometer to measure the intensity of light emitted from the surface of the fitting at pre-determined angles. The light intensity is measured using either a photometer with a corrective spectral response filter to match the CIE standard observer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

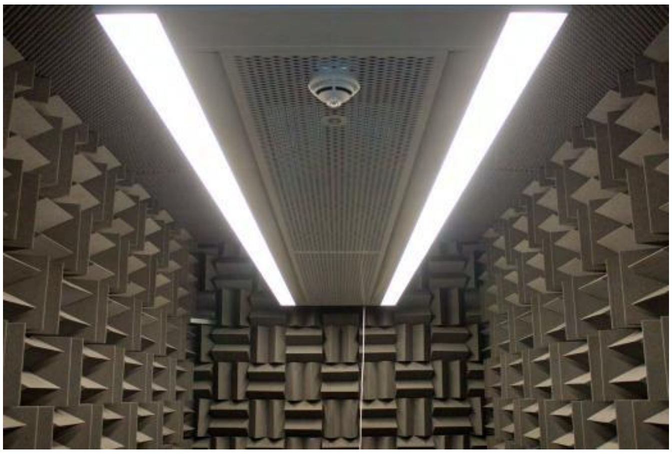
The Acoustic Test Room at Frenger is a hemi-anechoic chamber which utilises sound absorbing acoustic foam material in the shape of wedges to provide an echo free zone for acoustic measurements; the height of the acoustic foam wedge has a direct relationship with the maximum absorption frequency, hence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

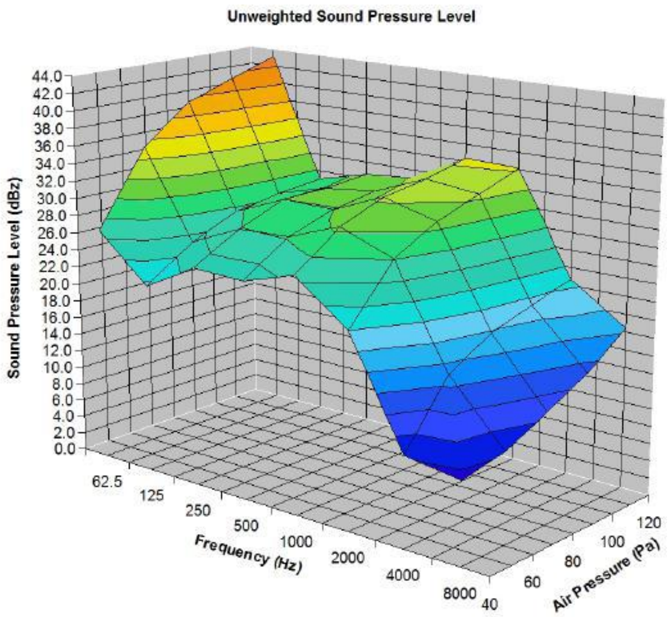
The use of acoustic absorbing material within the test room provides the simulation of a quiet open space without "reflections" which helps to ensure sound measurements from the sound source are accurate, in addition the acoustic material also helps reduce external noise entering the test room meaning 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.





Project References

123 Albert Street, Brisbane

700 Bourke Street, Melbourne

Google HQ, Sydney

South Australia Police, Adelaide

Sydney Water, Sydney

1 Shelley Street, Sydney

University of Sydney

Parramatta Justice Precinct

Project Vauxhall, Nottinghamshire

500 Collins Street, Melbourne

30 The Bond, Sydney

Vodafone, Hayes

BT, Leavesden

BT, Nottingham

Performance & Cost Matrix

CRITERIA	Traditional Chilled Ceiling (Radiant cooling element in each tile) 22 or 30% Open Area with either 1.5mm or 2.2mm holes.	Traditional Chilled Ceiling with Perimeter Fincoil Battery Beams 50% Open Area with 5mm holes on perimeter tiles.	Traditional Chilled Ceiling with perimeter "Radiant Beams" with 30% Open Area with 2.2mm holes.	Chilled Ceiling with X-Wing ® Radiant Beams throughout. With 30% Open Area with 2.2mm holes.	Hydroplank™ Chilled Ceiling
Cooling Range 55 to 60W/m² on the floor at 8.5 dT(K)	✓	✓	✓	✓	✓
Cooling Range 60 to 75W/m² on the floor at 8.5 dT(K)		✓	✓	✓	✓
Cooling Range 75 to 90W/m² on the floor at 8.5 dT(K)				✓	✓
Consistent Aesthetic of Ceiling with small perforations and low percentage Open Area	✓			✓	
Low air velocities in the Occupied Zone (less than 0.2m/s) and compliance to ISO 7730	✓		✓	✓	✓
Less than 1 chilled water connection per m² of chilled ceiling*	✓	✓	✓	✓	✓
Less than 1 chilled water connection per 3m² of chilled ceiling*		✓	✓	✓	✓
Less than 1 chilled water connection per 6m² of chilled ceiling*				✓	✓
Shallow Construction depth 200 to 250mm	✓				✓
Shallow Construction depth 250 to 350mm	✓		✓	✓	✓
Shallow Construction depth 350 to 500mm	✓	✓	✓	✓	✓
Low Cost/m² for metal ceiling & cooling devices**				✓	
Medium Cost/m² for metal ceiling & cooling devices**		✓	✓		✓
High Cost/m² for metal ceiling & cooling devices**	✓				✓
Less material content per m² of building per kW cooling				✓	
Lower embodied carbon				✓	
Lower material weight per kW cooling achieved				✓	

Notes:

* The less water connections on the chilled ceiling system the better, not only from an installation viewpoint but also from reduced risk of possible leakage.

** These are budget costs based on Supply Only of the Complete Metal Ceiling System complete with integrated lighting and cooling elements, be it copper in the ceiling tiles or Radiant Chilled Beams above the ceiling tiles.

Industry Associations

Always mindful of its place within the HEVAC industry, Frenger Systems pride themselves on broad range of trade associations and accreditations. With a clear service, product and environmental ethos across everything they do, Frenger is focused on meeting and consistently surpassing the expectations of its customers. Frenger invest heavily in achieving industry recognised accreditations and as part of ongoing commitment to their customers and continually assess the level of services they provide. Opening up their company to these independent organisations allows them to continually improve our customer service and satisfaction.

As an engaged member of the HEVAC industry, Frenger are actively asked to participate in industry specific discussions and studies. With this in mind Frenger are proud to have achieved and be linked with the following associations:

BSI EN ISO 9001:2015

Frenger Systems are registered by BSI for operating a Quality Management System which complies with the requirements of BS EN 9001:2015.

Eurovent

Frenger Systems participate in the EC programme for Chilled Beams.
Check ongoing validity of certificate: www.eurovent-certification.com or www.certiflash.com

Chilled Beam and Ceiling Association

The Chilled Beam and Ceiling Association has been formed by leading companies within the construction industry. The objective of the Association is to promote the use of Chilled Beams and Chilled Ceilings, and encourage best practice in their development and application.

HEVAC Member

HEVAC is the heating and ventilating contractors association. As a HEVAC member Frenger Systems are subject to regular, third party inspection and assessment to ensure their technical and commercial competence.

Federation of Environment Trade Association

The Federation of Environment Trade Association (FETA), of which Frenger Systems is a member of, is the recognised UK body which represents the interests of manufacturers, suppliers, installers and contractors within the heat pump, controls, ventilating, refrigeration & air conditioning industry.

UK Trade & Investment

Frenger Systems are members of both the UK TI (the former Department of Trade and Industry) as well as the Chamber of Commerce for Export Documentation.

Certified CIBSE CPD

Frenger Systems is a CIBSE approved “Continued Professional Development” (CPD) provider. Frenger offers 1 hour lunch time CPD presentations regarding “Chilled Beam Technology”, CPD presentations are usually held at Consulting Engineers local practices with lunch provided courtesy of Frenger. Alternatively half or full day Chilled Beam Technology training is available at Frenger’s UK Technical Academy in a dedicated training theatre with fully operational BMS system with various different Chilled Beam and Ceiling solutions integrated.

Booking of a CPD Presentation can be requested on Frenger’s home page, under the drop down menu headed “Company”, then “CPD Booking”. Alternatively email sales@frenger.co.uk.

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bsi ISO 9001 Quality Management Systems CERTIFIED

HEVAC

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