FTF GROUP®
Climate

the future of space conditioning

FTF Group Climate - Company Profile

and Chilled Beam Technical Portfolio

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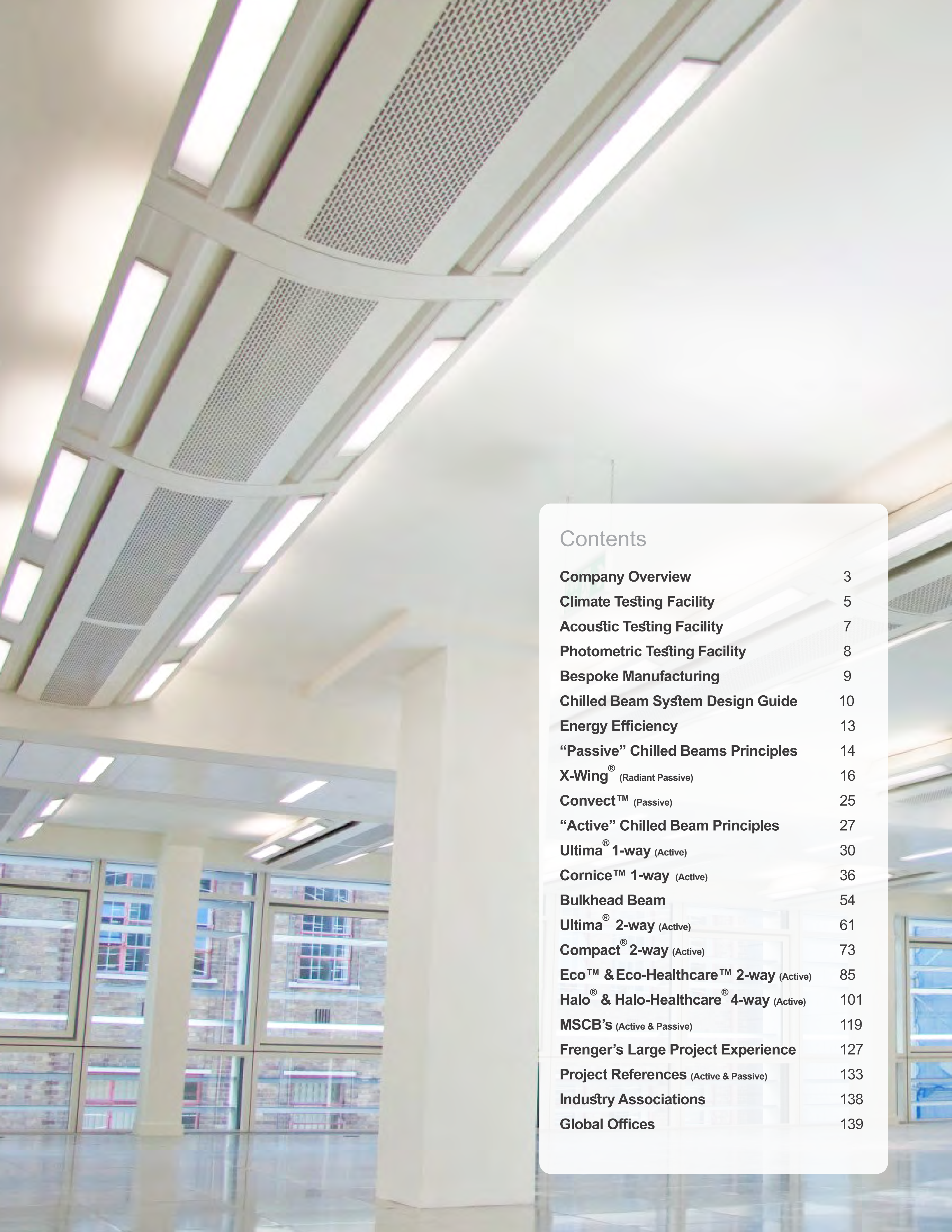


Contents

Company Overview

Frenger Systems is a wholly owned subsidiary of the FTF Group and is trading with the United States of America as FTF Group Climate. Frenger Systems is a renowned specialist manufacturer of space conditioning products for indoor climate / environments. Frenger has extensive experience dating back some 80 years and is at the forefront of the design, development and manufacture of water driven cooling and heating technologies. Over the years Frenger has earned an enviable reputation as a dependable supply partner capable of developing effective space conditioning solutions for the most complex of projects.

In 1962 Frenger designed, supplied and installed the "World's Largest Radiant Chilled Ceiling" system which was revolutionary at the time. This consisted of 1.88 million square foot of radiant chilled ceiling over the 27 storeys of the Shell Oil headquarters, situated on the river Thames in London, UK. The Thames water was used via secondary heat exchangers to cool the water that circulated on a closed circuit around the ceilings within the building. This building was also the first fully sealed air conditioned building in Europe. This installation is still operating after some 50 years and is a testament to the integrity of the product and to Frenger's design capabilities.

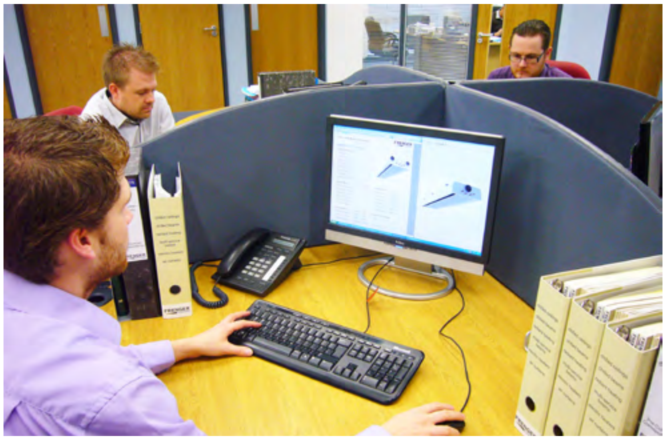
Frenger also pioneered with the supply of Chilled Beam and ceiling technology to Australia in 2003 and was for the first ever building to be awarded a 5 star energy rating. The building was called "The Bond", situated in Sydney and developed by Bovis Lend Lease (BLL); whom are now known as Lend Lease.

BLL spent considerable time researching Chilled Beam and ceiling Technology worldwide and undertook a great amount of due diligence before selecting a Chilled Beam supplier for their then highly confidential building ("The Bond", 30 Hickson Road, Sydney). Many of BLL's competition thought that it was not possible to gain a 5 star energy rating and as such BLL knew that the stakes were extremely high and much depended upon their success. Frenger were then chosen by BLL to play an integral part of what transpired to be a successful process and the building is still, some 10 years later, functioning well and coping with external temperatures in the region of 104°F for some parts of the year.

Since 2003 Frenger has supplied Chilled Beam technology to many 5 star and even 6 star energy rated buildings more recently in Australasia, some of these can be seen on pages 110 to 113 of this Company Profile under the title of "Project References".

In addition to Frenger providing the first Chilled Ceiling in 1962 and providing the first ever 5 star energy rated building in 2003, Frenger pioneered with Multi Service Chilled Beams ("MSCB's") in the UK and having designed, supplied and often installed many successful MSCB projects. Frenger were selected by Blyth and Blyth for the £160 Million Pound (Circa $250 Million US Dollars) refurbishment of London & Regionals "55 Baker Street" building which involved HBG Construction (now known as BAM Construction) amalgamating 3 separate buildings into one enormous building with 2 central atrium's and two internal streets.

Frenger designed, Climactic Tested (full scale laboratory mock up), manufactured and installed these MSCB's in 2007 which represented circa £7 million GBP (Circa $10.8 million US Dollars) order value to Frenger. This was and still is the world's largest MSCB installation. HBG's annual award for Best Sub-Contractor was also awarded to Frenger and Frenger also gained various letters of commendation from the Client, the Consulting Engineers and the Main Contractor regards their performance of their involvement with the £160 million GBP (Circa $250 million US Dollars) refurbishment project. Details of this and other major projects by Frenger can be found on page 109 of this Company Profile under the heading "Large Project experience".



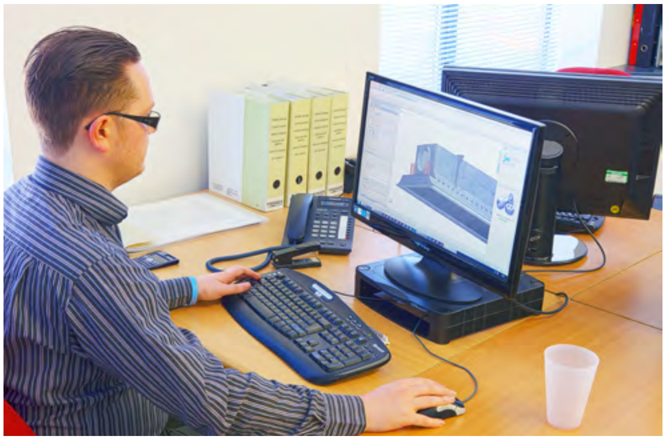
The reason as to why Frenger are chosen for such important high profile and complex projects for the space conditioning / indoor climate is because Frenger:

- Have the highest performing products on the market.
- Excellent product quality.
- Always deliver on what is promised and never over state / over sell.
- Have everything in-house to substantiate all aspects of the indoor environment.
- Manufacture as many key items in-house as possible to keep full control.
- Take ownership to deliver what is required, on time, on budget and to the correct specification.

Frenger employs professionally qualified Mechanical Engineers, Electrical Engineers, Lighting Designers, Building Services Engineers and Project Managers to give customers an unrivaled level of in house expertise for Chilled Beam and Multiservice Chilled Beam (MSCB) technologies. Frenger builds sound business relationships with clients and has won many accolades to this extent, which has warranted Frenger a justifiable reputation for delivering complex projects on time, within budget and to specification, every time. All aspects of the business are accredited to BS EN ISO9001:2008 and are regularly audited by the British Standards Institution (BSI).

Due to Frenger's continuing success, the shareholders of its parent company, the FTF Group, provided Frenger in 2009 with one of their fully owned outright multi million GBP buildings for fit out as a new UK Technical Facility. The building is situated in the East Midlands and holds a prominent position on the prestigious Pride Park corporate business center. Frenger have equipped this building to support all technical aspects of the companies' world wide operations.

The new headquarters are fully space conditioned with various different types of Chilled Beam, MSCB and Chilled Ceiling technologies, each controlled by a full building management system (BMS) which can demonstrate exactly how well each chilled system is functioning and their efficiencies. This building also houses Frenger's:



- Specialist manufacturing
- State-of-the-art Climatic Test facilities
- Photometric test laboratories
- Acoustic laboratory
- Lighting design capabilities
- 2D & 3D CAD operations
- Computational fluid dynamics
- Solidworks.

Climate Testing Facility

The FTF Group has 3 number climatic test laboratories located at it's technical center which is located at the prestigious Pride Park, Derby, England.

These purpose designed and built laboratories have nominal internal dimensions of 20.7 ft (L) x 18.7 ft (W) x 10.8 ft (H) and each environmental chamber includes it's own thermal wall so that both core and perimeter zones can be physically modeled in any of the rigs.

All 3 environmental chambers are fixed in size however the fitment of partition walling and false ceilings can be positioned to match the physical constraints of a project specific installation.

1 of 3 Climatic Test Laboratories

Catalogue Data - Standard Product

All FTF Group's products are designed by FTF Group's in-house Research and Development (R & D) department. Once any new product is ready for mass production these are tested in-house to the following British Standards for Catalogue Data to be collated / published:

- BS EN 14240:2004 – Ventilation for buildings – Chilled ceilings – Testing and rating.
- BS EN 14518:2005 – Ventilation for buildings – Chilled beams – Testing and rating of passive chilled beams.
- BS EN 15116:2008 – Ventilation in buildings – Chilled beams – Testing and rating of active chilled beams.
- BS EN 14037-2 – Radiant Panel Test Methods for Thermal Output.
- ISO 7730 – Ergonomics of the indoor environment.
- ASHRAE 55-2010 – Thermal Environmental conditions for human occupancy.

In addition to the above in-house comprehensive testing which utilizes state of the art equipment and BSRIA calibrated instrumentation to reduce the amount of uncertainty to an accuracy of + / - 2.5%, The FTF Group(s) subsidiary also subscribe to third part Validation Testing by Eurovent.

Eurovent certification testing is only for performance and takes no account of the indoor environment, whereas all FTF Group testing and published catalogue data is compliant to **ISO 7730** (Technical data available to download from Frenger's website under 'Technical Downloads', TDS 004A & TDS 245,), ergonomics of the indoor environment and ASHRAE 55-2010, thermal environmental conditions for human occupancy to ensure that occupancy comfort is maintained to the highest of standards.

Project Specific Testing

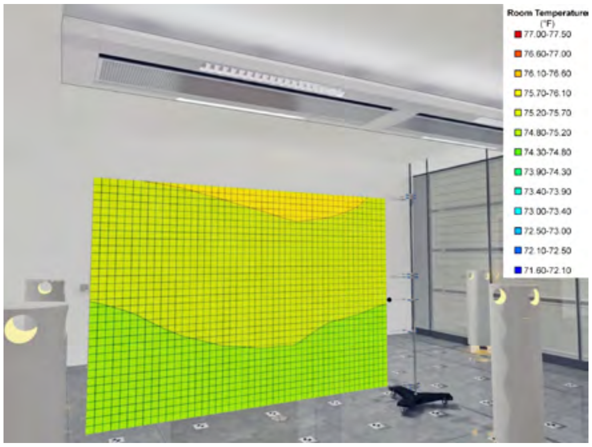
Project specific mock-up testing is a valuable tool which allows the Client to fully asses the proposed system and determine the resulting indoor quality and comfort conditions; the physical modeling is achieved by installing a full scale representation of a building zone complete with internal & external heat gains (Lighting, Small Power, Occupancy & Solar Gains).

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

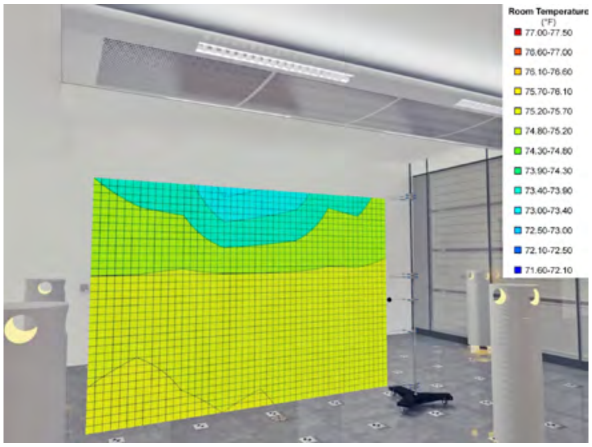
- Product performance under project specific conditions
- Spatial air temperature distribution
- Spatial air velocities
- Experience thermal comfort
- Project specific aesthetics
- Experience lighting levels (where relevant)
- Investigate the specific design and allow the system to be enhanced.

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

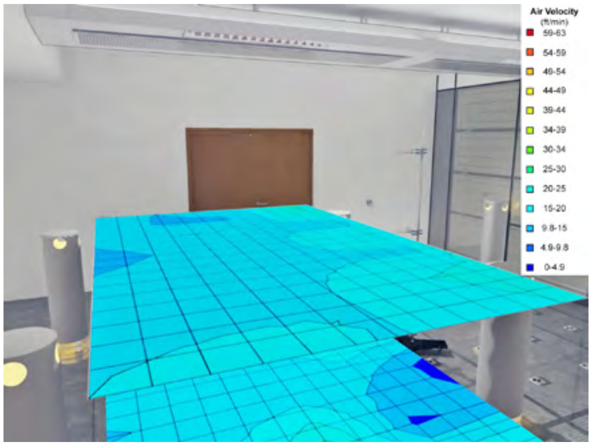
- Product capacity under design conditions
- Comfort levels
  - Air temperature distribution
  - Thermal stratification
  - Draft risk
  - Radiant temperature analysis
- Smoke test video illustrating air movement



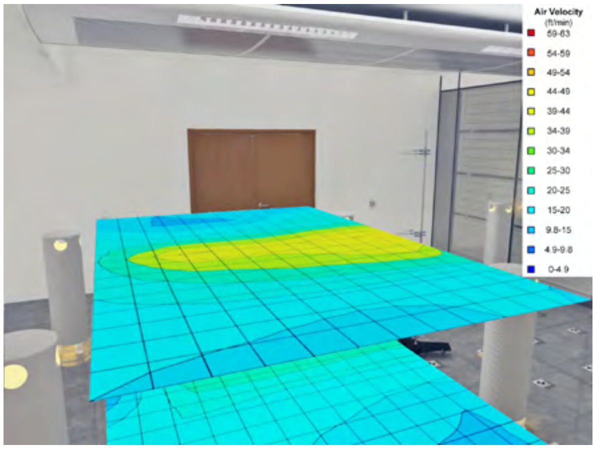
Active MSCB Room Temperature



Radiant Passive MSCB Room Temperature



Active MSCB Air Velocity



Radiant Passive MSCB Air Velocity

Acoustic Testing Facility

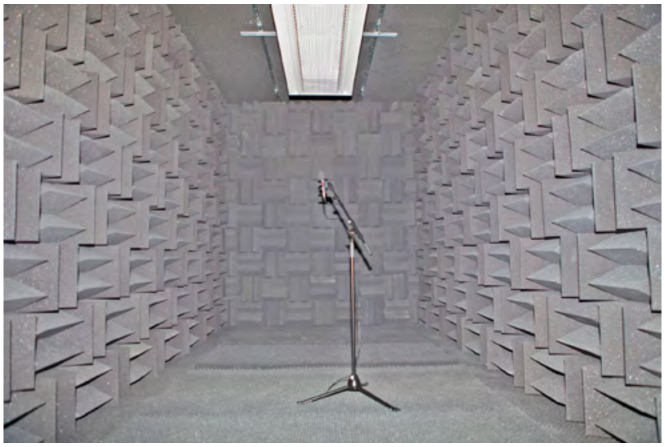
The Acoustic Test Room at FTF Group's Technical Facility is a hemi-anechoic chamber which utilizes sound absorbing acoustic foam material in the shape of wedges to provide an echo free zone for acoustic measurement; the height of the acoustic foam wedges has a direct relationship with the maximum absorption frequency, hence FTF Group had the wedges specifically designed to optimize the sound absorption at the peak frequency normally found with our active chilled beam products.

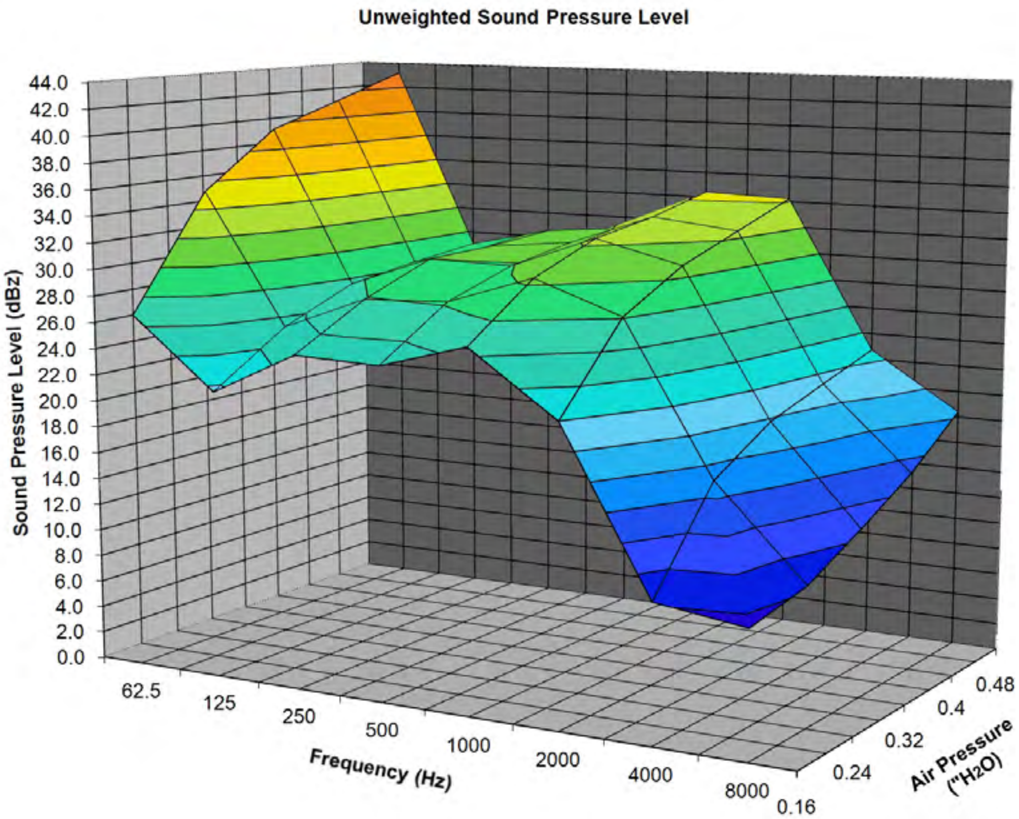
The use of acoustic absorbing material within the test room provides the simulation of a quiet open space without "reflections" which helps to ensure sound measurements from the sound source are accurate, in addition the acoustic material also helps reduce external noise entering the test room meaning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

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

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

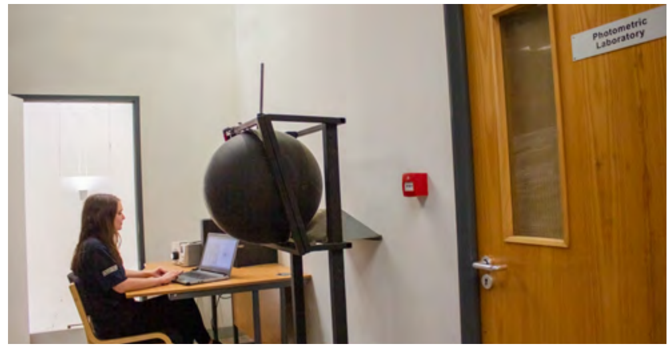
In addition to the above, FTF Group also send their new products for specialist third party Acoustic Testing. The results of which are very close and within measurement tolerances to that of FTF Group's in-house measurement of sound.



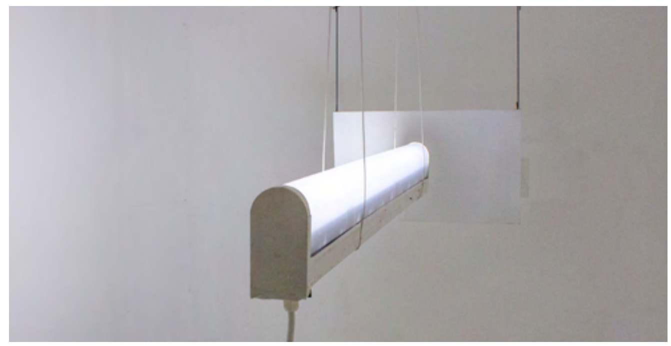


Photometric Testing Facilities

The Photometric test laboratories at FTF Group 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.



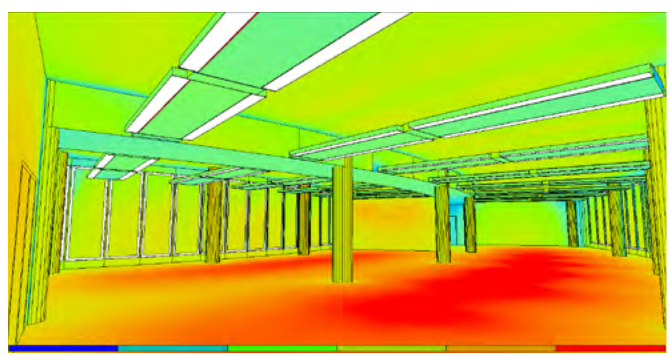
The industry uses both methods. Generally absolute lumen outputs are used for solid state lighting sources and relative lighting output ratios (LOR) are used for the more traditional sources. Where the LOR method is chosen then published Lamp manufacturer’s data is used to calculate actual lighting levels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

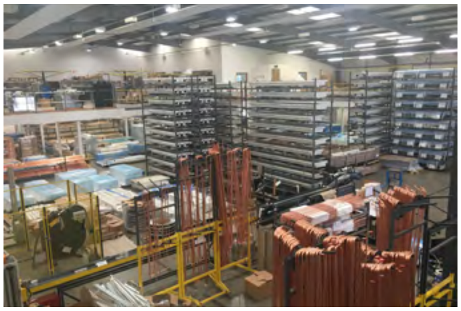


A full test report is compiled and supplied in “locked” PDF format. Data is collected and correlated using applicable software and is presented electronically to suit, usually in Eulumdat, CIBSE TM14 or IESN standard file format.

FTF Group 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 LEDs can be recorded. These recorded and plotted temperature distributions can be used to provide feedback and help optimize the light output of solid state light source based luminaires which are often found to be sensitive to junction temperatures.

Bespoke Manufacturing

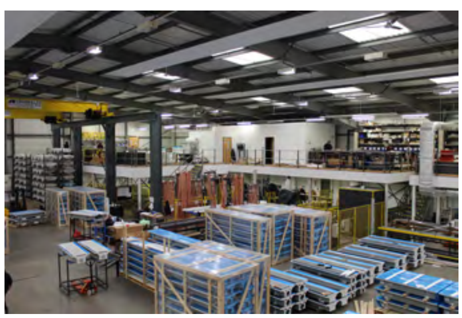
The Company has the manufacturing capability required to deliver the most complex of bespoke solutions. Facilities include the latest full CNC bending centers and machining equipment, together with a dedicated powder-coat paint plant to paint all of the components of the multiservice chilled beam.











Water distribution and pipe-work

Chilled Beam systems ('active' or 'passive') typically operate at a chilled water inlet (flow) temperatures of between 57°F and 68°F. If Active Chilled Beams are also used for heating as well as cooling, the system typically has two separate water circuits - the beam heating circuit will have water inlet temperatures of 95°F to 130°F whilst the air handling unit's heating coil may have a higher temperature water circuit.

Due to the lower temperature difference between flow inlet water and room air (14°F-18°F) in a dry cooling system, the water flow rates are higher and the pipe sizes in the distribution pipe-work are larger than in condensing (wet coil) systems.

Distribution pipe-work is typically sized to a pressure drop of 0.2 to 0.4 " H20 to enable balancing of the pipe-work system using small pressure drops in the balancing valves to avoid noise generation.

Copper, steel, plastic or composite pipes can be used but should be insulated to save energy consumption.

The main distribution pipe-work should be installed at a higher level than the chilled ceilings / beams to enable the venting of the pipework on the return mains at the highest points (e.g. using automatic venting valves).

Given the chilled beam systems operate above dew point, there is also scope for "Free Cooling" to further increase the energy efficiency of the system - see page 13 "Energy Efficiency" of this catalogue for further details.

Fresh Air Requirements

Fresh air is usually dehumidified at the AHU (air handling unit) to control the relative humidity (RH) before being supplied into the indoor environment and the dehumidification also caters for the 'Latent Heat Gains'.

Ordinarily the AHU manfacturers will provide the calculations to assist Consulting Engineers and HVAC system designers with the dehumidification plant sizing. The calculation is as detailed below and requires the use of a Psychometric Chart, full details of which, plus a worked example are available to download from FTF Group Climate's website under 'Technical Downloads', TDS 243.

Duct dimensions or raised floors for low level fresh air supply are relatively small, due to the primary airflow rate being based on fresh air requirements for respiratory purposes (or something slightly higher) to suit occupancy levels when compared with much higher air volume flow rates associated with systems trying to cool by use of air as opposed to cooling with water, such as VAV.

In passive beam solutions the fresh air is introduced separately to the Chilled Beam either at high level via swirl diffusers or at low level via displacement grilles.

There are pros and cons for the methods of supplying fresh air in association with Passive chilled beam systems. Supplying fresh air at high level is the most energy efficient as you do not need to reheat the fresh air so much following the dehumidification process as opposed to supplying the fresh air at floor level. Although it should be noted that introducing fresh air at floor level and extracting at ceiling level makes for improved IAQ (indoor air quality) as the occupants are more likely to benefit from fresh air passing them when the fresh air becomes heated by the occupants and heat sources, thus becoming more buoyant and rising up towards the ceiling for extract and/ or recirculation. Typically fresh air is supplied at 66°F for floor low level supply (no lower than 64°F) and typically 61°F no lower than 56°F for high level ceiling supply.

In traditional Active Chilled Beam systems, the ductwork is at high mounting level and is a proportionally balanced constant-air-flow distribution system or larger static regain system. If the ductwork is not proportionally balanced, then constant-pressure control dampers are utilised. Some Active Chilled Beams can also operate with minimum ventilation rates creating sufficient induction of secondary (recirculated room air) air to achieve required waterside cooling.

Air pressure control dampers can facilitate demand controlled zone ventilation (DCV), contributing to energy conservation (e.g. in office buildings where various tenants' office hours tend to differ). See Ventilation for further details of DCV with Active Chilled Beams.

Controls

Very basic controls can be used with chilled beam systems, because of the reaction time of chilled beams. The control principle can be on-off, time proportional on-off or modulating. The selection of the control system is dependent on the system design. In most cases all of the above mentioned control principles provide reliable operation of the system.

Given that Chilled Beams ('active', 'passive' and chilled ceilings) use elevated flow (inlet) water temperatures (i.e. above room dew point) and units generally sized relative to calculated room heat gain / losses there is reduced risk of any over cooling and / or over heating of the room space.

Control zones
Where the floor plan is large enough to differentiate perimeter and internal zones then separate control zones should be adopted.

Where internal zones have a relatively uniform heat loads it is possible to control as a single zone, or as a series of large control zones.

In perimeter areas, the control zones should be divided to reflect the local façade loads. The perimeter zones should allow for any possible future cellurisation / partitioning requirements.

Control systems
Most proprietary controls suppliers can offer integrated controls packages (Building Management Systems – "BMS") to cover all the requirements of a chilled ceiling or beam system, these variables being:

- Room zone temperature
- Room zone relative humidity
- Outside air temperature
- Chilled water flow and return temperature
- Low temperature hot water supply temperature
- Room occupancy sensor – where demand control ventilation (DCV) used
- Room CO² sensor – where DCV used
- AHU supply air temperature
- AHU supply air pressure
- AHU supply air relative humidity
- AHU supply air flow rate
- Chiller set point temperature

Condensation prevention

Chilled beam systems are designed to use the dry cooling principle by selecting the ventilation rate, supply air conditions and chilled water flow temperature so that no risk of condensation exists.

Dehumidification of the primary supply air in the air handling unit (AHU) is one of the important factors to prevent humidity levels (RH) exceeding that of the design "dew point" and thus avoiding the risk of condensation.
In order to ensure dehumidification of the supply air during periods of high outdoor temperatures and high RH, the AHU's cooling coil should be sized to not only dehumidify / cool the fresh outdoor air, but also additionally,allow for any internal latent gains.

The supply air humidity ratio should be so low that the ventilation airflow compensates for the internal humidity loads. In practice, the room air dew point temperature is ideally 34°F lower than the flow (inlet) temperature of chilled water in the chilled ceiling or chilled beam (active or passive) system.

It is recommended that connection pipes and valves be insulated. The following precautionary measures could be implemented in the BMS to avoid condensation:

- Internal RH is monitored to ensure the chilled water flow temperature is controlled above the calculated dew point.
- Condensation sensors can be utilized to shut off the chilled water supply when condensation is detected, this is recommended, especially when windows are openable to external air.
- In the absence of condensation sensors, openable windows should be equipped with window switches that trigger chilled water control valves to shut-off.

The most critical time to reach dry cooling is to maintain the required space humidity level during the morning start-up period. Therefore, it is recommended that you start dry air ventilation about 45 minutes before the water side cooling is commenced to help prevent the risk of condensation.

Heating with active chilled beams

The design of the heating system begins with defining the required heating capacity. In traditional heating systems, the design is often based on high safety margins when heat losses are calculated. Therefore, special care should be taken, as proper chilled beam heating operation should not be achieved by over-sizing the heating system. In a new office building, 8 to 14 BTU/hr/ft² (floor area) of heating capacity is usually adequate, although with careful design 19 BTU/hr/ft² can be achieved.

If the heating water flow (inlet) temperature of a chilled beam is higher than 122°F or the linear output of the active beam is higher than 310 to 518 BTU/hr/ft in a typical installation, secondary (recirculated air) air is often too warm to mix properly with the room air causing a higher level of stratification in the occupied zone. If designed correctly and the suggested maximum inlet temperature/BTU per foot heating is designed correctly, then a relatively low temperature gradient in the space occurs; thus maintaining comfortable thermal conditions as well as ensuring the energy efficiency of the system. Increased static pressure onto the active chilled beams also reduces room stratification.

At the perimeter of the building the level of stratification also depends on the window size and glazing inside surface temperature (U value dependent). The higher and colder the window, the colder the air falling down to the floor, and the temperature gradient between secondary air and room air becomes greater. Therefore, when, using chilled beams for heating it is recommended that the heat transmission of the windows is moderate (e.g. the inside surface temperature is higher than 54°F and the height is no more than 7ft).

The heating capacity of active chilled beams is reliant upon the primary airflow being in operation. The temperature gradient between the cold floor and the warm ceiling is slightly mixed by the cold window, but the gradient is still relatively high when the area has been unoccupied for long periods of time (e.g. early morning). Therefore, the ventilation needs to be started early enough to ensure that the warm room air near the ceiling is mixed well before the space is occupied. Sometimes it is necessary to close the warm water circulation of the beam system to increase the mixing of room air during start-up. Early morning air boost can also be used to achieve superior heating in unoccupied zones.

When an office room is occupied, the internal heat sources normally reduce the required heating output and the temperature gradient stays at an acceptable level. However, when calculating the heating capacity of the chilled beam it should be assumed that the air being returned to the heat exchanger is at least 1.5K higher than the design room temperature and that the extract air has a similar gradient.

Further details of the relationship between comfort can be downloaded from Frenger's website under 'Technical Downloads', TDS 004A and TDS 244.

Ventilation

Ventilation rates are calculated according to local building regulations or EU standards, particularly EN 15251:2007 Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics.

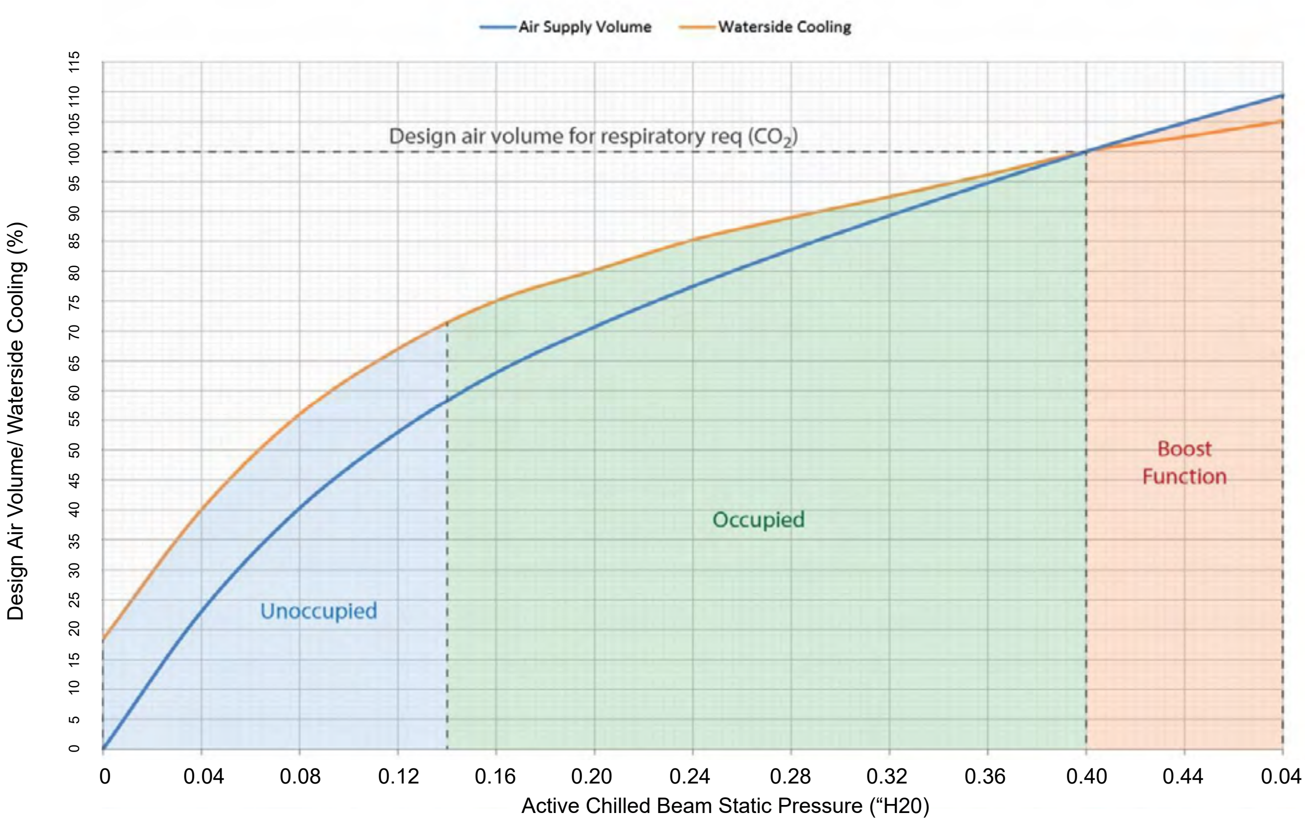
Active chilled beam system's primary airflow rate must satisfy comfort conditions, minimum ventilation requirement and internal humidity level. For passive chilled beams and chilled ceilings the supply air system is independent but must still satisfy the requirements.

The required ventilation rate in a typical office space is 0.2 to 0.5 CFM/ft². In order to keep humidity levels within the design parameters, the primary air handling unit must have the facility to dehumidify the supply air (see section ref: Condensation Prevention).

Active chilled beam systems normally use a constant airflow and operate with a primary supply air temperature reset by the season (in cooling season, 57° to 63°F and in heating season, 64° to 70°F). Lower supply air temperatures can be used if the room system (beam or other heating element) has the capacity also to heat the cold supply air in order to avoid over cooling the room (e.g. in meeting rooms). Also note DCV Active Chilled beam strategy to offset this issue.

Frenger active chilled beams (ACB's) can provide "Demand Control Ventilation" (DCV) without any need for moving parts or actuators on the beam itself which minimises maintenance and cost; this is achieved due to our patented induction nozzle design which maintains the Coander effect and high levels of induction at very low static pressures (<0.14 "H20) providing exceptional cooling performance. The relationship between static pressure, air supply volume and waterside cooling when in DCV mode can be seen in the chart below:-

When the specific length of active chilled beams are predetermined, the primary air flow rate to each beam has to be whatever the particular manufacturers chilled beam requires to achieve the cooling performance based on the given design supply air pressure, as well as to ensure effective heat transfer of the cooling coil and to guarantee the operation of the space air distribution. Care should be taken to ensure that the primary airflow rate is not too high in order to avoid excessive induced airflow, which can cause draughts in the occupied zone. The typical airflow rate of an active chilled beam is 3 to 15 CFM/ft of beam assuming a two way discharge and 2 to 11.5 CFM/ft for one way discharge beams for ensuring that high thermal comfort levels are maintained in the occupied space (ASHRAE 55 standard). Fourway (360 degree) discharge beams beams are the same 3 to 15 CFM/ft allowance but with an additional 2ft added to the beam length.



Please note this guide serves to provide a generic overview that provides useful information to support the application of Chilled Beams.

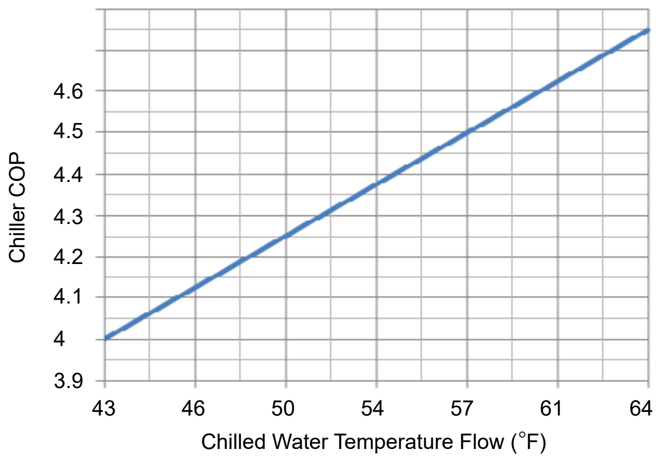
Frenger, disclaim all liability to any person for anything or for the consequences of anything done or omitted to be done wholly or partly in reliance upon the whole or any part of the contents of the above guide (pages 10-12).

Energy Efficiency

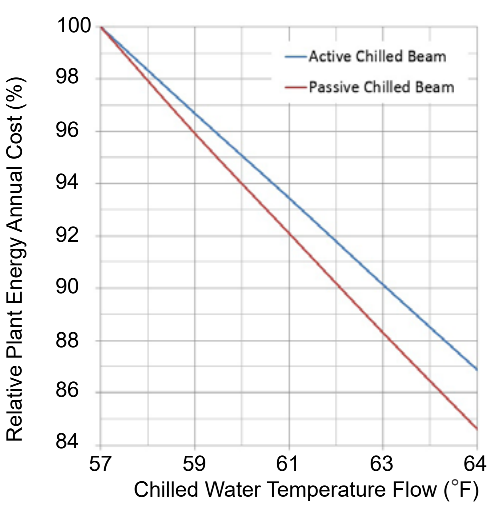
Lower Energy System

An Active Chilled Beam (ACB) system operates on elevated chilled water supply temperatures (designed to run 'dry' ,above dew point from 57°F to 63°F supply temperature) and have no moving parts (i.e. no fans or motors) which provide for a more energy efficient system when compared to a fan coil unit (FCU) system which is typically operated below dew point (wet) on a 43°F or 45°F supply temperature (which also means condensate drip tray is required) and are supplied with individual fans and motors. The coefficient of performance (COP) and or EER (energy efficiency ratio) is much higher for Chillers operating on 57/63 degrees (COP / EER is 4.5 standard chiller) when compared to FCU operation on 43/54 flow & return (COP / EER is 4.0) and with ACB units that run dry you can also make use of 'free cooling chillers to drastically increase the COP / EER to an average hourly rate of circa 13.5 for projects based on London weather data.

The total SFP (specific fan power) for an ACB system (in Watts energy used by the AHU for the total system per Ltrs / sec fresh air supplied) is typically much lower than that of a FCU system as ACB units have no fans and additional controls per terminal unit drawing energy all day / every day.



Frenger's latest generation of chilled beams can provide higher cooling levels than the previous old technology it is becoming more beneficial to increase the summer design chilled water flow temperature from the industry standard 57.0 °F to achieve increased energy savings; the following graph details typical plant energy savings for using a chilled water flow condition above 57.0 °F



Room Set-Point

Further energy savings can be achieved if the chilled beam system utilises a proportion of cooling via "Radiant Absorption"; the X-Wing chilled beam technology (60% convective / 40% radiant) not only provides exchange with the room air (via the convective component) but also provides direct radiant absorption from the warmer room surfaces and / or occupants. The reduced surface temperatures result in a reduction in spatial radiant temperature (or black bulb measurement) which means a reduction in operative temperature given that under normal operating conditions:

Operative Temp = 0.5 x (Air Temp + Radiant Temp)

As the operative temperature is lower it enables the system to be designed with a higher spatial air temperature and still achieve the same operative temperature; having an increased room air temperature results in reduced energy consumption due to lower heat gains and less cooling requirement.

Thermal Mass

If the X-Wing Radiant Passive Beam system is installed with exposed thermal mass it enables the X-Wing cooling element to have direct radiant exchange with the warmer thermal structure; as the thermal structure is cooled it can absorb energy during times of peak demand, this not only means that the HVAC plant can be smaller in size (saving capital expenditure) but also means increased efficiency. Based on completed buildings exposed thermal mass coupled with X-Wing radiant cooling can reduce the peak loads by up to 6 to 10 BTU/hr/ft².

Demand Control Ventilation

To improve energy usage with Active Chilled Beam systems it is possible to utilise "Demand Control Ventilation" (DCV) whereby the fresh air supply to the beam is reduced if areas are unoccupied or occupancy density is lower than the peak condition. The demand control can be controlled using either PIR sensors (for occupied / unoccupied control) or CO2 sensors to enable reduced fresh air during occupied times; the BMS system can control the fresh air volume by using motorised VAV (Variable Air Volume) dampers located in the duct system.

It is important that for occupied reduced air volume conditions the active beam is correctly selected to ensure the fresh air supply from the chilled beam still delivers the air horizontally (utilising the Coanda effect) to ensure occupant comfort. With Frenger's latest chilled beam induction nozzle technology it is possible to reduce the fresh air volumes to approximately 60% of the normal design condition and still achieve discharge Coanda; this is also achieved without any need for moving parts or motorised dampers directly on the chilled beams.

The advantage with a correctly designed VAV chilled beam system is that each control zone would only require a single duct mounted control damper to service multiple chilled beams (I.e. there is no requirement for a damper on each beam) which reduces capital expenditure, is simpler to commission, uses less energy to run as there are fewer electric actuators on the system and most importantly (maintaining one of the chilled beams greatest benefits) that of minimum maintenance and long life expectancy due to no moving parts on the actual chilled beam themselves.

“Radiant Passive” Chilled Beams

FTF Group has extensive experience in the design and manufacture of “Radiant”/convective passive chilled beam solutions; providing discreet and cost-effective space conditioning to commercial, educational and healthcare environments. Over the past 20 years products have been supplied to major projects throughout Europe, and as far afield as Australia. FTF Group’s “Radiant”/convective passive chilled beams offer a hybrid between conventional passive chilled beams and radiant chilled ceilings.

Low maintenance cooling systems

“Radiant”/convective passive chilled beams provide an efficient means of cooling and, with no moving parts, require little maintenance. This in turn ensures lower running costs. They can be installed above perforated or microperforated metal ceilings to provide up to 43 BTU/hr/ft of cost-effective cooling with minimal control requirements.

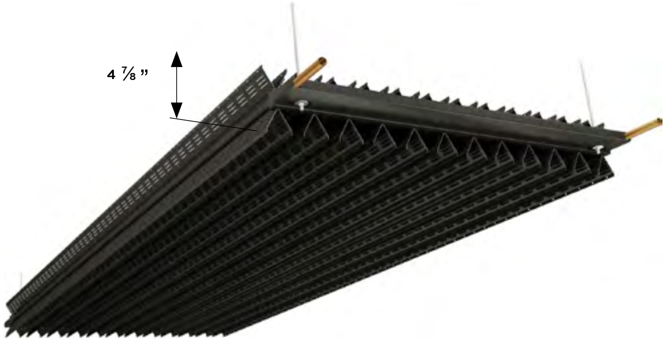
This type of solution does not create any noise or drafts in office environments, and improve both the comfort and is reported to increase the productivity of the occupants. The system ensures a very low degree of air movement below the chilled beams in order to comply with ASHRAE 55-2010 standard of 40 fpm and ISO 7730 standard of less than 50 fpm.

Operation

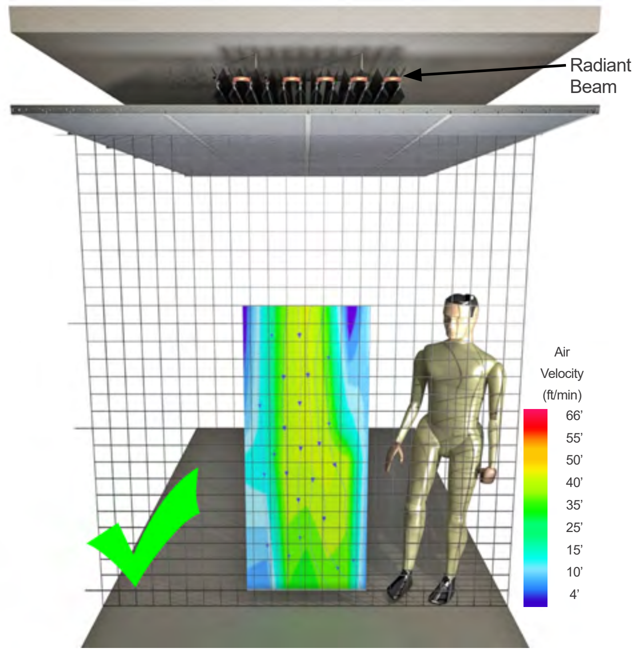
When cold water passes through our “Radiant”/convective passive chilled beam the warm room air is cooled against the surfaces. This chilled air, which then becomes heavier, then streams through the punched louvres in the radiant beam and percolates through the small ceiling perforations into space below (when concealed). In this way air is circulated within the room, with warm air from the room space being continually replaced by cooled air.

In addition to this convective process, the cold surfaces of the beam also absorb heat radiation from the building occupants and the warmer surrounding surfaces. The radiant quotient is approximately 40% of the total cooling effect (the other 60% of cooling being generated by the convective cooling effect described above). The ability of our “Radiant”/convective passive chilled beam to also cool by radiant absorption means that, when compared to a finned tube battery, our beam can deliver 40% more cooling without any additional risk of draft.

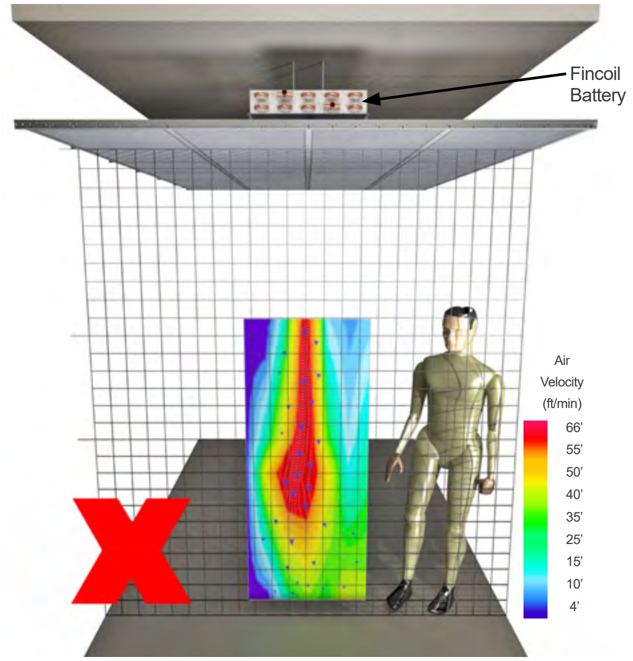
In addition to the convective heat transfer common to all passive chilled beams, the radiant effect of the products also cools the metal ceiling system (secondary radiation), which in turn re-radiates this cooling effect into the room. The radiant effect of the beam also provides a more comfortable environment for the building occupants and even less chance of any drafts (draft risk rating is reduced). The system provides the comfort and aesthetic benefits of radiant chilled ceilings at a significantly lower cost and whilst maintaining the higher cooling capacities associated with chilled beam installations.



X-Wing® (Radiant Chilled Beam)



Radiant Chilled Beam



Convective Only Fincoil Battery

Composition and manufacture

FTF Group's "Radiant"/convective passive chilled beams are constructed from coiled copper which is formed into serpentine coils utilizing full CNC, state-of-the-art automated decoiling and bending machines. This process eliminates the risk of any leaks as there are no joints in the copper water circuit of the product. The aluminum radiant "wings" which make up the cooling surface are mechanically fixed around the copper tube serpentine one piece coil in which the cold water is transported to provide 100% encapsulation of the waterways for optimum transfer of energy from the radiant wings to the copper waterways. Both the copper tubing and aluminum wings are 100% recyclable.

Dimensions

FTF Group "Radiant"/convective passive chilled beams are compact and versatile in the way that they can be mounted and located. Available in different widths and lengths and is less than 5" deep, systems can be installed in 10" ceiling voids.

Benefits of "Radiant"/Convective chilled beams

- No joints in the copper tube coil - no risk of leaks
- No noise or drafts; improved occupancy comfort and productivity
- No moving parts equates to reduced maintenance costs
- Capital costs now comparable and / or more competitive than traditional AC systems
- Improved efficiencies translates to lower running costs
- Can be installed within shallow ceiling voids

FTF Group's unique features

- Less than 5" deep
- Offers radiant and convective cooling
- Will operate efficiently above a micro-perforated ceiling
- Can be installed within a 10" deep total ceiling construction, if necessary due to height restrictions
- Minimal maintenance due to absence of closely spaced fins as associated with fincoil battery passive beams
- Very low air movement below chilled beam
- Cooling capacity up to 43 BTU/hr/ft above metal ceiling perforated to 28% free area and 0.094" or 0.118" perforation.

Commercial Offices

FTF Group's range of "Radiant"/convective passive chilled beams installed above perforated metal ceiling systems is a tried and tested solution used in many high-profile projects in the UK, Europe and Australia. The system provides high levels of comfort for occupants, with minimal control and maintenance requirements.

Furthermore, the radiant/convective nature of the product means that it is insensitive to the position of heat sources, and can be utilized with standard ceiling perforation patterns for greatly improved aesthetics.

Maintenance

FTF Group's range of "Radiant"/convective passive chilled beams are extremely easy to clean, requiring a simple wipe with a damp cloth.


Radiant Absorption
Warm Air "Convection"
Cool Air "Convection"

X-Wing®

Product Description

X-Wing® is one of the FTF Group's latest range of next generation Chilled Beams. Energy efficiency has been a key driver for such advancements in the FTF Group's Chilled Beam Technology.

X-Wing® is only 4.8" deep and can achieve up to 384 Btu/hr/ft as an exposed passive "Radiant" / convective cooling unit and up to 53 BTU/hr/ft² when concealed behind an S5046 perforated metal ceiling (both sets of maximum performance are based on 18dTF).

NB. The above performance figures are waterside cooling and no inclusion made for any additional cooling effect from any separate supply air system for respiratory requirements.

X-Wing® contains a number of Patented performance enhancing features, as can be expected from the FTF Group brand.

X-Wing® is constructed from copper and aluminum and is 100 percent recyclable. The copper coil is produced by the FTF Group's in house fully automatic bespoke "state of the art" serpentine bending machine. This produces seamless sinusoidal copper coils (without any joins) up to 18.3ft in length, with up to 12 water passes at 2.8" tube centers. The aluminum radiant "wings" are produced in house by bespoke power press and roll forming machines, all of which are then assembled by the FTF Group's fully automatic CNC controlled machine which mechanically bonds the "radiant wings" to be in metal to metal contact with the seamless copper waterways and thus providing 100% encapsulation of the waterways for optimum transfer of energy from the radiant wings to the copper waterways.

The finished products are hydraulically tested to 246 Psi positive pressure as standard before automatic machine wrapping and packaging.

The FTF Group, have automated the vast majority of processes for this particular next generation product to ensure that the highest levels of quality are both repeatable and consistent at all times.

Function

X-Wing® provides cooling by both convection and "Radiation". The radiant proportion creates no air movement, the only air movement comes from the convective proportion. As cold water passes through the chilled beam the warm room air is cooled against the beam's cooler surfaces. This cooled air, which is heavier due to it's higher density, then streams through the punched louvres in the radiant wings and percolates through the small ceiling perforations into the room space below (when concealed). 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 (the radiant wings / 4 per waterway) also absorb heat radiation from the building occupants and the warmer surrounding surfaces. X-Wing's® radiant quotient is approximately 40% of the total cooling effect (the other 60% of cooling being generated by the convective cooling effect described above). The ability of X-Wing® to cool by radiation means that, when compared to a finned tube battery, X-Wing® can deliver 40% more cooling without any additional risk of draft.

The efficiency of the convection process, coupled with the ability of the product to exchange energy by way of long-wave radiation, means that X-Wing® retains 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.

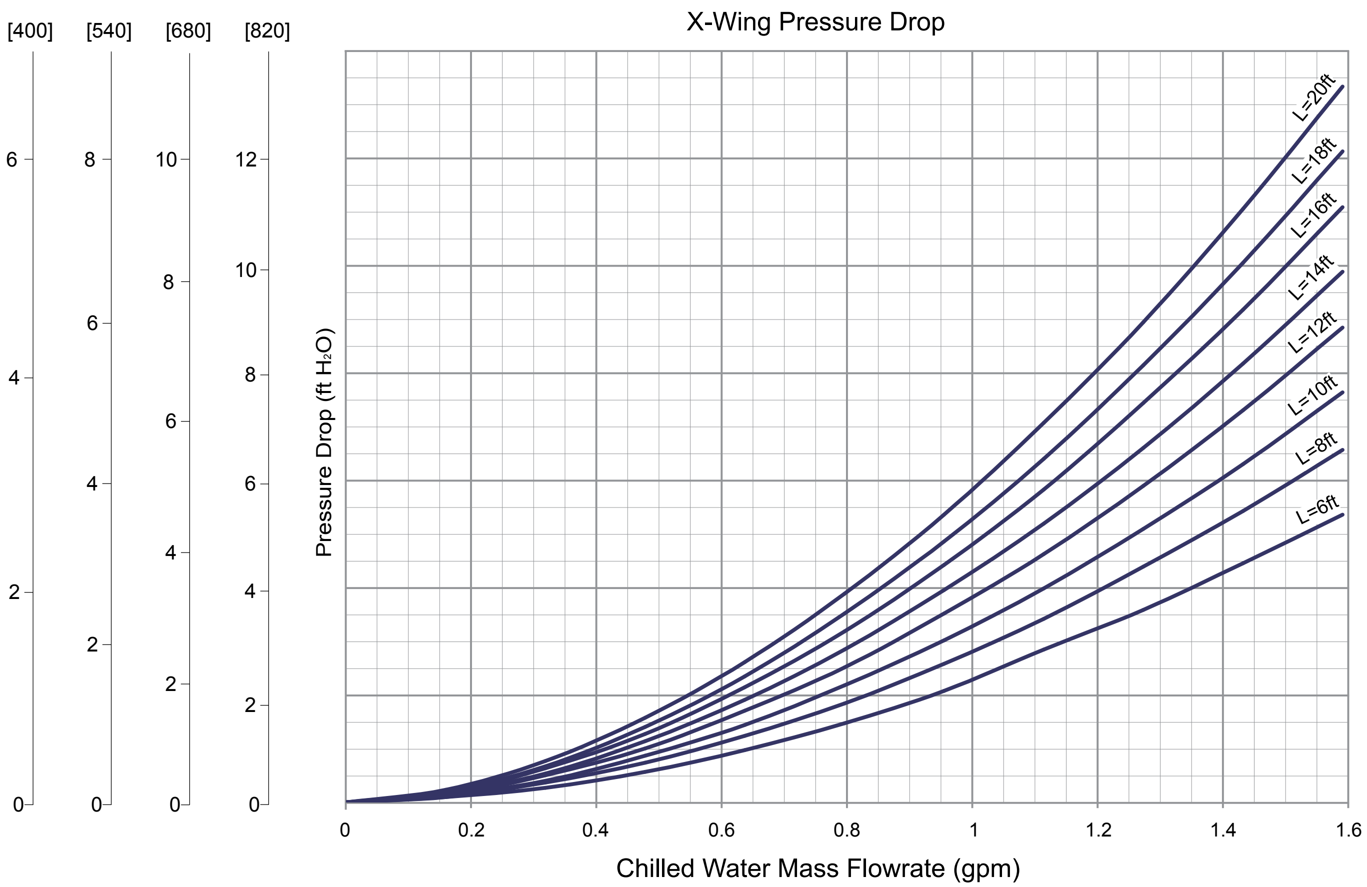
At a glance

- Shallow Depth unit (only 4.8").
- Only 2.6" clearance required behind unit and as little as 9.92" total ceiling construction (see page 17).
- Widths available 15.7", 21.3", 26.8" and 32.3".
- Lengths available 3.9ft up to 18.3ft in increments of 3.1".
- Can be installed exposed or ideal for "concealed" applications such as behind perforated metal ceilings or within architectural metal ceilings such for ceiling integration or freely suspended Multi Service Chilled Beams.
- Eliminated risk of water leakage. No joints in the copper coil, just one continuous serpentine for all product widths up to 13.1ft long and up to 18.3ft long for up to 1.8ft wide models (only 2 joints for 2.2ft and 2.7ft wide models over 13.1ft in length).
- Specialist black or white coating for smooth, long lasting, easy to clean, uniform finish that increase the radiant absorption coefficient for the product.
- 40 percent more allowable passive cooling for X-Wing® without increased draft risk, this is due to X-Wings® "Radiant" quotient as compared to passive fin coil convective cooling products by others.
- Can be installed above light fittings with no loss of performance.
- Provides indoor climate in accordance with BS EN ISO 7730 / ASHRAE 55.

Cooling Performance

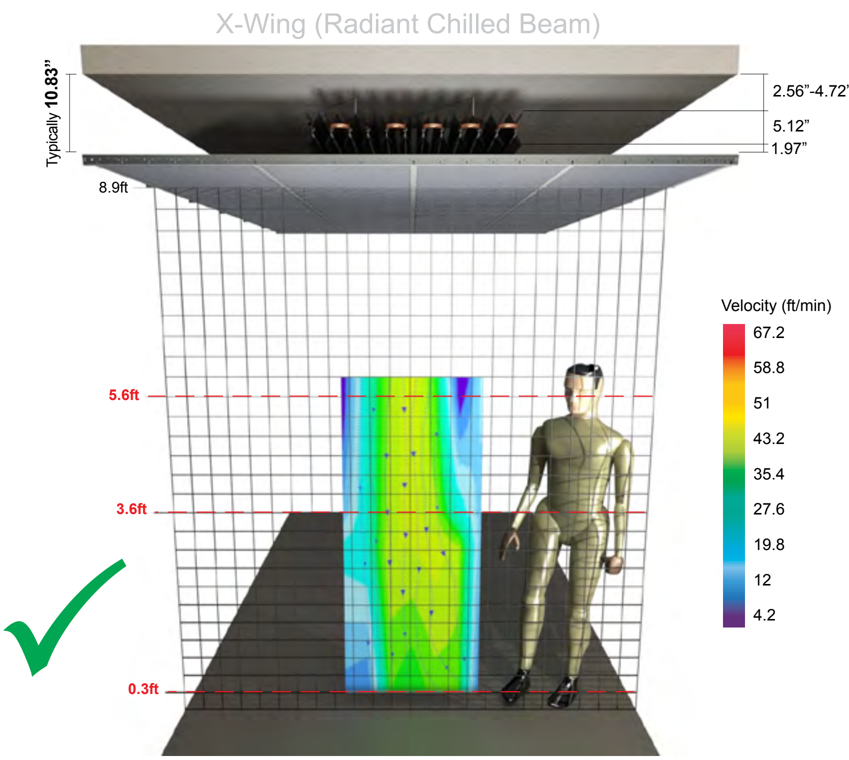
Perforation Pattern	X Wing® Output (Btu/h/ft/K)				Max Ceiling Output (BTU/hr/ft²/°F)
	XW 400-15	XW 540-15	XW 680-15	XW 820-15	
Exposed	10.2	14.4	18.9	21.4	-
S0.2" / 50%FA	10.1	13.5	16.9	20.0	9.6
S0.2" / 46%FA	10.0	13.4	16.7	19.8	9.4
D0.16" / 33%FA	9.5	12.6	15.5	18.2	7.1
D0.14" / 34%FA	9.4	12.4	15.3	17.9	7.1
D0.12" / 22%FA	8.5	11.0	13.4	15.4	5.2
S0.09" / 28%FA	8.6	11.1	13.6	15.6	5.6

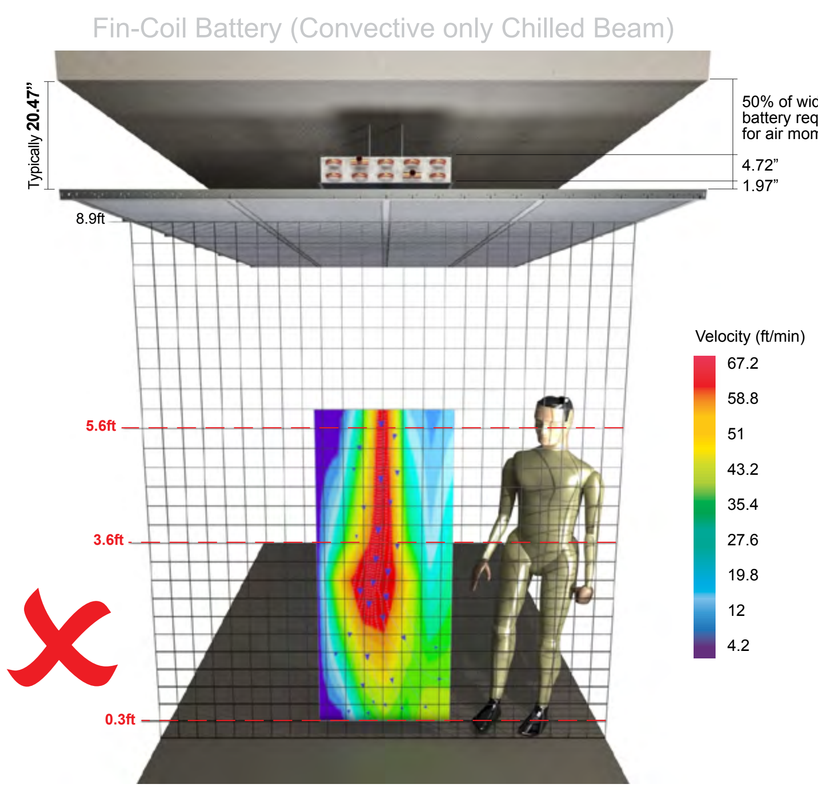
Pressure Drop



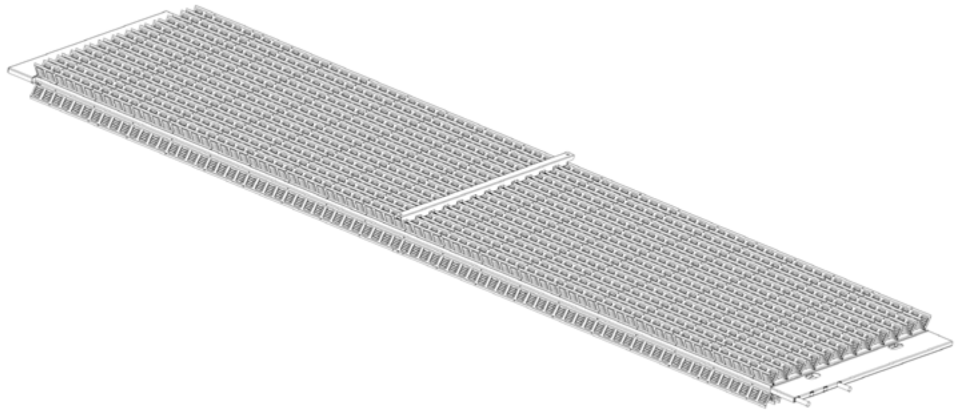
Increased Occupancy Comfort

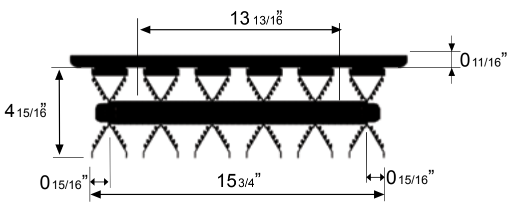
The following Climatic Test Report color Topography below shows comfortable air velocities directly below the X-Wing® radiant convective beam achieving 285.6 BTU/hr/ft as opposed to a convective only fin-coil battery also performing 285.6 BTU/hr/ft.



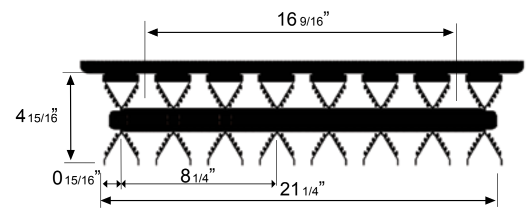


Product Dimensions

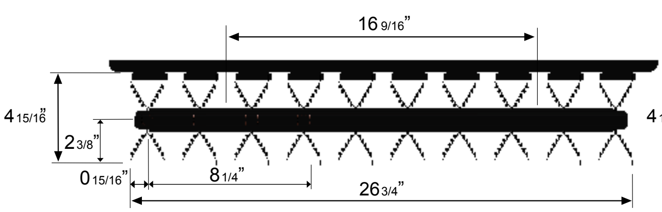




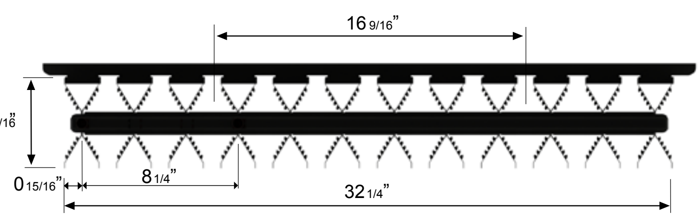
XW 400-15



XW 540-15



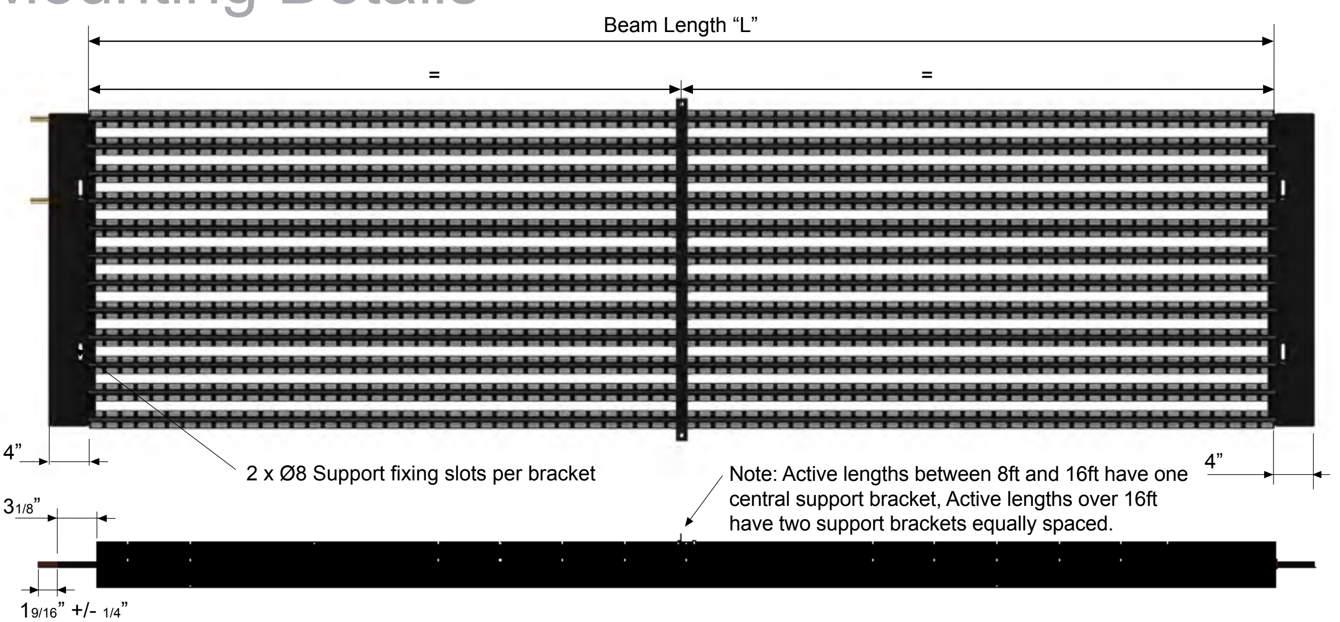
XW 680-15



XW 820-15

* Note all dimensions are ± 0 3/4"

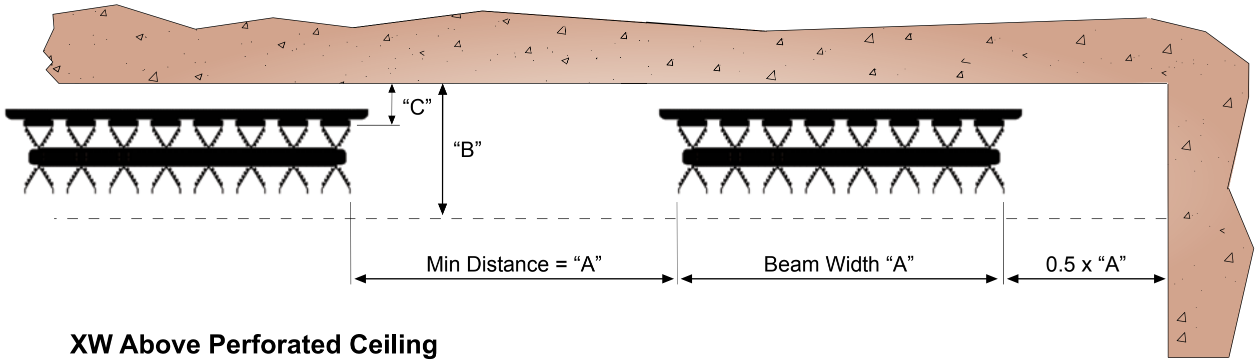
Mounting Details



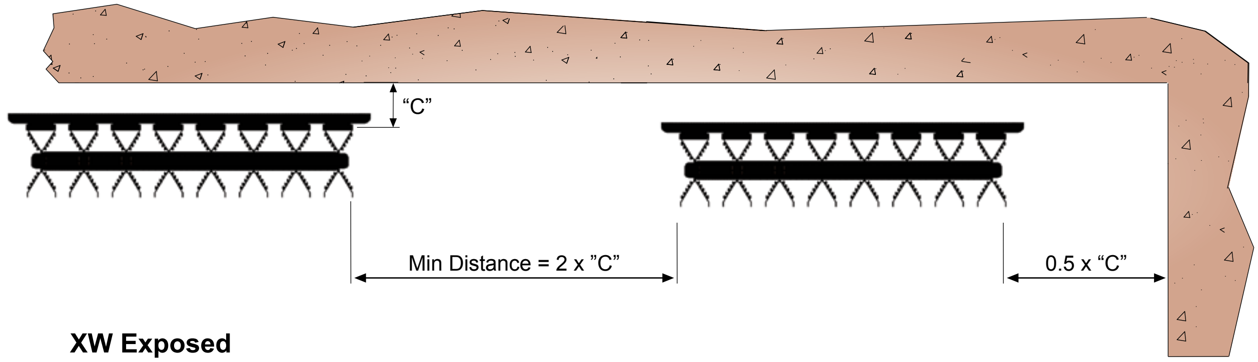
Weight & Water Content

Model Ref.	XW 400-15	XW 540-15	XW680-15	XW820-15
Dry Weight (lb/ft)	3.6	4.8	6.0	7.1
Water Content (US Gal/ft)	00.8	0.10	0.13	0.15

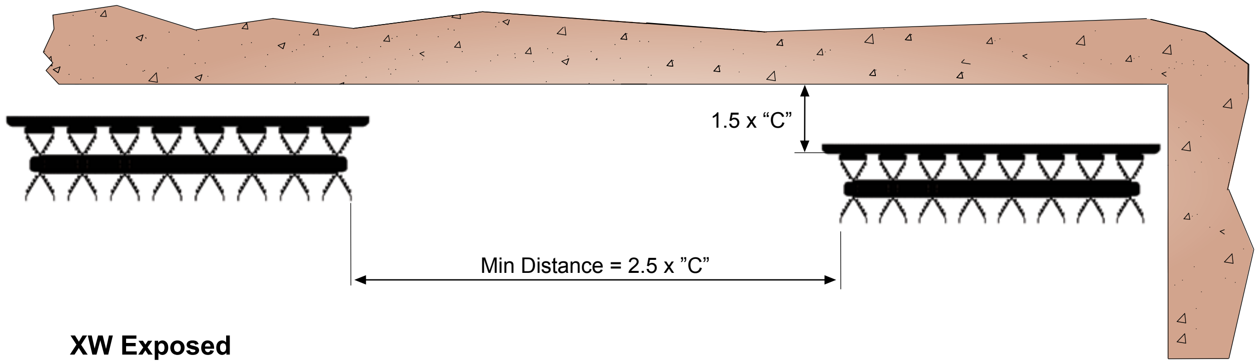
Product Positioning



XW Above Perforated Ceiling



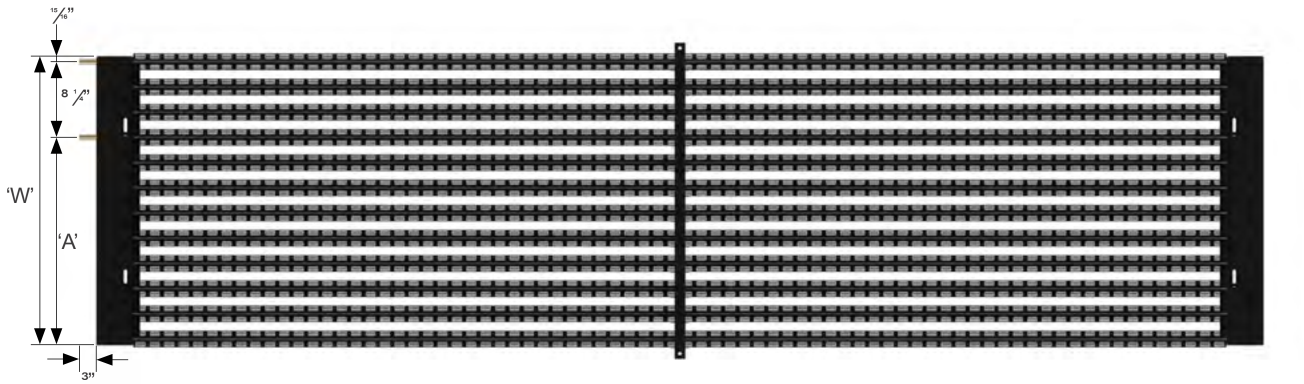
XW Exposed



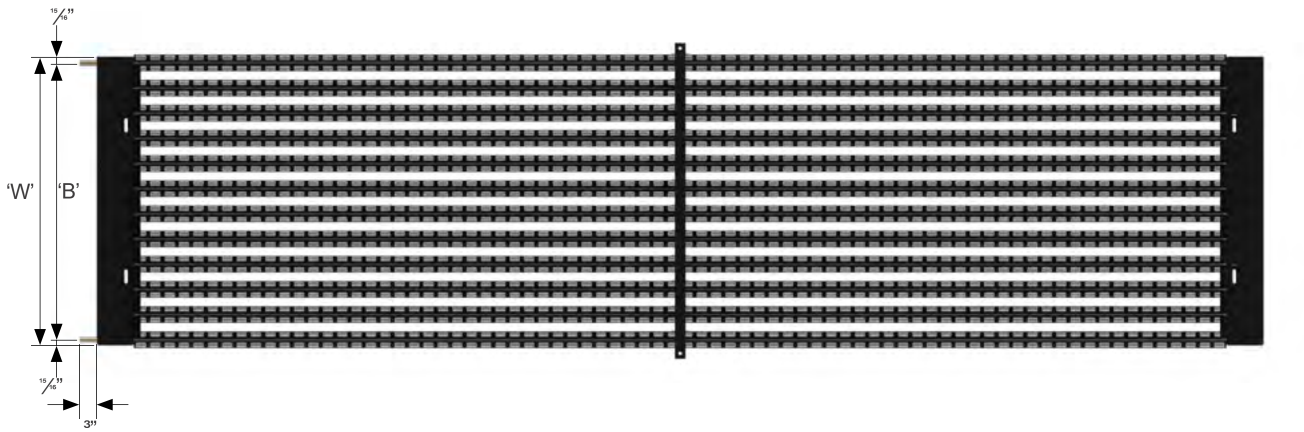
XW Exposed

Model Ref.	Dim "B"	Dim "C"
XW 400-15	9.92"	2.56"
XW 540-15	10.51"	3.15"
XW 680-15	11.89"	3.94"
XW 820-15	12.68"	4.72"

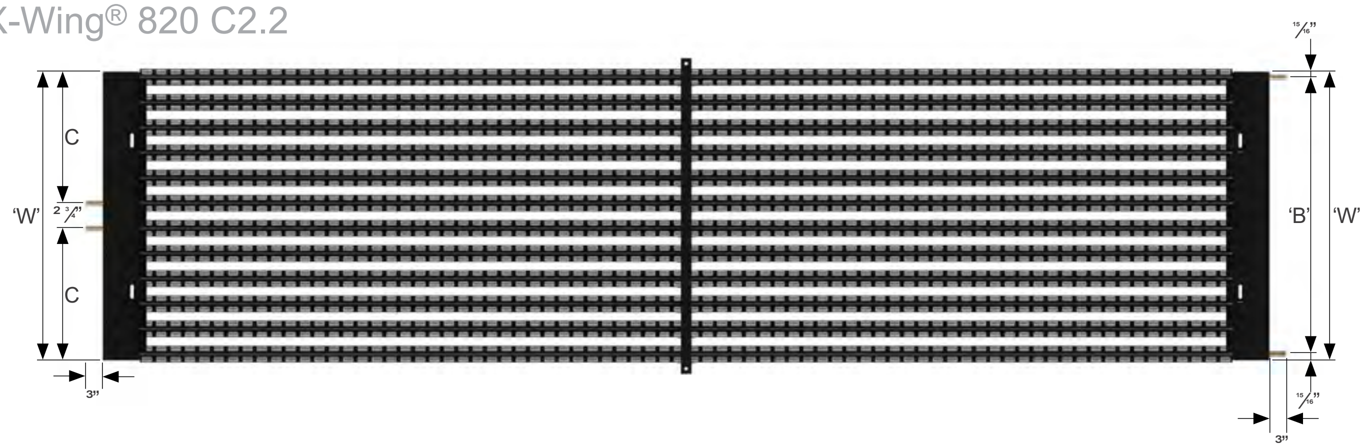
X-Wing® 820 C1.1



X-Wing® 820 C1 and C2



X-Wing® 820 C2.2

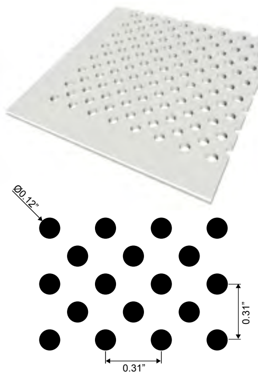


Model Ref.	Width ‘W’	Dim ‘A’	Dim ‘B’	Dim ‘C’
XW 400-15	15 ¾”	7 ½”	11”	6 ½”
XW 540-15	21 ¼”	13”	19 ¼”	9 ¼”
XW 680-15	26 ¾”	18 ½”	24 ¾”	12”
XW 820-15	32 ¼”	24”	30 ¼”	14 ¾”

All dimensions ± 1/8”

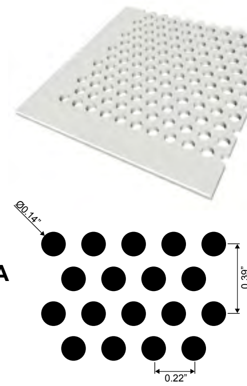
Perforation Pattern Options

Diagonal Pitch



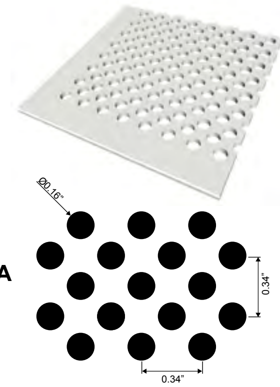
0.12" hole
3.1" pitch
22% open area

D0.12"/22%FA



0.14" hole
0.22" x 0.39" pitch
34% open area

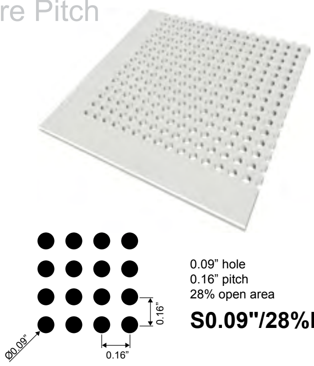
D0.14"/34%FA



0.16" hole
0.34" pitch
33% open area

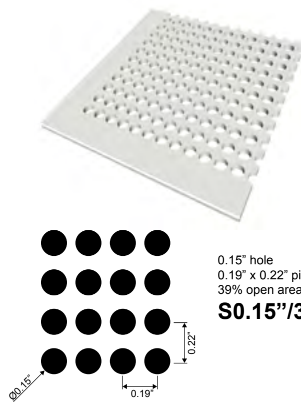
D0.16"/33%FA

Square Pitch



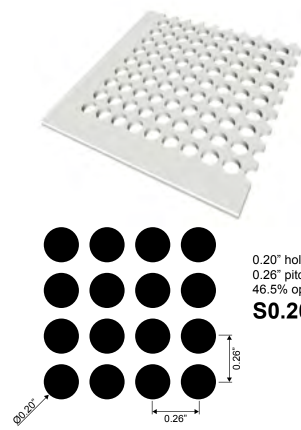
0.09" hole
0.16" pitch
28% open area

S0.09"/28%FA



0.15" hole
0.19" x 0.22" pitch
39% open area

S0.15"/39%FA



0.20" hole
0.26" pitch
46.5% open area

S0.20"/46%FA

Product Ordering Codes

3. Waterside Connection

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

Flow/Return Orientation

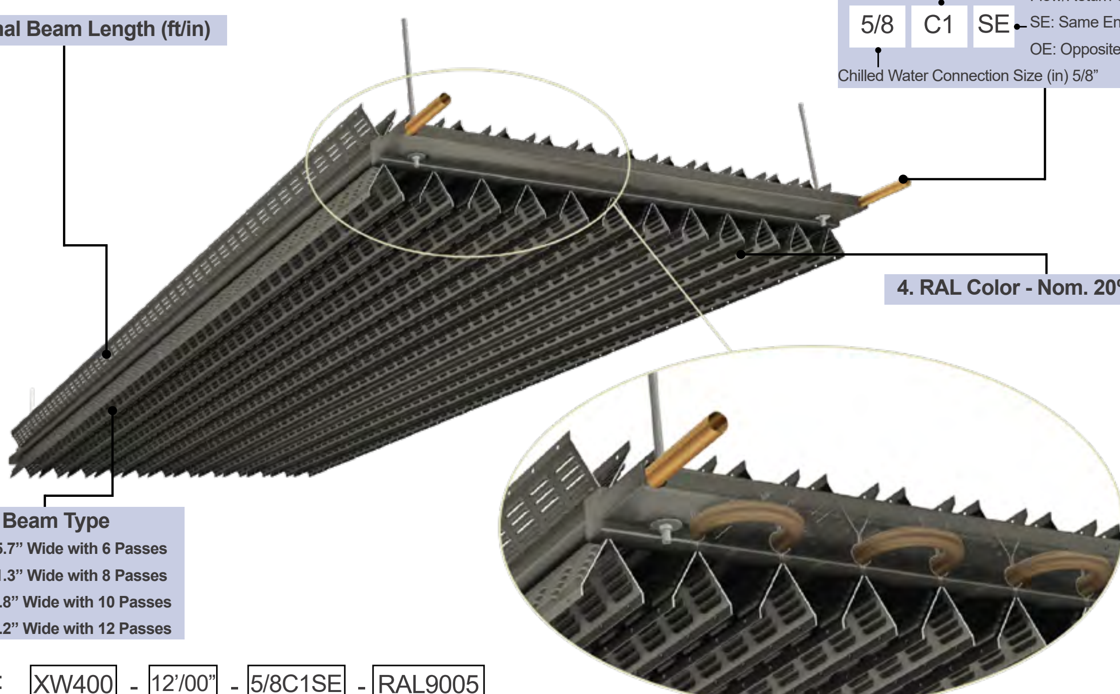
5/8 | C1 | SE

SE: Same End

OE: Opposite End

Chilled Water Connection Size (in) 5/8"

2. Nominal Beam Length (ft/in)



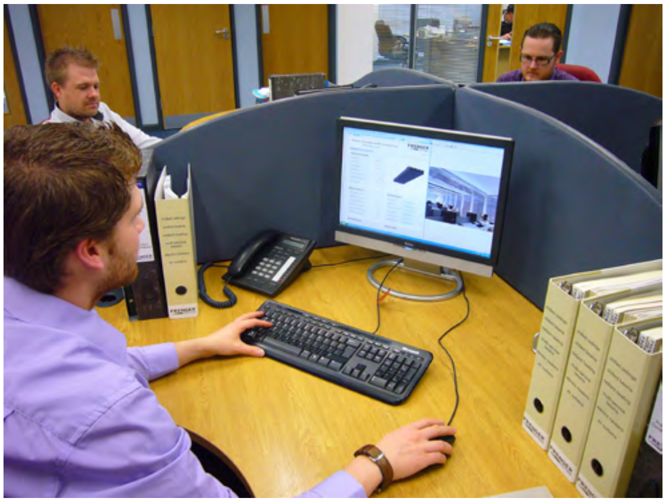
4. RAL Color - Nom. 20% Gloss

1. Beam Type

- XW400 - 15.7" Wide with 6 Passes
- XW540 - 21.3" Wide with 8 Passes
- XW680 - 26.8" Wide with 10 Passes
- XW820 - 32.2" Wide with 12 Passes

Example: XW400 (1) - 12'/00" (2) - 5/8C1SE (3) - RAL9005 (4)

Calculation Program



X-Wing Selection Data

System Type	CICB	
Model Ref	XW820	
Active Length	5’ 0”	
Manifold Type	C1	
Perforation Hole Size	0.177	Inches
Perforation Free Area	30%	
Return Air Gap	4.72	Inches

The FTF Group’s calculation program for X-Wing® is extremely user friendly.

Simply select from the drop down menu the “system type”. Select the model, manifold and perforation as per the particular project requirements.
The “return air gaps” is the clearance behind the X-Wing® unit (see product dimensions page 21) to the underside of roof slab.

Design Conditions

Flow Water Temperature	57.0	°F
Return Water Temperature	61.0	°F
Air Supply Temperature	60.00	°F
Average Room Condition	76.0	°F
“Air On” Thermal Gradient	0.0	°F
Room Relative Humidity	50.0	%

Complete your project data in the “Design Conditions” section. Please note that the “Air On” Thermal Gradient can be used up to 1.0ºC for MSCB system types without the calculation program flagging up *“talk to the FTF Group’s technical personnel”*, although we recommend that it is much safer to design to a worst case scenario and not to rely on a room temperature gradient.

Performance Data

Room - Mean Water dT	17.0	°F
Waterside Performance	**1462**	**BTU/Hr**
Water Mass Flowrate	0.732	gpm
Waterside Pressure Drop	1.17	ft H20

“Performance Data” will then be automatically be calculated. Likewise “Dimensional Date” will be also automatically calculated. Finally, the “Design Check” should read “Ok” in green, or detail some warnings in red.

Calculation programs for X-Wing® are available upon request.

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

FTF GROUP® Climate

“Radiant” Chilled Beam (RCB) Calculation Tool

Is this the latest version?

Project Ref.

X-Wing Selection Data

System Type	CICB	
Model Ref	XW820	
Active Length	5’ 0”	
Manifold Type	C1	
Perforation Hole Size	0.177	Inches
Perforation Free Area	30%	
Return Air Gap	4.72	Inches

Design Conditions

Flow Water Temperature	57.0	°F
Return Water Temperature	61.0	°F
Air Supply Temperature	60.0	°F
Average Room Condition	76.0	°F
“Air On” Thermal Gradient	0.0	°F
Room Relative Humidity	50.0	%

Dimensional Data

Beam Depth	5.75”	
Beam Width	2’ 8”	
O/A Beam Lenght	65.8”	
CW Connection	Ø1/2-SE	
Water Volume	0.8	gal
Total Dry Weight	40.9	lb

Performance Data

Room - Mean Water dT	17.0	°F
Waterside Performance	**1462**	**BTU/Hr**
Water Mass Flowrate	0.732	gpm
Waterside Pressure Drop	1.17	ft H20

Design Check

Cooling Circuit	OK
Cooling Function	OK

Model Ref: XW820-1520-15C1SE-RAL9005

Notes:
1) Performance calculations are based upon normal clean portable water. It is the systems engineer’s responsibility to allow for any reduction in colloing or heating performance due to additives that may reduce the water systems heat transfer coefficient
2) Pressure drop calculations are based upon ASHRAE guides using clean potable water and exclude any additional losses associated with entry / exit losses, pipe fouling or changes in water quality; it is the system engineer’s responsibility to use good engineering practice.

Convect™

Convect™ is Frenger’s latest Fincoil Passive Chilled Beam which can provide low-end energy efficient cooling and is available as either an exposed unit (FHCB) or as a unit concealed behind a metal perforated ceiling (RCB).

Convect™ FHCB units for exposed applications are available as standard with exposed surfaces powder-coat painted white RAL 9010 as standard (other colours available upon request) and have a perforated front fascia to deliver the conditioned air discharge; several different perforation patterns are available but the exact perforation selection will be dependent upon the required cooling output.

Convect™ RCB units for concealed applications are available in either self finish (copper, aluminium, steel) or can be supplied with we sprayed black finish to the underside of the Fincoil element and side rails to help conceal the unit behind the ceiling.

Convect™ is available in depths of 5”, 7” and 8” and can achieve up to *520 BTU/hr/ft when exposed (FHCB) and up to 54 BTU/hr/ft² when concealed (RCB) behind an S5046 perforated metal ceiling (both sets of maximum performance are based on 10∆tk).

NB. The above performance figures are waterside cooling and no inclusion made for any additional cooling effect from any separate supply air system for respiratory requirements.

The Convect™ cooling element is constructed from copper (approximately 20% recycles material) and aluminium (approximately 15% recycled material) and is hydraulically tested to 290 PSI positive pressure as standard before final assembly.

Function

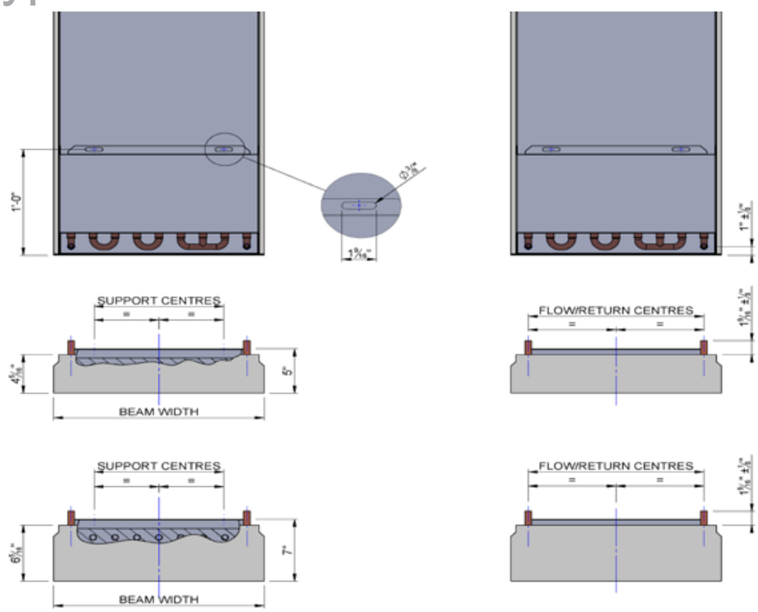
Convect™ provides the majority of cooling by convection (circa 95%). As cold water passes through the chilled beam the warm air is cooled against the beams cooler surfaces. This cooled air, which is heavier due to its higher density, then streams through the Fincoil aluminium fins and percolates through the small ceiling perforations into the room space below (when concealed). In this way air is circulated within the room, with warm air from the room being continually replaced by cooled air.

At a glance

- Widths available 14 3/16”, 16 3/16”, 18 1/8”, 20 1/16”, 22 1/16”, 24 1/16” and 25 15/16”
- Lengths available 3ft up to 13ft.
- Can be installed exposed or ideal for ‘concealed’ applications such as behind perforated metal ceilings or within architectural metal ceilings such for ceiling integrations or freely suspended Multi Service Chilled Beams.
- No moving parts and so little or no maintenance is required.
- Eurovent certified performance.
- Provides indoor climate in accordance with **BS EN ISO 7730 / ASHRAE 55.**

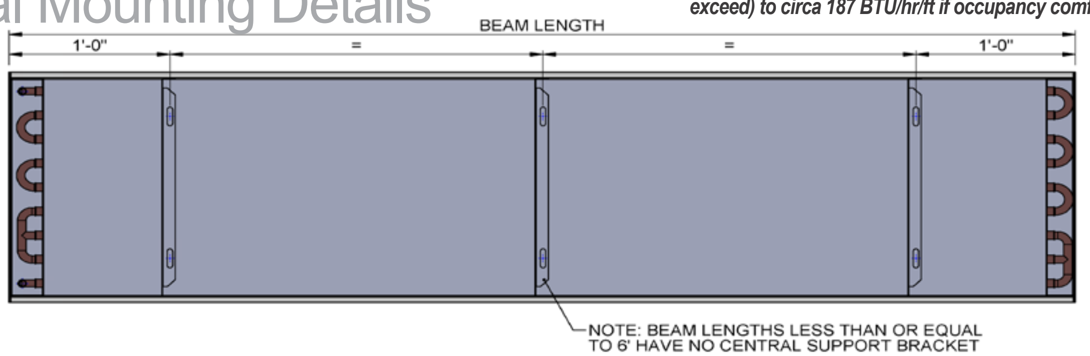
As Convect™ is a Fincoil 95% ‘Convective’ cooling solution, care must be taken during selection to ensure that air velocities entering the occupied zone do not cause draught; CBCA guidelines recommend a maximum cooling effect of 234 BTU/hr/ft when positioned behind a perforated fascia, if the Fincoil element is exposed then the maximum cooling effect should be reduced (limited to / not exceed) to circa 187 BTU/hr/ft if occupancy comfort is a criteria.

Typical Product Dimensions



Note: The above product dimensions are for a typical Convect™ beam. Other aesthetic options are available, please contact FTF Groups technical department for further information.

Typical Mounting Details



Cooling Performance

Convect™ Model Ref. R1 beams

Convect	ΔtK - 12.5°F						
L (ft)	362-R1	412-R1	462-R1	512-R1	562-R1	612-R1	662-R1
3	267	308	348	388	430	471	511
4	363	419	475	531	589	649	705
6	564	656	747	841	937	1037	1132
8	781	913	1045	1181	1322	1467	1606
10	1014	1189	1367	1550	1739	1933	2117
11.8	1219	1434	1651	1875	2105	2339	2560
13	1390	1638	1888	2144	2406	2671	2919

Convect™ Model Ref. R2 beams

Convect	ΔtK - 12.5°F						
L (ft)	362-R2	412-R2	462-R2	512-R2	562-R2	612-R2	662-R2
3	353	408	462	517	573	631	685
4	482	559	635	713	794	876	995
6	759	886	1014	1146	1282	1423	1557
8	1062	1247	1434	1627	1826	2029	2222
10	1390	1638	1888	2144	2406	2671	2919
11.8	1680	1983	2285	2593	2903	3214	3501
13	1921	2267	2610	2956	3301	3643	3955

Cooling circuit Δt = 5°F (Water in-out), C2 manifold used throughout, 5" unit depth, Exposed Beam & 100% Return Air Gap Ratio

For red values, 234 BTU/hr/ft is exceeded. Care should be taken to ensure the beams are not placed in an occupied zone.

Convect™ Model Ref. R1 beams

Convect	ΔtK - 14.5°F						
L (ft)	362-R1	412-R1	462-R1	512-R1	562-R1	612-R1	662-R1
3	326	376	426	476	528	580	630
4	444	514	584	656	729	804	875
6	697	813	929	1049	1172	1299	1421
8	973	1140	1309	1484	1665	1850	2026
10	1270	1495	1722	1955	2195	2438	2668
11.8	1533	1808	2084	2366	2653	2941	3210
13	1752	2067	2382	2702	3023	3343	3638

Convect™ Model Ref. R2 beams

Convect	ΔtK - 14.5°F						
L (ft)	362-R2	412-R2	462-R2	512-R2	562-R2	612-R2	662-R2
3	432	500	568	637	708	781	850
4	593	690	786	886	989	1094	1195
6	944	1106	1270	1439	1614	1793	1964
8	1332	1596	1807	2053	2304	2559	2798
10	1752	2068	2382	2702	3024	3344	3639
11.8	2120	2501	2875	3250	3620	3983	4314
13	2424	2853	3270	3682	4085	4477	4836

Cooling circuit Δt = 5°F (Water in-out), C2 manifold used throughout, 5" unit depth, Exposed Beam & 100% Return Air Gap Ratio

For red values, 234 BTU/hr/ft is exceeded. Care should be taken to ensure the beams are not placed in an occupied zone.

Convect™ Model Ref. R1 beams

Convect	ΔtK - 16.5°F						
L (ft)	362-R1	412-R1	462-R1	512-R1	562-R1	612-R1	662-R1
3	389	449	509	571	633	697	758
4	532	617	702	790	880	973	1061
6	841	984	1128	1276	1430	1587	1738
8	1182	1390	1600	1817	2039	2266	2481
10	1551	1829	2109	2394	2684	2975	3246
11.8	1876	2215	2550	2890	3229	3565	3873
13	2146	2530	2908	3286	3659	4025	4358

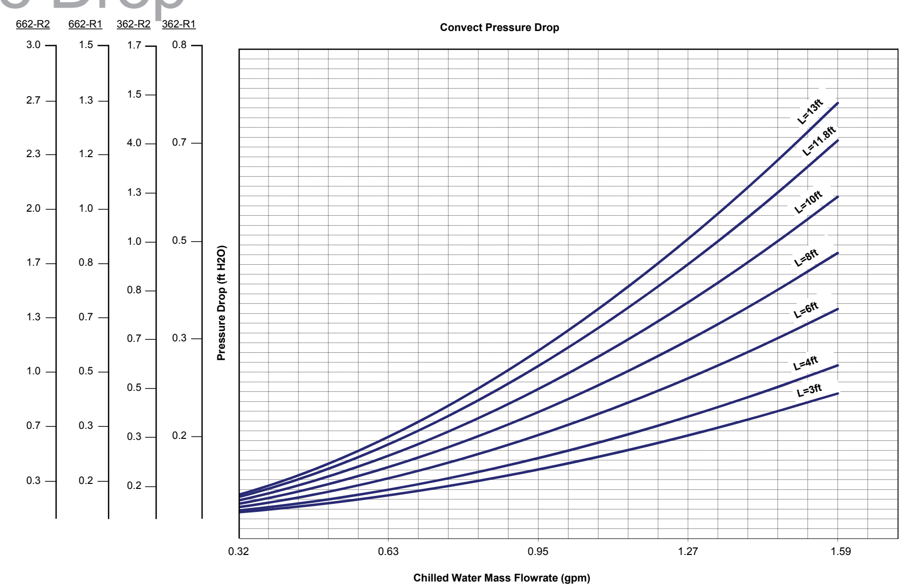
Convect™ Model Ref. R2 beams

Convect	ΔtK - 16.5°F						
L (ft)	362-R2	412-R2	462-R2	512-R2	562-R2	612-R2	662-R2
3	517	600	683	768	855	945	1030
4	714	832	952	1075	1202	1333	1457
6	1147	1348	1551	1761	1976	2197	2405
8	1628	1921	2214	2513	2815	3118	3398
10	2146	2531	2909	3286	3660	4025	4358
11.8	2694	3050	3488	3918	4337	4746	5124
13	2958	3463	3942	4407	4861	5315	5757

Cooling circuit Δt = 5°F (Water in-out), C2 manifold used throughout, 5" unit depth, Exposed Beam & 100% Return Air Gap Ratio

For red values, 234 BTU/hr/ft is exceeded. Care should be taken to ensure the beams are not placed in an occupied zone.

Pressure Drop



Active Chilled Beams

FTF Group manufactures and supplies a range of active chilled beams with the highest performance curves on the market. FTF Group draw upon high performance technologies and patented / registered design features to deliver efficient cooling to commercial, educational and healthcare environments.

Efficient and quiet space conditioning

FTF Group's patented battery angles, air chamber geometry and unique burst nozzle strip enables their Active chilled beams to deliver unrivalled levels of cooling capacity with a given air volume whilst ensuring that the reconditioned air is delivered into the space in a controlled manner that best suits the application. The units are so efficient that they can provide cooling in excess of 73 BTU/hr/ft with fresh air supply of as little as 0.2 CFM/ft2.

Units are designed to integrate into suspended ceiling systems. They fit easily into the most common ceiling designs and have removable underplates that can be perforated to match perforated metal ceilings where required or to best compliment mineral fiber or plasterboard ceilings. These removable underplates provide access for maintenance, although maintenance is minimal given that there are no moving parts.

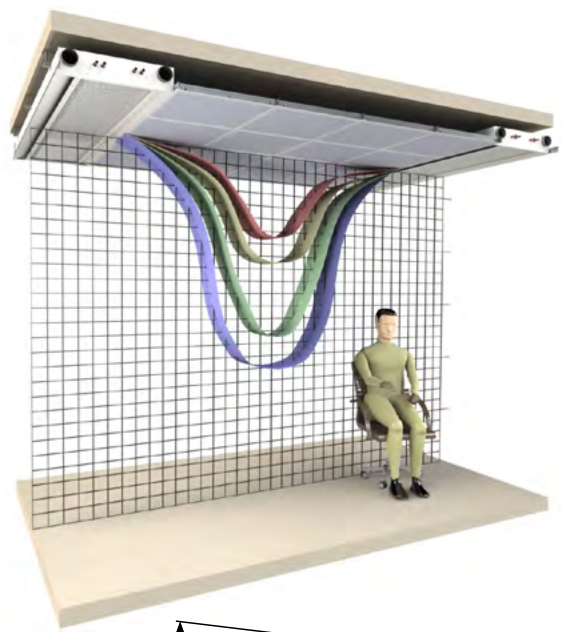
FTF Group's Active beams are also designed to ensure low noise levels. They incorporate a patented air chamber burst nozzle strip technology which delivers cool air to the room very quietly, and makes them suitable for discreet installation in hotels, offices, hospitals, schools and banks. Air delivery can be accurately controlled so that air velocities do not exceed 40 gpm, ensuring compliance with ASHRAE 55-2010 and 50 gpm for ISO 7730 compliance by use of discrete air deflector vanes mounted as part of the patented and registered designed air chambers. Beams can be supplied with factory fitted condensation sensors.

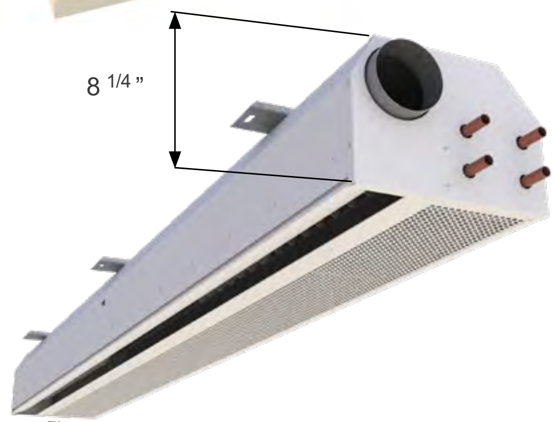
Operation

An active chilled beam is essentially a water-driven, ceiling-mounted induction unit. It uses a supply of fresh ventilation air to induce warm room air (recirculated air) through the unit's cooling fincoil battery. The FTF Group beam is able to induce and condition 4-5 times as much room air as fresh air supplied. Conditioned air is then quietly reintroduced into the room, entraining to the ceiling rather than being jetted out directly below the beam, thanks to patented air chamber design that produces a Coanda effect. The patented nozzle technology also allows the Company to determine and factory-set the airflow dispersion characteristics of each unit. Beams can deliver a cooling capacity in excess of 3142 BTU/hr.

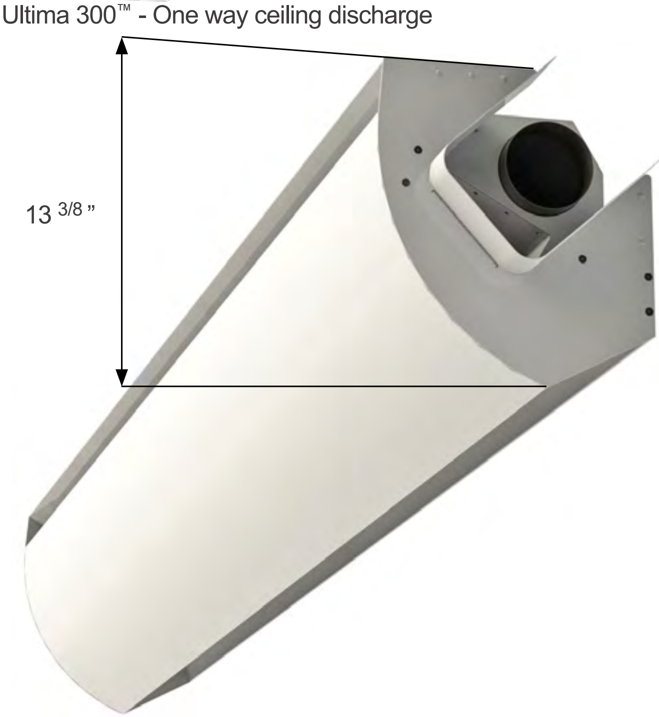
Composition and manufacture

Air is cooled as it passes through a fin coil battery, which comprises aluminum fins with copper tubes through which water passes. The heat of the room is taken in through the aluminum fins, and transferred into the water circuit through the copper tube and transported away via the circulating chilled water back to a central chiller unit. Active chilled beams have no moving parts, and as such maintenance costs are minimal.





Ultima 300™ - One way ceiling discharge



Cornice™ One way ceiling discharge

Composition and manufacture

Air is cooled as it passes through a fin coil battery, which comprises aluminium fins with copper tubes through which water passes. The heat of the room is taken in through the aluminium fins, and transferred into the water circuit through the copper tube and transported away via the circulating chilled water back to a central chiller unit. Active Chilled Beams have no moving parts, and as such maintenance costs are minimal.

Dimensions

The Frenger units have side-mounted air chambers that facilitate high cooling in very compact dimensions. Our slim line beams range which can operate with up to 106 CFM and is just **5.2"deep**, whereas our High Output beam range which can operate with up to 170 CFM and is just 8.2" deep. **Both of which can achieve 1034 BTU/hr/ft total cooling.**

Benefits of active chilled beams

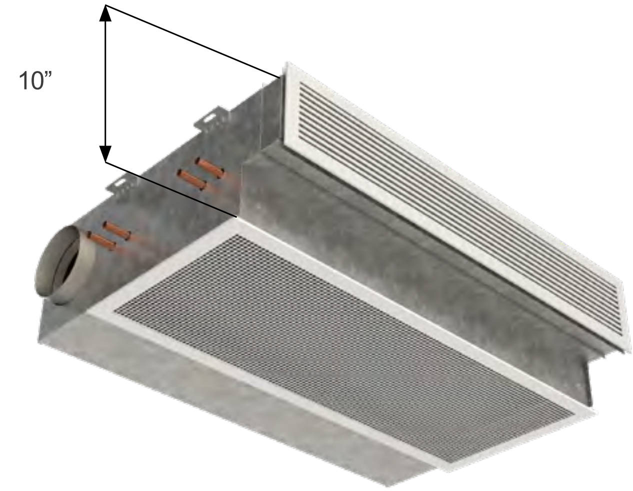
- Units can deliver cooling, heating, fresh air and lighting.
- **A range of beams with 1-way, 2-way and 360 Degree air discharge.**
- No moving parts equates to reduced maintenance costs.
- Capital costs now comparable and / or less than traditional air conditioning systems.
- Improved efficiencies translate to lower running costs.
- Can be installed in shallow ceiling voids.
- Units can deliver cooling capacities in excess of 63 BTU/hr/ft².
- Long life expectancy - in excess of 30 years.

Frenger's unique features

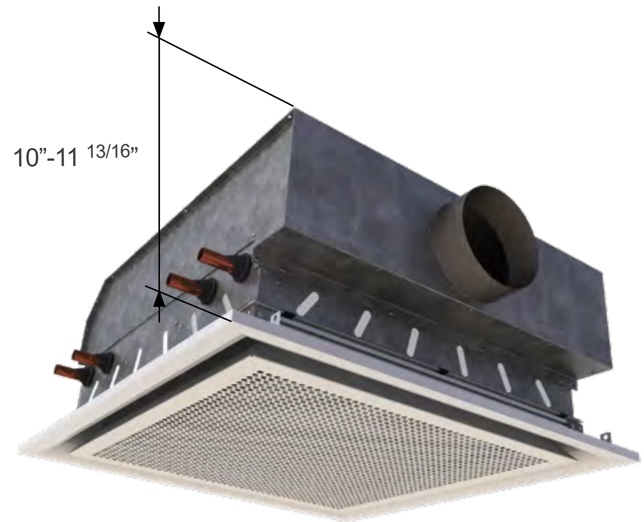
- All recirculated air is induced through the removable underplate and consequently there is no need for a return air path via the ceiling void.
- Advanced Patented battery angle technology delivers induction ratios of 5:1, enabling effective cooling at supply air rates as low as 0.2 CFM/ft²
- Patented burst nozzle strips design result in optimised heat exchange performance and quiet operation.
- Advanced air chamber design creates a Coanda effect, with air entraining to the ceiling for improved occupancy comfort levels.
- Registered designs for concealed air discharge vanes provide "fan shaped distribution" technology as standard which reduces the risk of high air speeds in the occupied zone providing higher levels of thermal comfort.
- Air delivery can be accurately controlled such that velocities do not exceed the 49 ft/min as required by ISO 7730.
- Beams can be tailor made to pretty much whatever length, width and configuration a project requires whilst also being fully optimised.

Air Distribution

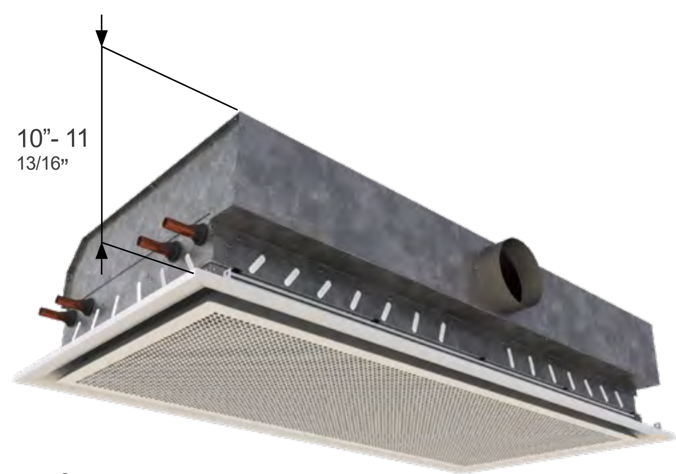
Frenger's range of Active Chilled Beams have been specifically designed to deliver air into the space in a controlled and predictable manner. **All beams create a Coanda effect in the unit which encourages the supplied air to entrain to the ceiling or soffit, furthermore, units can be manufactured with varying throw characteristics (short, medium or long) and even with different air delivery characteristics from either side of the unit, or at one end of a unit if required.**



Bulkhead One way ceiling discharge beam



Halo® 2ft - 360 degree discharge pattern



Halo® 4ft - 360 degree discharge pattern

Air Distribution Continued

Air distribution and comfort levels are determined by many factors; supply air temperature, air volume, air pressure, air direction and entrainment (Coanda effect) and beam spacing. Extensive laboratory tests have been undertaken by Frenger in their inhouse state-of-the-art climatic test laboratories, to develop a library of empirical data presented in the form of scatter diagrams, which enables the designer to select the most appropriate product configuration for any given condition.

Maintenance

Chilled Beams have no internal moving parts and have little to no maintenance requirements other than periodically cleaning the heat exchanger battery (recommended annually or bi annually for Hospital applications and every 5-10 years for office environments).

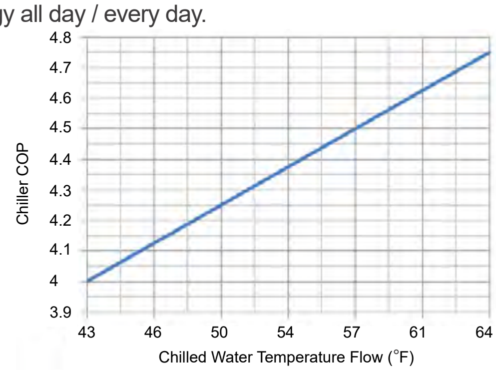
All units are provided with simple access to the heat exchanger battery through the Chilled Beams removable underplate - there is no requirement to access the ceiling void for maintenance or cleaning of the Chilled Beam or heat exchange battery.

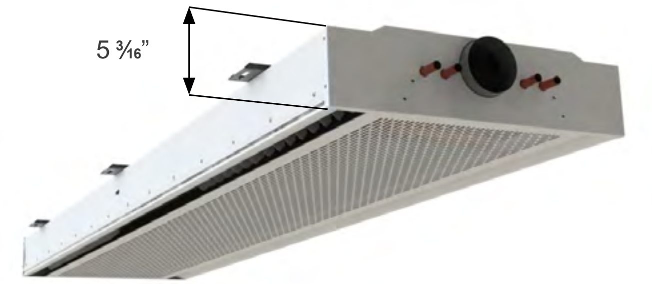
Eco-Healthcare models have a “drop down battery” that enables the heat exchanger battery to be easily lowered (even whilst the beam is still in operation) for deep cleaning of all 4 sides of the heat exchanger battery and internal casing of the beam - this is particularly popular within hospital applications.

Energy Efficient

An Active Chilled Beam (ACB) system operates on elevated chilled water supply temperatures (designed to run ‘dry’ ,above dew point ,typically from 57°F to 63°F supply temperature) and have no moving parts (i.e. no fans or motors) which provide for a more energy efficient system when compared to other HVAC system which typically operated below dew point (wet) on a 43°F or 45°F supply temperature (which also means condensate drip trays are required) and are supplied with individual fans and motors. The coefficient of performance (COP) and or EER (energy efficiency ratio) is much higher for Chillers operating on 14/17 degrees (typical COP / EER is 4.5 for a standard chiller) when compared to other HVAC systems operating on 43/54 flow & return (COP / EER is typically 4.0) and with active chilled beam units that run dry you can also make use of ‘Free Cooling Chillers’ to drastically increase the COP / EER to an average hourly rate of 13.5 for projects based on London weather data.

The total SFP (specific fan power) for an active chilled beam system (in Watts energy used by the AHU for the total system per Ltrs / sec fresh air supplied) is typically much lower than that of other mainstream HVAC system as active chilled beam units have no fans and no additional controls per terminal unit consuming energy all day / every day.

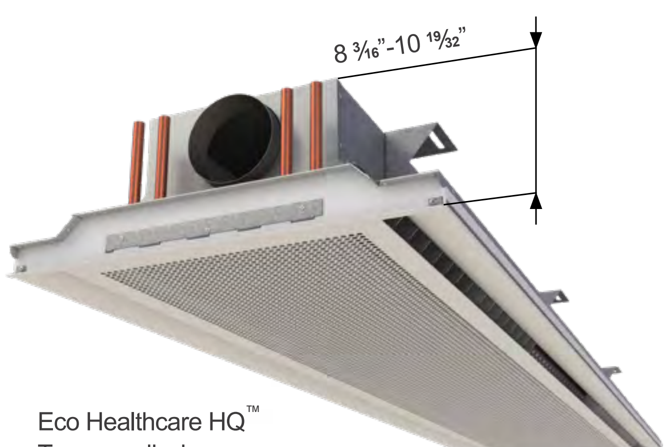




Compact® Two way discharge

Ultima® Two way discharge

Eco HQ™ Two way discharge



Eco Healthcare HQ™
Two way discharge

Ultima™ 300-1 way

Ultima™ 300 is one of Frenger's latest range of high performance™ Chilled Beams. Energy efficiency has been a key driver for such advancements in Frenger's Chilled Beam Technology.

Ultima™ **300** is only **8 ¼" deep** and **11 ½" wide** and can achieve **852 BTU/hr/ft total cooling** (based on 18dTF and 16CFM/ft for a 8ft long beam supplied at 60°F with a 0.4in$H_2$0).

The Ultima™ 300 beam contains a number of **Frenger's Patented performance enhancing features** and as can be expected from the Frenger brand. The
Ultima™ 300 beam is designed to be easily tailored to suit the unique parameters of individual project sites, for the optimum product / system efficiencies. This is partly achieved by the FTF Group's "burst nozzle" arrangement that not only encourages induction, but also reduces noise. Given the size and amount of burst nozzles being appropriately quantified for each project, this provides consistent jet velocities, equal distribution of the air discharge and continuous jet velocities, equal distribution of the air discharge and continuous induction through the heat exchanger (battery). There are no dead spots due to plugging back nozzles from a standard pitch or having to adjust the pressure in the system to suit the amount of open standard nozzles sizes as associated with many competitors' active beams as dead spots and/or reduced velocities decrease their cooling capacities/efficiencies.

Frenger's beams all have a "closed back", this means that all induced air (recirculated room air) is induced through the underplate within the room space to avoid any need for perimeter flash gaps and/or openings in the ceiling system. This also provides for a better quality of recirculated air as the recirculated air does not mix with any air from the ceiling void. The induction ratio for Ultima™ 300 is typically 4-5 times that of the supply air (fresh air) rate.

The Ultima™ 300 chilled beam outer casing is constructed from extruded aluminum and zintec pressed steel. The casing facilitates aluminum burst nozzle strips (project specific) and a high performance heat exchange battery constructed from copper and aluminum. Beams are available in lengths from 4ft up to 12ft in 4" increments.

In addition to Ultima's™ 300 high cooling performance capability of in excess of 550 BTU/hr/ft, **Ultima**™ **300 can operate well and induce at low air volumes, as little as 1.1 CFM/ft and even with low static pressure of just 0.08"$H_2$0. Likewise Ultima**™ **300 can handle high air volumes up to 9 CFM/ft and up to 0.24"$H_2$0.** Please note however that these high air volumes should be avoided wherever possible and are the absolute maximum and should not be exceeded. As a "rule of thumb" 8 CFM/ft from a 1 way discharge beam is the maximum for occupancy comfort compliance to BS EN 7730.

The maximum total supply air for the product is limited to 80 CFM. If the total air volume is more than 50 CFM, refer to the Ultima™ active chilled beam by Frenger.

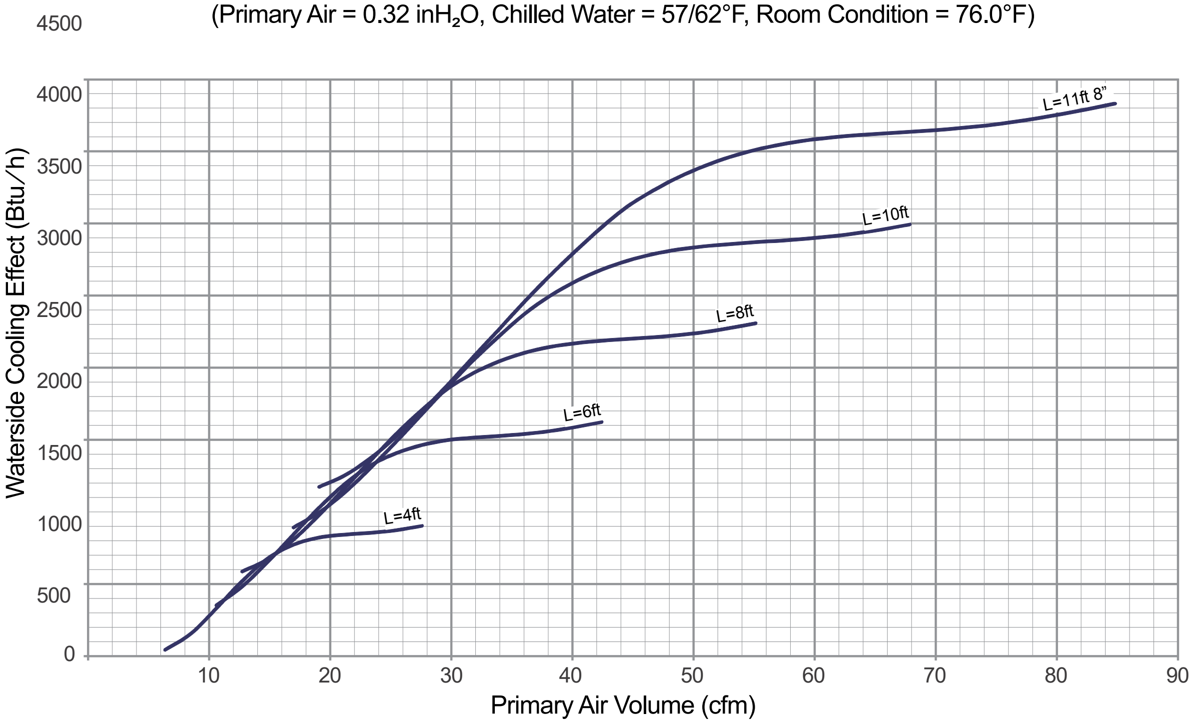
Ultima™ 300 can have integrated heating with separate connections (2 pipe connections for cooling and 2 pipes for heating).

At a glance

- Can handle high air volumes (upto 80 CFM total).
- High output "**852 BTU/hr/ft**".
- Only **11 ½"** wide.
- One way discharge.
- Optimize discharge nozzles sizes and pitch factory set to best suit project requirements.
- Coanda effect is initiated within the beam.
- Smooth curved discharge slot as opposed to traditional faceted discharge slots for improved aesthetics.
- Discharge veins are concealed within the beam for improved aesthetics.
- **Fan shape distribution for increased occupancy comfort**.
- Unique fast fixing of removable underplates that prevents any sagging even on long beam lengths of 12ft.
- Various different perforation patterns available for removable underplates.
- 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 i**n accordance with BS EN ISO 7730 / ASHRAE 55**

Cooling Performance

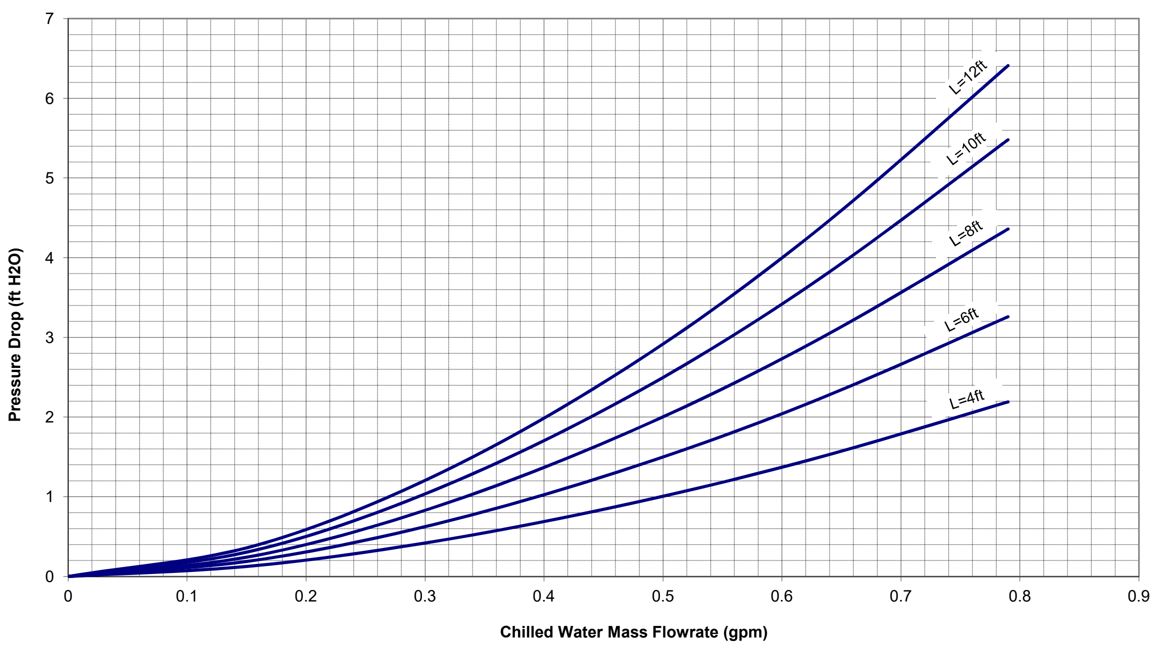
Ultima™ 300 Waterside Cooling Effect at 16.5dTF
(Primary Air = 0.32 inH_2O, Chilled Water = 57/62°F, Room Condition = 76.0°F)



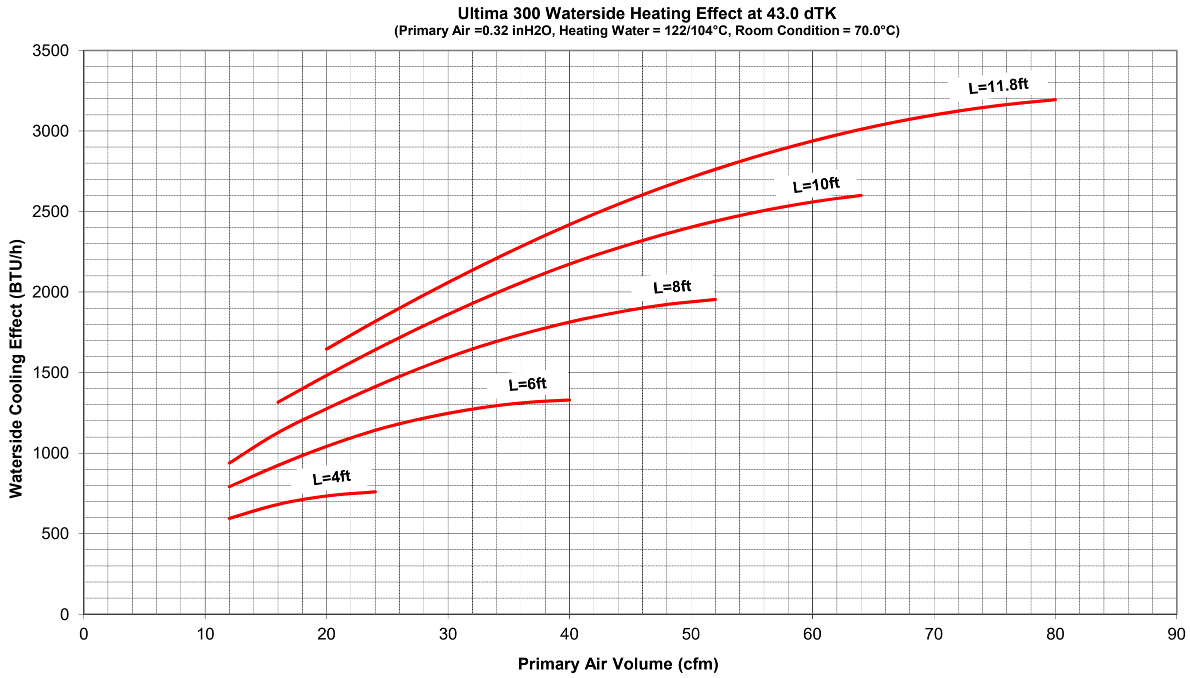
Cooling figures are based on a cooling & heating beams, additional cooling is possible with a cooling only product - contact the FTF Group for more information.

Pressure Drop

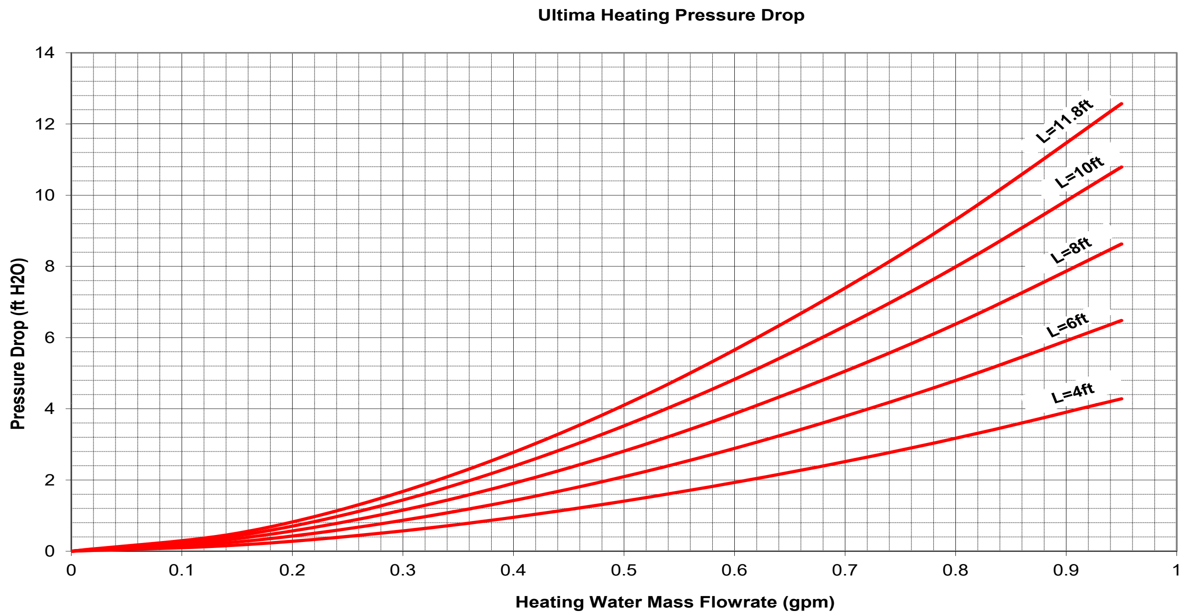
Ultima 300 Pressure Drop



Heating Performance



Pressure Drop



Cooling Selection Tables

Cooling at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 in H_2O		Water															
Q (CFM)	Ultima 300	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
10	4.0	518	0.207	C2	0.22	604	0.241	C2	0.29	693	0.277	C2	0.36	784	0.313	C2	0.45
	6.0	549	0.219	C2	0.36	638	0.255	C2	0.47	729	0.291	C2	0.59	822	0.328	C2	0.73
20	4.0	798	0.319	C2	0.47	941	0.376	C2	0.62	1089	0.435	C2	0.80	1241	0.495	C2	0.99
	6.0	1106	0.442	C2	1.22	1302	0.520	C2	1.62	1502	0.600	C2	2.06	1705	0.681	C2	2.56
	8.0	1157	0.462	C2	1.76	1357	0.542	C2	2.31	1560	0.623	C2	2.94	1765	0.705	C2	3.63
	10.0	1161	0.464	C2	2.21	1358	0.542	C2	2.89	1557	0.622	C2	3.67	1759	0.702	C2	4.52
	11.8	1190	0.475	C2	2.69	1389	0.554	C2	3.51	1591	0.635	C2	4.44	1795	0.717	C2	5.47
30	6.0	1310	0.523	C2	1.63	1544	0.617	C2	2.16	1782	0.711	C2	2.76	2021	0.807	C2	3.43
	8.0	1706	0.681	C2	3.42	2002	0.799	C2	4.50	2298	0.917	C2	5.71	2593	1.035	C2	7.05
	10.0	1841	0.735	C2	4.88	2152	0.859	C2	6.39	2462	0.983	C2	8.08	2770	1.106	C2	9.94
	11.8	1858	0.742	C2	5.79	2168	0.866	C2	7.57	2477	0.989	C2	9.55	2648	1.057	C3	3.65
	8.0	1854	0.740	C2	3.94	2173	0.867	C2	5.18	2490	0.994	C2	6.57	2806	1.120	C2	8.10
	10.0	2334	0.932	C2	7.34	2720	1.086	C2	9.59	2940	1.174	C3	3.73	3327	1.328	C3	4.62
	11.8	2570	1.026	C2	10.14	2827	1.129	C3	4.07	3248	1.297	C3	5.17	3667	1.464	C3	6.39

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.24 inH_2O, 1 x Ø4" air connection.
Please refer to FTF Group Technical Department for selections not covered within these tables.

Cooling at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 in H_2O		Water															
Q (CFM)	Ultima 300	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
10	4.0	513	0.205	C2	0.22	601	0.240	C2	0.29	691	0.276	C2	0.36	784	0.313	C2	0.45
	6.0	610	0.243	C2	0.44	711	0.284	C2	0.57	814	0.325	C2	0.72	920	0.367	C2	0.89
20	4.0	846	0.338	C2	0.52	1008	0.402	C2	0.70	1175	0.469	C2	0.91	1347	0.538	C2	1.14
	6.0	1121	0.448	C2	1.26	1327	0.530	C2	1.67	1538	0.614	C2	2.15	1752	0.699	C2	2.68
	8.0	1167	0.466	C2	1.79	1372	0.548	C2	2.36	1580	0.631	C2	3.00	1790	0.715	C2	3.72
	10.0	1219	0.487	C2	2.41	1427	0.570	C2	3.15	1637	0.654	C2	4.00	1848	0.738	C2	4.93
	11.8	1320	0.527	C2	3.22	1541	0.615	C2	4.20	1763	0.704	C2	5.31	1986	0.793	C2	6.53
30	6.0	1426	0.569	C2	1.88	1691	0.675	C2	2.51	1959	0.782	C2	3.23	2250	0.888	C2	4.02
	8.0	1785	0.713	C2	3.68	2103	0.840	C2	4.87	2419	0.966	C2	6.21	2731	1.090	C2	7.69
	10.0	1872	0.747	C2	5.01	2191	0.875	C2	6.58	2507	1.001	C2	8.33	2820	1.126	C2	10.24
	11.8	1882	0.752	C2	5.92	2197	0.877	C2	7.74	2509	1.002	C2	9.76	2682	1.071	C2	3.72
42	6.0	1509	0.602	C2	2.07	1791	0.715	C2	2.77	2073	0.828	C2	3.56	2354	0.940	C2	4.43
	8.0	2054	0.820	C2	4.67	2410	0.962	C2	6.17	2762	1.103	C2	7.83	3110	1.242	C2	9.66
	10.0	2501	0.998	C2	8.23	2914	1.163	C2	10.77	3143	1.255	C3	4.16	3563	1.423	C3	5.17
	11.8	2686	1.072	C2	10.91	2944	1.173	C3	4.34	3390	1.354	C3	5.54	3832	1.530	C3	6.87

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.32 inH_2O, 1 x Ø4" air connection.
Please refer to FTF Group Technical Department for selections not covered within these tables.

Cooling at 0.40 Nozzle Pressure

Nozzle Pressure 0.40 in H_2O		Water															
Q (CFM)	Ultima 300	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
10	4.0	557	0.223	C2	0.25	651	0.260	C2	0.33	748	0.298	C2	0.42	846	0.338	C2	0.51
20	4.0	964	0.385	C2	0.65	1139	0.455	C2	0.86	1318	0.526	C2	1.10	1501	0.599	C2	1.37
	6.0	1214	0.485	C2	1.43	1428	0.570	C2	1.89	1645	0.657	C2	2.41	1864	0.744	C2	2.99
	8.0	1250	0.499	C2	2.01	1464	0.584	C2	2.64	1680	0.671	C2	3.34	1898	0.758	C2	4.13
	10.0	1320	0.527	C2	2.76	1541	0.615	C2	3.60	1765	0.705	C2	4.56	1988	0.794	C2	5.60
30	4.0	1003	0.400	C2	0.70	1194	0.477	C2	0.93	1392	0.556	C2	1.21	1594	0.636	C2	1.51
	6.0	1585	0.633	C2	2.26	1864	0.744	C2	2.98	2145	0.856	C2	3.80	2425	0.968	C2	4.70
	8.0	1911	0.763	C2	4.16	2236	0.893	C2	5.45	2558	1.021	C2	6.90	2878	1.149	C2	8.49
	10.0	1980	0.791	C2	5.54	2307	0.921	C2	7.23	2631	1.050	C2	9.10	2823	1.127	C3	3.49
	11.8	1992	0.795	C2	6.54	2316	0.925	C2	8.51	2637	1.053	C2	10.69	2841	1.134	C3	4.12
42	6.0	1651	0.659	C2	2.41	1951	0.779	C2	3.21	2250	0.898	C2	4.10	2546	1.017	C2	5.09
	8.0	2253	0.899	C2	5.51	2629	1.050	C2	7.21	3002	1.199	C2	9.11	3209	1.281	C3	3.46
	10.0	2671	1.066	C2	9.30	2943	1.175	C3	3.73	3379	1.349	C3	4.74	3812	1.522	C3	5.86
	11.8	2675	1.068	C3	3.70	3132	1.250	C3	4.86	3587	1.432	C3	6.15	4039	1.612	C3	7.58

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.40 inH_2O, 1 x Ø4" air connection.
Please refer to FTF Group Technical Department for selections not covered within these tables.

Heating Selection Tables

Heating at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 H_2O		Water											
	Cornice	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
Q (CFM)	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
10	6.0	-	-	-	-	-	-	1069	0.190	0.37	1223	0.190	0.38
20	4.0	-	-	-	-	-	-	1117	0.190	0.25	1277	0.190	0.25
	6.0	-	-	-	1216	0.190	0.38	1418	0.190	0.38	1620	0.190	0.38
	8.0	1165	0.190	0.50	1391	0.190	0.50	1630	0.190	0.50	1927	0.214	0.62
	10.0	1290	0.190	0.62	1551	0.190	0.63	1849	0.206	0.72	2219	0.247	0.99
	11.8	1384	0.190	0.73	1660	0.190	0.73	2037	0.227	1.00	2439	0.271	1.37
30	6.0	1146	0.190	0.38	1374	0.190	0.38	1602	0.190	0.38	1893	0.211	0.45
	8.0	1354	0.190	0.50	1624	0.190	0.50	1988	0.221	0.66	2401	0.267	0.91
	10.0	1507	0.190	0.63	1858	0.207	0.73	2317	0.258	1.07	2783	0.310	1.47
	11.8	1615	0.190	0.73	2057	0.229	1.01	2555	0.284	1.48	3056	0.340	2.03
42	8.0	1473	0.190	0.50	1803	0.201	0.55	2273	0.253	0.83	2750	0.306	1.16
	10.0	1682	0.190	0.63	2204	0.245	0.98	2751	0.306	1.45	3299	0.367	1.99
	11.8	1882	0.209	0.87	2470	0.275	1.40	3066	0.341	2.04	3661	0.407	2.78

Flow-adjusted waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.24, 1 x Ø4" air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 H_2O		Water											
	Cornice	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
Q (CFM)	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
10	4.0	-	-	-	-	-	-	-	-	-	1041	0.190	0.25
	6.0	-	-	-	-	-	-	118	0.190	0.37	1276	0.190	0.37
20	4.0	-	-	-	-	-	-	1181	0.190	0.25	1349	0.190	0.25
	6.0	-	-	-	1266	0.190	0.37	1478	0.190	0.38	1690	0.190	0.38
	8.0	1211	0.190	0.50	1451	0.190	0.50	1694	0.190	0.50	2038	0.227	0.68
	10.0	1341	0.190	0.62	1610	0.190	0.63	1956	0.218	0.80	2351	0.262	1.10
	11.8	1439	0.190	0.73	1739	0.193	0.76	2164	0.241	1.11	2594	0.289	1.52
30	6.0	1206	0.190	0.38	1445	0.190	0.37	1687	0.190	0.38	2044	0.227	0.52
	8.0	1411	0.190	0.50	1693	0.190	0.50	2115	0.235	0.73	2551	0.284	1.01
	10.0	1567	0.190	0.63	1968	0.219	0.80	2454	0.273	1.18	2943	0.327	1.63
	11.8	1674	0.190	0.73	2175	0.242	1.12	2702	0.300	1.63	3229	0.359	2.23
42	6.0	1269	0.190	0.38	1522	0.190	0.38	1817	0.202	0.42	2231	0.248	0.60
	8.0	1555	0.190	0.51	1956	0.218	0.64	2463	0.274	0.95	2978	0.331	1.33
	10.0	1782	0.198	0.68	2352	0.262	1.10	2932	0.326	1.62	3512	0.391	2.22
	11.8	1999	0.222	0.96	2622	0.292	1.55	3249	0.361	2.26	3873	0.431	3.07

Flow-adjusted waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.32, 1 x Ø4" air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

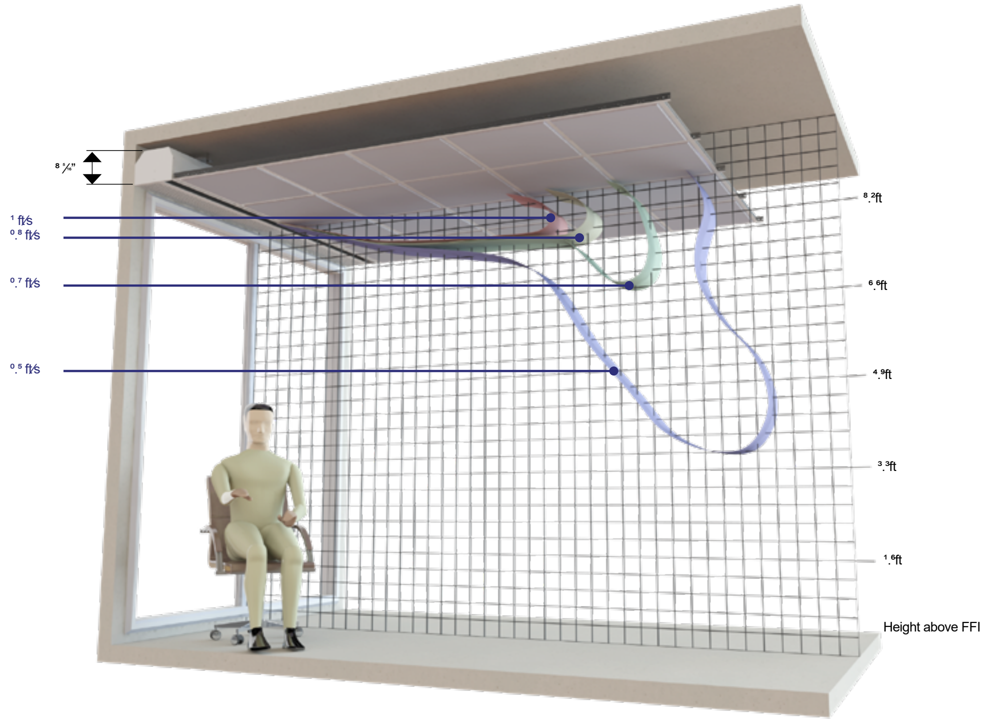
Heating at 0.40 Nozzle Pressure

Nozzle Pressure 0.40 H_2O		Water											
	Cornice	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
Q (CFM)	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
10	4.0	-	-	-	-	-	-	-	-	-	1057	0.190	0.25
20	4.0	-	-	-	-	-	-	1218	0.190	0.25	1392	0.190	0.25
	6.0	1072	0.190	0.37	1286	0.190	0.37	1501	0.190	0.38	1719	0.191	0.38
	8.0	1227	0.190	0.50	1472	0.190	0.50	1722	0.192	0.51	2077	0.231	0.71
	10.0	1362	0.190	0.62	1633	0.190	0.63	1999	0.222	0.83	2404	0.267	1.14
30	4.0	-	-	-	1132	0.190	0.25	1319	0.190	0.25	1508	0.190	0.25
	6.0	1242	0.190	0.38	1490	0.190	0.38	1753	0.195	0.39	2125	0.236	0.55
	8.0	1433	0.190	0.50	1792	0.192	0.51	2163	0.241	0.76	2604	0.290	1.05
	10.0	1586	0.190	0.63	2006	0.223	0.83	2498	0.278	1.22	2995	0.333	1.68
	11.8	1696	0.190	0.73	2216	0.247	1.16	2752	0.306	1.69	3290	0.366	2.31
42	6.0	1332	0.190	0.37	1599	0.190	0.38	1959	0.218	0.48	2394	0.266	0.68
	8.0	1599	0.190	0.50	2042	0.227	0.69	2558	0.285	1.02	3080	0.343	1.41
	10.0	1836	0.204	0.71	2413	0.268	1.15	2999	0.334	1.68	3585	0.399	2.30
	11.8	2043	0.227	1.00	2673	0.297	1.60	3308	0.368	2.33	3939	0.438	3.16

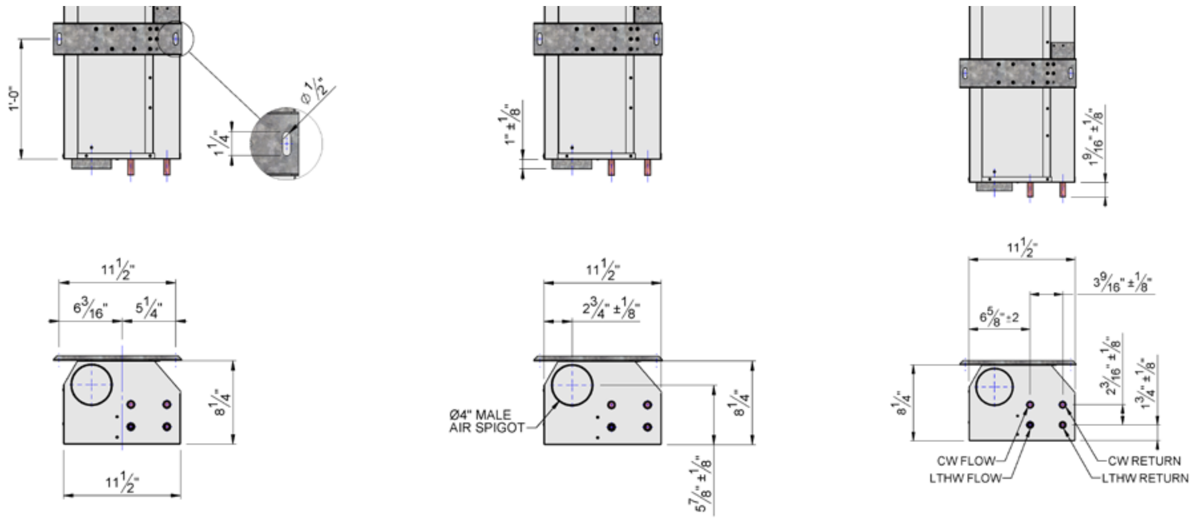
Flow-adjusted waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.40, 1 x Ø4" air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Scatter Diagram

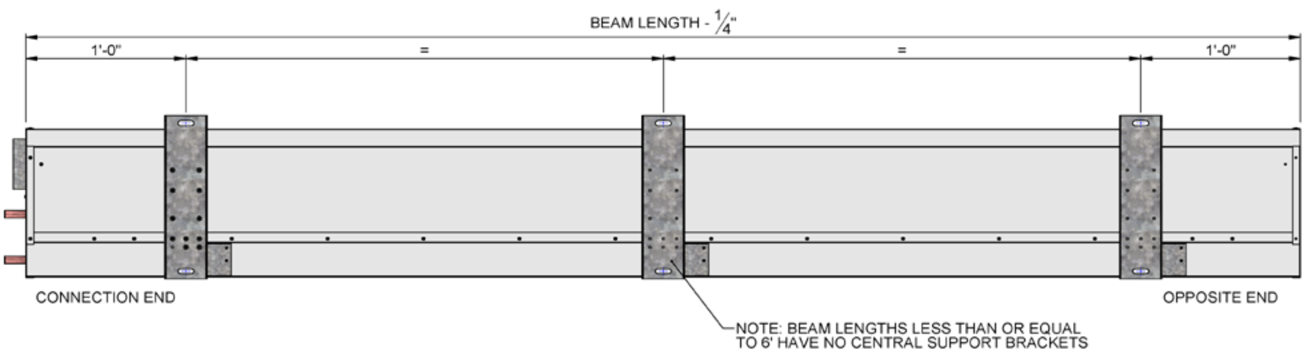
Fresh Air Volume 14 CFM/ Active Ft @ 0.3” in H_2O



Product Dimensions



Mounting Details



Cornice™

Product Description

Cornice™ is one of 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.

Cornice™ is only 1ft 1⅜" deep and can achieve **540 BTU/hr/ft total cooling** (based on 18dTF and 7.7 CFM/ft for a beam supplied at 60.8°F with a 0.4inH_2O).

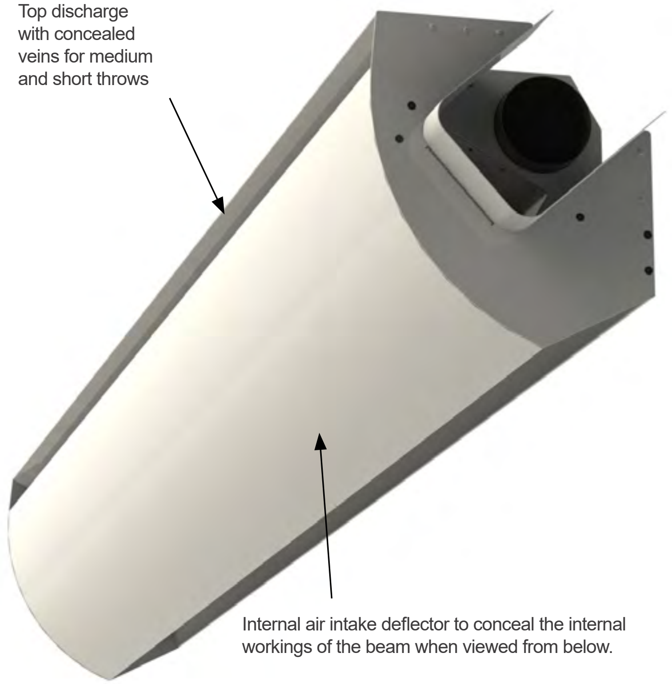
The Cornice™ beam contains a number of **Patented performance enhancing features** and as can be expected from the FTF Group brand, the Cornice™ beam is designed to be easily tailored to suit the unique parameters of individual project sites, for the optimum product / system efficiencies. This is partly achieved by the "burst nozzle" arrangement that not only encourages induction, but also reduces noise. Given the size and amount of burst nozzles being appropriately quantified for each project, this provides consistent jet velocities, equal distribution of the air discharge and continuous induction through the heat exchanger (battery). There are no dead spots due to plugging back nozzles from a standard pitch or having to adjust the pressure in the system to suit the amount of open standard nozzle sizes as associated with many competitors' active beams as dead spots and/or reduced 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 front fascias true and straight for long lengths, even up to 11ft 8".

Cornice™ can be used in most types of commercial building (such as cellular offices, banks and hospitals) but are most suited to "Hotel Applications" with its facility to discreetly nestle in the corner along a back wall, usually directly above the bed location with optimal features such as:

- LED lighting - see page 47.
- Condensation tray - see page 47.
- Electric Radiant Heating - see page 45.

All induced / recirculated room air is via the FTF Group's unique air intake which conceals the inside workings of the active beam even when viewed from directly below, whilst an occupant is resting in bed for example. This is a "Registered Community Design" feature to the FTF Group along with the other features and Patented performance enhancing components.



Cornice™ discharges its reconditioned air (which is a mixture of circa 20% fresh air and 80% recirculated air) at high level out of the top of the unit which then entrains across the ceiling before gently dispersing and mixing with the room air.

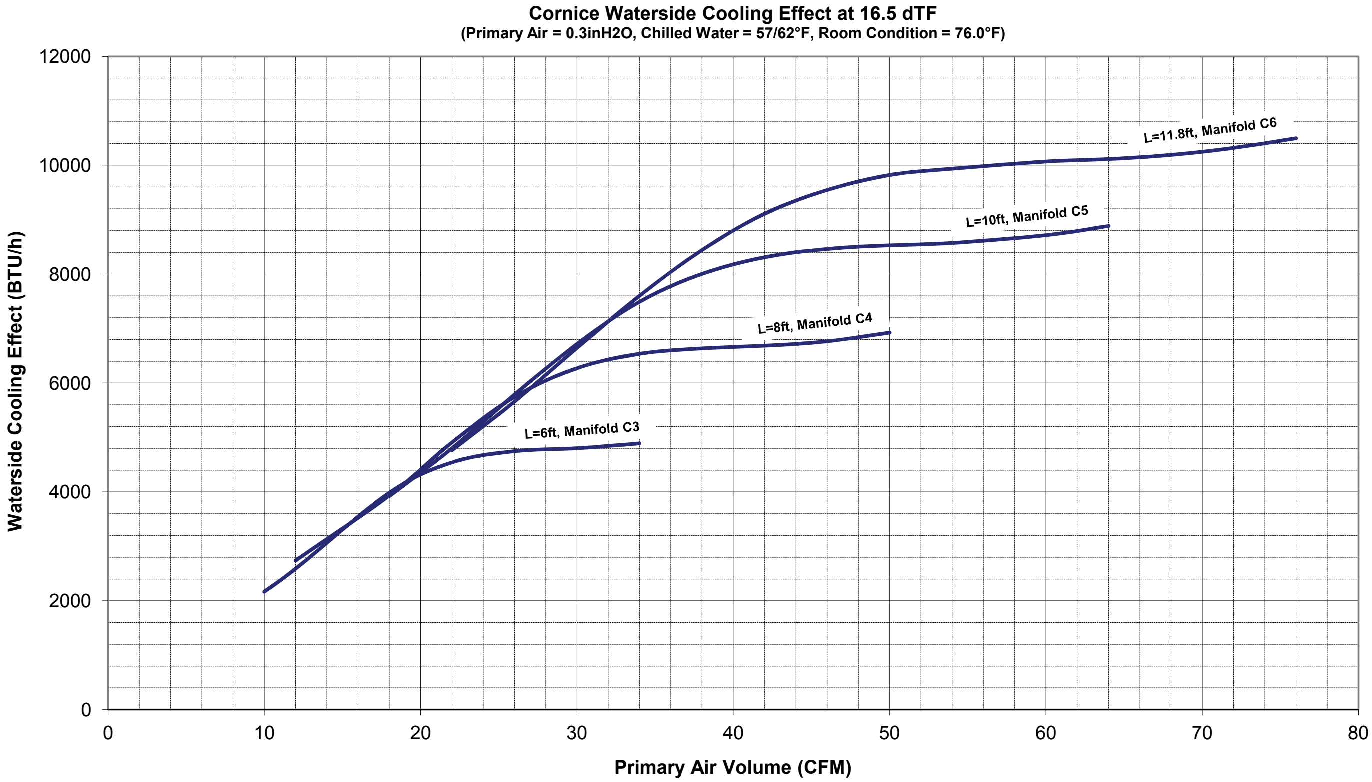
Cornice™ can have a variety of different front fascias for different aesthetics. The front fascia is easily removable for cleaning purposes and / or access to the control valves which are neatly concealed behind the removable main front fascia.

Cornice™ is available in any length from 4ft up to 11ft 8" in 4" increments and has another useful design feature of "telescopic" extension ends from the end gables to "fine tune" onsite a "Wall to Wall" installation.

At a glance

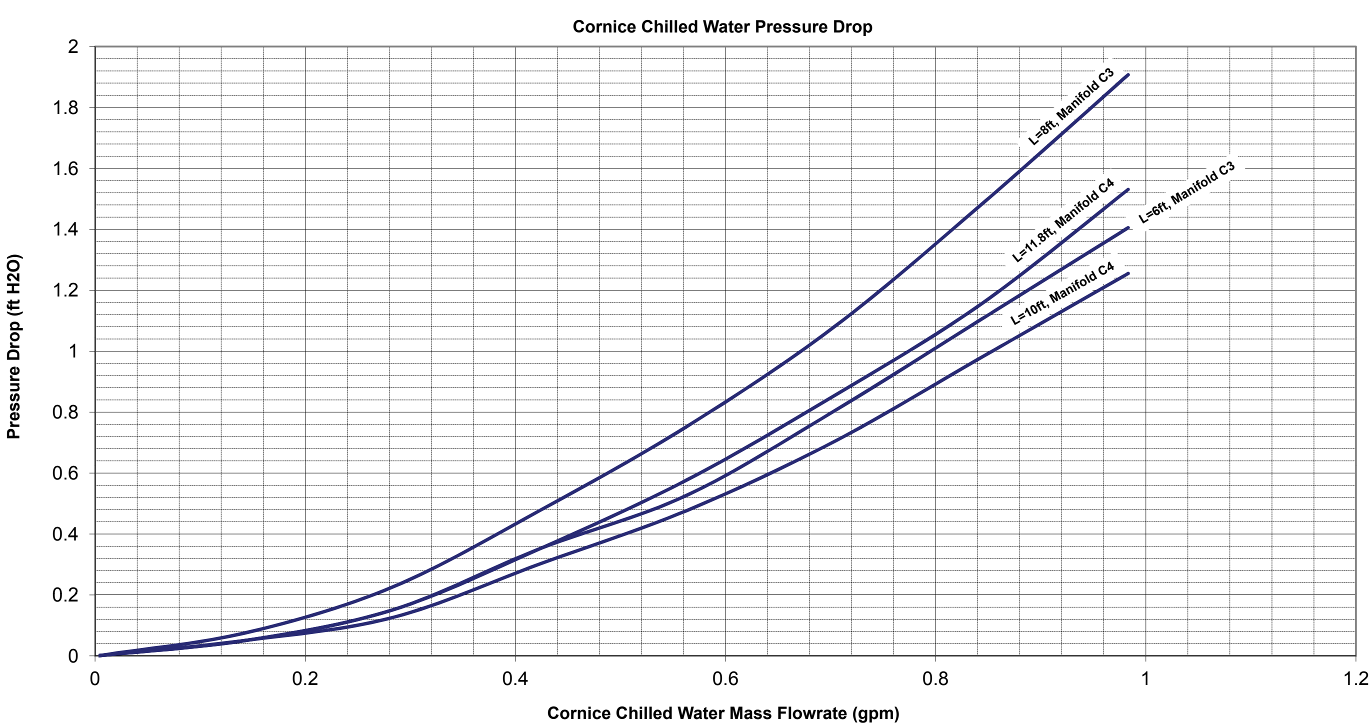
- Telescopic ends for full "Wall to Wall" installation.
- Controls are (factory fitted or site fitted) concealed behind easily removable front fascia panel.
- LED Lighting can be incorporated within the Cornice™ unit as an optional extra.
- Different front fascia designs (perforations) are available for Cornice™.
- L.T.H.W heating function (4 pipe) is available.
- Electric Radiant Heating to the main front fascia available.
- Acoustic options for sound reducing material to be added can be accommodated for "silent nights".
- Air deflector on air intake for concealed internal components of the active beam for improved aesthetics when viewed from below.

Cooling Performance

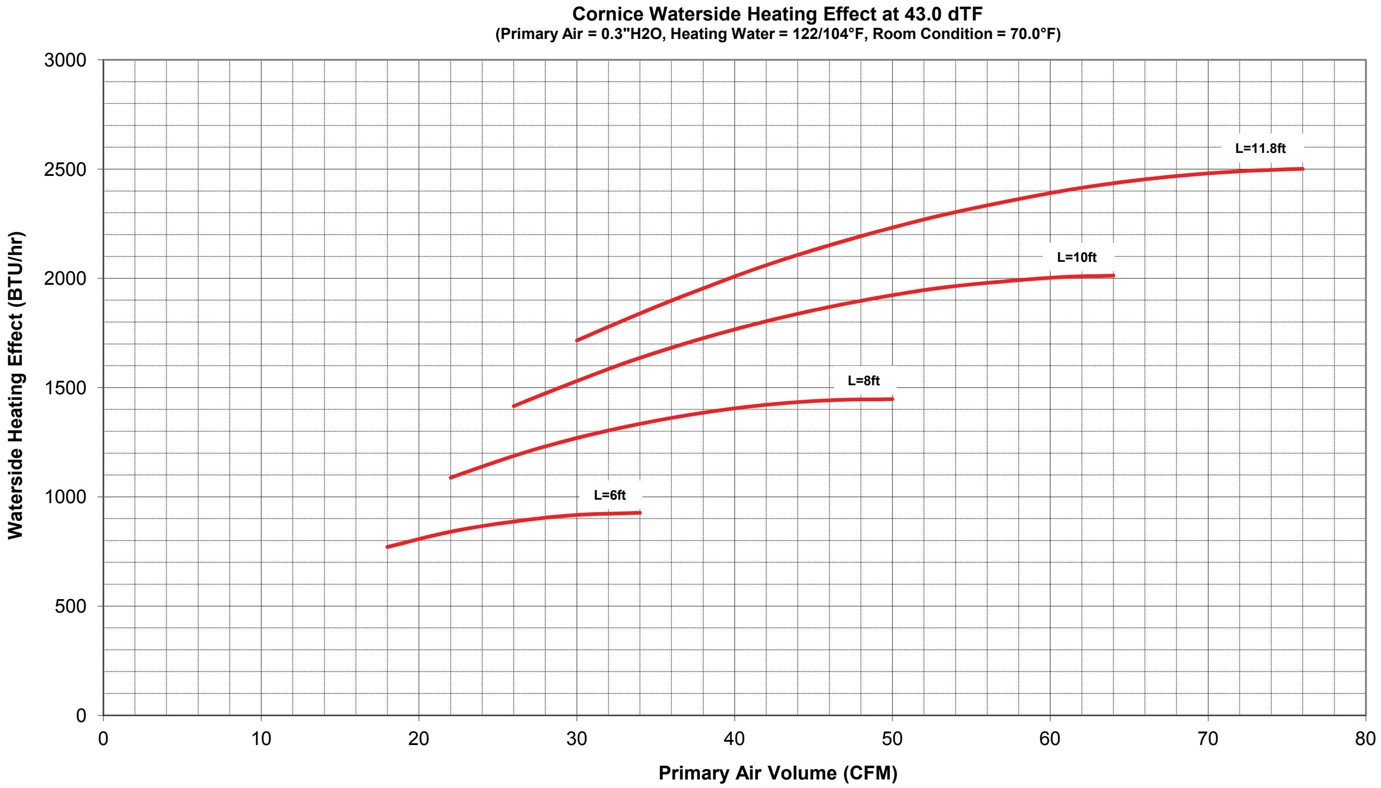


Cooling figures are based on a cooling & heating beams, additional cooling is possible with a cooling only product - contact the FTF Group for more information.

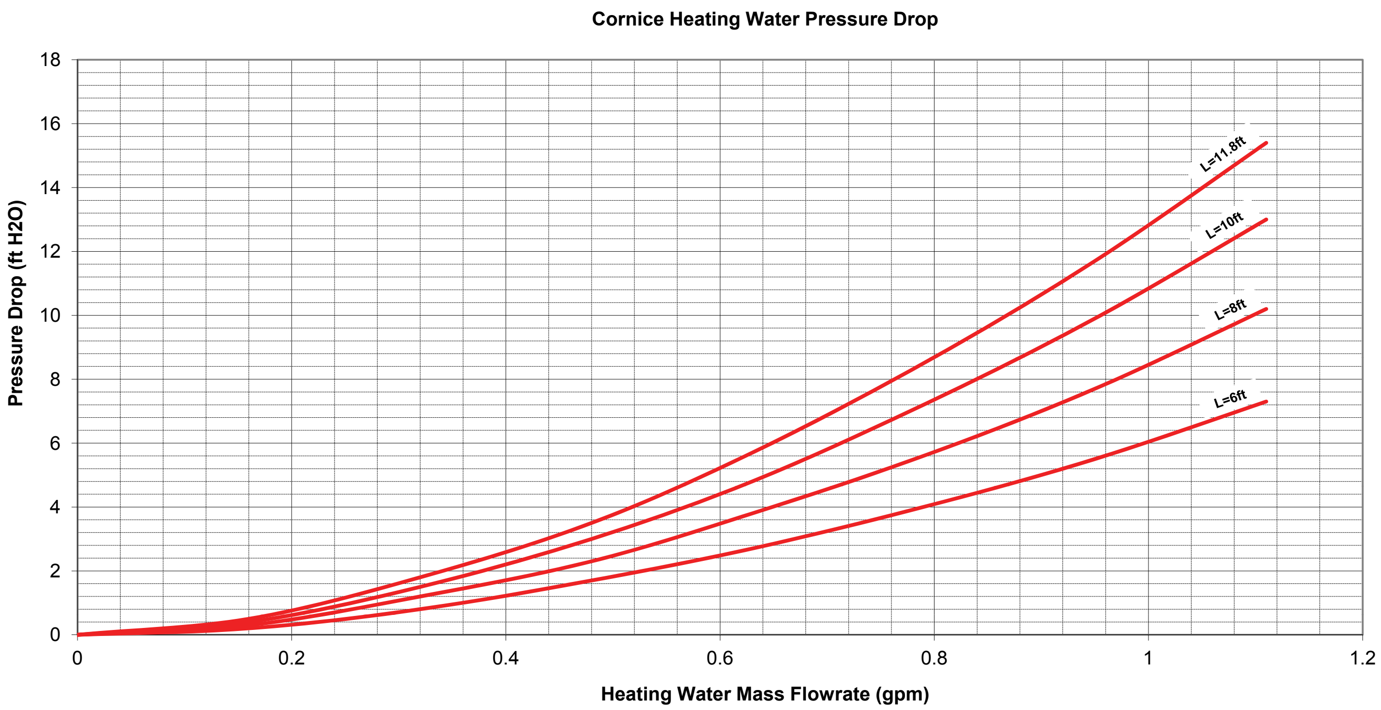
Pressure Drop



Heating Performance



Pressure Drop



Cooling Selection Tables

Cooling at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 inH$_2$O		Water															
Q (CFM)	Cornice	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H$_2$O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H$_2$O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H$_2$O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H$_2$O)
10	6.0	1876	0.749	C3	1.0	1972	0.788	C3	1.1	2068	0.826	C3	1.1	2164	0.864	C3	1.2
	8.0	2108	0.842	C3	1.6	2213	0.884	C3	1.8	2318	0.926	C3	1.9	2424	0.968	C3	2.1
	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	6.0	3772	1.506	C3	3.2	3959	1.581	C3	3.5	4145	1.655	C3	3.8	4331	1.730	C3	4.1
	8.0	4123	1.647	C3	5.3	4322	1.726	C3	5.7	4520	1.805	C3	6.2	4719	1.884	C3	6.7
	10.0	4088	1.632	C3	6.6	4282	1.710	C3	7.2	4476	1.787	C3	7.8	4558	1.820	C4	4.0
	11.8	4102	1.638	C3	7.9	4188	1.672	C4	4.1	4384	1.751	C4	4.5	4580	1.829	C4	4.8
30	6.0	4017	1.604	C3	3.6	4214	1.683	C3	3.9	4411	1.762	C3	4.2	4609	1.840	C3	4.6
	8.0	5430	2.169	C4	4.3	5696	2.275	C4	4.6	5963	2.381	C4	5.0	6229	2.488	C4	5.4
	10.0	6127	2.447	C4	6.8	6423	2.565	C4	7.3	6721	2.685	C4	7.9	6871	2.744	C5	4.5
	11.8	6119	2.444	C5	4.3	6418	2.563	C5	4.7	6716	2.682	C5	5.1	7014	2.801	C5	5.5
42	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	5594	2.234	C4	4.5	5868	2.343	C4	4.9	6141	2.452	C4	5.3	6415	2.562	C4	5.7
	10.0	7116	2.842	C5	4.7	7463	2.981	C5	5.1	7811	3.119	C5	5.6	8161	3.259	C5	6.0
	11.8	8109	3.238	C5	7.0	8505	3.397	C5	7.6	8735	3.488	C6	4.4	9126	3.645	C6	4.7

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.24 inH$_2$O, 1 x Ø4” air connection.
Please refer to FTF Group Technical Department for selections not covered within these tables.

Cooling at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 inH$_2$O		Water															
Q (CFM)	Cornice	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H$_2$O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H$_2$O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H$_2$O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H$_2$O)
10	6.0	1993	0.796	C3	1.1	2094	0.836	C3	1.2	2197	0.877	C3	1.3	2299	0.918	C3	1.4
	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	6.0	3990	1.593	C3	3.5	4188	1.672	C3	3.9	4385	1.751	C3	4.2	4582	1.830	C3	4.5
	8.0	4175	1.667	C3	5.4	4373	1.747	C3	5.8	4572	1.826	C3	6.3	4770	1.905	C3	6.8
	10.0	4192	1.674	C3	7.0	4387	1.752	C3	7.5	4489	1.793	C4	3.9	4688	1.872	C4	4.3
	11.8	4289	1.713	C4	4.3	4496	1.795	C4	4.7	4701	1.878	C4	5.1	4906	1.959	C4	5.5
30	6.0	4497	1.796	C3	4.4	4717	1.884	C3	4.8	4937	1.972	C3	5.1	5159	2.060	C3	5.6
	8.0	5814	2.322	C4	4.8	6099	2.435	C4	5.2	6384	2.549	C4	5.6	6671	2.664	C4	6.1
	10.0	6301	2.516	C4	7.1	6604	2.637	C4	7.7	6766	2.702	C5	4.3	7069	2.823	C5	4.7
	11.8	6198	2.475	C5	4.4	6499	2.595	C5	4.8	6798	2.715	C5	5.2	7097	2.834	C5	5.6
42	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	6265	2.502	C4	5.5	6571	2.624	C4	5.9	6878	2.747	C4	6.4	7190	2.871	C4	6.9
	10.0	7729	3.087	C5	5.5	8106	3.237	C5	5.9	8486	3.389	C5	6.4	8871	3.543	C5	6.9
	11.8	8588	3.429	C5	7.7	8831	3.527	C6	4.4	9245	3.692	C6	4.8	9660	3.858	C6	5.2

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.32 inH$_2$O, 1 x Ø4” air connection.
Please refer to FTF Group Technical Department for selections not covered within these tables.

Cooling at 0.40 Nozzle Pressure

Nozzle Pressure 0.40 inH_2O		Water															
Q (CFM)	Cornice	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)
10	6.0	2161	0.863	C3	1.2	2270	0.907	C3	1.3	2379	0.950	C3	1.5	2489	0.994	C3	1.6
	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	6.0	4216	1.684	C3	3.9	4421	1.765	C3	4.3	4625	1.847	C3	4.6	4830	1.929	C3	5.0
	8.0	4370	1.745	C3	5.8	4575	1.827	C3	6.3	4781	1.909	C3	6.8	4987	1.991	C3	7.4
	10.0	4442	1.774	C3	7.7	4563	1.822	C4	4.1	4772	1.906	C4	4.4	4981	1.989	C4	4.7
	11.8	4638	1.852	C4	4.9	4858	1.940	C4	5.4	5076	2.027	C4	5.8	5293	2.114	C4	6.2
30	6.0	4900	1.957	C3	5.1	5140	2.053	C3	5.5	5383	2.150	C3	6.0	5630	2.248	C3	6.5
	8.0	6182	2.469	C4	5.4	6481	2.588	C4	5.8	6782	2.708	C4	6.3	7087	2.830	C4	6.8
	10.0	6590	2.632	C4	7.7	6781	2.708	C5	4.4	7092	2.832	C5	4.7	7403	2.957	C5	5.1
	11.8	6503	2.597	C5	4.8	6812	2.721	C5	5.2	7121	2.844	C5	5.7	7428	2.966	C5	6.1
42	6.0	5247	2.095	C3	5.7	5508	2.200	C3	6.2	5775	2.306	C3	6.7	5830	2.328	C4	3.5
	8.0	6827	2.727	C4	6.3	7164	2.861	C4	6.9	7507	2.998	C4	7.5	7859	3.138	C4	8.0
	10.0	8291	3.311	C5	6.2	8696	3.473	C5	6.7	9107	3.637	C5	7.3	9527	3.805	C5	7.8
	11.8	8886	3.549	C6	4.5	9315	3.720	C6	4.9	9745	3.892	C6	5.3	10179	4.065	C6	5.7

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.40 inH_2O, 1 x Ø4" air connection.
Please refer to FTF Group Technical Department for selections not covered within these tables.

Cooling at 0.48 Nozzle Pressure

Nozzle Pressure 0.48 inH_2O		Water															
Q (CFM)	Cornice	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)
10	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	6.0	4183	1.670	C3	3.9	4382	1.750	C3	4.2	4582	1.830	C3	4.6	4782	1.910	C3	4.9
	8.0	4491	1.793	C3	6.1	4700	1.877	C3	6.7	4909	1.960	C3	7.2	5119	2.044	C3	7.7
	10.0	4479	1.789	C3	7.8	4611	1.841	C4	4.1	4820	1.925	C4	4.5	5029	2.008	C4	4.8
	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	6.0	5058	2.020	C3	5.4	5307	2.119	C3	5.8	5560	2.220	C3	6.3	5819	2.324	C3	6.8
	8.0	6112	2.445	C4	5.3	6415	2.562	C4	5.7	6709	2.679	C4	6.2	7007	2.798	C4	6.7
	10.0	6643	2.653	C4	7.8	6854	2.737	C5	4.5	7163	2.861	C5	4.8	7473	2.984	C5	5.2
	11.8	6697	2.674	C5	5.1	7011	2.800	C5	5.5	7324	2.925	C5	6.0	7637	3.050	C5	6.4
42	6.0	5501	2.197	C3	6.2	5782	2.309	C3	6.7	5832	2.329	C4	3.4	6099	2.436	C4	3.7
	8.0	7062	2.820	C4	6.7	7414	2.961	C4	7.3	7774	3.104	C4	7.9	7907	3.158	C5	4.5
	10.0	8246	3.293	C5	6.2	8647	3.453	C5	6.7	9053	3.615	C5	7.2	9466	3.780	C5	7.8
	11.8	8807	3.517	C6	4.5	9226	3.684	C6	4.8	9646	3.852	C6	5.2	10068	4.021	C6	5.6

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.48 inH_2O, 1 x Ø4" air connection.
Please refer to FTF Group Technical Department for selections not covered within these tables.

Heating at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 H_2O		Water											
Q (CFM)	Cornice	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
10	6.0	591	0.190	0.3	720	0.190	0.3	850	0.190	0.3	989	0.198	0.4
	8.0	695	0.190	0.5	847	0.190	0.5	1016	0.204	0.5	1216	0.244	0.7
	10.0	-	-	-	-	-	-	-	-	-	-	-	-
	11.8	-	-	-	-	-	-	-	-	-	-	-	-
20	6.0	781	0.190	0.3	955	0.191	0.3	1197	0.240	0.5	1444	0.289	0.7
	8.0	923	0.190	0.5	1199	0.240	0.7	1489	0.298	1.1	1781	0.357	1.4
	10.0	1074	0.215	0.8	1398	0.280	1.2	1725	0.346	1.7	2051	0.411	2.4
	11.8	1192	0.239	1.1	1545	0.310	1.7	1899	0.380	2.4	2250	0.451	3.3
30	6.0	860	0.190	0.3	1097	0.220	0.4	1382	0.277	0.7	1670	0.334	0.9
	8.0	1126	0.226	0.6	1479	0.296	1.0	1835	0.368	1.5	2189	0.439	2.1
	10.0	1345	0.269	1.1	1750	0.351	1.8	2153	0.431	2.6	2552	0.511	3.4
	11.8	1496	0.300	1.6	1935	0.388	2.5	2370	0.475	3.6	2798	0.561	4.8
42	6.0	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	1254	0.251	0.8	1653	0.331	1.3	2051	0.411	1.8	2444	0.490	2.5
	10.0	1579	0.316	1.5	2051	0.411	2.4	2516	0.504	3.4	2973	0.596	4.5
	11.8	1787	0.358	2.2	2303	0.461	3.4	2810	563	4.8	3310	0.663	6.4

Flow-adjusted waterside heating effect table. Heating circuit Δt = 10°F (Water in-out), nozzle pressure of 0.24, 1 x Ø4” air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 H_2O		Water											
Q (CFM)	Cornice	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
10	6.0	617	0.190	0.3	752	0.190	0.3	886	0.190	0.3	1046	0.210	0.4
	8.0	-	-	-	-	-	-	-	-	-	-	-	-
	10.0	-	-	-	-	-	-	-	-	-	-	-	-
	11.8	-	-	-	-	-	-	-	-	-	-	-	-
20	6.0	818	0.190	0.3	1018	0.204	0.4	1274	0.255	0.6	1535	0.308	0.8
	8.0	967	0.194	0.5	1269	0.254	0.8	1575	0.315	1.2	1881	0.377	1.6
	10.0	1136	0.228	0.8	1480	0.297	1.3	1825	0.366	1.9	2167	0.434	2.6
	11.8	1265	0.253	1.2	1641	0.329	1.9	2014	0.404	2.7	2383	0.477	3.6
30	6.0	914	0.190	0.3	1202	0.241	0.5	1514	0.303	0.8	1828	0.366	1.1
	8.0	1202	0.241	0.7	1577	0.316	1.2	1953	0.691	1.7	2327	0.466	2.3
	10.0	1425	0.285	1.2	1850	0.371	2.0	2272	0.455	2.8	2688	0.539	3.8
	11.8	1582	0.317	1.8	2041	0.409	2.8	2494	0.500	3.9	2940	0.589	5.2
42	6.0	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	1375	0.276	0.9	1812	0.363	1.5	2246	0.450	2.2	2674	0.536	2.9
	10.0	1691	0.339	1.7	2192	0.439	2.6	2685	0.538	3.8	3172	0.635	5.0
	11.8	1897	0.380	2.4	2439	0.489	3.8	2973	0.596	5.3	3503	0.702	7.1

Flow-adjusted waterside heating effect table. Heating circuit Δt = 10°F (Water in-out), nozzle pressure of 0.32, 1 x Ø4” air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.40 Nozzle Pressure

Nozzle Pressure 0.40 H_2O		Water											
Q (CFM)	Cornice	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	$\dot{Q}$(BTU/hr)	$\dot{m}$(gpm)	Δ(ft H_2O)	$\dot{Q}$(BTU/hr)	$\dot{m}$(gpm)	Δ(ft H_2O)	$\dot{Q}$(BTU/hr)	$\dot{m}$(gpm)	Δ(ft H_2O)	$\dot{Q}$(BTU/hr)	$\dot{m}$(gpm)	Δ(ft H_2O)
10	6.0	627	0.190	0.3	763	0.190	0.3	901	0.190	0.3	1070	0.214	0.4
	8.0	-	-	-	-	-	-	-	-	-	-	-	-
	10.0	-	-	-	-	-	-	-	-	-	-	-	-
	11.8	-	-	-	-	-	-	-	-	-	-	-	-
20	6.0	834	0.190	0.3	1043	0.209	0.4	1303	0.261	0.6	1566	0.314	0.8
	8.0	986	0.198	0.5	1292	0.259	0.8	1603	0.321	1.2	1914	0.384	1.6
	10.0	1159	0.232	0.9	1511	0.303	1.4	1865	0.374	2.0	2216	0.444	2.7
	11.8	1296	0.260	1.2	1682	0.337	2.0	2068	0.414	2.8	2449	0.491	3.8
30	6.0	950	0.190	0.3	1261	0.253	0.6	1580	0.317	0.8	1901	0.381	1.2
	8.0	1234	0.247	0.8	1613	0.323	1.2	1993	0.399	1.8	2370	0.475	2.4
	10.0	1451	0.291	1.3	1882	0.377	2.0	2310	0.463	2.9	2731	0.547	3.9
	11.8	1610	0.323	1.8	2078	0.416	2.8	2539	0.509	4.0	2994	0.600	5.4
42	6.0	1021	0.204	0.4	1373	0.275	0.7	1732	0.347	1.0	2091	0.419	1.4
	8.0	1440	0.289	1.0	1886	0.378	1.6	2329	0.467	2.3	2764	0.554	3.1
	10.0	1735	0.348	1.8	2240	0.449	2.7	2738	0.548	3.9	3228	0.647	5.2
	11.8	1932	0.387	2.5	2480	0.497	3.9	3019	0.605	5.5	3552	0.712	7.3

Flow-adjusted waterside heating effect table. Heating circuit Δt = 10°F (Water in-out), nozzle pressure of 0.40, 1 x Ø4" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.48 Nozzle Pressure

Nozzle Pressure 0.48 H_2O		Water											
Q (CFM)	Cornice	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	$\dot{Q}$(BTU/hr)	$\dot{m}$(gpm)	Δ(ft H_2O)	$\dot{Q}$(BTU/hr)	$\dot{m}$(gpm)	Δ(ft H_2O)	$\dot{Q}$(BTU/hr)	$\dot{m}$(gpm)	Δ(ft H_2O)	$\dot{Q}$(BTU/hr)	$\dot{m}$(gpm)	Δ(ft H_2O)
10	6.0	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	-	-	-	-	-	-	-	-	-	-	-	-
	10.0	-	-	-	-	-	-	-	-	-	-	-	-
	11.8	-	-	-	-	-	-	-	-	-	-	-	-
20	6.0	848	0.190	0.3	1069	0.214	0.4	1331	0.267	0.6	1598	0.320	0.9
	8.0	1005	0.201	0.5	1316	0.264	0.8	1632	0.327	1.2	1948	0.390	1.7
	10.0	1183	0.237	0.9	1543	0.309	1.4	1905	0.382	2.1	2265	0.454	2.8
	11.8	-	-	-	-	-	-	-	-	-	-	-	-
30	6.0	1001	0.201	0.4	1321	0.265	0.6	1646	0.330	0.9	1972	0.395	1.2
	8.0	1267	0.254	0.8	1649	0.330	1.3	2033	0.407	1.8	2412	0.483	2.4
	10.0	1477	0.296	1.3	1914	0.383	2.1	2347	0.470	3.0	2774	0.556	4.0
	11.8	1639	0.328	1.9	2115	0.424	2.9	2585	0.518	4.2	3048	0.611	5.6
42	6.0	1121	0.225	0.5	1499	0.300	0.8	1882	0.377	1.1	2261	0.453	1.6
	8.0	1505	0.301	1.1	1959	0.392	1.7	2409	0.483	2.4	2851	0.571	3.3
	10.0	1778	0.356	1.8	2287	0.458	2.8	2788	0.559	4.0	3282	0.658	5.4
	11.8	1967	0.394	2.6	2520	0.505	4.0	3063	0.614	5.6	3600	0.721	7.4

Flow-adjusted waterside heating effect table. Heating circuit Δt = 10°F (Water in-out), nozzle pressure of 0.48, 1 x Ø4" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

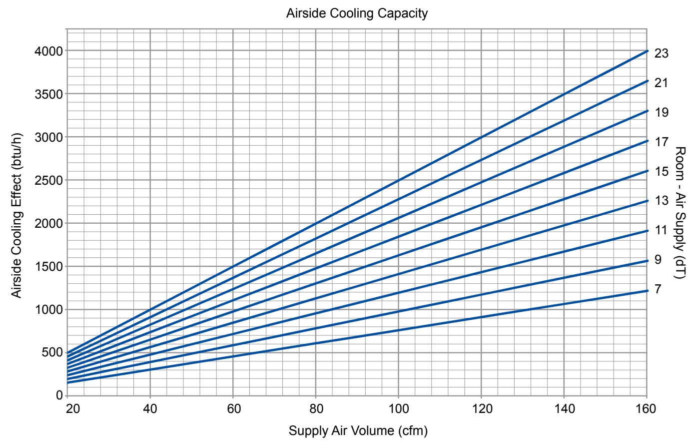
Air Cooling Effect

Cooling effect supplied in the ventilation air

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.

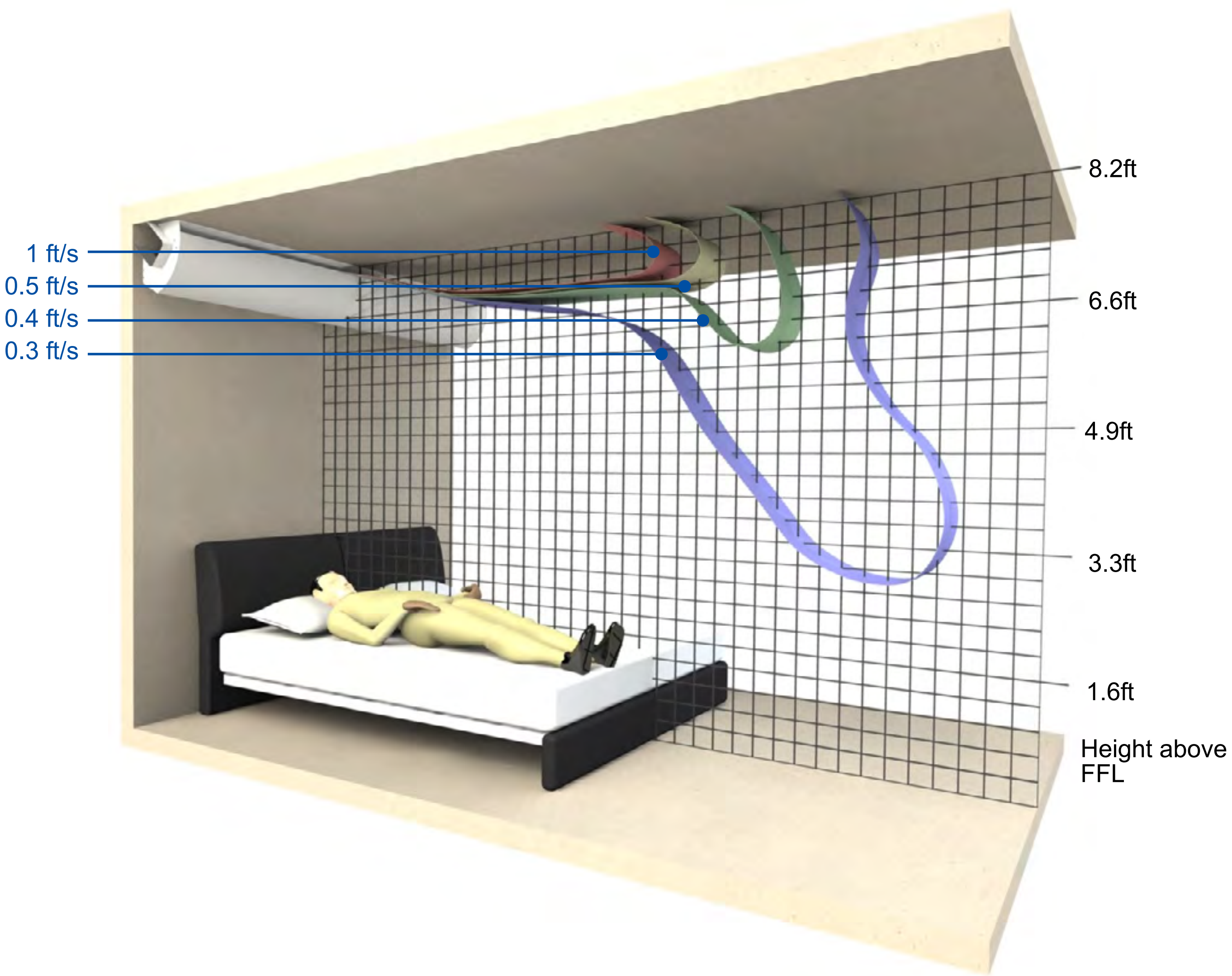
3. The remaining cooling effect has to be supplied by the beam.



Air cooling effect as a function of airflow.

Scatter Diagram

Fresh Air Volume 10.3 CFM / Active ft @ 0.3” inH_2O (Short throw)



Electric Radiant Heating

Electric Radiant Heating Option

Electric radiant heating is an available upgrade to the Cornice™ Chilled Beam unit. This option is available to any model options, be it in conjunction with condensation drip tray and / or LED light options. The width of the Cornice™ unit does however increase by 3 15⁄16" from the standard Cornice™ unit if electric radiant heating is chosen and the front fascia needs to be solid (not perforated) - see Fig 1.1 page 39 for details and page 42 for dimensions.

The removable front fascia of the Cornice™ unit is activated by an IP55 rated electric heating foil film applied to the inside of the fascia. Although IP55 is water jet resistant the electrical supply connection by the installed MUST incorporate a 30mA residual current device (RCD).

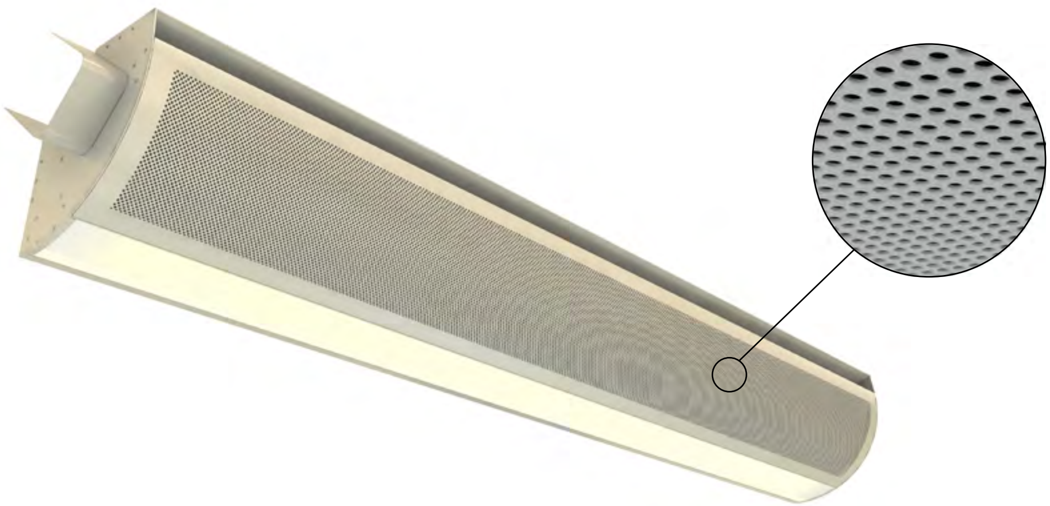
The surface temperature of the front fascia can reach upto 212°F and can yield the equivalent of 253.6 BTU/hr/ft², see available heating table for the different Cornice™ unit lengths available.

Important Note: When calculating your room heat losses, be mindful of the cooling effect from the supply air, and if supply air temperature is lower than the intended room condition in heating mode.

Available Heating			
Beam Length (ft)	**Heating Capacity (BTU/hr)**	**Voltage (V)**	**Surface Temp (°F)**
4.8	1791.4	120	Up to 212°F
6.4	2388.5	120	Up to 212°F
8.0	2985.6	120	Up to 212°F
9.8	3582.7	120	Up to 212°F

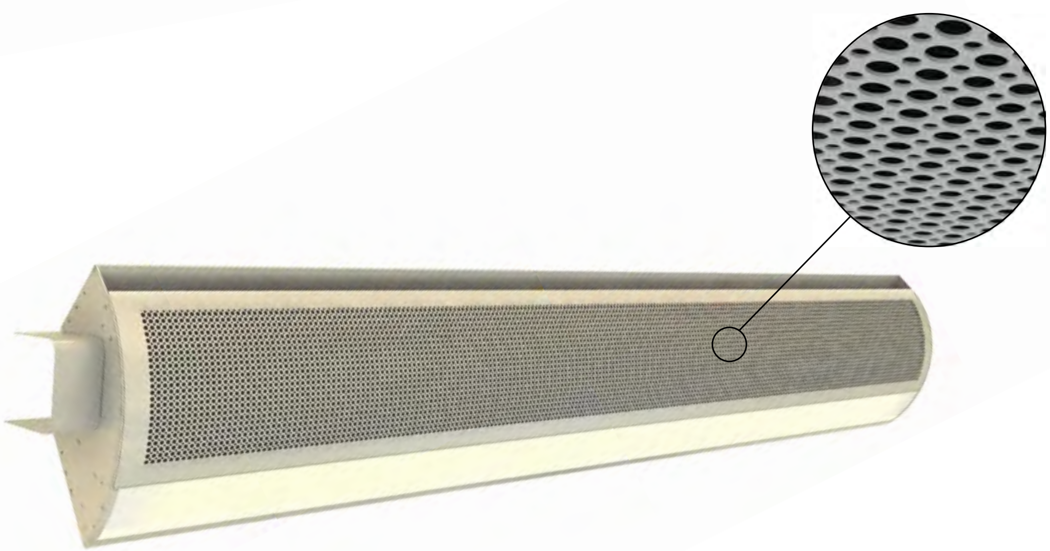
Fig 1.1
Cornice™ unit with Electric Radiant and LED Lighting - standard width plus 3 15⁄16" if radiant heating option chosen in addition to lighting - see page 42 for dimensions

Perforation Pattern Options



Dot Perforation
33% Free Area

Slot Perforation
45% Free Area



Double Dot Perforation
50% Free Area

Lighting Options

Integrated LED Lighting

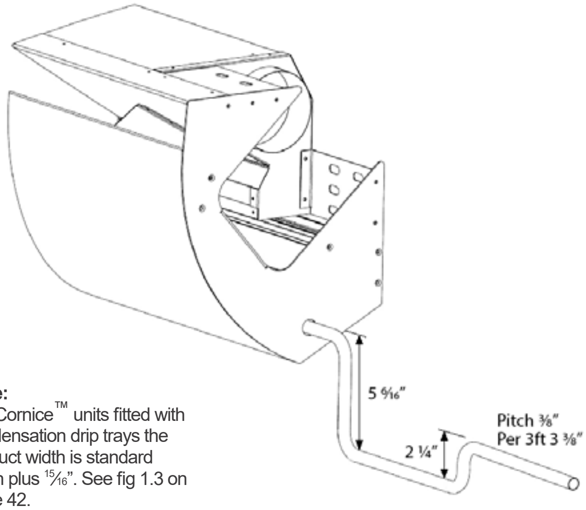
LED lighting can be integrated into FTF Group's Cornice™ Chilled Beam to provide a constant wash of light (that can be color changing LED's if so desired) or just one end section or both end sections illuminated as reading lights. White LED color temperatures 2700, 3000, 4000 and 6000k available.

Maintenance of the luminaires is greatly reduced given the long life expectancy of LED lighting as opposed to other forms of lighting. All LED luminaires factory fitted by FTF Group are 100% tested for electrical safety and functionality in accordance with BS 60598-1 prior to packaging and dispatch of the Cornice™ Chilled Beam unit.

Tests include:

- Earth Continuity Test
- Insulation Resistance Test.
- Polarity Check.
- Function Test.

Condensation Outlet



Note:
For Cornice™ units fitted with condensation drip trays the product width is standard width plus 15⁄16". See fig 1.3 on page 42.

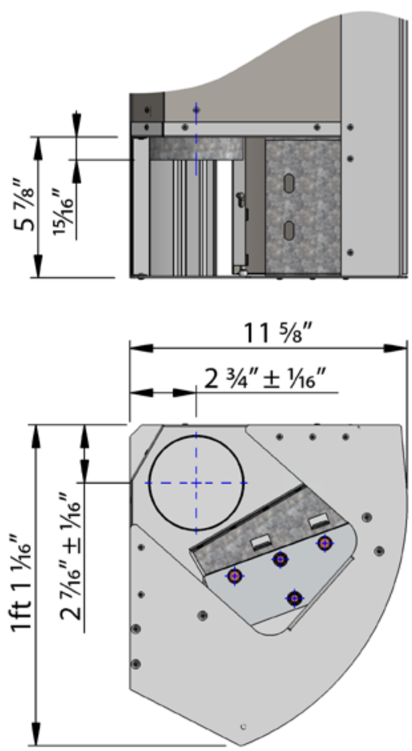
The condensation outlet should be connected to a soil stack or foul water system. Usually connection ends would be at the bathroom side wall when installed in a hotel application.

Ensure that when connecting to the condensation outlet the installation pipe work has a gradient of at least 25⁄32" fall per meter away from the connection end from the chilled beam condensate outlet. Also, it is good practice to form a water trap as recommended in the diagram opposite.

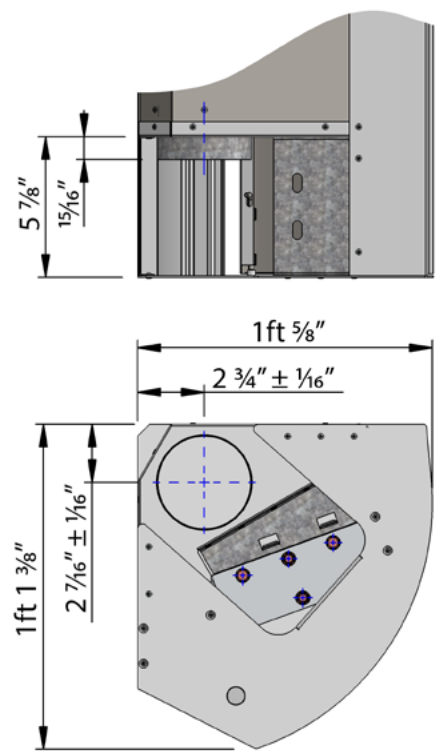
The use of Biocide tablets being used in the condensation tray / collection pan is also recommended to be used by the maintainer of the building systems as part of their planned maintenance as stagnant condensate accumulating in the collection pan / pipe work trap could provide habitant for various bacteria.

Product Dimensions

Standard Product

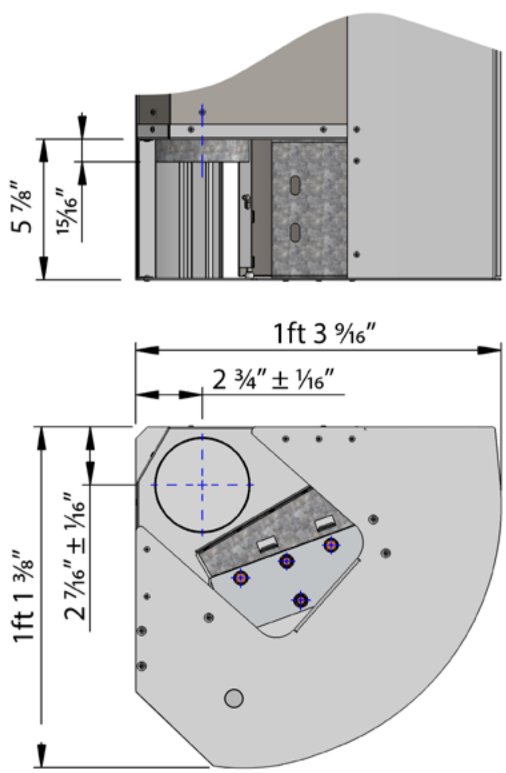


Cornice™ with Condensate Tray

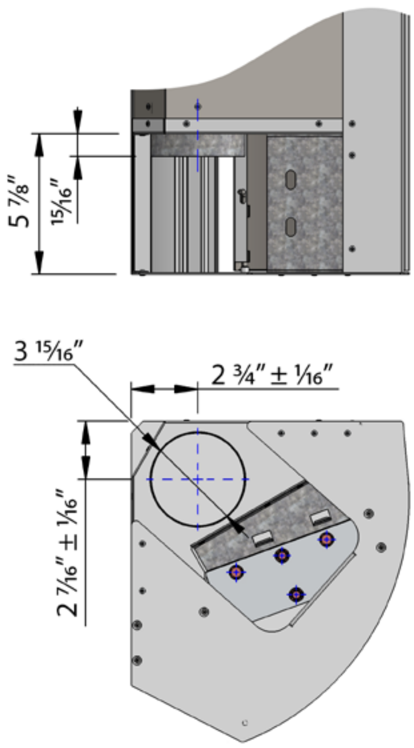


Cornice™ with Radiant Heating & Lighting

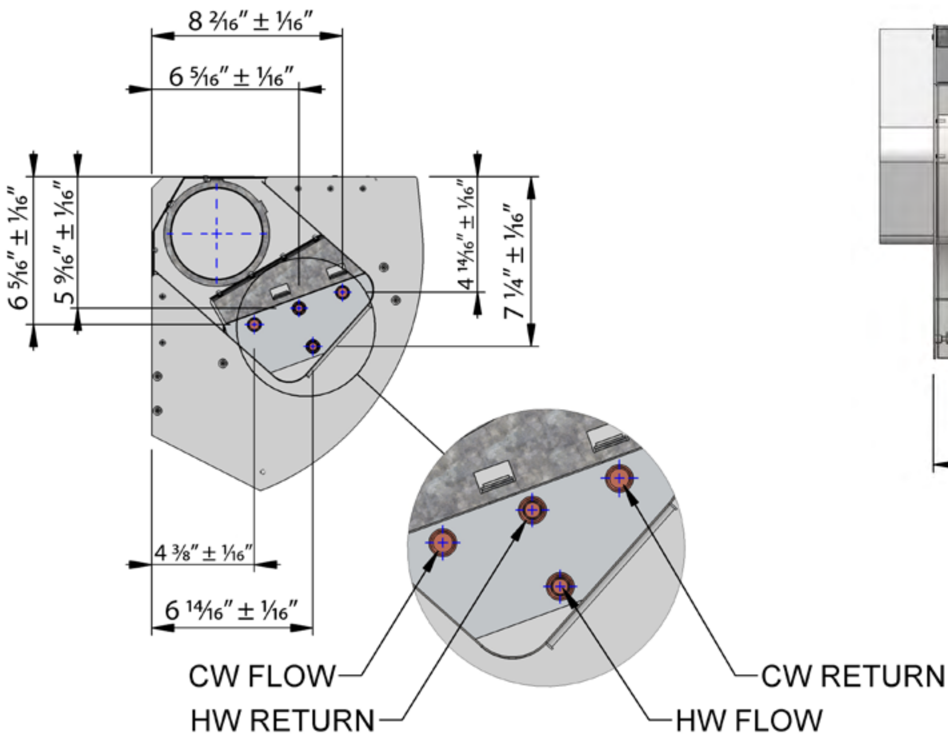
(and condensation tray if applicable)

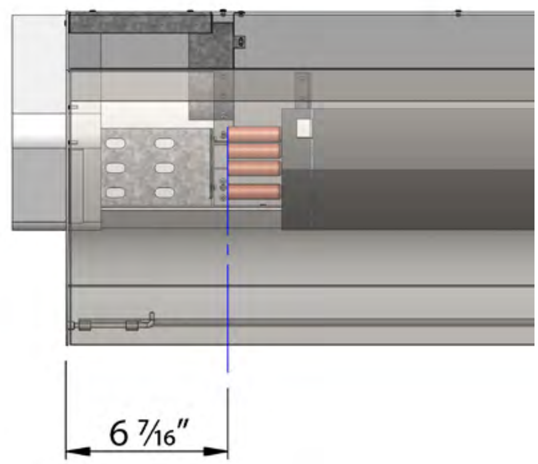


Air Connection

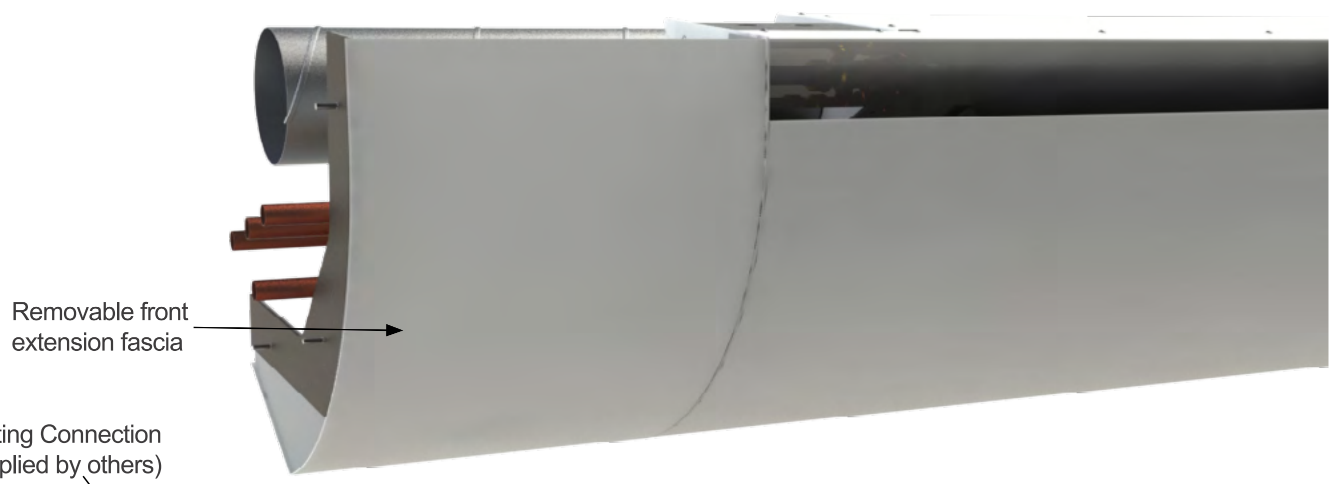


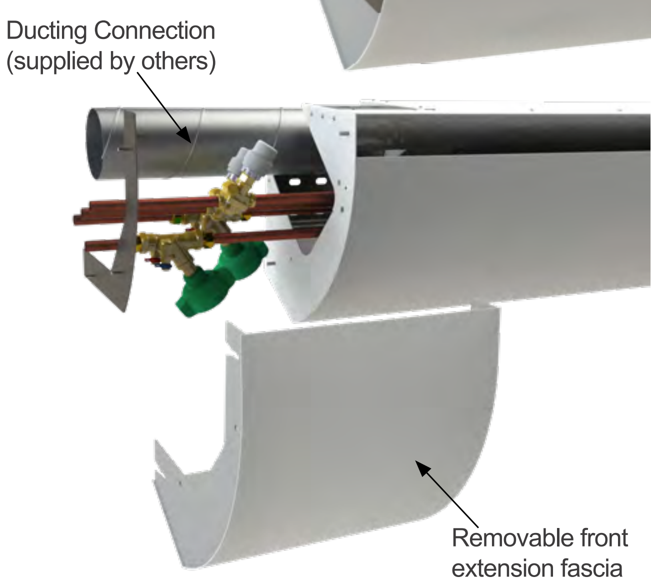
Water Connection

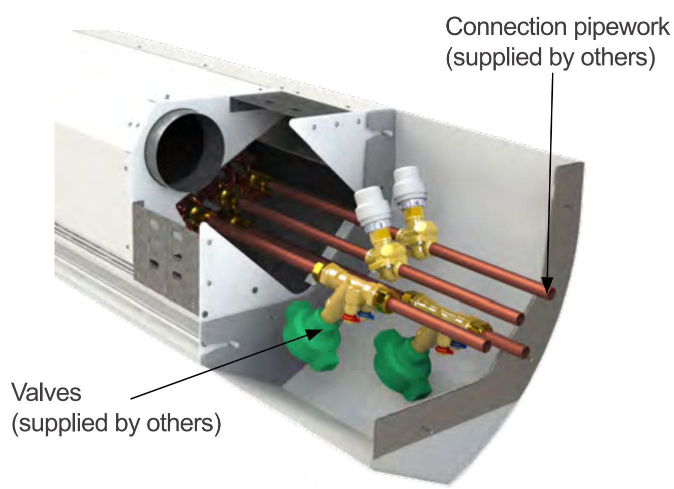




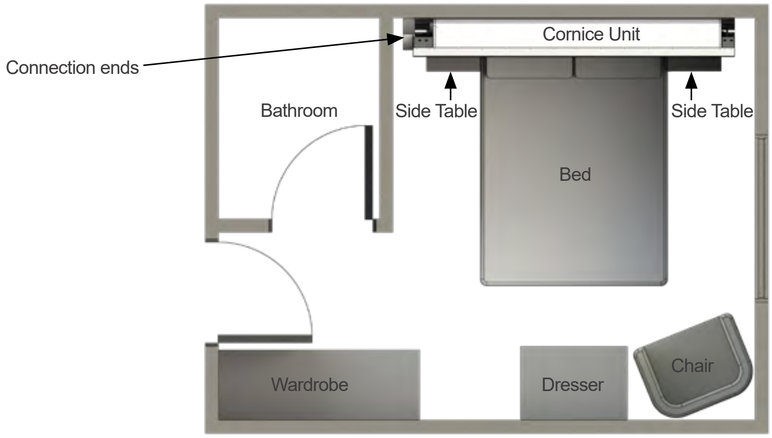
Note: Standard model only



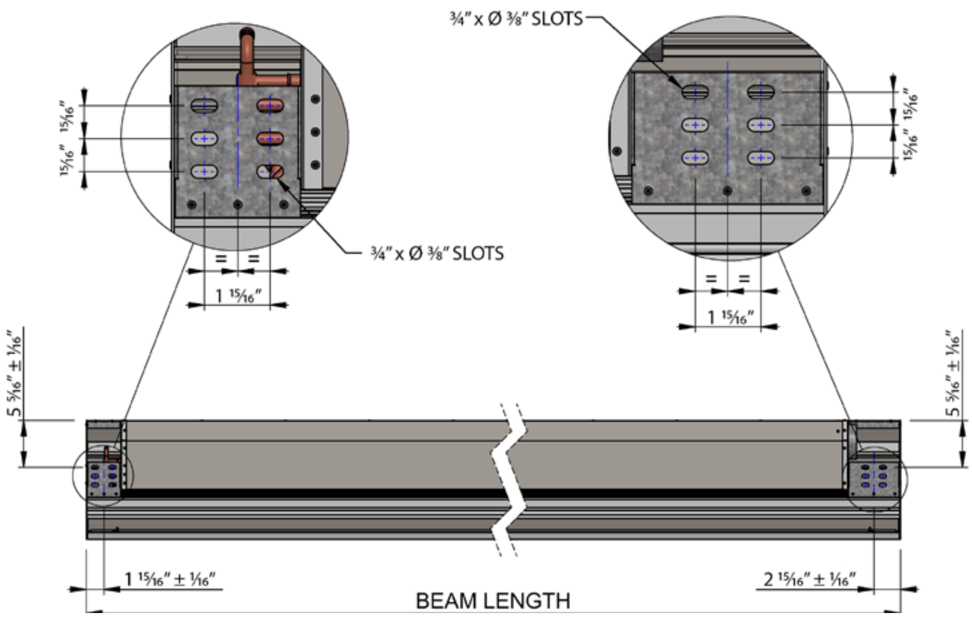


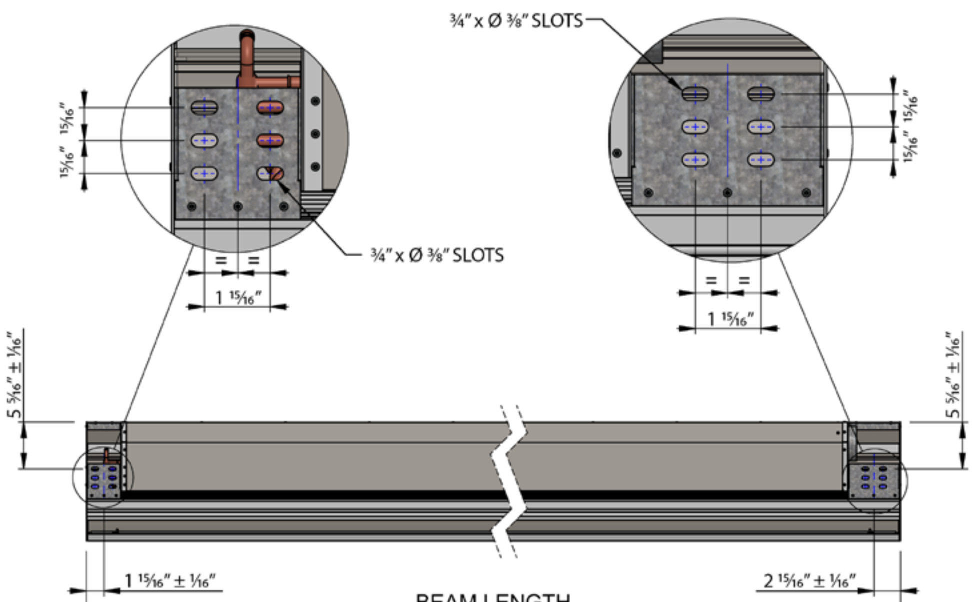


Mounting Details



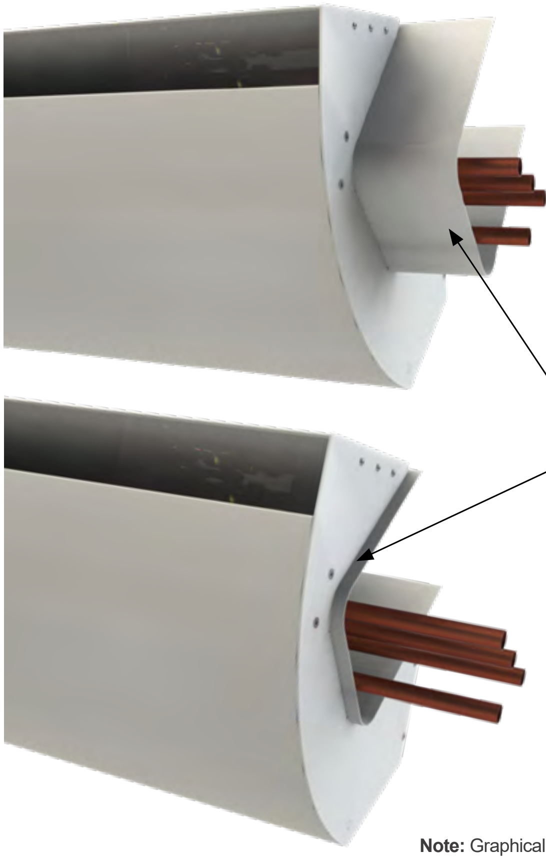
Suggested typical hotel room arrangement for connection ends.



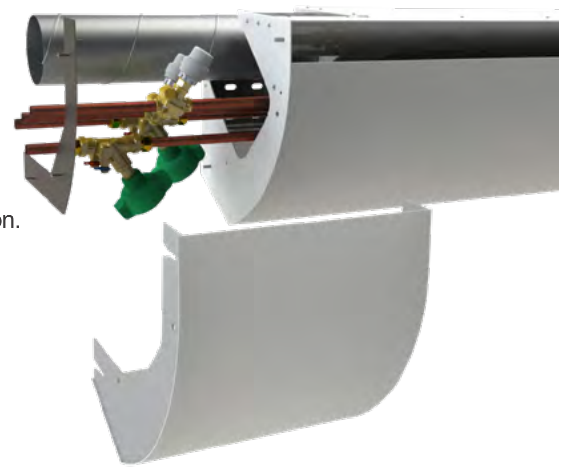


Note: Standard Cornice™ model only

Cornice™ Connection Covers



Telescopic extensions for final wall to wall installation. Zero to 2 15⁄16" adjustment length as standard, however longer lengths can be ordered.



Note: If separate short length removable front fascias required as detailed on page 43, these would require ordering separately along with quantities and lengths required.

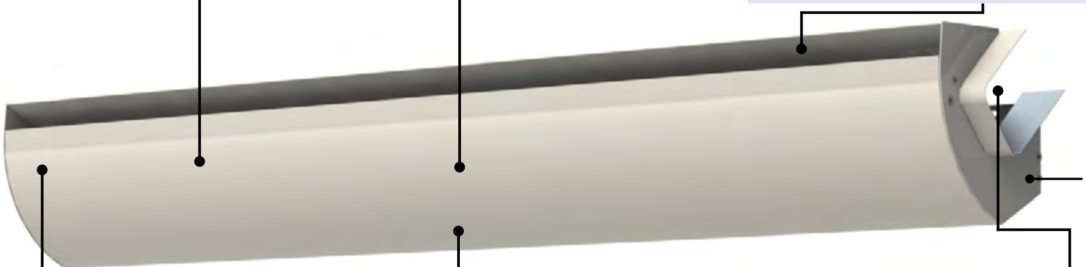
Note: Graphical representation of Cornice™ Standard Model. Cornice™ model dimensions vary - please see page 42 for details.

Product Ordering Codes

2. Function
CO - Ceiling Int. Cooling Only
CH - Ceiling Int. Cooling & LTHW Heating
CR - Ceiling Int. Cooling & Radiant Heating

4. Underplate
7D - 7Ø & 4Ø Double Dot / 50% Free Area
4D - 4Ø DOT / 33% Free Area
5S - 5x35 Slot / 45% Free Area

6. Air Supply / Discharge
Air Supply Volume (CFM)
25 04 L
Air Discharge Characteristic -
L: Long Throw - No Discharge Vanes
M: Medium Throw - 18° Discharge Vanes
S: Short Throw - 35° Discharge Vanes
Air Supply Nozzle Pressure (inH_2O)



Condensation outlet

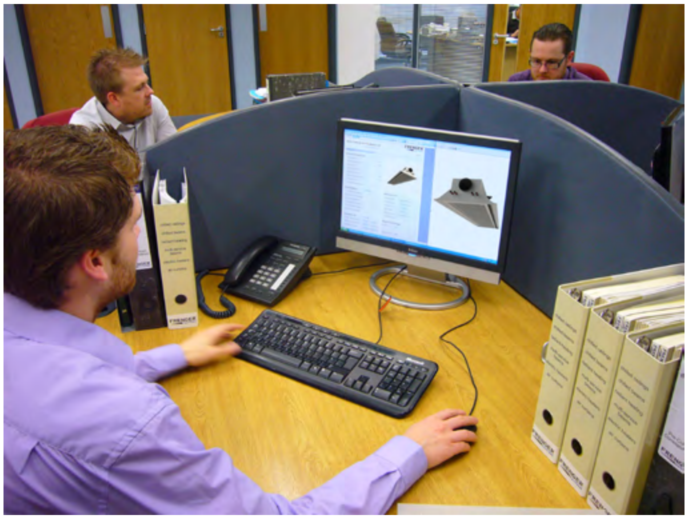
1. Beam Type
C - Cornice Standard
CL - Cornice with Lighting
CC - Cornice with Condensation Outlet
CCL - Cornice with Condensate outlet and Lighting

3. Nominal Beam Length (ft / in)

5. Waterside Connection
Battery Manifold Types - C3/C4/C5/C6
½ C³ H - Orientation - H: Horizontal
Chilled Water Connection Size (in) ½" / ¾"

Example: CN | CH | 4'00" | 7D | - H | 1/2C3H | 2504L
1 2 3 4 5 6

Calculation Program



Active Chilled Beam Calculation Tool

FTF GROUP® Climate

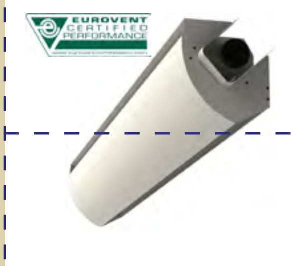
Is this the latest version?

version iV1.3.1

Project Ref.

Cornice Active Beam Data

Air Connection	1x4”	
Product Overall Length	8’00”	ft inches
Manifold Type	C4	
Air Discharge Throw	L	
Nozzle Static Pressure	0.4	”H2O
Fresh Air Supply Volume	42	CFM
LTHW Heating Function	Yes	
Radiant Heating (Electric)	No	
Lighting	No	
Condensation Drain Outlet	No	



Design Conditions	Cooling		Heating	
Flow Water Temperature	57.0	°F	122.0	°F
Return Water Temperature	62.0	°F	104.0	°F
Air Supply Temperature	60.8	°F	66.2	°F
Average Room Condition	75.0	°F	69.8	°F
“Air On” Thermal Gradient	32.9	°F		
Room Relative Humidity	50.0	%		

Dimensional Data

Width x Depth	11 1/2 x 8 1/4	Inches
Overall Length	8’ 0”	ft Inches
Water Volume	0.5	Gal
Dry Weight	64.2	lb
CW Connection	1/2	”
LTHW Connection	1/2	”

Performance Data	Cooling		Heating	
Room - MWT	15.50	°F	43.20	°F
Air On Coil - MWT	48.40	°F	37.80	°F
Waterside Performance	7335	BTU/h	1548	BTU/h
Water Mass Flowrate	2.929	gpm	0.172	gpm
Waterside Pressure Drop	7.2	ft H2O	0.4	ft H2O
Airside Performance	2124	BTU/h	-325	BTU/H
Total Sensible Performance	**9458**	**BTU/h**	**1224**	**BTU/h**
Sound Effect LW	< 35	dB(A)		

Design Check (Warnings)

Supply Air	OK	
Cooling Circuit	OK	
Heating Circuit	OK	
Turn Down Vol @ 40Pa	26.6	CFM
Calculated Dew Point	55.1	°F

Model Ref: CNCH8’ 0”-1x4”H1/2”C4H-420.4L

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

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

Cornice Active Beam Data

Air Connection	1x4”	
Product Overall Length	8’ 0”	ft Inches
Manifold Type	C4	
Air Discharge Throw	L	
Nozzle Static Pressure	0.4	” H2O
Fresh Air Supply Volume	42	CFM
LTHW Heating Function	Yes	
Radiant Heating (Electric)	No	
Lighting	No	
Condensation Drain Outlet	No	

Frenger’s calculation program for Cornice™ 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 being the highest and C2 being the lowest).

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

Design Conditions	Cooling		Heating	
Flow Water Temperature	57.0	°F	122.0	°F
Return Water Temperature	62.0	°F	104.0	°F
Air Supply Temperature	60.8	°F	66.2	°F
Average Room Condition	75.0	°F	69.8	°F
Thermal Gradient	32.9	°F		
Room Relative Humidity	50.0	%		

Complete your project data in the “Design Conditions” section. Please note that the “Air On” Thermal Gradient should not be used in normal instances unless placed above a window - seek technical advice from FTF Group.

Performance Data	Cooling		Heating	
Room - Mean Water dT	8.50	°F	24.00	°F
Air On Coil - Mean Water dT	8.96	°F	21.00	°F
Waterside Performance	562	BTU/h	447	BTU/h
Waterside Mass Flowrate	0.045	gpm	0.011	gpm
Waterside Pressure Drop	1.8	ft H2O	1.1	ft H2O
Airside Performance	203	BTU/h	-96	BTU/h
Total Sensible Performance	**765**	**BTU/h**	**351**	**BTU/h**
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 programs for Cornice™ are available upon request.

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

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

Bulkhead Beam

Bulkhead Beam

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

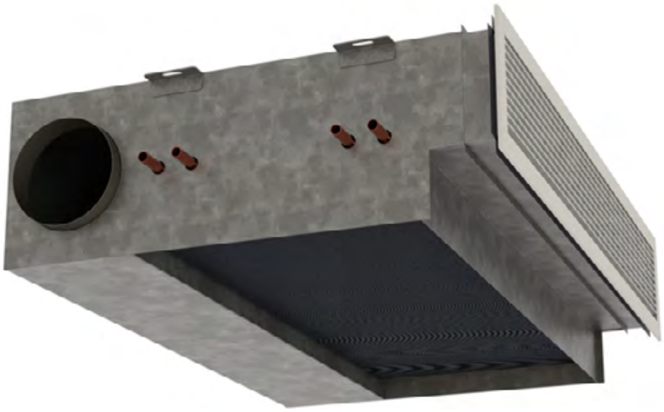
The Bulkhead beam contains a number of performance enhancing features as can be expected from the Frenger brand. The beam is designed for discreet installation into bulkheads, primarily for use in hotel bedrooms.

All induced / recirculated room air is via the return air grille which conceals the inside workings of the Active Beam, from an occupant which is resting in bed for example. The Bulkhead beam discharges its reconditioned air (which is a mixture of fresh air and recirculated air) at high level out of the top of the unit which then entrains across the ceiling (dependent upon discharge mounting height relative to ceiling) before gently dispersing and mixing with the room air.

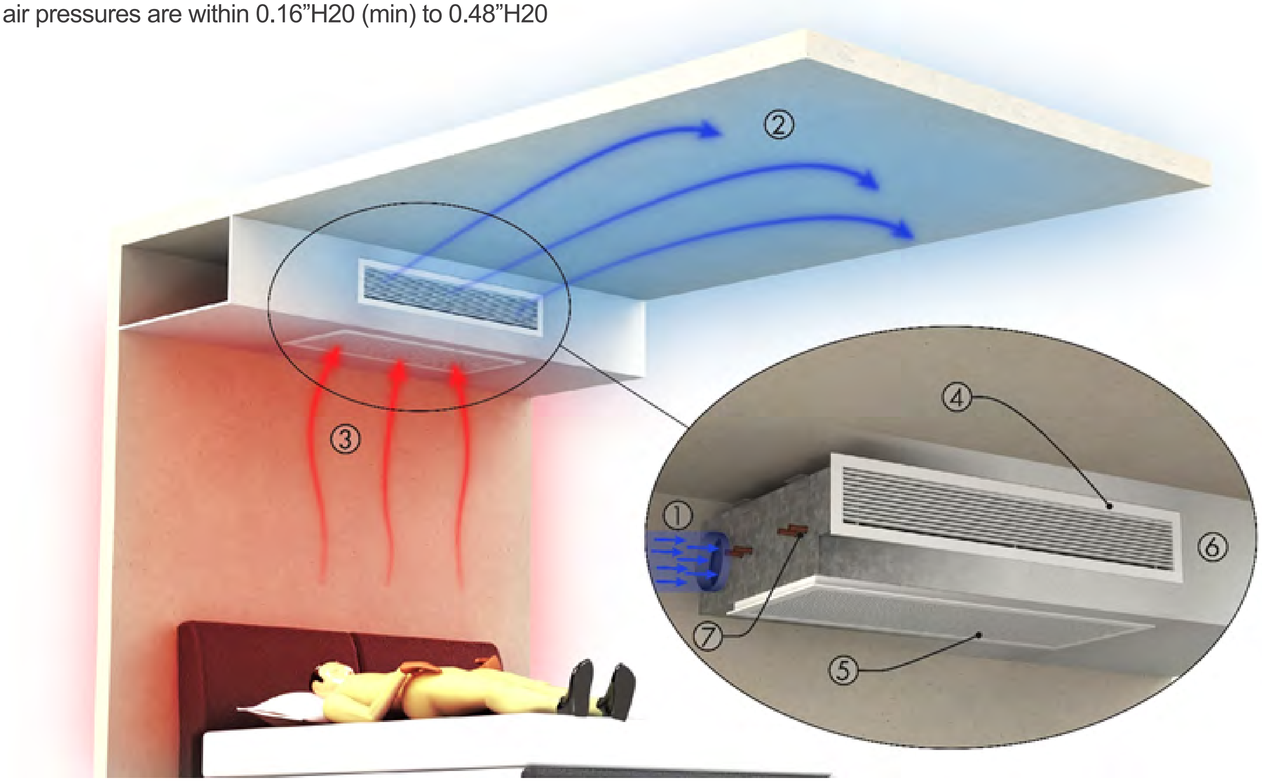
Beam Function Principles

Fresh air is supplied to the Chilled Beam where it mixes with reconditioned room air, which is induced through the heat exchanger battery via the return air grille (supplied by installer). The reconditioned and fresh air is then introduced to the room through the air discharge grille (part of the unit supplied by Frenger), comfortably cooling or heating the room as appropriate.

The fresh air can be supplied at a constant volume or have a turn down from 100% of design volume to 60% then 40% of design volume dependent upon room occupancy. Typical supply air pressures are within 0.16"H20 (min) to 0.48"H20 (max).

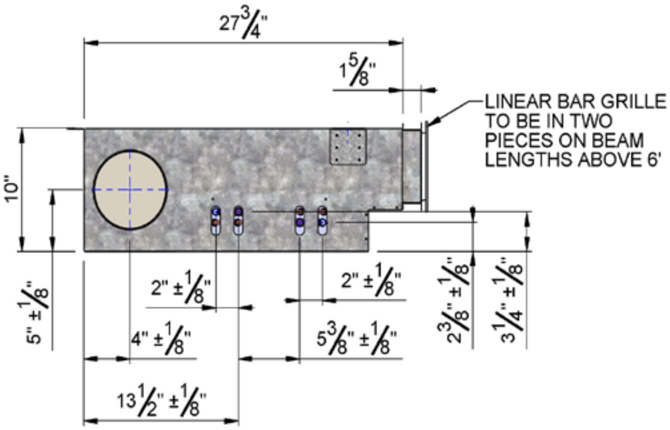


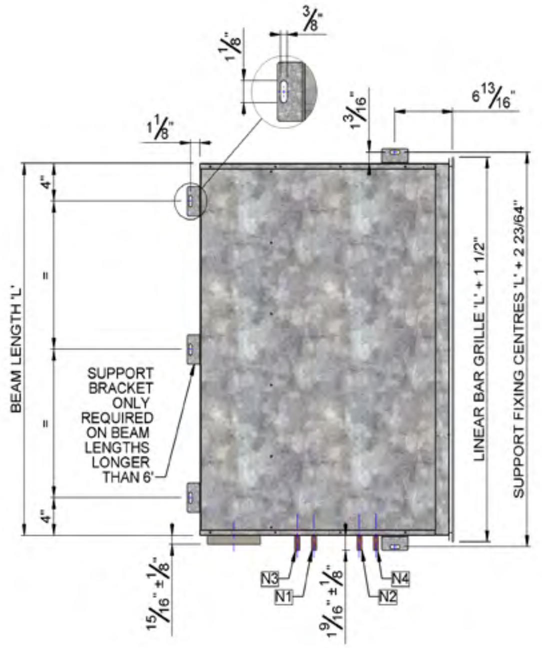
(1) - Fresh Air Supply.
(2) - Cooled Air Introduced into the Room by the Chilled Beam.
(3) - Warm Air Induced into the Heat Exchanger Battery Via the Return Air Grille.
(4) - Air Discharge Grille.
(5) - Return Air Grille (supplied by installer).
(6) - Bulkhead.
(7) - Water Connections.



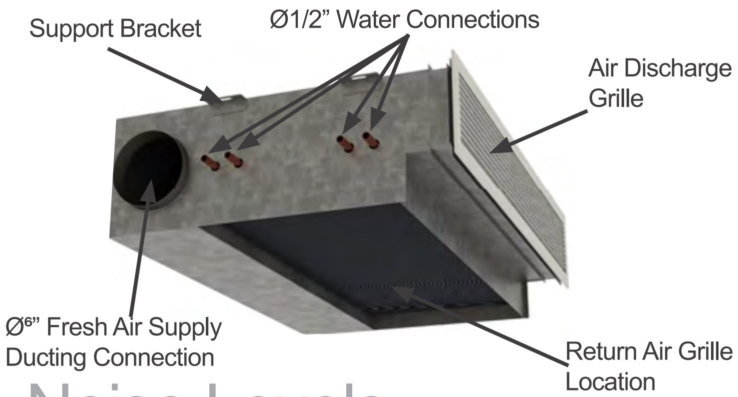
Product Details

Dimensions





N1: Chilled Water Flow - Ø½" Copper Pipe
N2: Chilled Water Return - Ø½" Copper Pipe
N3: Heating Water Flow - Ø1/2" Copper Pipe
N4: Heating Water Return - Ø1/2" Copper Pipe

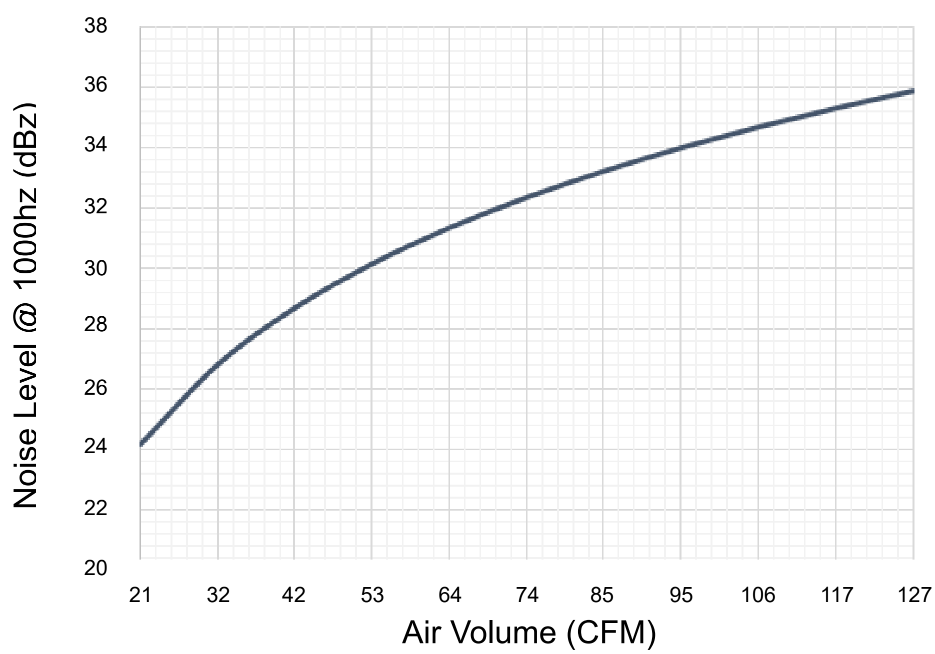


Note: Return air grille to be supplied by installer. Minimum dimensions @ 50% open area perforation
Width = 1' 4 11/16"
Length = Beam nom. length (decreased open area perforation will require larger grille in order to compensate).

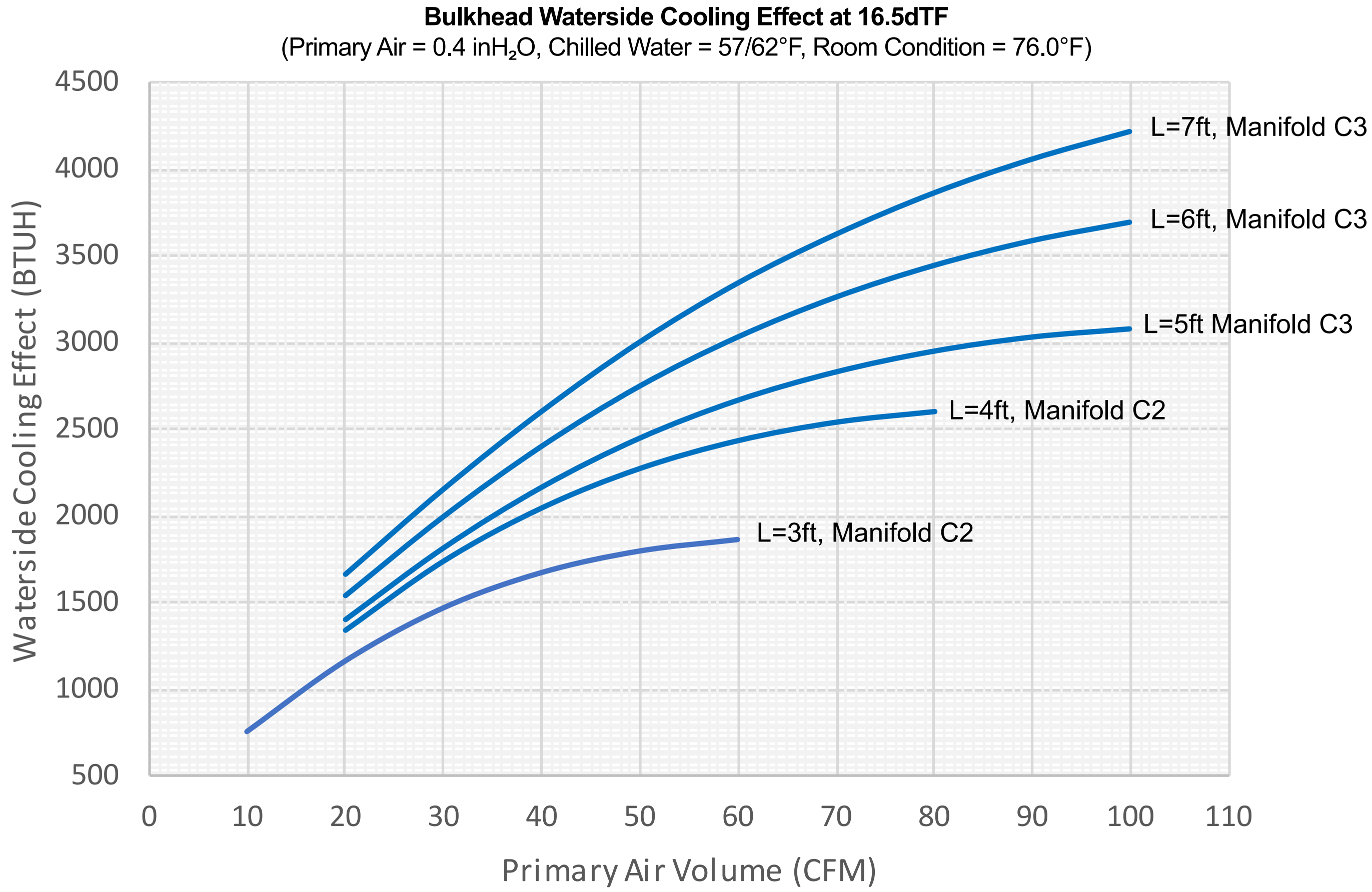
Nominal Beam Lengths: 3ft, 14ft, 6ft, 8ft, 10ft, 12ft.
(Other beam lengths available upon request)

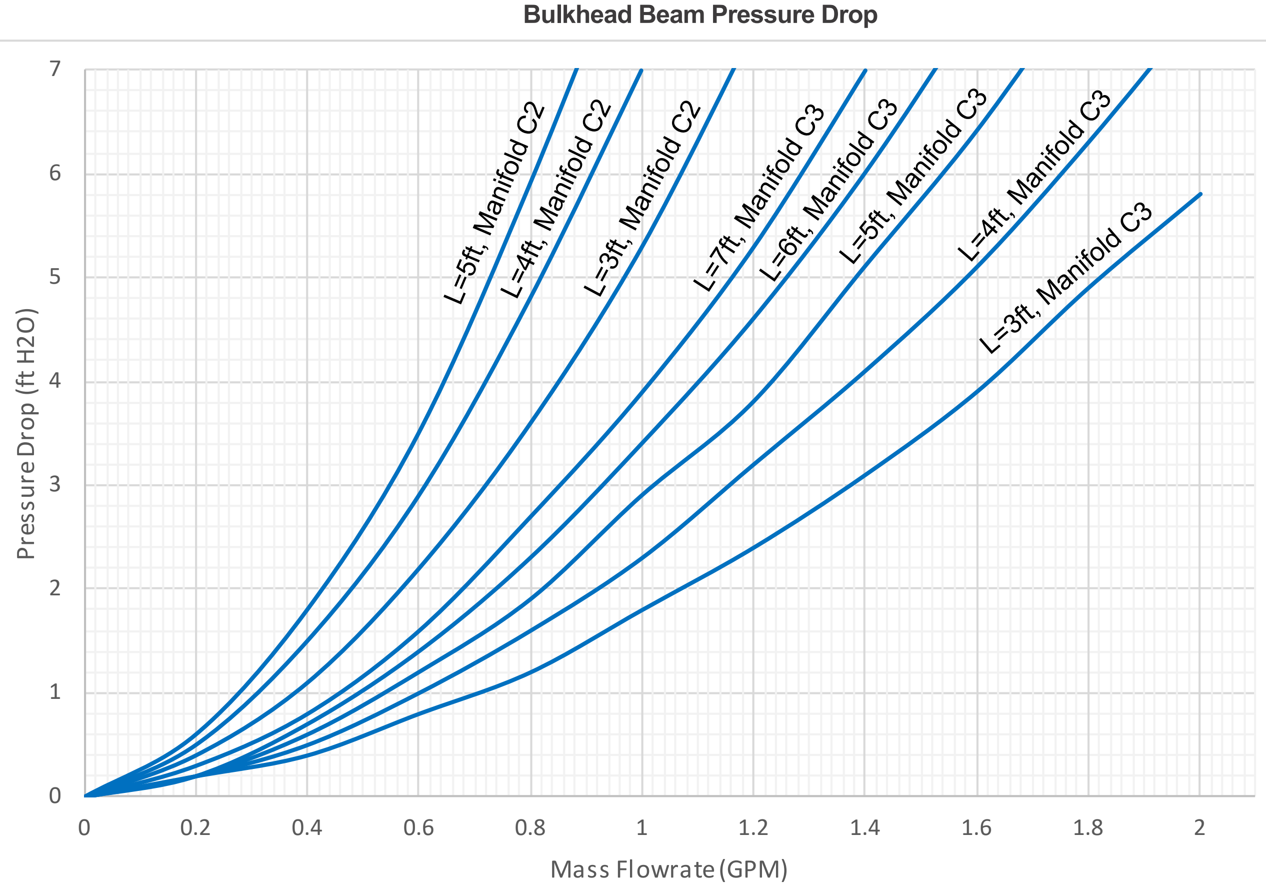
Noise Levels

The graph below shows the noise levels at 1000Hz (dBz) for the Bulkhead Chilled Beam at increasing air volumes (l/s)

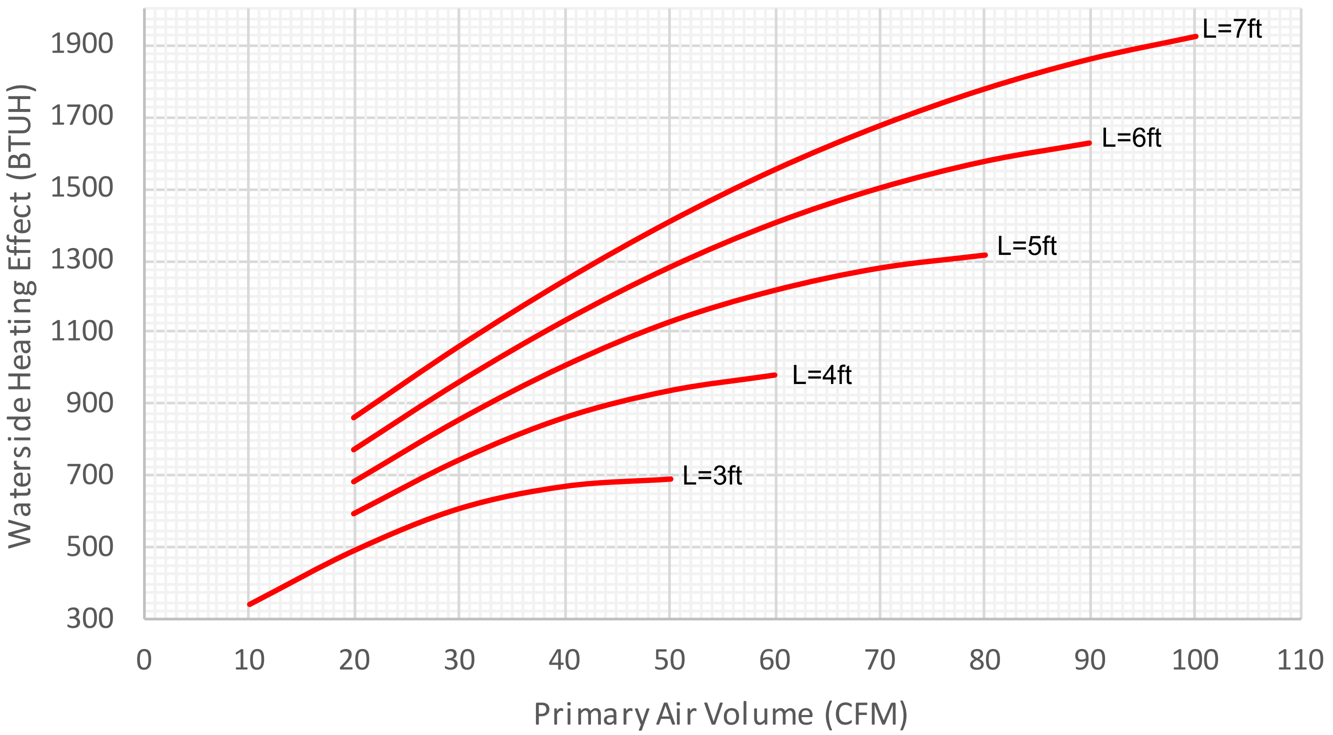


Cooling Performance

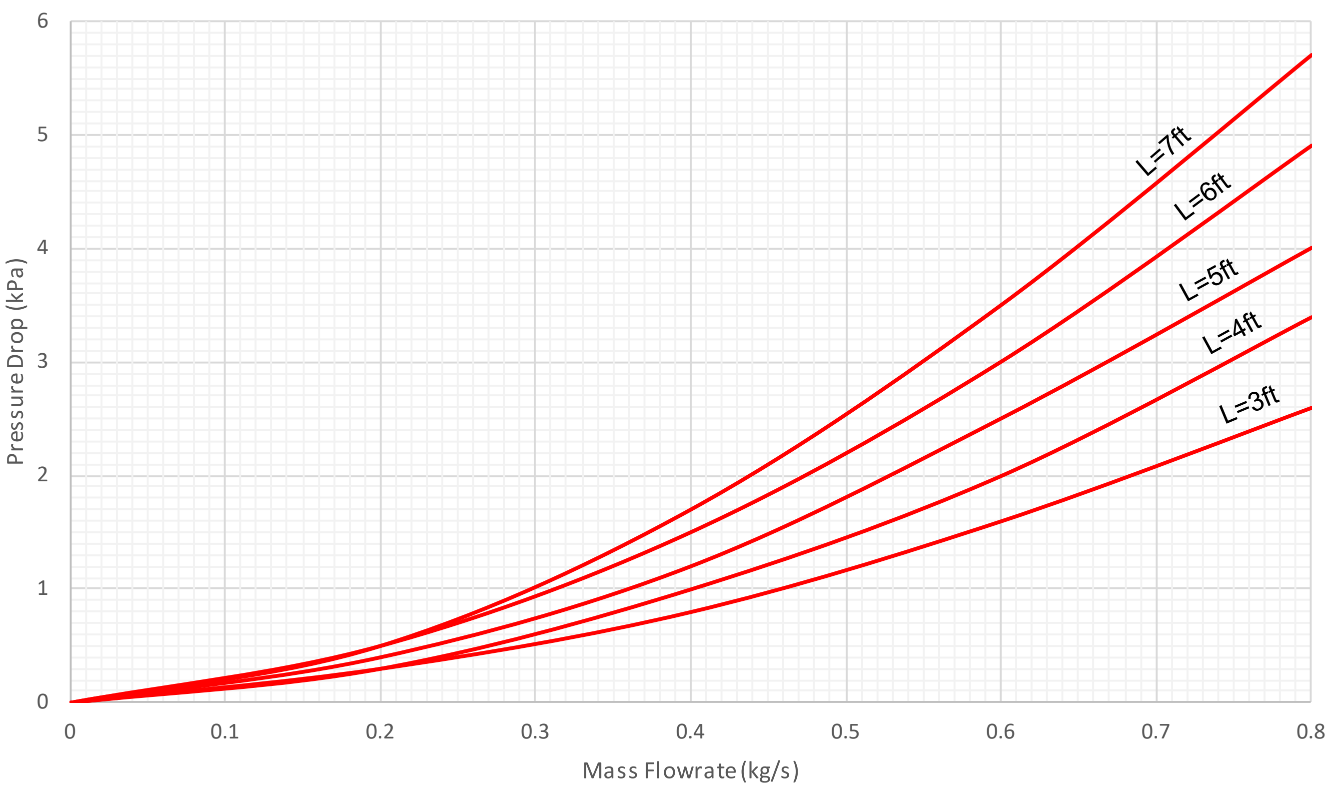




Bulkhead Beam Waterside Heating Effect at 43dTF
(Primary Air = 0.4 inH_2O, Heating Water = 120/110°F, Room Condition = 72.0°F)



Bulkhead Beam Pressure Drop



Cooling Selection Tables

Cooling at 0.32” H20 Nozzle Pressure

Nozzle Pressure 0.32 inH^{2}O		Water															
Q (CFM)	Bulkhead	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	Manifold	ΔP(ft H^{2}O)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	Manifold	ΔP(ft H^{2}O)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	Manifold	ΔP(ft H^{2}O)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	Manifold	ΔP(ft H^{2}O)
40	3.0	953	0.32	C2	0.8	1137	0.38	C2	1.1	1328	0.45	C2	1.4	1525	0.51	C2	1.7
	4.0	1199	0.4	C2	1.5	1428	0.48	C2	2	1663	0.56	C2	2.5	1903	0.64	C2	3.2
	5.0	1397	0.47	C2	2.3	1660	0.56	C2	3.1	1928	0.65	C2	4	2199	0.74	C2	5
	6.0	1565	0.53	C2	3.4	1849	0.62	C2	4.4	2136	0.72	C2	5.7	2224	0.74	C3	2.1
	7.0	1709	0.57	C2	4.5	2009	0.67	C2	5.9	2137	0.72	C3	2.2	2432	0.81	C3	2.8
60	3.0	1018	0.34	C2	0.9	1216	0.41	C2	1.2	1422	0.48	C2	1.5	1634	0.55	C2	1.9
	4.0	1404	0.47	C2	1.9	1674	0.56	C2	2.6	1950	0.65	C2	3.3	2228	0.75	C2	4.1
	5.0	1721	0.58	C2	3.3	2042	0.68	C2	4.4	2365	0.79	C2	5.7	2441	0.82	C3	2
	6.0	1978	0.66	C2	5	2337	0.78	C2	6.6	2455	0.82	C3	2.4	2810	0.94	C3	3
	7.0	2195	0.74	C2	6.9	2351	0.79	C3	2.6	2734	0.91	C3	3.3	3122	1.04	C3	4.2
80	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4.0	1444	0.49	C2	2	1722	0.58	C2	2.7	2005	0.67	C2	3.5	2290	0.77	C2	4.3
	5.0	1871	0.63	C2	3.8	2219	0.74	C2	5.1	2566	0.86	C2	6.5	2655	0.89	C3	2.3
	6.0	2230	0.75	C2	6.1	2379	0.8	C3	2.3	2772	0.93	C3	3	3170	1.06	C3	3.7
	7.0	2286	0.77	C3	2.5	2718	0.91	C3	3.3	3157	1.06	C3	4.2	3597	1.2	C3	5.3

Water = 6°F dT, 51% Open Area Perforated Inlet Grille, Air Discharge = L, Hydraulic Pressure Drop < 7 ft H2O, Lengths shown up to 7ft, longer lengths are available up to 12ft refer to product calculation tools for relevant performance.

Cooling at 0.4” H20 Nozzle Pressure

Nozzle Pressure 0.4 inH^{2}O		Water															
Q (CFM)	Bulkhead	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	Manifold	ΔP(ft H^{2}O)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	Manifold	ΔP(ft H^{2}O)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	Manifold	ΔP(ft H^{2}O)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	Manifold	ΔP(ft H^{2}O)
40	3.0	1062	0.36	C2	0.9	1259	0.42	C2	1.2	1464	0.49	C2	1.6	1673	0.56	C2	2
	4.0	1323	0.45	C2	1.7	1562	0.52	C2	2.3	1806	0.61	C2	2.9	2053	0.69	C2	3.6
	5.0	1524	0.51	C2	2.7	1796	0.6	C2	3.6	2071	0.69	C2	4.5	2348	0.79	C2	5.6
	6.0	1689	0.57	C2	3.8	1983	0.66	C2	5	2279	0.76	C2	6.4	2406	0.81	C3	2.3
	7.0	1829	0.61	C2	5.1	2140	0.72	C2	6.6	2299	0.77	C3	2.5	2607	0.87	C3	3.1
60	3.0	1157	0.39	C2	1.1	1386	0.47	C2	1.5	1621	0.54	C2	1.9	1863	0.62	C2	2.4
	4.0	1556	0.52	C2	2.3	1848	0.62	C2	3	2143	0.72	C2	3.9	2440	0.82	C2	4.8
	5.0	1875	0.63	C2	3.8	2211	0.74	C2	5.1	2547	0.85	C2	6.4	2666	0.89	C3	2.3
	6.0	2132	0.71	C2	5.7	2307	0.77	C3	2.2	2669	0.89	C3	2.8	3036	1.02	C3	3.5
	7.0	2166	0.73	C3	2.3	2554	0.85	C3	3	2949	0.99	C3	3.8	3347	1.12	C3	4.7
80	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4.0	1651	0.55	C2	2.5	1968	0.66	C2	3.4	2288	0.77	C2	4.3	2607	0.87	C2	5.4
	5.0	2075	0.7	C2	4.5	2451	0.82	C2	6	2574	0.86	C3	2.2	2947	0.99	C3	2.8
	6.0	2423	0.81	C2	7	2612	0.87	C3	2.7	3029	1.01	C3	3.4	3449	1.15	C3	4.3
	7.0	2500	0.84	C3	2.9	2953	0.99	C3	3.8	3409	1.14	C3	4.9	3867	1.29	C3	6

Water = 6°F dT, 51% Open Area Perforated Inlet Grille, Air Discharge = L, Hydraulic Pressure Drop < 7 ft H2O, Lengths shown up to 7ft, longer lengths are available up to 12ft refer to product calculation tools for relevant performance.

Heating Selection Tables

Cooling at 0.32” H20 Nozzle Pressure

Nozzle Pressure 0.32 in H^{2}O		Water											
Q (CFM)	Bulkhead	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	ΔP(ft H^{2}O)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	ΔP(ft H^{2}O)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	ΔP(ft H^{2}O)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	ΔP(ft H^{2}O)
40	3.0	461	0.1	0.1	624	0.13	0.2	798	0.16	0.2	980	0.2	0.3
	4.0	618	0.13	0.2	825	0.17	0.3	1042	0.21	0.4	1265	0.26	0.5
	5.0	741	0.15	0.3	981	0.2	0.4	1230	0.25	0.6	1482	0.3	0.8
	6.0	841	0.17	0.4	1108	0.23	0.6	1382	0.28	0.8	1658	0.34	1.1
	7.0	930	0.19	0.5	1221	0.25	0.8	1517	0.31	1.1	1814	0.37	1.4
60	3.0	436	0.09	0.1	597	0.12	0.1	771	0.16	0.2	954	0.2	0.3
	4.0	666	0.14	0.2	906	0.19	0.3	1158	0.24	0.4	1418	0.29	0.6
	5.0	865	0.18	0.3	1158	0.24	0.5	1460	0.3	0.8	1765	0.36	1
	6.0	1023	0.21	0.5	1355	0.28	0.8	1692	0.34	1.1	2029	0.41	1.5
	7.0	1156	0.24	0.7	1518	0.31	1.1	1882	0.38	1.6	2244	0.45	2.1
80	3.0	-	-	-	-	-	-	-	-	-	-	-	-
	4.0	628	0.13	0.2	857	0.18	0.3	1100	0.23	0.4	1351	0.28	0.5
	5.0	889	0.18	0.4	1204	0.25	0.6	1529	0.31	0.8	1857	0.38	1.1
	6.0	1116	0.23	0.6	1488	0.3	0.9	1865	0.38	1.4	2240	0.45	1.8
	7.0	1300	0.27	0.9	1714	0.35	1.4	2128	0.43	2	2537	0.51	2.6

Water = 10°F dT, 51% Open Area Perforated Inlet Grille, Air Discharge = L, Lengths shown up to 7ft, longer lengths are available up to 12ft refer to product calculation tools for relevant performance.

Cooling at 0.4” H20 Nozzle Pressure

Nozzle Pressure 0.4 in H^{2}O		Water											
Q (CFM)	Bulkhead	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	ΔP(ft H^{2}O)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	ΔP(ft H^{2}O)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	ΔP(ft H^{2}O)	$\dot{Q}$(Btu/h)	$\dot{m}$(gpm)	ΔP(ft H^{2}O)
40	3.0	498	0.1	0.1	670	0.14	0.2	852	0.18	0.2	1041	0.21	0.3
	4.0	650	0.14	0.2	862	0.18	0.3	1083	0.22	0.4	1308	0.27	0.5
	5.0	763	0.16	0.3	1006	0.21	0.4	1258	0.26	0.6	1513	0.31	0.8
	6.0	859	0.18	0.4	1130	0.23	0.6	1408	0.29	0.8	1687	0.34	1.1
	7.0	948	0.19	0.5	1244	0.25	0.8	1545	0.31	1.1	1846	0.37	1.5
60	3.0	497	0.1	0.1	683	0.14	0.2	883	0.18	0.2	1091	0.22	0.3
	4.0	727	0.15	0.2	982	0.2	0.3	1249	0.26	0.5	1521	0.31	0.6
	5.0	915	0.19	0.4	1216	0.25	0.6	1525	0.31	0.8	1836	0.37	1.1
	6.0	1065	0.22	0.6	1401	0.29	0.9	1742	0.35	1.2	2081	0.42	1.6
	7.0	1188	0.24	0.8	1554	0.32	1.2	1922	0.39	1.6	2287	0.46	2.1
80	3.0	-	-	-	-	-	-	-	-	-	-	-	-
	4.0	724	0.15	0.2	989	0.2	0.3	1267	0.26	0.5	1550	0.32	0.7
	5.0	977	0.2	0.4	1314	0.27	0.7	1659	0.34	0.9	2005	0.41	1.3
	6.0	1187	0.24	0.7	1572	0.32	1	1961	0.4	1.5	2345	0.47	1.9
	7.0	1358	0.28	1	1780	0.36	1.5	2200	0.45	2.1	2615	0.53	2.7

Water = 10°F dT, 51% Open Area Perforated Inlet Grille, Air Discharge = L, Lengths shown up to 7ft, longer lengths are available up to 12ft refer to product calculation tools for relevant performance.

Ultima™

Product Description

Ultima™ is one of 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.

Ultima™ is only 8.2" deep and can achieve 1165 BTU/hr/ft total cooling (based on 18dTF and 16CFM/ft for a 8ft long beam supplied at 60°F with a 0.4in$H_2$0).

The Ultima™ beam contains a number of Patented performance enhancing features and as can be expected from the the FTF Group brand, the Ultima beam is designed to be easily tailored to suit the unique parameters of individual project sites, for the optimum product / system efficiencies. This is partly achieved by the "burst nozzle" arrangement that not only encourages induction, but also reduces noise. Given the size and amount of burst nozzles being appropriately quantified for each project, this provides consistent jet velocities, equal distribution of the air discharge and continuous induction through the heat exchanger (battery). There are no dead spots due to plugging back nozzles from a standard pitch or having to adjust the pressure in the system to suit the amount of open standard nozzle sizes as associated with many competitors' active beams as dead spots and / or reduced 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 12ft.

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

The Ultima™ Chilled Beam outer casing is constructed from extruded aluminum and zintec pressed steel. The casing facilitates an aluminum burst nozzle strip (project specific) and a high performance heat exchange battery constructed from copper and aluminum. Beams are available in lengths from 4ft up to 12ft in 4" increments. Typically 2ft wide 1.6ft wide is also available).

In addition to Ultima's™ high cooling performance capability of in excess of 1100 BTU/hr/ft, Ultima™ can operate well and induce at low air volumes, as little as 2.2 CFM/ft and even with a low static pressure of just 0.16in$H_2$0. Likewise Ultima™ can handle high air volumes up to 18 CFM/ft and up to 0.48in$H_2$0. Please note 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" 15 CFM/ft from a 2 way discharge beam is the maximum for occupancy comfort to BS EN 7730.

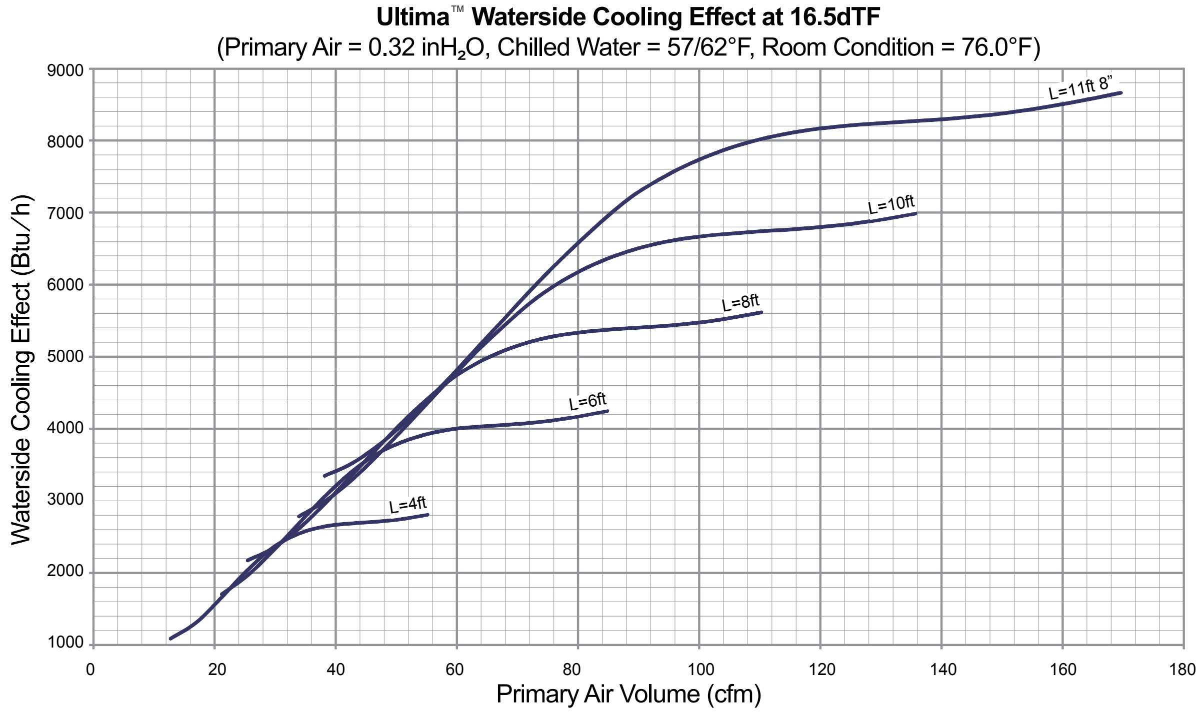
The maximum total supply air for the product is limited to 170 CFM. If the total air volume is less than 106 CFM, refer to the Compact™ active chilled beams by the FTF Group. Visually both units appear identical from the underside.

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

At a glance

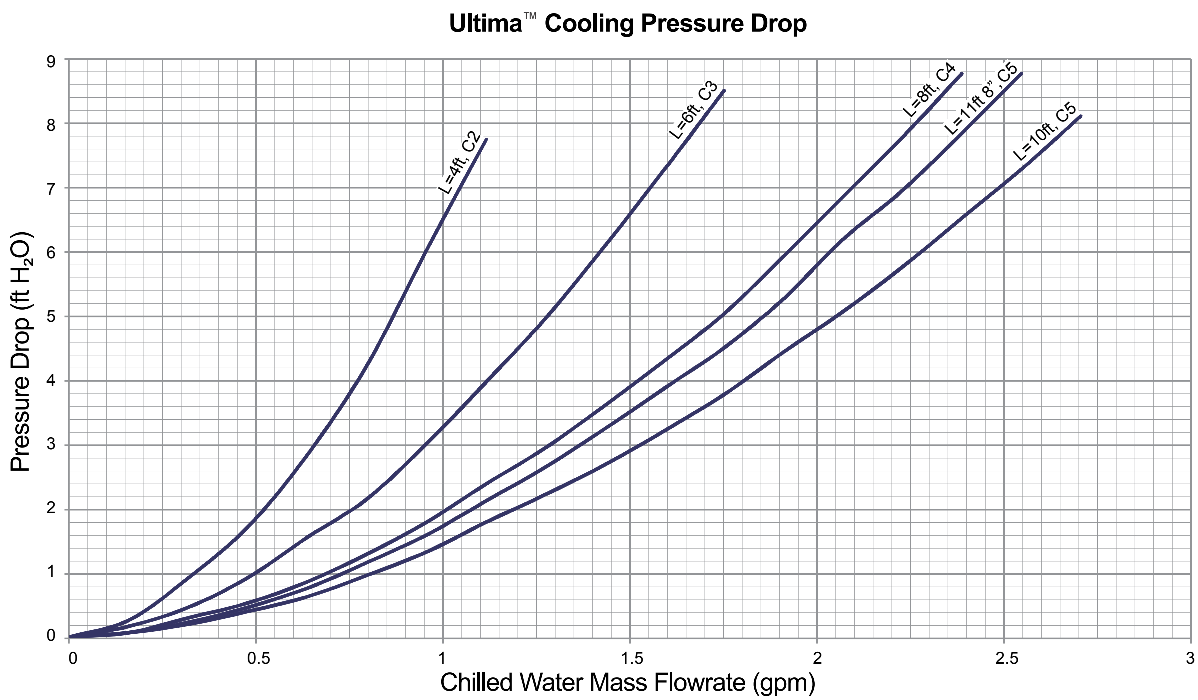
- Can handle high Air Volume (upto 170 CFM total).
- Optimize discharge nozzle sizes and pitch factory set to best suit project requirements.
- Coanda effect is initiated within the beam.
- Smooth curved discharged slot as opposed to traditional faceted discharge slots for improved aesthetics.
- Discharge veins are concealed within the beam for improved aesthetics.
- Fan shape distribution for increased occupancy comfort.
- Unique fast fixing of removable underplates that prevents any sagging even on long beam lengths of 12ft.
- Various different perforation patterns available for removable underplates
- 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 / ASHRAE 55

Cooling Performance

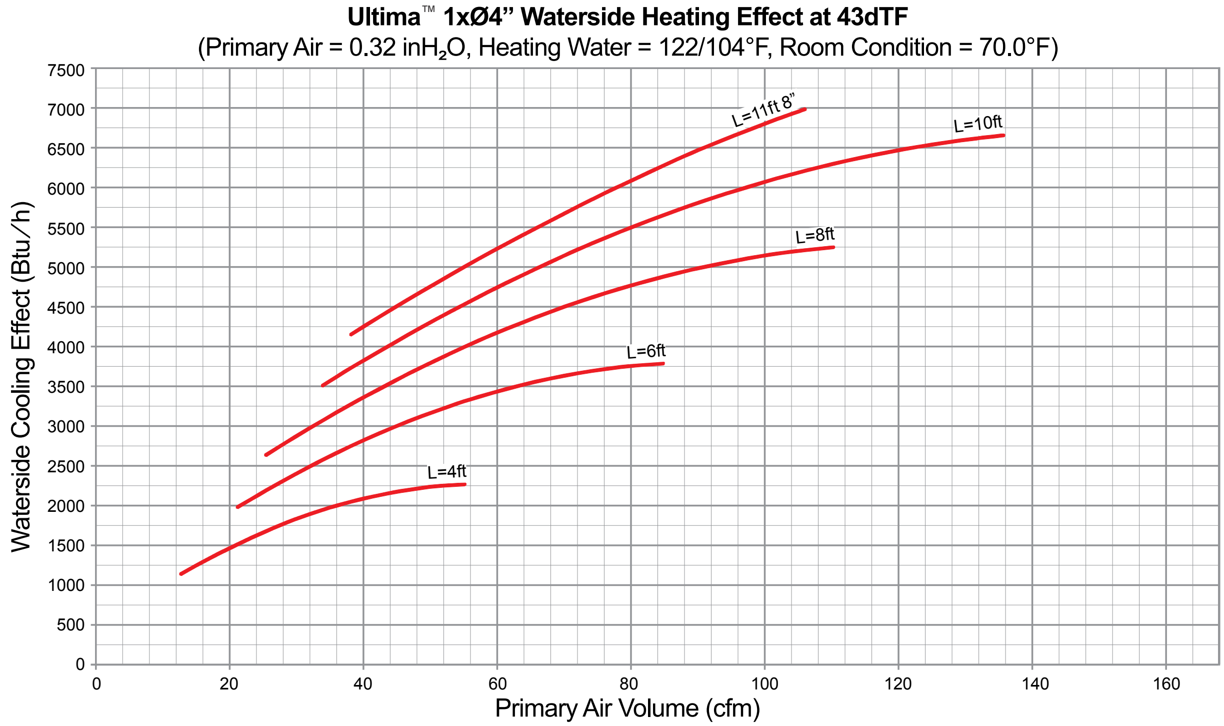


Cooling figures are based on a cooling & heating beams, additional cooling is possible with a cooling only product - contact the FTF Group for more information.

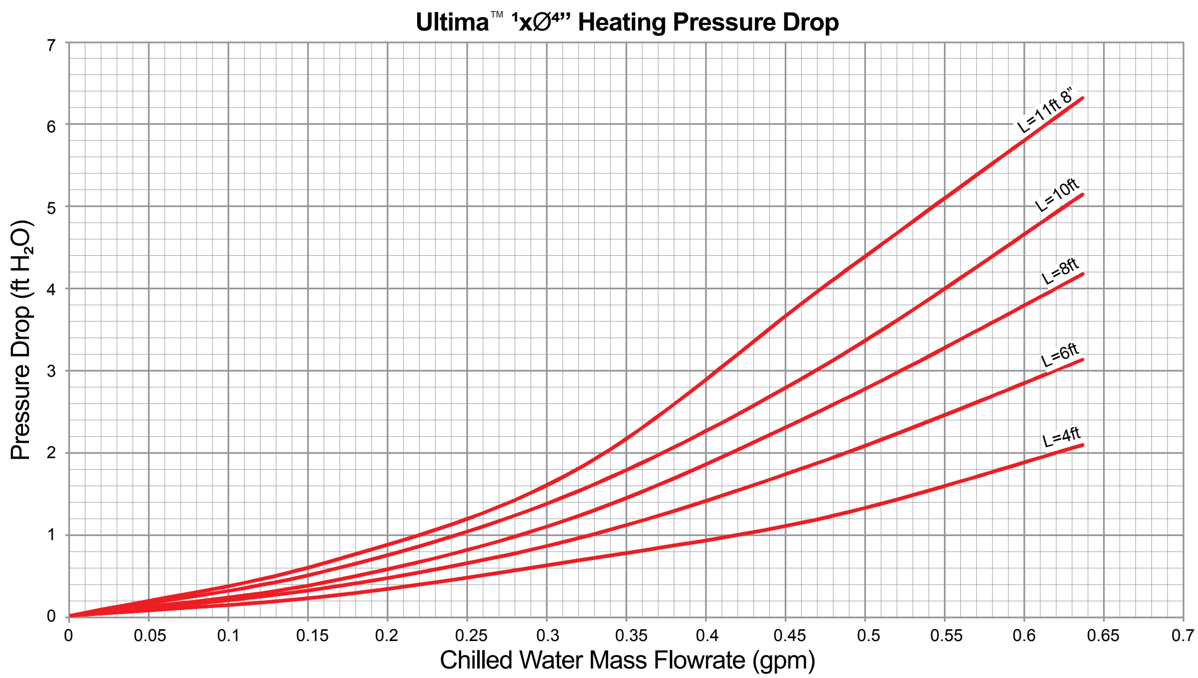
Pressure Drop



Heating Performance



Pressure Drop



Cooling Selection Tables

Cooling at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 in H_2O		Water															
(CFM)	Ultima	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1485	0.595	C2	2.3	1776	0.711	C2	3.1	2068	0.828	C2	4.1	2359	0.945	C2	5.1
	6.0	2230	0.893	C3	2.5	2663	1.067	C3	3.4	3099	1.241	C3	4.4	3534	1.415	C3	5.5
	8.0	2492	0.998	C3	4.2	2960	1.186	C3	5.6	3284	1.316	C4	3.0	3752	1.503	C4	3.7
	10.0	2494	0.999	C3	5.3	2954	1.183	C3	7.1	3287	1.317	C4	3.8	3746	1.501	C4	4.7
	11.8	2501	1.002	C3	6.3	2844	1.139	C4	3.5	3297	1.321	C4	4.5	3754	1.504	C4	5.6
62	6.0	2368	0.949	C3	2.8	2827	1.133	C3	3.8	3288	1.317	C3	4.9	3578	1.433	C4	2.5
	8.0	3350	1.342	C4	6.6	3800	1.522	C4	3.8	4416	1.769	C4	4.9	4866	1.949	C5	3.5
	10.0	3684	1.476	C4	4.6	4374	1.752	C4	6.2	4907	1.966	C5	4.5	5596	2.242	C5	5.6
	11.8	3809	1.526	C4	5.7	4366	1.749	C5	4.3	5068	2.030	C5	5.6	5769	2.311	C5	7.0
84	8.0	3257	1.304	C4	2.9	3886	1.556	C4	3.9	4514	1.808	C4	5.1	4975	1.993	C5	3.6
	10.0	4272	1.711	C4	5.9	4896	1.961	C5	4.4	5686	2.277	C5	5.8	6471	2.592	C5	7.2
	11.8	4686	1.877	C5	4.8	5568	2.230	C5	6.5	6285	2.518	C6	4.2	7165	2.870	C6	5.3

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.24 inH_2O, 1 x Ø5" air connection.
For green values, a Ø3/4" manifold connection size is required.

Nozzle Pressure 0.24 in H_2O		Water															
(CFM)	Ultima	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
106	10.0	4456	1.785	C5	4.0	5303	2.124	C5	5.4	5983	2.396	C6	3.5	6830	2.736	C6	4.4
	11.8	5290	2.119	C5	6.3	6103	2.444	C6	4.2	7081	2.836	C6	5.4	8053	3.226	C6	6.8
126	11.8	5336	2.137	C5	6.4	6156	2.466	C6	4.3	7142	2.861	C6	5.5	8122	3.253	C6	6.9
148	11.8	5388	2.158	C5	6.5	6217	2.490	C6	4.3	7212	2.889	C6	5.6	8201	3.285	C6	7.0

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.24 inH_2O, 1 x Ø5" air connection.
For green values, a Ø3/4" manifold connection size is required.
Please refer to the FTF Group Technical Department for selection not covered within these tables.

Cooling at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 in H_2O		Water															
(CFM)	Ultima	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1660	0.665	C2	2.8	1993	0.798	C2	3.8	2324	0.931	C2	4.9	2650	1.062	C2	6.2
	6.0	2340	0.931	C3	2.7	2810	1.125	C3	3.7	3279	1.313	C3	4.8	3743	1.499	C3	6.1
	8.0	2523	1.011	C3	4.2	3002	1.203	C3	5.7	3325	1.332	C4	3.0	3804	1.524	C4	3.8
	10.0	2557	1.024	C3	5.5	3028	1.213	C3	7.4	3370	1.350	C4	3.9	3841	1.539	C4	4.9
	11.8	2664	1.067	C3	7.0	3031	1.214	C4	3.9	3512	1.407	C4	5.0	3993	1.600	C4	6.2
62	6.0	2647	1.060	C3	3.3	3170	1.270	C3	4.6	3688	1.477	C3	5.9	4009	1.606	C4	3.0
	8.0	3403	1.363	C4	3.1	4076	1.633	C4	4.3	4744	1.900	C4	5.5	5221	2.091	C5	3.9
	10.0	3798	1.521	C4	4.8	4341	1.739	C5	3.6	5064	2.028	C5	4.7	5783	2.316	C5	5.9
	11.8	3862	1.547	C4	5.8	4424	1.772	C5	4.4	5141	2.059	C5	5.7	5853	2.345	C5	7.2
84	8.0	3635	1.456	C4	3.5	4349	1.742	C4	4.8	4857	1.946	C5	3.4	5569	2.231	C5	4.3
	10.0	4428	1.774	C5	3.7	5298	2.122	C5	5.1	6159	2.467	C5	6.6	6833	2.737	C6	4.1
	11.8	4933	1.976	C5	5.3	5876	2.354	C5	7.1	6629	2.655	C6	4.6	7566	3.030	C6	5.8

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.32 inH_2O, 1 x Ø5" air connection.
For green values, a Ø3/4" manifold connection size is required.

Nozzle Pressure 0.32 in H_2O		Water															
(CFM)	Ultima	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
106	8.0	4077	1.633	C4	4.6	4653	1.864	C5	3.4	5440	2.179	C5	4.5	6218	2.491	C5	6.1
	10.0	4941	1.979	C5	4.8	5891	2.360	C5	6.5	6643	2.661	C6	4.1	7586	3.038	C6	4.7
	11.8	5738	2.298	C5	7.2	6617	2.651	C6	4.8	7683	3.077	C6	6.2	8736	3.499	C6	6.7
126	10.0	5048	2.022	C5	4.9	6016	2.410	C5	6.7	6785	2.718	C6	4.3	7745	3.102	C6	5.2
	11.8	5947	2.382	C5	7.7	6860	2.748	C6	5.1	7958	3.188	C6	6.6	9043	3.622	C6	9.6
148	11.8	6056	2.426	C5	7.9	6987	2.799	C6	5.3	8102	3.245	C6	6.8	9203	3.686	C6	9.8

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.32 inH_2O, 1 x Ø5" air connection.
For green values, a Ø3/4" manifold connection size is required.
Please refer to the FTF Group Technical Department for selection not covered within these tables.

Cooling at 0.4 Nozzle Pressure

Nozzle Pressure 0.4 in H_2O		Water															
	Ultima	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
(CFM)	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1833	0.734	C2	3.3	2187	0.876	C2	4.4	2352	0.942	C3	1.7	2705	1.084	C3	2.2
	6.0	2528	1.013	C3	3.1	3009	1.205	C3	4.2	3490	1.398	C3	5.4	3812	1.527	C4	2.8
	8.0	2674	1.071	C3	4.7	3165	1.268	C3	6.3	3524	1.411	C4	3.3	4016	1.609	C4	4.2
	10.0	2727	1.092	C3	6.2	3103	1.243	C4	3.4	3595	1.440	C4	4.4	4087	1.637	C4	5.5
	11.8	2880	1.154	C3	8.0	3285	1.316	C4	4.4	3798	1.521	C4	5.7	4308	1.725	C4	7.1
62	6.0	2916	1.168	C3	4.0	3479	1.393	C3	5.4	3852	1.543	C4	2.8	4408	1.766	C4	3.6
	8.0	3619	1.450	C4	3.5	4389	1.758	C4	4.9	4922	1.971	C5	3.5	5617	2.250	C5	4.4
	10.0	3890	1.558	C4	5.0	4618	1.850	C5	4.0	5357	2.146	C5	5.2	6091	2.440	C5	6.5
	11.8	3926	1.573	C4	6.0	4680	1.875	C5	4.9	5416	2.170	C5	6.3	6147	2.462	C5	7.8
84	6.0	3096	1.240	C3	4.4	3480	1.394	C4	2.4	4078	1.634	C4	3.1	4462	1.787	C4	2.2
	8.0	4013	1.607	C4	4.2	4769	1.910	C4	5.6	5347	2.142	C5	4.1	6102	2.444	C5	5.1
	10.0	4821	1.953	C5	4.3	5724	2.293	C5	5.8	6621	2.652	C5	7.5	7363	2.949	C6	4.7
	11.8	5262	2.108	C5	5.9	6227	2.494	C5	8.0	7039	2.820	C6	5.1	7999	3.204	C6	6.4

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.4 in H_2O, 1 x Ø5" air connection.
For green values, a Ø3/4" manifold connection size is required.

Nozzle Pressure 0.4 inH_2O		Water															
	Ultima	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
(CFM)	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
106	8.0	4446	1.781	C4	5.3	5088	2.038	C5	4.0	5922	2.372	C5	5.2	6747	2.703	C5	6.6
	10.0	5426	2.173	C5	5.6	6429	2.575	C5	7.6	7264	2.910	C6	4.9	8262	3.310	C6	6.1
	11.8	6187	2.478	C5	8.3	7146	2.862	C6	5.5	8258	3.308	C6	7.1	9368	3.752	C6	8.9
126	8.0	4460	1.786	C5	3.2	5346	2.141	C5	4.4	6017	2.410	C6	2.8	7091	2.840	C5	7.1
	10.0	5525	2.213	C5	5.8	6552	2.625	C5	7.8	7402	2.965	C6	5.0	8424	3.374	C6	6.3
	11.8	6325	2.534	C6	4.5	7503	3.005	C6	6.0	8670	3.473	C6	7.7	9838	3.941	C6	9.6
148	10.0	5723	2.293	C5	6.1	6599	2.643	C6	4.1	7670	3.072	C6	5.3	8729	3.496	C6	6.7
	11.8	6414	2.569	C6	4.6	7616	3.051	C6	6.1	8805	3.527	C6	7.9	9995	4.003	C6	9.9

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.4 in H_2O, 1 x Ø5" air connection.
For green values, a Ø3/4" manifold connection size is required.
Please refer to the FTF Group Technical Department for selection not covered within these tables.

Cooling at 0.48 Nozzle Pressure

Nozzle Pressure 0.48 inH_2O		Water															
	Ultima	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
(CFM)	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1959	0.782	C2	3.7	2299	0.918	C2	4.9	2639	1.054	C2	6.2	2977	1.189	C2	7.6
	6.0	2707	1.081	C2	10.3	3024	1.208	C3	4.2	3462	1.382	C3	5.4	3898	1.557	C3	6.6
	8.0	2817	1.125	C3	5.1	3282	1.311	C3	6.7	3745	1.495	C3	8.5	4203	1.679	C3	10.4
	10.0	2834	1.132	C3	6.6	3298	1.317	C3	8.6	3758	1.501	C3	10.8	4127	1.648	C4	5.6
62	6.0	3095	1.236	C3	4.4	3625	1.448	C3	5.8	4154	1.659	C3	7.3	4683	1.870	C3	9.0
	8.0	3892	1.554	C3	9.0	4398	1.756	C4	4.9	5031	2.009	C4	6.2	5663	2.261	C4	7.6
	10.0	4150	1.657	C4	5.6	4832	1.930	C4	7.4	5509	2.200	C4	9.3	6082	2.429	C5	6.5
	11.8	4277	1.708	C4	7.0	4971	1.985	C4	9.1	5564	2.222	C5	6.6	6257	2.499	C5	8.1
84	6.0	3288	1.313	C3	4.8	3864	1.543	C3	6.4	4436	1.772	C3	8.2	5009	2.000	C3	10.1
	8.0	4226	1.688	C4	4.6	4945	1.975	C4	6.0	5663	2.261	C4	7.6	6383	2.549	C4	9.4
	10.0	5048	2.016	C4	7.9	5873	2.346	C4	10.3	6568	2.623	C5	7.4	7393	2.953	C5	9.1
	11.8	5463	2.182	C4	10.7	6226	2.486	C5	8.0	7103	2.837	C5	10.1	7981	3.187	C5	12.3

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.48 in H_2O, 1 x Ø5" air connection.
For green values, a Ø3/4" manifold connection size is required.

Nozzle Pressure 0.48 inH_2O		Water															
	Ultima	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
(CFM)	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
106	8.0	4423	1.766	C4	4.9	5189	2.072	C4	6.5	5950	2.376	C4	8.2	6714	2.681	C4	10.2
	10.0	5511	2.201	C4	9.2	6265	2.502	C5	6.8	7172	2.864	C5	8.6	8083	3.228	C5	10.6
	11.8	6070	2.424	C5	7.6	7071	2.824	C5	9.9	8078	3.226	C5	12.5	9107	3.637	C5	15.4
126	8.0	4652	1.858	C4	5.3	5468	2.183	C4	7.0	6276	2.506	C4	9.0	6885	2.750	C5	6.2
	10.0	5742	2.293	C4	9.8	6523	2.605	C5	7.3	7475	2.985	C5	9.2	8432	3.367	C5	11.4
	11.8	6474	2.585	C5	8.5	7547	3.014	C5	11.1	8633	3.448	C5	14.0	9761	3.898	C5	17.3
148	10.0	5939	2.372	C4	10.4	6770	2.704	C5	7.7	7765	3.101	C5	9.8	8768	3.502	C5	12.1
	11.8	6679	2.667	C5	8.9	7817	3.122	C5	11.8	8953	3.575	C5	14.9	-	-	-	-

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.48 in H_2O, 1 x Ø5" air connection.
For green values, a Ø3/4" manifold connection size is required.
Please refer to the FTF Group Technical Department for selection not covered within these tables.

Heating Selection Tables

Heating at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 H_2O		Water											
	Ultima	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
Q (CFM)	L (ft)	P (btu/h)	P (gpm)	P (ft H_2O)	P (btu/h)	P (gpm)	P (ft H_2O)	P (btu/h)	P (gpm)	P (ft H_2O)	P (btu/h)	P (gpm)	P (ft H_2O)
42	4.0	1171	0.190	0.2	1460	0.190	0.2	1784	0.199	0.2	2255	0.252	0.4
	6.0	1549	0.190	0.4	2087	0.233	0.5	2735	0.305	0.8	3387	0.378	1.1
	8.0	1826	0.204	0.6	2581	0.288	1.0	3345	0.373	1.6	4104	0.458	2.2
	10.0	2131	0.238	1.0	2983	0.333	1.7	3834	0.428	2.6	4674	0.522	3.5
	11.8	2357	0.263	1.3	3278	0.366	2.3	4193	0.468	3.5	5095	0.5269	4.8
62	6.0	1677	0.190	0.4	2399	0.268	0.7	3154	0.352	1.0	3904	0.436	1.5
	8.0	2246	0.251	0.8	3174	0.354	1.5	4098	0.457	2.3	5005	0.559	3.1
	10.0	2667	0.298	1.4	3722	0.416	2.5	4761	0.531	3.7	5782	0.645	5.1
	11.8	2955	0.330	2.0	4094	0.457	3.5	5211	0.582	5.1	6312	0.705	7.0
84	8.0	2467	0.275	1.0	3494	0.390	1.8	4505	0.503	2.7	5493	0.613	3.7
	10.0	3058	0.341	1.8	4254	0.475	3.1	5422	0.605	4.7	6574	0.734	6.4
	11.8	3438	0.384	2.6	4739	0.529	4.5	6014	0.671	6.6	6674	0.756	1.2

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.24 in H_2O, 1 x Ø5" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Nozzle Pressure 0.24 H_2O		Water											
	Ultima	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
Q (CFM)	L (ft)	P (btu/h)	P (gpm)	P (ft H_2O)	P (btu/h)	P (gpm)	P (ft H_2O)	P (btu/h)	P (gpm)	P (ft H_2O)	P (btu/h)	P (gpm)	P (ft H_2O)
106	10.0	3471	0.387	2.4	4803	0.536	4.1	6100	0.681	6.1	6839	0.763	1.1
	11.8	3929	0.439	3.5	5386	0.601	5.9	6274	0.700	1.1	7742	0.864	1.6
126	11.8	4173	0.466	3.8	5712	0.638	6.5	6667	0.744	1.2	8223	0.918	1.7
148	11.8	4282	0.478	4.0	5860	0.654	6.8	6839	0.763	1.3	8437	0.942	1.8

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.24 in H_2O, 1 x Ø5" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 H_2O		Water											
	Ultima	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
Q (CFM)	L (ft)	P (btu/h)	P (gpm)	P (ft H_2O)	P (btu/h)	P (gpm)	P (ft H_2O)	P (btu/h)	P (gpm)	P (ft H_2O)	P (btu/h)	P (gpm)	P (ft H_2O)
42	4.0	1244	0.190	0.2	1555	0.190	0.2	1971	0.220	0.3	2494	0.278	0.4
	6.0	1612	0.190	0.4	2326	0.248	0.6	2908	0.325	0.9	3595	0.401	1.3
	8.0	1933	0.216	0.6	2731	0.305	1.1	3531	0.394	1.7	4322	0.482	2.4
	10.0	2255	0.252	1.1	3155	0.352	1.9	4047	0.452	2.8	4921	0.549	3.8
	11.8	2500	0.279	1.5	3476	0.388	2.6	4435	0.495	3.9	5373	0.600	5.3
62	6.0	1820	0.203	0.4	2632	0.294	0.8	3457	0.386	1.2	4276	0.477	1.7
	8.0	2399	0.268	0.9	3383	0.378	1.7	4359	0.487	2.5	5319	0.594	3.5
	10.0	2826	0.315	1.6	3931	0.439	2.7	5017	0.560	4.1	6089	0.680	5.6
	11.8	3124	0.349	2.2	4312	0.481	3.8	5475	0.611	5.6	6626	0.740	7.6
84	8.0	2697	0.301	1.1	3815	0.426	2.0	4912	0.548	3.1	5985	0.668	4.3
	10.0	3269	0.365	2.0	4537	0.506	3.5	5778	0.645	5.2	6440	0.719	0.9
	11.8	3646	0.407	2.9	5013	0.560	4.9	6361	0.710	7.3	7184	0.802	1.3

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.32 in H_2O, 1 x Ø5" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Nozzle Pressure 0.32 H_2O		Water											
	Ultima	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
Q (CFM)	L (ft)	P (btu/h)	P (gpm)	P (ft H_2O)	P (btu/h)	P (gpm)	P (ft H_2O)	P (btu/h)	P (gpm)	P (ft H_2O)	P (btu/h)	P (gpm)	P (ft H_2O)
106	8.0	3075	0.343	1.5	4344	0.484	2.8	5558	0.620	4.1	6750	0.753	5.7
	10.0	3756	0.419	2.7	5188	0.3579	4.7	6316	0.705	1.0	7401	0.826	1.2
	11.8	4195	0.468	3.9	5743	0.641	6.6	7239	0.808	1.4	8265	0.923	1.7
126	10.0	3985	0.445	3.0	5504	0.614	5.2	6316	0.705	1.0	7852	0.876	1.4
	11.8	4525	0.505	4.4	6186	0.691	7.5	7239	0.808	1.4	8917	0.995	2.0
148	11.8	4752	0.530	4.8	6490	0.725	8.1	7597	0.848	1.6	9363	1.045	2.2

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.32 in H_2O, 1 x Ø5" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.4 Nozzle Pressure

Nozzle Pressure 0.4 H_2O		Water											
Q (CFM)	Ultima	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
42	4.0	1289	0.190	0.2	1616	0.190	0.2	2086	0.233	0.3	2626	0.293	0.5
	6.0	1637	0.190	0.4	2274	0.254	0.6	2967	0.331	0.9	3661	0.409	1.3
	8.0	1970	0.220	0.7	2780	0.310	1.2	3594	0.401	1.8	4399	0.491	2.5
	10.0	2301	0.257	1.1	3221	0.360	1.9	4135	0.462	2.9	5033	0.562	4.0
	11.8	2560	.286	1.6	3564	0.398	2.7	4553	0.508	4.1	5523	0.616	5.5
62	6.0	1919	0.214	0.5	2716	0.303	0.8	3595	0.401	1.3	4428	0.494	1.8
	8.0	2463	0.275	1.0	3397	0.379	1.7	4441	0.496	2.6	5409	0.604	3.6
	10.0	3877	0.321	1.6	3925	0.438	2.7	5096	0.569	4.2	6179	0.690	5.7
	11.8	3180	0.355	2.3	4311	0.481	3.8	5571	0.622	5.8	6740	0.752	7.8
84	6.0	2057	0.230	0.5	2986	0.333	1.0	3918	0.437	1.5	4832	0.539	2.1
	8.0	2813	0.314	1.2	3950	0.441	2.2	5065	0.565	3.3	6156	0.687	4.5
	10.0	3347	0.374	2.1	4626	0.516	3.6	5877	0.656	5.4	6596	0.736	1.0
	11.8	3711	0.414	3.0	5092	0.568	5.1	6449	0.720	7.5	7313	0.816	1.3

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.4 in H_2O, 1 x Ø5" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Nozzle Pressure 0.4 H_2O		Water											
Q (CFM)	Ultima	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
106	8.0	3248	0.363	1.7	4543	0.507	3.0	5799	0.647	4.5	6400	0.714	0.8
	10.0	3870	0.432	2.9	5319	0.594	4.9	6736	0.752	7.3	7625	0.851	1.3
	11.8	4282	0.478	4.0	5843	0.652	6.8	6869	0.767	1.3	8438	0.942	1.8
126	8.0	3391	0.378	1.8	4754	0.531	3.2	6067	0.677	4.8	6682	0.746	0.8
	10.0	4164	0.465	3.3	5719	0.638	5.6	6632	0.740	1.1	8206	0.916	1.5
	11.8	4657	0.520	4.7	6341	0.708	7.8	7475	0.834	1.5	9176	1.024	2.1
148	10.0	4359	0.487	3.6	5987	0.668	6.1	6932	0.774	1.1	8589	0.959	1.6
	11.8	4949	0.552	5.2	6104	0.681	1.1	7945	0.887	1.7	9751	1.088	2.3

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.4 in H_2O, 1 x Ø5" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.48 Nozzle Pressure

Nozzle Pressure 0.48 H_2O		Water											
Q (CFM)	Ultima	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
42	4.0	1517	0.190	0.2	1938	0.216	0.3	2369	0.264	0.4	2860	0.318	0.5
	6.0	2003	0.223	0.5	2686	0.299	0.8	3238	0.360	1.1	3856	0.429	1.4
	8.0	2444	0.272	0.9	3256	0.362	1.5	3905	0.434	2.0	4625	0.515	2.7
	10.0	2849	0.317	1.5	3773	0.420	2.4	4505	0.501	3.3	5316	0.591	4.4
62	6.0	2473	0.275	0.7	3316	0.369	1.1	3987	0.444	1.5	4732	0.527	2.1
	8.0	3062	0.341	1.3	4043	0.450	2.1	4817	0.536	2.9	5675	0.631	3.9
	10.0	3536	0.393	2.2	4639	0.516	3.5	5506	0.613	4.7	6470	0.720	6.2
	11.8	3895	0.433	3.0	5089	0.566	4.8	6027	0.671	6.4	-	-	-
84	6.0	2766	0.308	0.8	3732	0.415	1.4	4493	0.500	1.9	5330	0.593	2.5
	8.0	3547	0.395	1.7	4670	0.520	2.8	5500	0.618	3.7	6525	0.726	5.0
	10.0	4117	0.458	2.8	5366	0.597	4.5	6348	0.706	6.0	-	-	-
	11.8	4525	0.504	3.9	5876	0.654	6.2	6943	0.773	8.3	-	-	-

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.48 in H_2O, 1 x Ø5" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

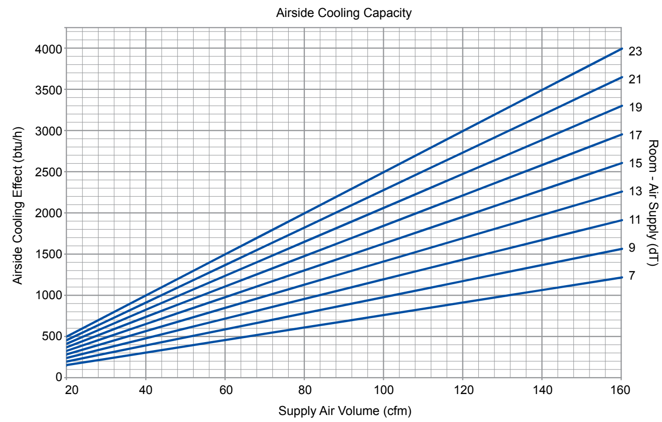
Air Cooling Effect

Cooling effect supplied in the ventilation air

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.

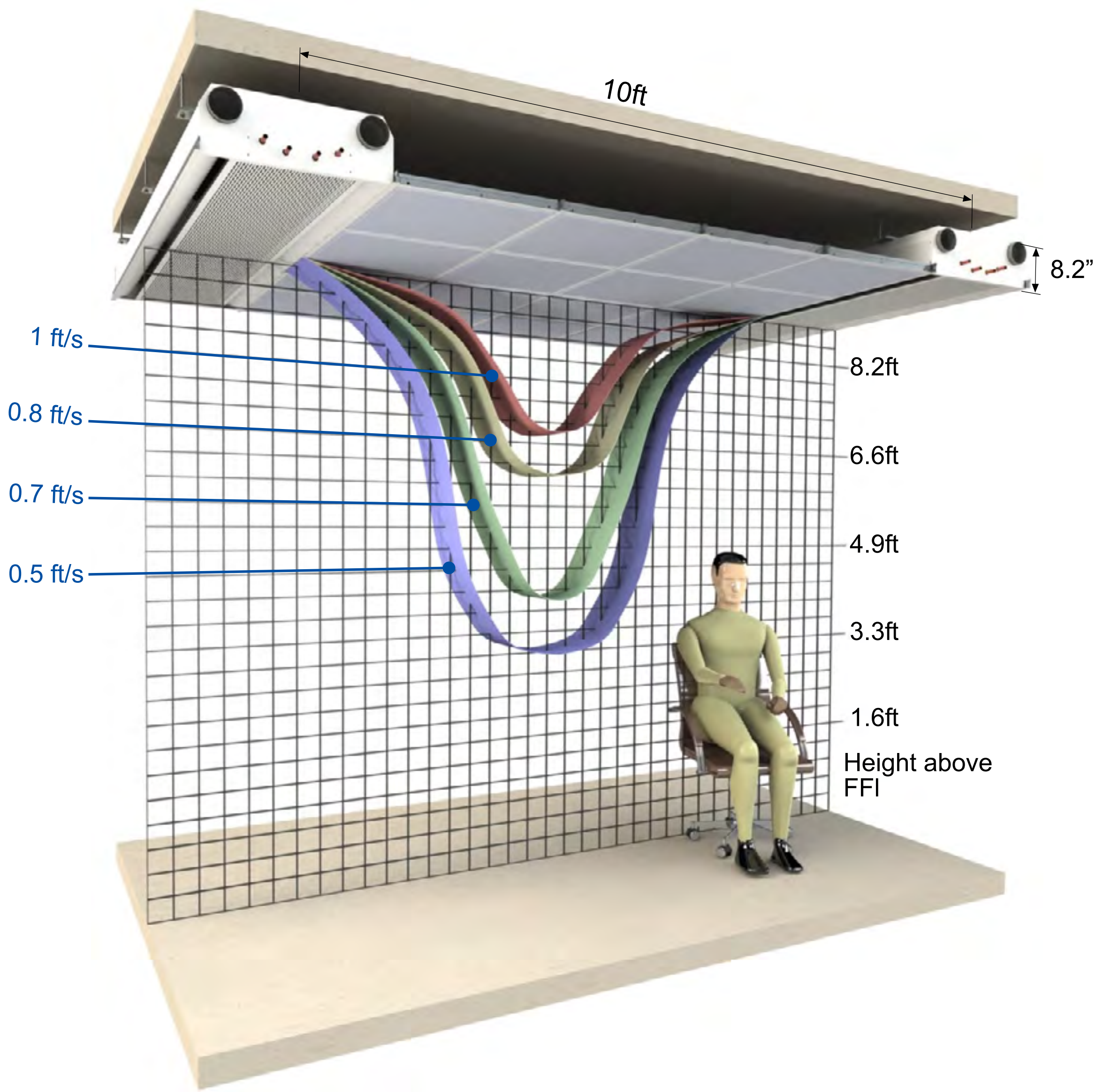
3. The remaining cooling effect has to be supplied by the beam.



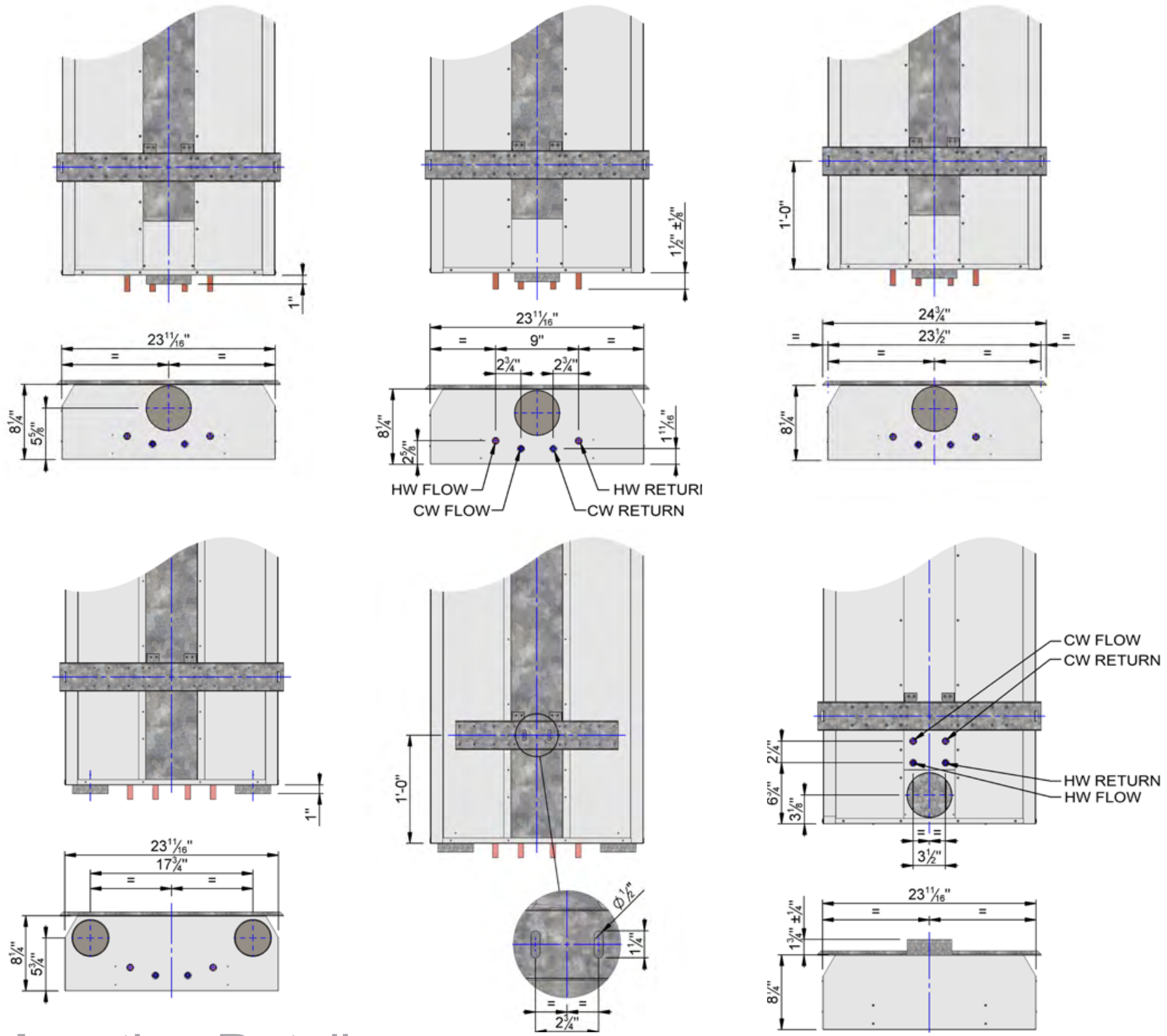
Air cooling effect as a function of airflow.

Scatter Diagram

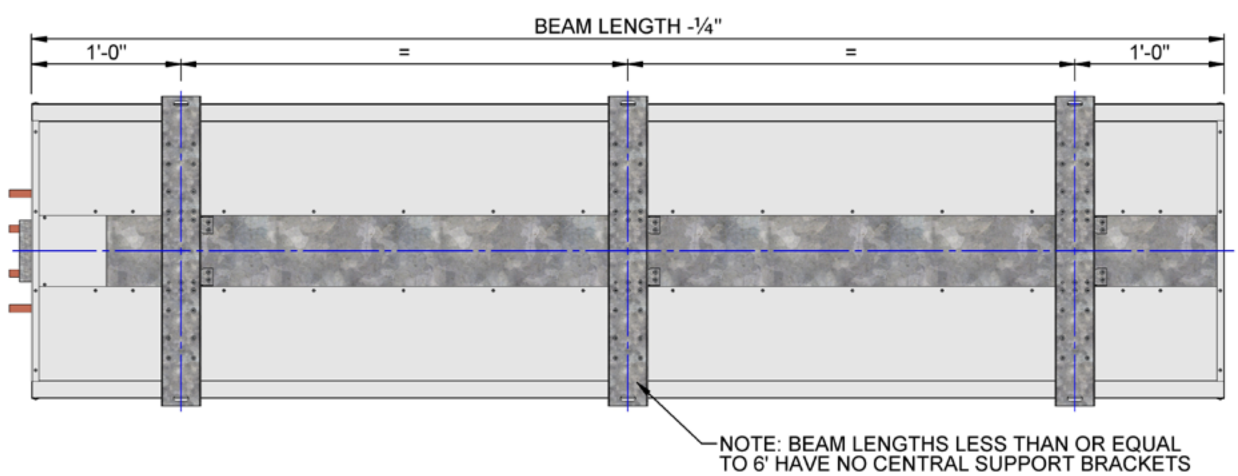
Fresh Air Volume 47 CFM / Active ft @ 0.3” in H_2O



Product Dimensions

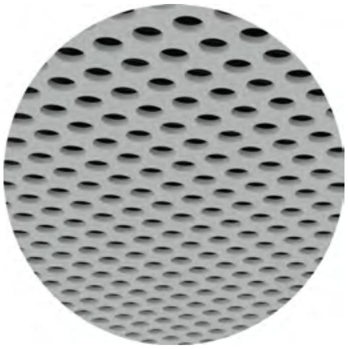


Mounting Details



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
MO - Multiservice Cooling Only
MH - Multiservice 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

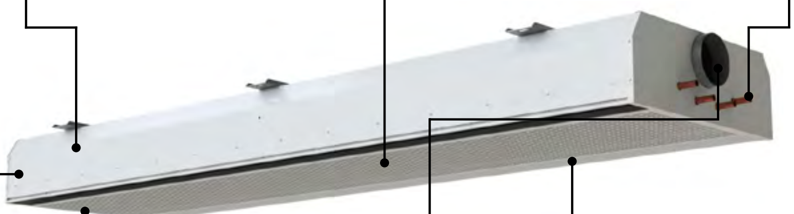
6. Waterside Connection

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

3/4 | C5 | H

Orientation - H: Horizontal / V: Vertical

Chilled Water Connection Size (in) 1/2” or 3/4”



1. Beam Type

UL - Ultima

3. Nominal Beam Length (ft / in)

5. Airside Connection

Air Connection Qty

1 x 5 H

Orientation - H: Horizontal / V: Vertical

Air Connection Spigot Size (in) 4” / 5”

7. Air Supply / Discharge

Air Supply Volume (CFM)

43 | 100 | L

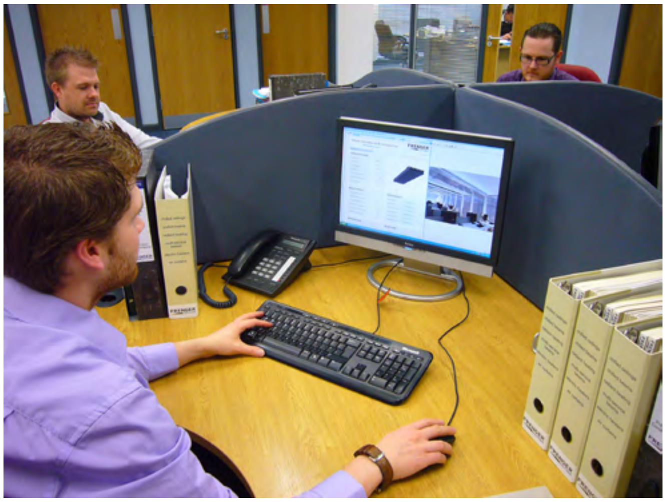
Air Discharge Characteristic -
L: Long Throw - No Discharge Vanes
M: Medium Thrown - 18° Discharge Vanes
S: Short Throw - 35° Discharge Vanes

Air Supply Nozzle Pressure (in H_2O)

Example:

UL	CH	11’08”	7D	-	1 x 5H	3/4C5H	-	43100L
1	2	3	4		5	6		7

Calculation Program



Ultima Active Beam Data

Air Connection	2 x 4”	
Product Overall Length	9’ 4”	ft inches
Manifold Type	C4	
Air Discharge Throw	M	
Nozzle Static Pressure	0.22	” H_2O
Fresh Air Supply Volume	70	CFM
Heating Function	Yes	
Underplate Perforation Type	43% OBR	

The FTF Group’s calculation program for Ultima™ is extremely user friendly.

Simply select from the drop down menu the “Air Connection” configuration. Air volumes in excess of 84.8 CFM and up to 106 CFM should be 2 x 3” diameter.

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

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

“Underplate Perforated” options can be found on page 71.

Design Conditions	Cooling		Heating	
Flow Water Temperature	57.0	°F	122.0	°F
Return Water Temperature	63.0	°F	104.0	°F
Air Supply Temperature	54.0	°F	67.0	°F
Average Room Condition	76.0	°F	69.0	°F
“Air On” Thermal Gradient	1.3	°F		
Room Relative Humidity	50.0	%		

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	16.0	°F	44.0	°F
Waterside Performance	5185	BTU/Hr	4481	BTU/Hr
Water Mass Flowrate	1.726	gpm	0.499	gpm
Waterside Pressure Drop	6.0	ft H_2O	3.3	ft H_2O
Airside Performance	1802	BTU/Hr	-155	BTU/Hr
Total Sensible Performance	**6987**	**BTU/Hr**	**4237**	**BTU/Hr**
Sound Effect Lw	< 35	dB(A)		

“Performance Data” will then be automatically calculated. Likewise “Dimensional Data” will also be calculated.

Finally, the “Design Check” should read “Ok” in green, or detail some warnings in red.
Calculation programs for Ultima™ are available upon request.

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

Active Chilled Beam Calculation Tool

FTF GROUP® Climate

imperial version 3.1

Project Ref.

Ultima Active Beam Data

Air Connection	2 x 4”	
Product Overall Length	9’ 4”	ft inches
Manifold Type	C4	
Air Discharge Throw	M	
Nozzle Static Pressure	0.22	” H_2O
Fresh Air Supply Volume	70	CFM
Heating Function	Yes	
Underplate Perforation Type	43% OBR	

Design Conditions	Cooling		Winter	
Flow Water Temperature	57.0	°F	122.0	°F
Return Water Temperature	63.0	°F	104.0	°F
Air Supply Temperature	54.0	°F	67.0	°F
Average Room Condition	76.0	°F	69.0	°F
“Air On” Thermal Gradient	1.3	°F		
Room Relative Humidity	50.0	%		

Dimensional Data

Width x Depth	2ft x 10ft	
Water Volume	1.2	gal
Dry Weight	155.9	lb
CW Connection	Ø½	inch
LTHW Connection	Ø½	inch

Performance Data	Cooling		Heating	
Room - Mean Water dT	16.0	°F	44.0	°F
Waterside Performance	5185	BTU/Hr	4481	BTU/Hr
Water Mass Flowrate	1.726	gpm	0.499	gpm
Waterside Pressure Drop	6.0	ft H_2O	3.3	ft H_2O
Airside Performance	1802	BTU/Hr	-155	BTU/Hr
Total Sensible Performance	**6987**	**BTU/Hr**	4327	BTU/Hr
Sound Effect Lw	< 35	dB(A)		

Design Check (Warnings)

Supply Air	OK	
Cooling Circuit	OK	
Heating Circuit	OK	
Turn Down @ 0.16 “H_2O	61.5	CFM
Calculated Dew Point	56.0	°F

Model Ref: ULCH9’ 4”5S-2x4”H1/2C4H-700.22M

Notes:
1) Performance calculations are based upon normal clean potable water, it is the system engineer’s responsibility to allow for any reduction in cooling or heating performance due to additives that may reduce the water systems heat transfer coefficient.
2) Pressure drop calculations are based upon ASHRAE guides using clean potable water and exclude any additional losses associated with entry / exit losses, pipe fouling or changes in water quality; it is the system engineer’s responsibility to use good engineering practice.
3) Air discharge throw guidance based on beams on 3m centers for alternative layouts contact FTF Group Technical Dept for throw settings

Compact™

Product Description

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

Compact™ is only 5.2" deep and can achieve up to 1167 BTU/hr/ft total cooling (based on 18dTF and 16 CFM/ft for a 6ft long beam, supplied at 60°F with a 0.4in$H_2$0).

The Compact™ beam contains a number of Patented performance enhancing features and as can be expected from the FTF Group brand, the Compact™ beam is designed to be easily tailored to suit the unique parameters of individual project sites, for the optimum product / system efficiencies. This is partly achieved by the "burst nozzle" arrangement that not only encourages induction, but also reduces noise. Given the size and amount of burst nozzles being appropriately quantified for each project, this provides consistent jet velocities, equal distribution of the air discharge and continuous induction through the heat exchanger (battery). There are no dead spots due to plugging back nozzles from a standard pitch or having to adjust the pressure in the system to suit the amount of open standard nozzle sizes as associated with many competitors' active beams as dead spots and / or reduced 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 12ft.

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

The Compact™ Chilled Beam outer casing is constructed from extruded aluminum and zintec pressed steel. The casing facilitates an aluminum burst nozzle strip (project specific) and a high performance heat exchange battery constructed from copper and aluminum. Beams are available in lengths from 4ft up to 12ft in 4" increments. Typically 2ft wide (1.6ft wide is also available).

In addition to Compact's™ high cooling performance capability of in excess of 1100 BTU/hr/ft, Compact™ can operate well and induce at low air volumes, as little as 2 CFM/ft and even with a low static pressure of just 0.16in $H_2$0. Likewise Compact™ can handle high air volumes up to 18 CFM/ft and up to 0.48in$H_2$0. Please note 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" 15 CFM/ft from a 2 way discharge beam is the maximum for occupancy comfort compliance to BS EN 7730.

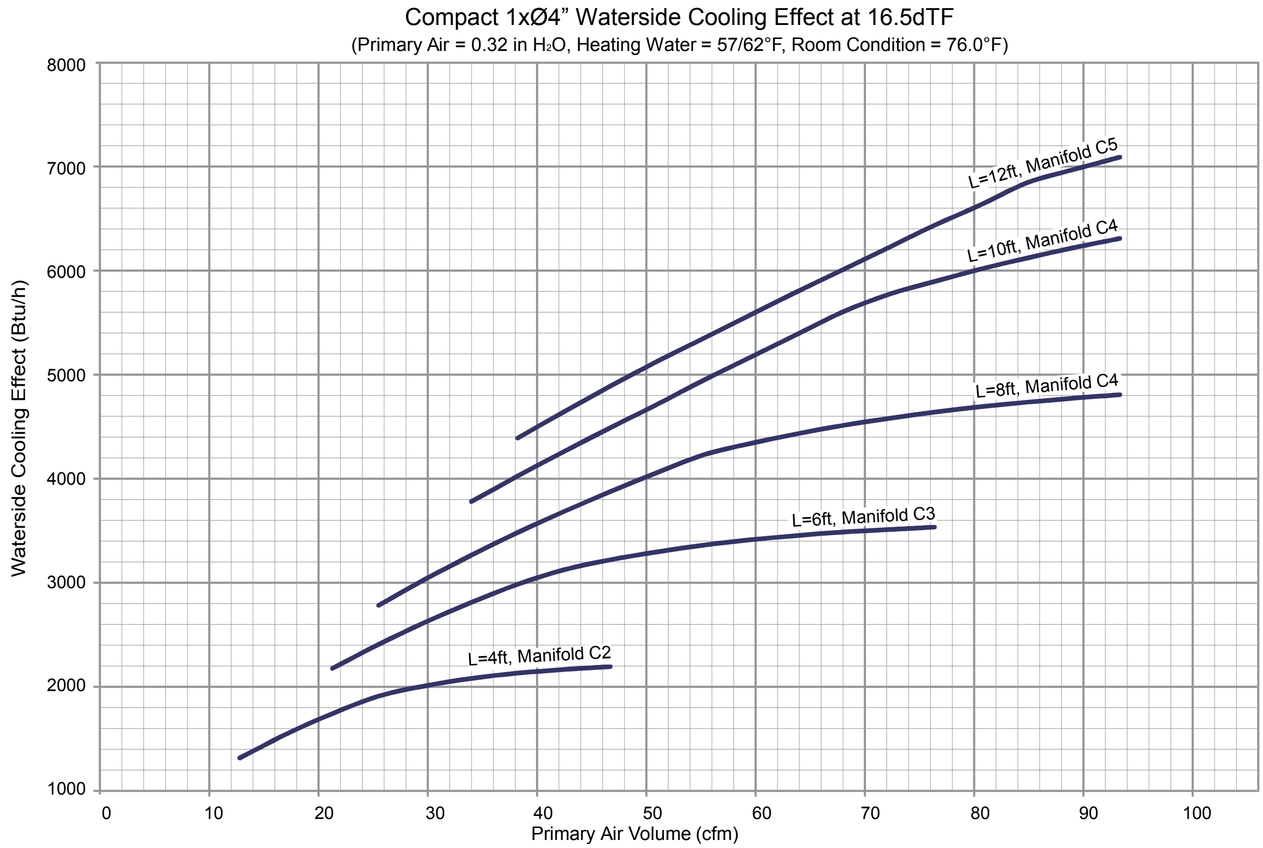
Compact™ can have integrated heating with separate connections (2 pipe connections for cooling and 2 pipes for heating).

The maximum total supply air for the product is limited to 106 CFM. If the total air volume is more than 106 CFM or if you require increased heating performance, refer to the Ultima™ or Eco™ range of active chilled beams by the FTF Group. Visually both units appear identical from the underside.

At a glance

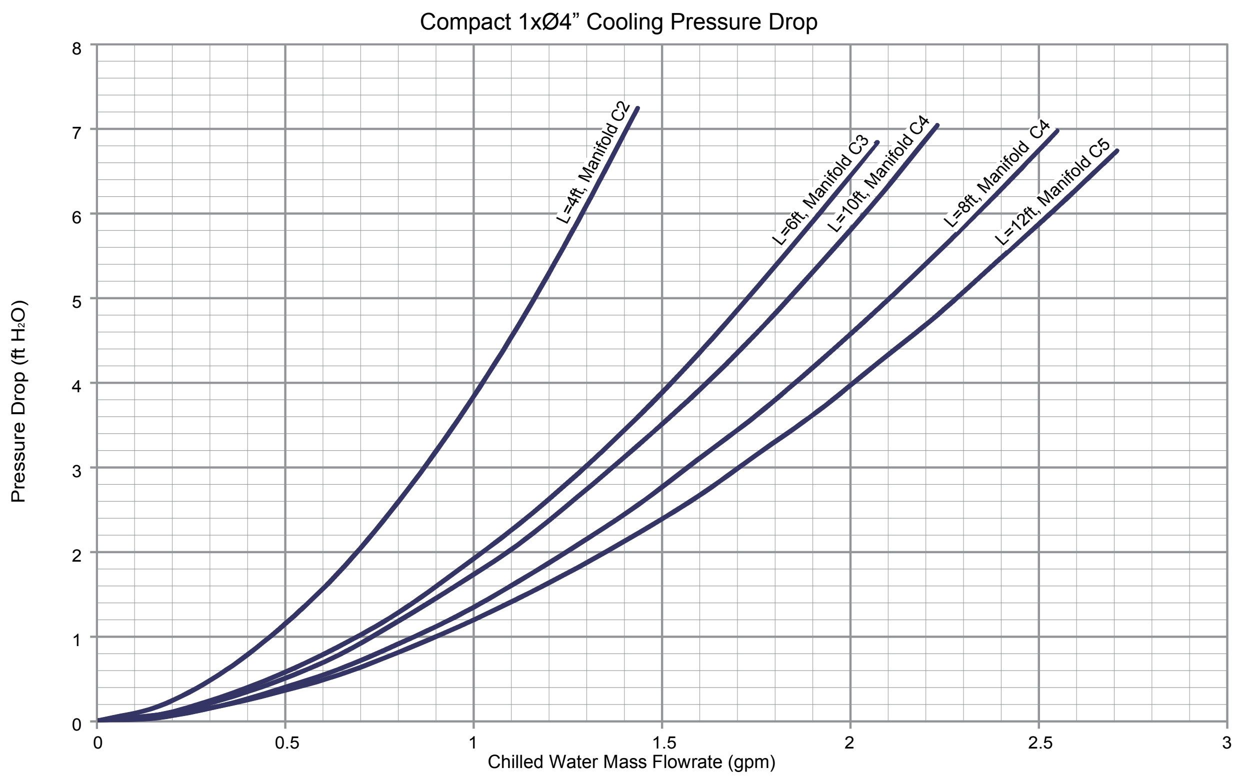
- Shallow Depth (only 5.2").
- High output "1167 BTU/hr/ft"
- Optimize discharge nozzle sizes and pitch factory set to best suit project requirements.
- Coanda effect is initiated within the beam.
- Smooth curved discharged slot as opposed to traditional faceted discharge slots for improved aesthetics.
- Discharge veins are concealed within the beam for improved aesthetics.
- Fan shape distribution for increased occupancy comfort.
- Unique fast fixing of removable underplates that prevents any sagging even on long beam lengths of 12ft
- Various different perforation patterns available for removable underplates
- 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 / ASHRAE 55.

Cooling Performance

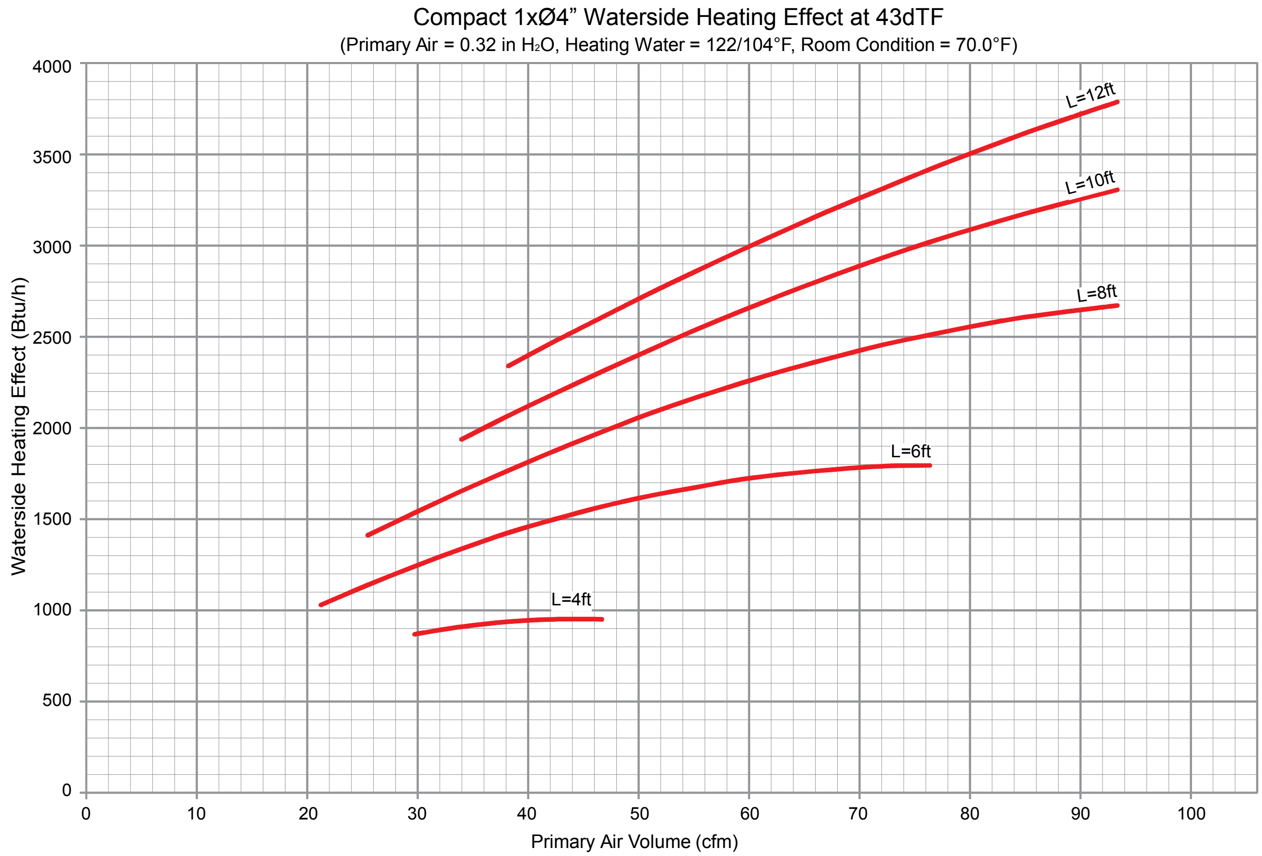


Cooling figures are based on a cooling & heating beam, additional cooling is possible with a cooling only product - contact the FTF Group for more information.

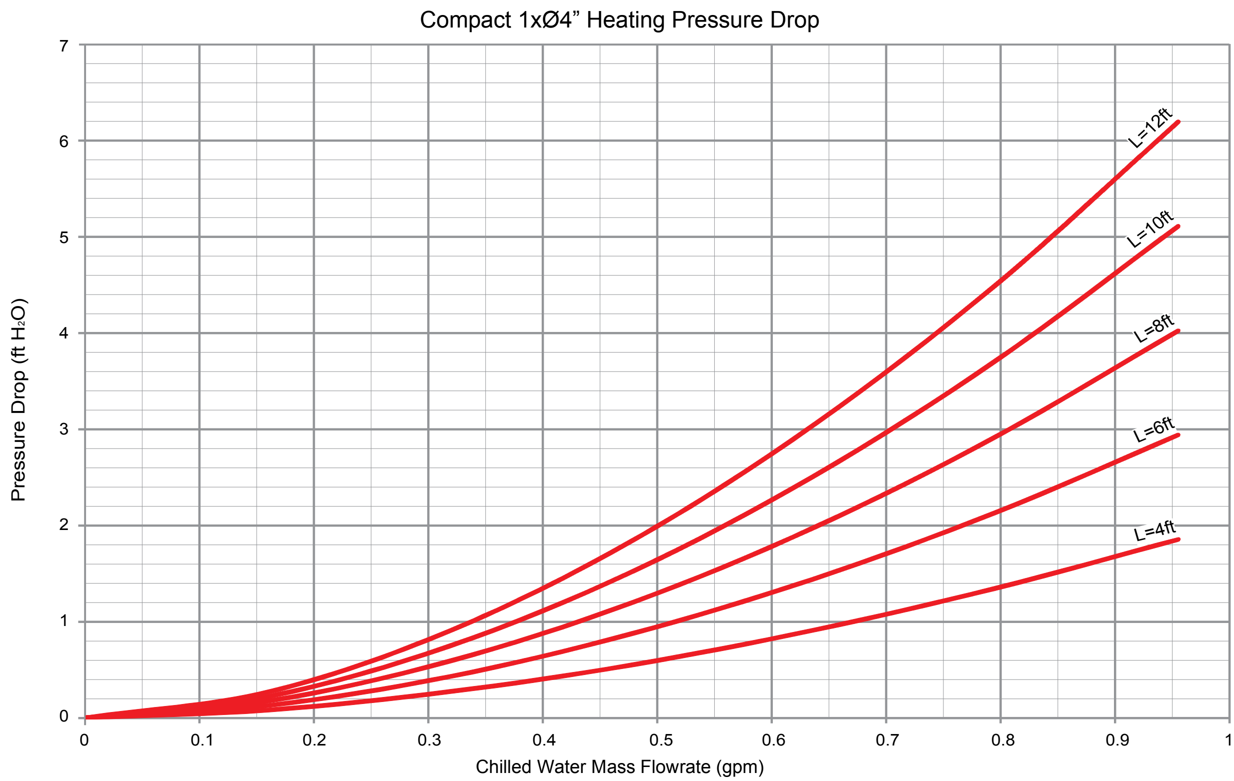
Pressure Drop



Heating Performance



Pressure Drop



Cooling Selection Tables

Cooling at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 inH_2O		Water															
	Compact	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
(CFM)	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	1935	0.773	C2	3.48	2350	0.939	C2	4.88	2799	1.118	C2	6.50	2916	1.164	C3	2.27
	8.0	2232	0.892	C3	1.99	2710	1.083	C3	2.80	3197	1.277	C3	3.73	3720	1.485	C3	4.80
	10.0	2598	1.038	C3	3.35	3137	1.256	C3	4.65	3723	1.487	C3	6.17	4015	1.603	C4	3.77
	11.8	2841	1.136	C3	4.65	3437	1.373	C3	6.43	3819	1.525	C4	4.09	4390	1.753	C4	5.23
62	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	2148	0.859	C2	4.18	2575	1.209	C2	5.82	2813	1.123	C3	2.10	3250	1.298	C3	2.74
	8.0	2715	1.085	C3	2.75	3293	1.316	C3	3.87	3887	1.552	C3	5.16	4533	1.810	C3	6.63
	10.0	3302	1.320	C3	4.94	3740	1.494	C4	3.25	4419	1.765	C4	4.34	5144	2.054	C4	5.59
	11.8	3437	1.373	C4	3.33	4168	1.665	C4	4.65	4968	1.984	C4	6.20	5400	2.156	C5	4.18
84	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	2948	1.178	C3	3.16	3546	1.417	C3	4.44	4139	1.653	C3	5.88	4556	1.819	C4	3.59
	10.0	3747	1.497	C3	6.16	4272	1.707	C4	4.06	5025	2.007	C4	5.42	5538	2.211	C5	3.65
	11.8	4064	1.624	C4	4.38	4957	1.980	C4	6.14	5531	2.209	C5	4.28	6417	2.562	C5	5.52

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.24 in H_2O, 1 x Ø4” air connection.
For green values, a Ø3/4” manifold connection size is required.

Cooling at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 in H_2O		Water															
	Compact	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
(CFM)	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1171	0.468	C2	0.89	1466	0.586	C2	1.30	1757	0.702	C2	1.78	2044	0.816	C2	2.32
	6.0	2076	0.829	C2	3.90	2522	1.008	C2	5.48	2696	1.077	C3	1.95	3129	1.249	C3	2.55
	8.0	2441	0.975	C3	2.30	2953	1.180	C3	3.24	3460	1.382	C3	4.31	3981	1.589	C3	5.51
	10.0	2861	1.143	C3	3.97	3416	1.365	C3	5.47	3851	1.538	C4	3.50	4403	1.758	C4	4.47
	11.8	3142	1.256	C3	5.60	3647	1.457	C4	3.77	4238	1.692	C4	4.95	4827	1.927	C4	6.26
62	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	2272	0.908	C2	4.54	2781	1.111	C2	6.37	2954	1.180	C3	2.28	3423	1.367	C3	2.97
	8.0	2898	1.158	C3	3.05	3519	1.406	C3	4.31	4174	1.667	C3	5.75	4492	1.794	C3	3.47
	10.0	3556	1.421	C3	5.65	4055	1.620	C4	3.72	4771	1.905	C4	4.96	5515	2.202	C4	6.37
	11.8	3753	1.500	C4	3.87	4511	1.802	C4	5.38	5098	2.036	C5	3.77	5851	2.336	C5	4.84
84	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	3102	1.240	C3	3.43	3776	1.508	C3	4.83	4516	1.804	C3	6.45	4810	1.921	C4	3.89
	10.0	3740	1.495	C4	3.18	4546	1.816	C4	4.49	5382	2.149	C4	6.00	5891	2.352	C5	4.03
	11.8	4380	1.750	C4	4.96	5049	2.017	C5	3.61	5960	2.380	C5	4.84	6906	2.757	C5	6.24

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.32 in H_2O, 1 x Ø4” air connection.
For green values, a Ø3/4” manifold connection size is required.

Cooling at 0.4 Nozzle Pressure

Nozzle Pressure 0.4 in H_2O		Water															
(CFM)	Compact	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1290	0.516	C2	1.04	1614	0.645	C2	1.51	1933	0.772	C2	2.07	2247	0.897	C2	2.71
	6.0	2218	0.887	C2	4.37	2691	1.075	C2	6.12	2889	1.154	C3	2.19	3347	1.336	C3	2.86
	8.0	2585	1.033	C3	2.54	3122	1.247	C3	3.57	3654	1.459	C3	4.74	4204	1.678	C3	6.04
	10.0	3023	1.208	C3	4.37	3610	1.443	C3	6.01	4071	1.626	C4	3.85	4652	1.857	C4	4.91
	11.8	3328	1.330	C3	6.17	3860	1.542	C4	4.15	4486	1.792	C4	5.46	5011	2.001	C5	3.74
62	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	2488	0.994	C2	5.27	2722	1.088	C3	1.95	3237	1.293	C3	2.65	3749	1.497	C3	3.45
	8.0	3118	1.246	C3	3.45	3782	1.511	C3	4.86	4487	1.792	C3	6.48	4832	1.929	C4	3.92
	10.0	3755	1.501	C3	6.21	4291	1.714	C4	4.10	5040	2.013	C4	5.46	5564	2.221	C5	3.69
	11.8	3967	1.585	C4	4.26	4763	1.903	C4	5.91	5388	2.152	C5	4.15	6179	2.467	C5	5.32
84	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	3394	1.357	C3	3.98	4114	1.644	C3	5.56	4527	1.808	C4	3.45	5264	2.102	C4	4.51
	10.0	4048	1.618	C4	3.61	4871	1.946	C4	5.03	5765	2.302	C4	6.72	6371	2.544	C5	4.59
	11.8	4651	1.859	C4	5.51	5315	2.124	C5	3.95	6259	2.500	C5	5.29	7323	2.924	C5	6.91

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.4 in H_2O, 1 x Ø4” air connection.
For green values, a Ø3/4” manifold connection size is required.

Cooling at 0.48 Nozzle Pressure

Nozzle Pressure 0.48 in H_2O		Water															
(CFM)	Compact	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1316	0.438	C2	0.82	1657	0.552	C2	1.17	2001	0.666	C2	1.60	2338	0.778	C2	2.08
	6.0	2369	0.788	C2	3.58	2829	0.941	C2	4.91	3285	1.093	C2	6.39	3770	1.255	C2	8.03
	8.0	2975	0.990	C2	7.68	3521	1.172	C2	10.20	3817	1.270	C3	3.70	4339	1.444	C3	4.65
	10.0	3263	1.086	C3	3.64	3852	1.282	C3	4.89	4428	1.474	C3	6.27	5030	1.674	C3	7.77
	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
62	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	2694	0.897	C2	4.42	3218	1.071	C2	6.06	3761	1.252	C2	7.90	4387	1.460	C2	9.95
	8.0	3661	1.218	C2	10.66	3998	1.331	C3	3.90	4655	1.549	C3	5.11	5327	1.773	C3	6.45
	10.0	4013	1.335	C3	5.14	4743	1.578	C3	6.92	5523	1.838	C3	8.89	5964	1.985	C4	5.35
	11.8	4458	1.483	C3	7.43	5275	1.756	C3	9.86	5821	1.937	C4	6.14	6618	2.203	C4	7.66
84	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	2808	0.934	C2	4.74	3357	1.117	C2	6.49	3948	1.314	C2	8.46	4083	1.359	C3	2.85
	8.0	3662	1.219	C3	3.30	4395	1.463	C3	4.56	5125	1.706	C3	5.98	5905	1.965	C3	7.55
	10.0	4664	1.552	C3	6.55	5558	1.850	C3	8.86	6083	2.024	C4	5.40	6961	2.317	C4	6.84
	11.8	5251	1.748	C3	9.65	5899	1.963	C4	6.15	6847	2.279	C4	7.97	7894	2.627	C4	9.99

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.4 in H_2O, 1 x Ø48” air connection.
For green values, a Ø3/4” manifold connection size is required.

Heating Selection Tables

Heating at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 H_2O		Water											
Q (CFM)	Compact	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
42	4.0	755	0.190	0.10	1007	0.190	0.10	1258	0.190	0.10	1510	0.190	0.10
	6.0	1246	0.190	0.17	1662	0.190	0.17	2087	0.232	0.23	2520	0.280	0.32
	8.0	1605	0.190	0.24	2117	0.236	0.34	2633	0.293	0.49	3152	0.351	0.65
	10.0	1903	0.212	0.37	2481	0.279	0.58	3064	0.341	0.82	3646	0.406	1.08
	11.8	2117	0.236	0.53	2746	0.306	0.82	3378	0.376	1.15	4005	0.446	1.51
62	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	1389	0.190	0.17	1857	0.207	0.19	2344	0.261	0.28	2839	0.316	0.39
	8.0	1954	0.217	0.30	2573	0.286	0.48	3198	0.356	0.69	3820	0.425	0.91
	10.0	2359	0.262	0.54	3073	0.342	0.84	3786	0.421	1.18	4491	0.500	1.56
	11.8	2632	0.293	0.78	3409	0.379	1.19	4180	0.465	1.66	4941	0.550	2.18
84	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	1376	0.190	0.17	1842	0.205	0.19	2334	0.260	0.28	2835	0.315	0.39
	8.0	2133	0.237	0.35	2819	0.314	0.56	3507	0.390	0.81	4187	0.466	1.07
	10.0	2716	0.302	0.69	3535	0.393	1.07	4345	0.483	1.50	5141	0.572	1.97
	11.8	3086	0.343	1.03	3985	0.444	1.57	4869	0.542	2.17	5741	0.639	2.83

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.24 in H_2O, 1 x Ø4” air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 H_2O		Water											
Q (CFM)	Compact	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
42	4.0	837	0.190	0.10	1116	0.190	0.10	1394	0.190	0.10	1673	0.190	0.10
	6.0	1331	0.190	0.17	1775	0.198	0.18	2227	0.248	0.26	2687	0.299	0.35
	8.0	1707	0.190	0.24	2242	0.250	0.38	2786	0.310	0.54	3330	0.371	0.72
	10.0	2012	0.224	0.41	2625	0.292	0.64	3239	0.360	0.90	3849	0.428	1.19
	11.8	2243	0.250	0.59	2913	0.324	0.91	3579	0.398	1.27	4236	0.471	1.66
62	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	1528	0.190	0.17	2049	0.228	0.23	2589	0.288	0.34	3136	0.349	0.46
	8.0	2091	0.233	0.34	2750	0.306	0.54	3413	0.380	0.77	4072	0.453	1.02
	10.0	2501	0.278	0.60	3253	0.362	0.93	3999	0.445	1.30	4737	0.527	1.71
	11.8	2784	0.310	0.86	3599	0.401	1.31	4402	0.490	1.82	5193	0.578	2.38
84	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	1546	0.190	0.17	2086	0.232	0.24	2654	0.295	0.35	3228	0.359	0.49
	8.0	2346	0.261	0.42	3100	0.345	0.67	3853	0.429	0.95	4561	0.507	1.25
	10.0	2911	0.324	0.78	3783	0.421	1.21	4643	0.517	1.69	5431	0.604	2.17
	11.8	3279	0.365	1.14	4224	0.470	1.74	5155	0.574	2.40	6006	0.668	3.07

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.32 inH_2O, 1 x Ø4” air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.4 Nozzle Pressure

Nozzle Pressure 0.4 H_2O		Water											
Q (CFM)	Compact	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
42	4.0	893	0.190	0.10	1191	0.190	0.10	1489	0.190	0.10	1797	0.200	0.11
	6.0	1372	0.190	0.17	1828	0.203	0.203	2286	0.254	0.27	2751	0.306	0.37
	8.0	1741	0.194	0.25	2284	0.254	0.39	2836	0.316	0.56	3389	0.377	0.74
	10.0	2052	0.228	0.43	2677	0.298	0.66	3306	0.368	0.93	3930	0.437	1.23
	11.8	2295	0.255	0.61	2982	0.332	0.94	3667	0.408	1.32	4345	0.483	1.74
62	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	1624	0.190	0.16	2166	0.241	0.25	2722	0.303	0.37	3282	0.365	0.50
	8.0	2155	0.240	0.36	2821	0.314	0.56	3490	0.388	0.80	4155	0.462	1.06
	10.0	2549	0.284	0.62	3310	0.368	0.96	4066	0.452	1.34	4812	0.535	1.76
	11.8	2834	0.315	0.89	3662	0.408	1.35	4479	0.498	1.88	5284	0.588	2.45
84	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	1709	0.190	0.17	2307	0.257	0.28	2921	0.325	0.42	3536	0.393	0.57
	8.0	2463	0.274	0.46	3235	0.360	0.72	4004	0.446	1.02	4761	0.530	1.34
	10.0	2991	0.333	0.82	3870	0.431	1.26	4737	0.527	1.75	5591	0.622	2.28
	11.8	3342	0.372	1.18	4297	0.478	1.79	5237	0.583	2.47	6165	0.686	3.21

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.4 in H_2O, 1 x Ø4" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.48 Nozzle Pressure

Nozzle Pressure 0.48 H_2O		Water											
Q (CFM)	Compact	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
42	4.0	1143	0.190	0.06	1371	0.190	0.06	1600	0.190	0.06	1892	0.211	0.08
	6.0	1500	0.190	0.11	1847	0.206	0.12	2302	0.256	0.18	2765	0.308	0.25
	8.0	1743	0.194	0.16	2284	0.254	0.25	2835	0.316	0.37	3389	0.377	0.50
	10.0	2045	0.229	0.27	2682	0.299	0.43	3316	0.369	0.62	3946	0.439	0.84
	11.8	-	-	-	-	-	-	-	-	-	-	-	-
62	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	1696	0.190	0.11	2240	0.249	0.17	2803	0.312	0.26	3368	0.375	0.35
	8.0	2180	0.243	0.23	2842	0.316	0.37	3507	0.390	0.53	4167	0.464	0.72
	10.0	2551	0.284	0.39	3310	0.368	0.61	4065	0.452	0.88	4809	0.535	1.18
	11.8	2834	0.315	0.56	3663	0.408	0.87	4483	0.449	1.24	5291	0.589	1.65
84	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	1850	0.206	0.12	2487	0.277	0.21	2803	0.312	0.26	3781	0.421	0.43
	8.0	2535	0.282	0.30	3311	0.369	0.48	3507	0.390	0.53	4842	0.539	0.93
	10.0	3018	0.336	0.52	3891	0.433	0.82	4065	0.452	0.88	5601	0.623	1.54
	11.8	3347	0.373	0.74	4298	0.478	1.15	4483	0.499	1.24	6154	0.685	2.16

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.48 in H_2O, 1 x Ø4" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

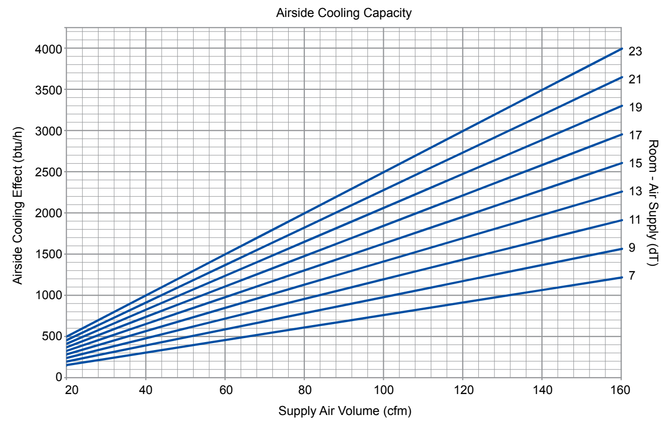
Air Cooling Effect

Cooling effect supplied in the ventilation air

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.

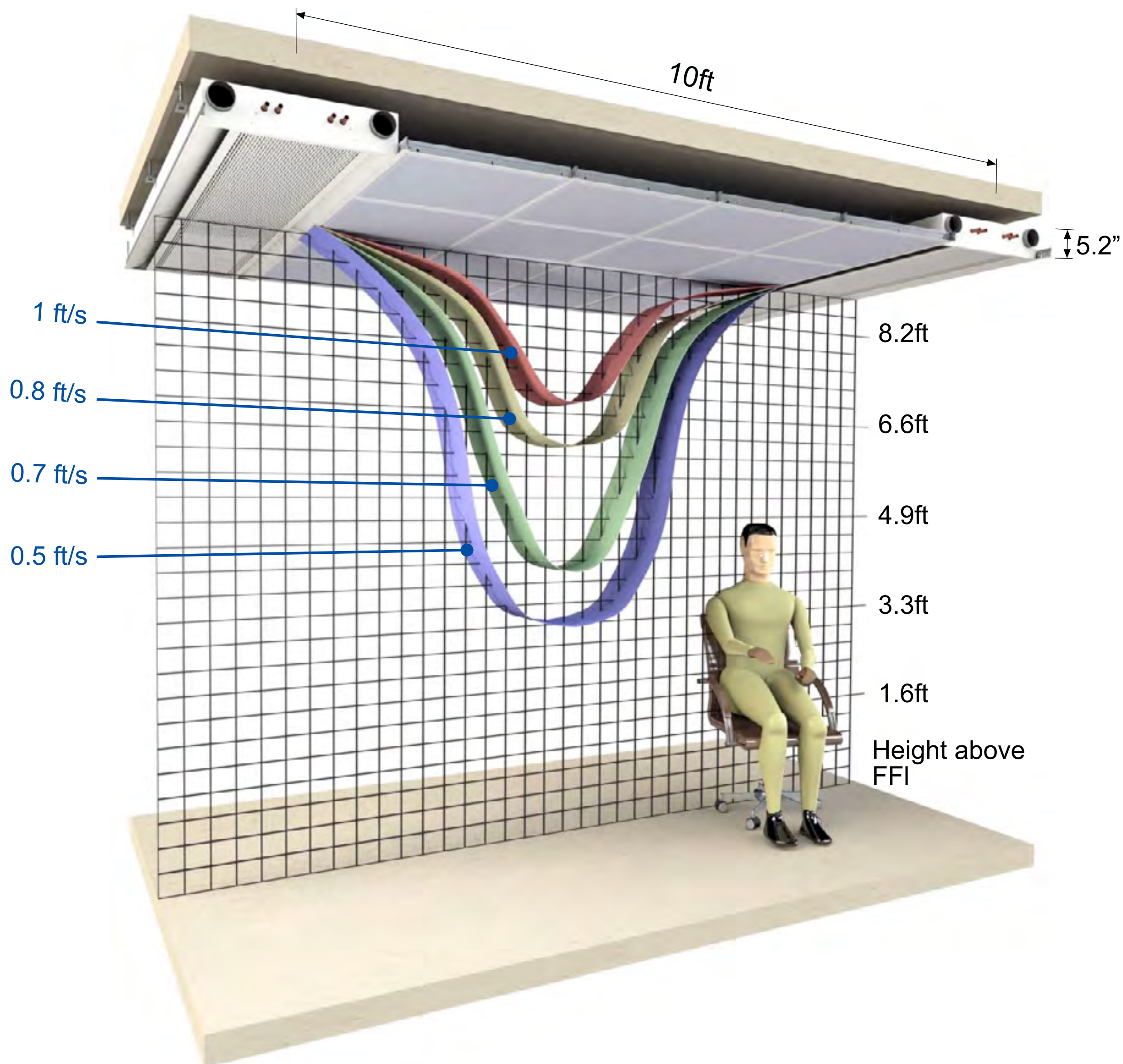
3. The remaining cooling effect has to be supplied by the beam.



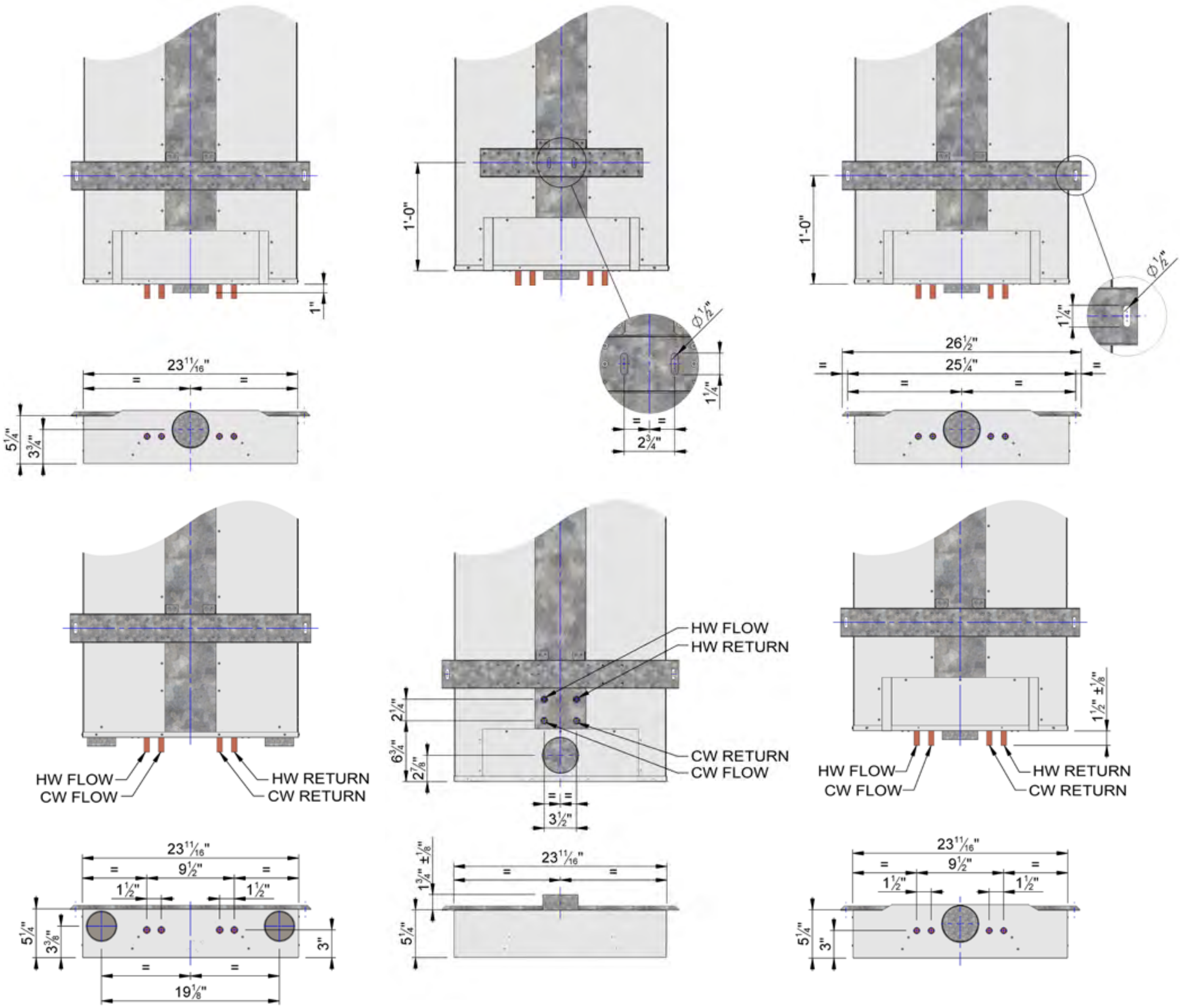
Air cooling effect as a function of airflow.

Scatter Diagram

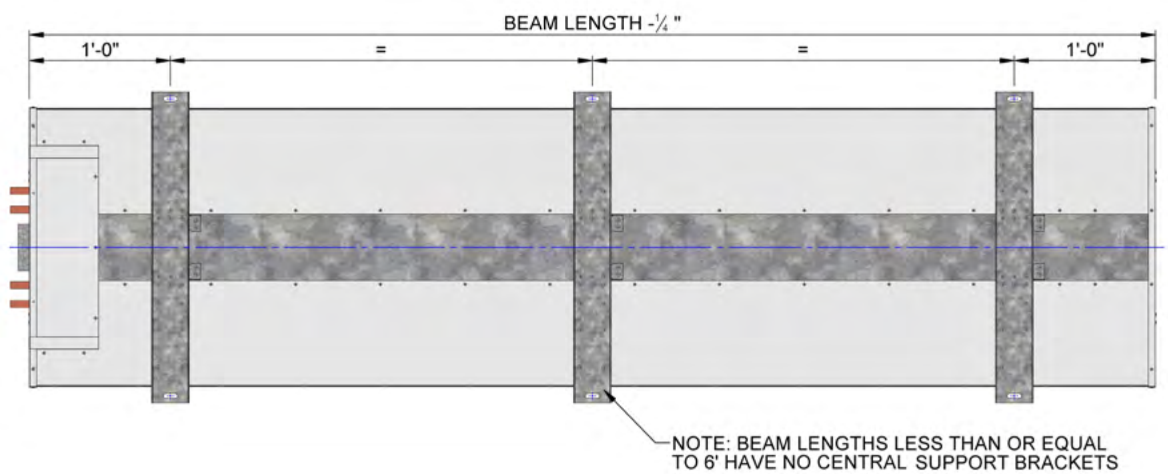
Fresh Air Volume 14 CFM / ft @ 0.3 in H_2O



Product Dimensions



Mounting Details



Perforation Pattern Options

Slot Perforation
45% Free Area

Dot Perforation
33% Free Area

Double Dot Perforation
50% Free Area

Product Ordering Codes

2. Function

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

4. Underplate

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

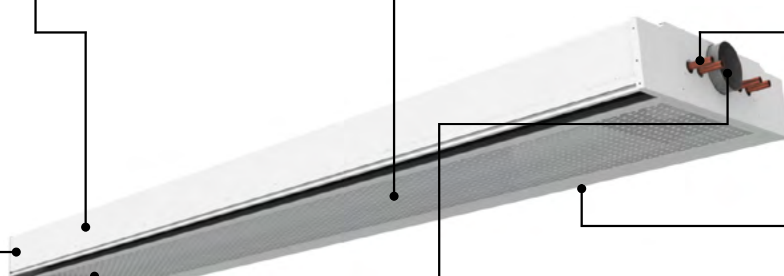
6. Waterside Connection

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

1/2 C3 H

Orientation - H: Horizontal / V: Vertical

Chilled Water Connection Size (in) 1/2" or 3/4"



1. Beam Type

CO - Compact

3. Nominal Beam Length (ft / in)

5. Airside Connection

Air Connection Qty

1 x 4 H

Orientation - H: Horizontal / V: Vertical

Air Connection Spigot Size (in) 3" / 4"

7. Air Supply / Discharge

Air Supply Volume (CFM)

40 04 L

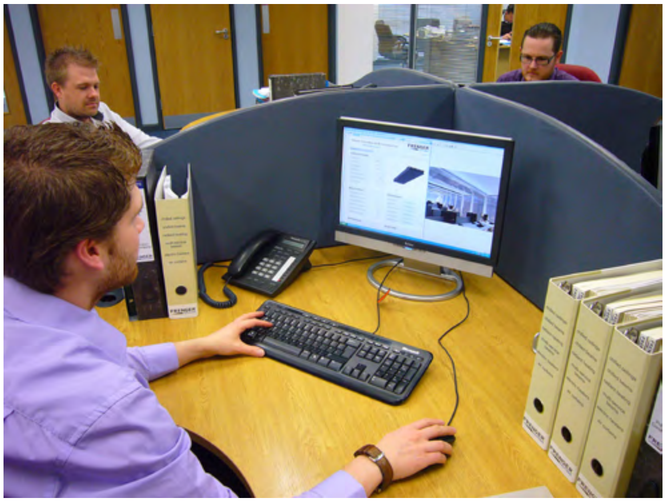
Air Discharge Characteristic -
L: Long Throw - No Discharge Vanes
M: Medium Thrown - 18° Discharge Vanes
S: Short Throw - 35° Discharge Vanes

Air Supply Nozzle Pressure (in H_2O)

Example:

CO	CH	11'08"	7D	-	1 x 4H	1/2C3H	-	4004L
1	2	3	4		5	6		7

Calculation Program



Compact Active Beam Data

Air Connection	1 x 4"	
Product Overall Length	9' 4"	ft inches
Manifold Type	C4	
Air Discharge Throw	M	
Nozzle Static Pressure	0.22	" H_2O
Fresh Air Supply Volume	70	CFM
Heating Function	Yes	
Underplate Perforation Type	43% OBR	

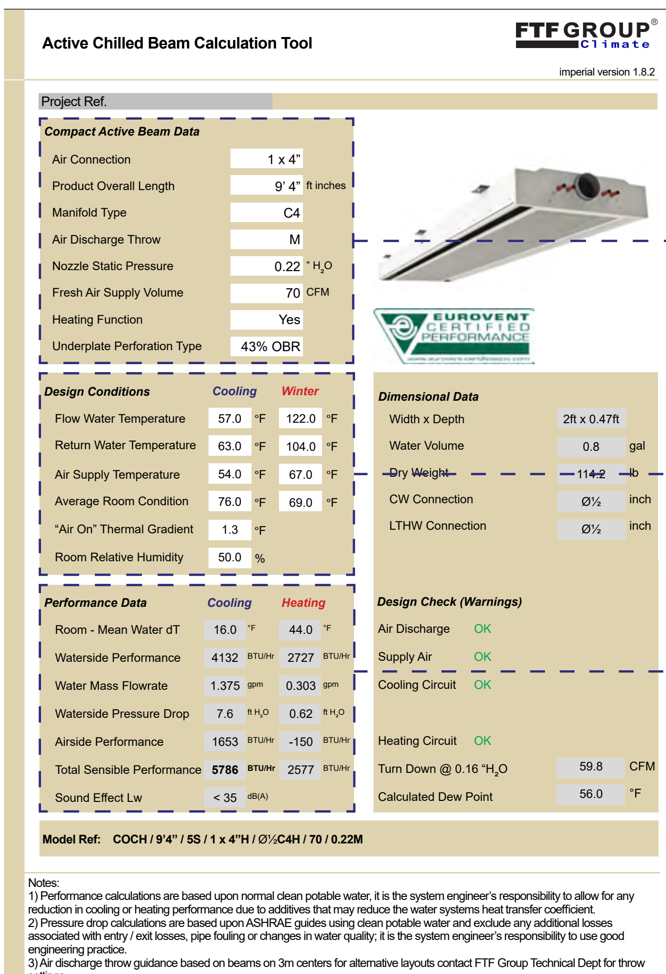
The FTF Group's calculation program for Compact™ is extremely user friendly.

Simply select from the drop down menu the "Air Connection" configuration. Air volumes in excess of 84.8 CFM and up to 106 CFM should be 2 x 3" diameter.

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

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

"Underplate Perforated" options can be found on page 83.



Active Chilled Beam Calculation Tool

FTF GROUP® Climate

imperial version 1.8.2

Project Ref.

Compact Active Beam Data

Air Connection	1 x 4"	
Product Overall Length	9' 4"	ft inches
Manifold Type	C4	
Air Discharge Throw	M	
Nozzle Static Pressure	0.22	" H_2O
Fresh Air Supply Volume	70	CFM
Heating Function	Yes	
Underplate Perforation Type	43% OBR	

Design Conditions	*Cooling*		*Winter*	
Flow Water Temperature	57.0	°F	122.0	°F
Return Water Temperature	63.0	°F	104.0	°F
Air Supply Temperature	54.0	°F	67.0	°F
Average Room Condition	76.0	°F	69.0	°F
"Air On" Thermal Gradient	1.3	°F		
Room Relative Humidity	50.0	%		

Dimensional Data

Width x Depth	2ft x 0.47ft	
Water Volume	0.8	gal
Dry Weight	114.2	lb
CW Connection	Ø½	inch
LTHW Connection	Ø½	inch

Performance Data	*Cooling*		*Heating*	
Room - Mean Water dT	16.0	°F	44.0	°F
Waterside Performance	4132	BTU/Hr	2727	BTU/Hr
Water Mass Flowrate	1.375	gpm	0.303	gpm
Waterside Pressure Drop	7.6	ft H_2O	0.62	ft H_2O
Airside Performance	1653	BTU/Hr	-150	BTU/Hr
Total Sensible Performance	**5786**	**BTU/Hr**	2577	BTU/Hr
Sound Effect Lw	< 35	dB(A)		

Design Check (Warnings)

Air Discharge	OK	
Supply Air	OK	
Cooling Circuit	OK	
Heating Circuit	OK	
Turn Down @ 0.16 "H_2O	59.8	CFM
Calculated Dew Point	56.0	°F

Model Ref: COCH / 9'4" / 5S / 1 x 4"H / Ø½C4H / 70 / 0.22M

Notes:
1) Performance calculations are based upon normal clean potable water, it is the system engineer's responsibility to allow for any reduction in cooling or heating performance due to additives that may reduce the water systems heat transfer coefficient.
2) Pressure drop calculations are based upon ASHRAE guides using clean potable water and exclude any additional losses associated with entry / exit losses, pipe fouling or changes in water quality; it is the system engineer's responsibility to use good engineering practice.
3) Air discharge throw guidance based on beams on 3m centers for alternative layouts contact FTF Group Technical Dept for throw settings

Design Conditions

	Cooling		*Heating*	
Flow Water Temperature	57.0	°F	122.0	°F
Return Water Temperature	63.0	°F	104.0	°F
Air Supply Temperature	54.0	°F	67.0	°F
Average Room Condition	76.0	°F	69.0	°F
"Air On" Thermal Gradient	1.3	°F		
Room Relative Humidity	50.0	%		

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	16.0	°F	44.0	°F
Waterside Performance	4132	BTU/Hr	2727	BTU/Hr
Water Mass Flowrate	1.375	gpm	0.303	gpm
Waterside Pressure Drop	2.61	ft H_2O	0.62	ft H_2O
Airside Performance	1653	BTU/Hr	-150	BTU/Hr
Total Sensible Performance	**5786**	**BTU/Hr**	**2577**	**BTU/Hr**
Sound Effect Lw	< 35	dB(A)		

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

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

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

Eco HQ™ &
Eco-Healthcare HQ™

Product Description

Eco™ HQ is one of 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™ HQ is 9" deep as standard and can be increased to **10 ½" deep for higher air volumes.** Eco™ HQ and can achieve **1167 BTU/hr/ft total cooling** (based on 18dTK and 16 CFM/ft for a 8ft beam supplied at 60°F with a 0.4inH_2O).

The Eco™ HQ is constructed from "High Quality" extruded aluminum side profiles, powdercoat finish to all visible components that not only makes for a robust product that has precision interfaces, but also enhances performance. This beam also contains a number of FTF Group's Patented performance enhancing features and as can be expected from the FTF Group's brand, the Eco HQ™ 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 the FTF Group's "burst nozzle" arrangement that not only encourages induction, but also reduces noise. Given the size and amount of burst nozzles being appropriately quantified for each project, this provides consistent jet velocities, equal distribution of the air discharge and continuous induction through the entire length of the heat exchanger (battery). There are no dead spots due to plugging back nozzle sizes as associated with many competitors' active beams as dead spots and / or reduced jet velocities decrease their cooling capacities / efficiencies.

The FTF Group's heat exchanger batteries are also fitted with extruded aluminium profiles to not only enhance performance but also provide a continuous clip on facility for the underplate. This arrangement keeps the underplates true and flat for long lengths, even up to 11ft 8".

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

Eco™ HQ is available in any length from 4ft up to 12ft" in 4" increments and it constructed from a combination of zinc coated mild steel for non critical components, extruded aluminium where precision and a high quality robust construction is required.

The air chamber for Eco™ HQ is the largest in the FTF Group's product range and can accommodate up to 190 CFM with its 6 5⁄16" diameter single air inlet connection point.

Eco™ HQ beams 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 of recirculated air as the recirculated air does not mix with any air from the ceiling void. The induction ratio of Eco™ HQ is typically 5 times that of the supply air (fresh air) rate.

In addition to Eco™ HQ's high cooling performance capability of in excess of 1000 BTU/hr/ft, **Eco™ HQ can operate well and induce at low air volumes, as little as 2 CFM/ft and even with a low static pressure of just 0.16inH_2O. Likewise Eco HQ can handle high air volumes up to 19 BTU/hr/ft and up to 0.5inH_2O.** Please note 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" 15 CFM/hr/ft from a 2 way discharge beam is the maximum for occupancy comfort compliance to BS EN 7730.

Eco™ HQ 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 57 CFM/hr/ft, which equates to 16 CFM/hr/ft for a 11ft 8" long beam.

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

At a glance

- High output **"1167 BTU/hr/ft"** cooling only beam.
- Can accommodate up to 190 CFM.
- Optimise discharge nozzle sizes and pitch factory set to best suit project requirements.
- Coanda effect is initiated within the beam.
- Discharge vanes are concealed within the beam for improved aesthetics.
- **Fan shape distribution for increased occupancy comfort.**
- **Unique fast fixing or removable underplates that prevents any sagging even on long beam lengths of 12ft".**
- **Various different perforation patters available for removable underplates.**
- **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 / ASHRAE 55.**

Hygiene

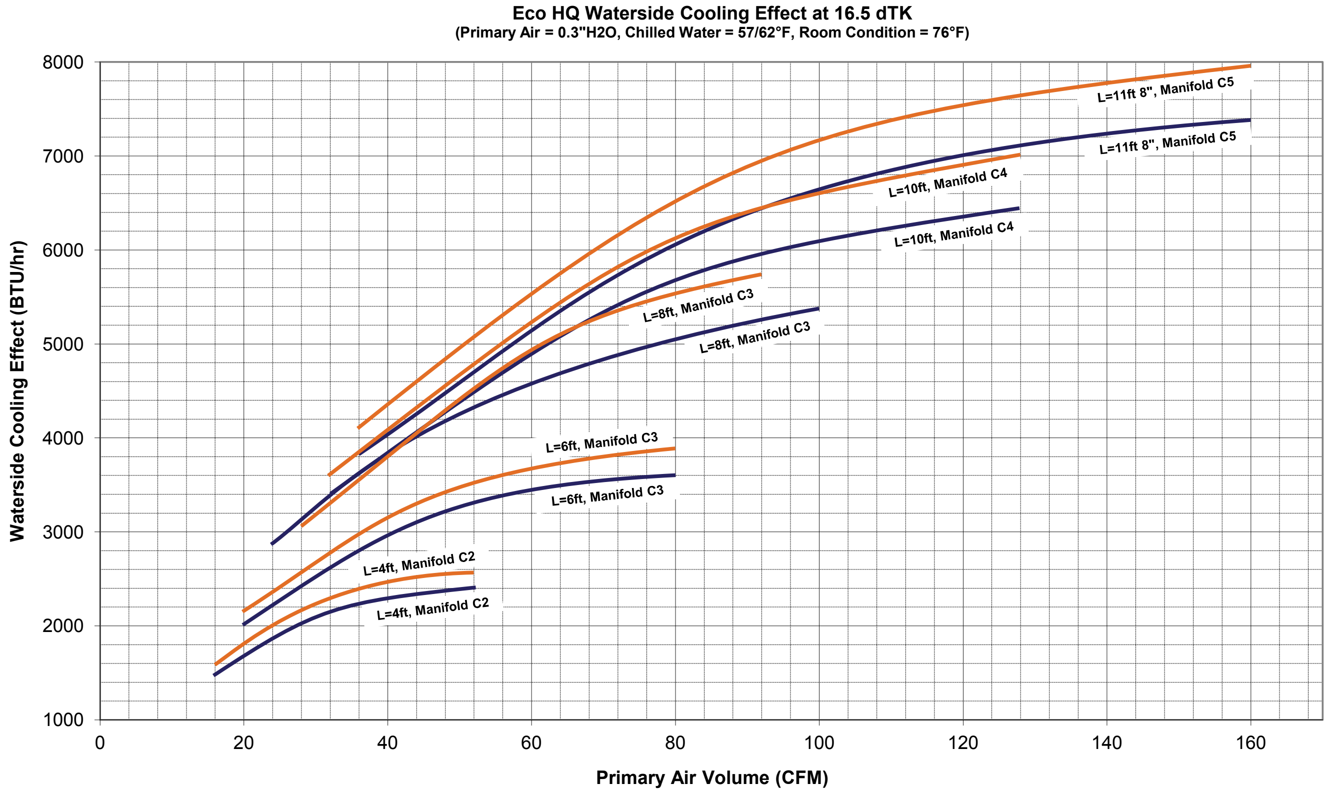
It is important to clean the product to ensure that it looks its best, that it operates at an optimum level, that it will last as long as possible and that it does not present an infection control risk. During development of the Frenger Eco-Healthcare™ HQ chilled beam the ease of cleaning was of the highest priority.

The underplate to Eco-Healthcare™ HQ is simple to lower or totally remove. The underplate hooks onto a patented extruded aluminum section which is part of the fin coil battery. When "joggled" off the extrusion the underplate can hang on the factory fitted safety cords.

When the underplate is either hanging down on the safety cords or totally removed, the fin coil battery is accessible from below. The fin coil battery can be easily lowered by the removal of four retaining screws (pozi headed screwdriver) to enable 2 ⅜" clearance behind the fin coil battery and ample clearance to both sides where air passes.

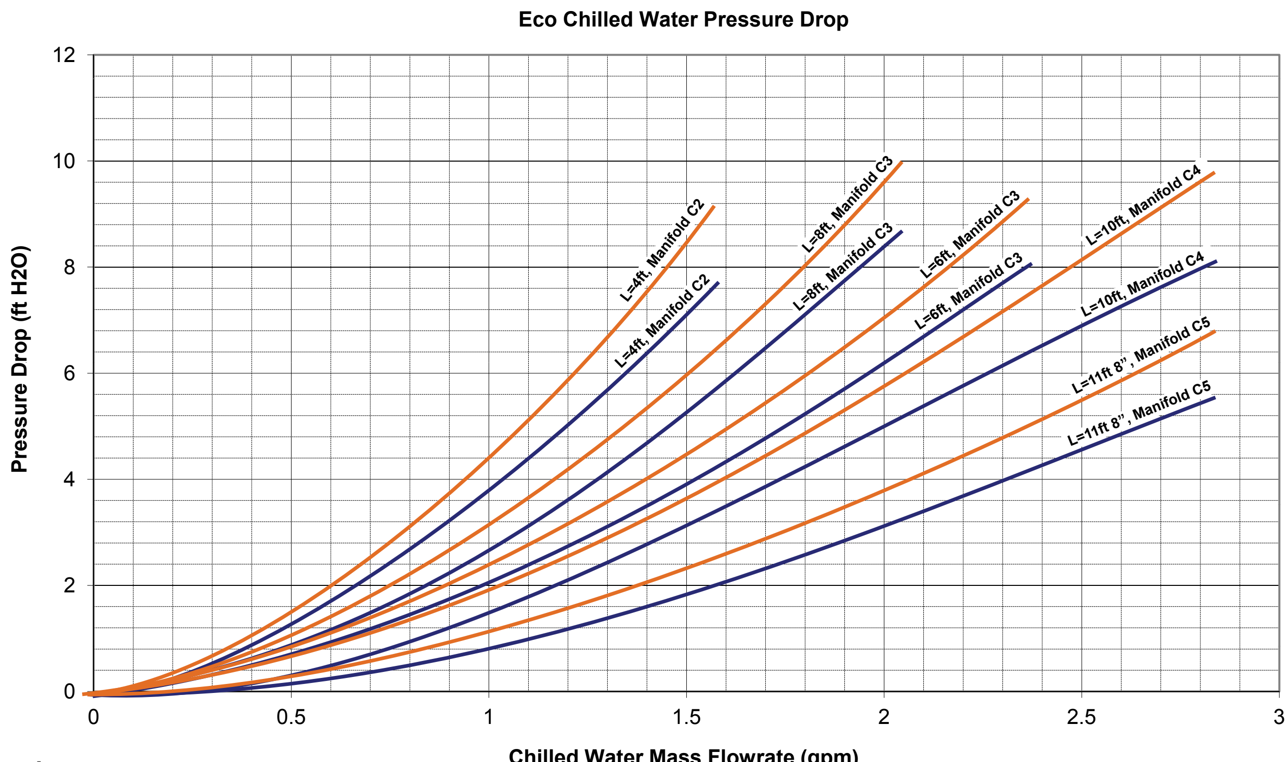
*Eco-Healthcare™ HQ only

Cooling Performance



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

Pressure Drop



Legend:

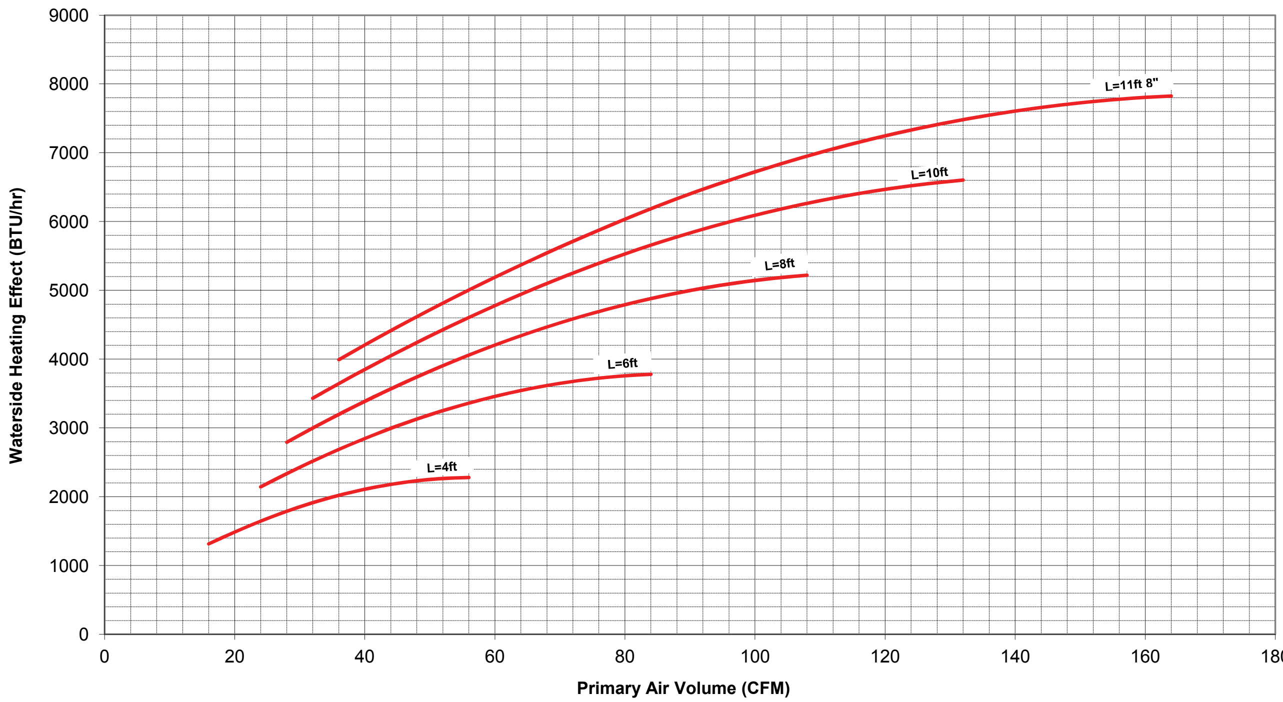
= Cooling Only

= Cooling & Heating

**Please note Eco-Healthcare™ HQ and Eco™ HQ with integrated lighting performance figures may be different - please refer to calculation program or contact Frenger's technical department for more information.*

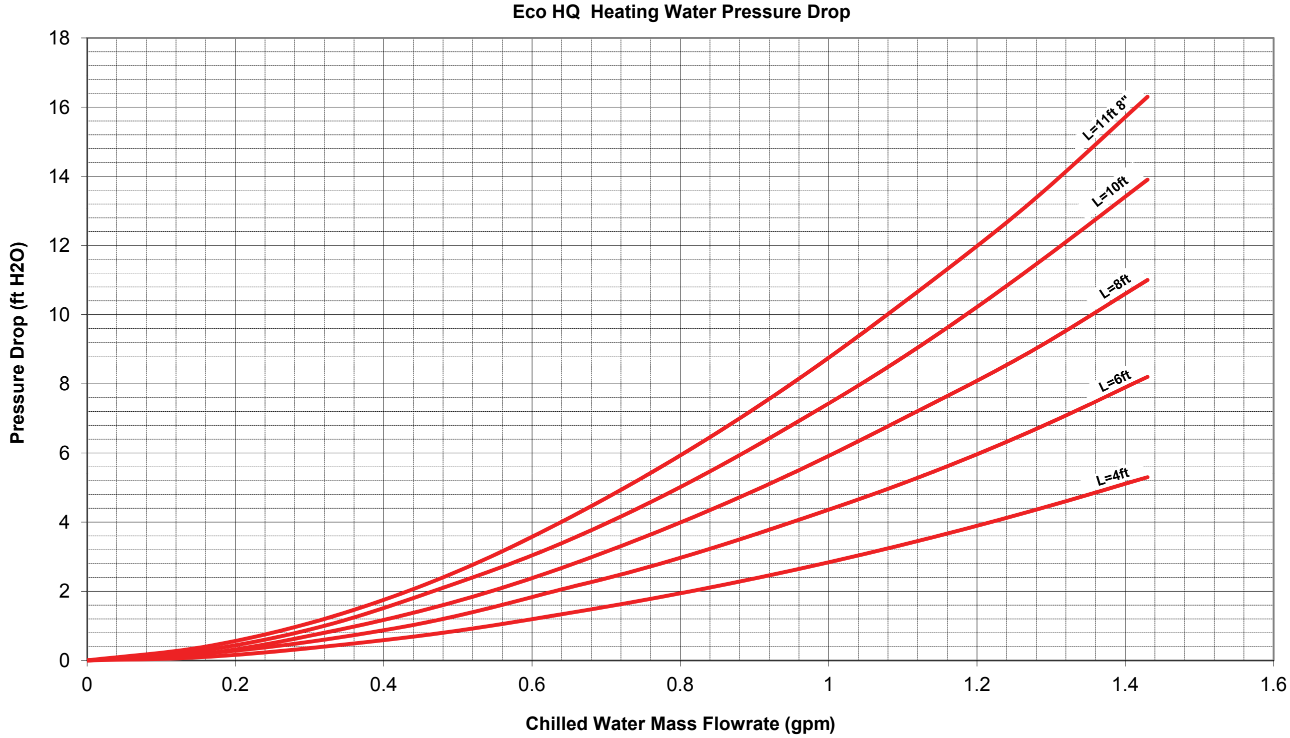
Heating Performance

Eco HQ Waterside Heating Effect at 43.0 dTK
(Primary Air = 0.3"H2O, Heating Water = 122/104°F, Room Condition = 70°F)



Pressure Drop

Eco HQ Heating Water Pressure Drop



**Please note Eco-Healthcare™ HQ and Eco™ HQ with integrated lighting performance figures may be different - please refer to calculation program or contact Frenger's technical department for more information.*

Cooling Selection Tables

Cooling only at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 in H_2O		Water															
(CFM)	Eco HQ	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1658	0.663	C2	2.3	2021	0.807	C2	3.3	2371	0.947	C2	4.4	2716	1.085	C2	5.6
	6.0	2346	0.938	C2	6.2	2578	1.030	C3	2.5	3050	1.218	C3	3.3	3536	1.412	C3	4.3
	8.0	2554	1.021	C3	3.3	3095	1.237	C3	4.6	3684	1.471	C3	6.1	4379	1.748	C3	7.9
	10.0	2892	1.156	C3	5.1	3515	1.405	C3	7.1	3896	1.556	C4	3.9	4490	1.793	C4	5.1
	11.8	3125	1.249	C3	6.8	3590	1.434	C4	4.0	4209	1.681	C4	5.3	4860	1.940	C4	6.7
62	6.0	2670	1.067	C2	8.0	3020	1.207	C3	3.2	3544	1.415	C3	4.3	4062	1.622	C3	5.6
	8.0	3189	1.274	C3	4.7	3913	1.564	C3	6.6	4285	1.711	C4	3.6	4970	1.984	C4	4.7
	10.0	3786	1.513	C3	7.7	4228	1.689	C4	4.4	5048	2.016	C4	5.9	6024	2.405	C4	7.7
	11.8	3822	1.527	C4	4.4	4667	1.865	C4	6.1	5213	2.082	C5	4.1	6054	2.417	C5	5.3
84	8.0	3515	1.405	C3	5.6	4216	1.684	C3	7.8	4743	1.894	C4	4.4	5433	2.169	C4	5.6
	10.0	4057	1.621	C4	4.1	4938	1.973	C4	5.7	5919	2.364	C4	7.6	6411	2.559	C5	5.0
	11.8	4593	1.836	C4	5.8	5283	2.111	C5	4.1	6286	2.510	C5	5.5	7429	2.966	C5	7.1
106	10.0	4363	1.744	C4	4.6	5233	2.091	C4	6.5	5940	2.372	C5	4.4	6805	2.717	C5	5.6
	11.8	5037	2.013	C4	6.9	5817	2.324	C5	4.9	6881	2.748	C5	6.5	8070	3.222	C5	8.3

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.24 ft H_2O, 1 x Ø5" air connection.
For green values, a Ø¾" manifold connection size is required.
Please refer to FTF Group's Technical Department for selections not covered within these tables.

Cooling only at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 in H_2O		Water															
(CFM)	Eco HQ	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1743	0.697	C2	2.5	2128	0.850	C2	3.5	2519	1.006	C2	4.7	2936	1.172	C2	6.1
	6.0	2520	1.007	C2	7.1	2797	1.117	C3	2.8	3302	1.318	C3	3.8	3812	1.522	C3	4.9
	8.0	2800	1.119	C3	3.8	3361	1.343	C3	5.3	3938	1.573	C3	7.0	4332	1.730	C4	3.8
	10.0	3181	1.271	C3	6.1	3691	1.475	C4	3.6	4299	1.717	C4	4.7	4908	1.959	C4	6.0
	11.8	3370	1.347	C4	3.6	4020	1.606	C4	4.9	4662	1.862	C4	6.4	5323	2.125	C4	8.0
62	6.0	2606	1.041	C3	2.5	3182	1.271	C3	3.5	3765	1.504	C3	4.7	4386	1.751	C3	6.1
	8.0	3438	1.374	C3	5.3	4210	1.682	C3	7.5	4622	1.846	C4	4.1	5354	2.137	C4	5.3
	10.0	3786	1.513	C4	3.6	4569	1.826	C4	5.1	5384	2.150	C4	6.8	5938	2.371	C5	4.4
	11.8	4163	1.664	C4	5.1	5004	1.999	C4	7.0	5665	2.262	C5	4.8	6502	2.596	C5	6.1
84	6.0	2733	1.092	C3	2.7	3337	1.333	C3	3.8	3960	1.582	C3	5.1	4644	1.854	C3	6.6
	8.0	3753	1.500	C3	6.2	4257	1.701	C4	3.5	5038	2.012	C4	4.8	5872	2.344	C4	6.1
	10.0	4348	1.737	C4	4.6	5303	2.119	C4	6.4	5933	2.369	C5	4.3	6881	2.747	C5	5.6
	11.8	4945	1.976	C4	6.7	5710	2.281	C5	4.7	6756	2.698	C5	6.3	7919	3.162	C5	8.0
106	8.0	3914	1.564	C3	6.6	4423	1.767	C4	3.8	5246	2.095	C4	5.1	6108	2.439	C4	6.5
	10.0	4622	1.847	C4	5.1	5674	2.267	C4	7.1	6311	2.520	C5	4.8	7286	2.909	C5	6.1
	11.8	5418	2.165	C4	7.6	6217	2.484	C5	5.4	7426	2.966	C5	7.2	8725	3.483	C5	9.1

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.32 ft H_2O, 1 x Ø5" air connection.
For green values, a Ø¾" manifold connection size is required.
Please refer to FTF Group's Technical Department for selections not covered within these tables.

Cooling only at 0.4 Nozzle Pressure

Nozzle Pressure 0.24 in H_2O		Water															
(CFM)	Eco HQ	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)	$\dot{Q}$ (BTU/hr)	$\dot{m}$ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1901	0.760	C2	2.9	2319	0.927	C2	4.1	2746	1.097	C2	5.5	3205	1.280	C2	7.1
	6.0	2660	1.063	C2	7.8	2965	1.185	C3	3.1	3492	1.394	C3	4.2	4026	1.607	C3	5.4
	8.0	2959	1.182	C3	4.2	3549	1.418	C3	5.9	4165	1.663	C3	7.7	4576	1.827	C4	4.2
	10.0	3364	1.344	C3	6.7	3903	1.560	C4	3.9	4545	1.815	C4	5.2	5195	2.074	C4	6.6
	11.8	3576	1.429	C4	3.9	4267	1.705	C4	5.4	4957	1.980	C4	7.1	5551	2.216	C5	4.7
62	4.0	2025	0.809	C2	3.2	2472	0.988	C2	4.5	2941	1.174	C2	6.1	3470	1.386	C2	7.9
	6.0	2840	1.135	C3	2.8	3466	1.385	C3	4.0	4102	1.638	C3	5.4	4786	1.911	C3	7.0
	8.0	3645	1.457	C3	5.9	4158	1.661	C4	3.4	4904	1.958	C4	4.6	5673	2.265	C4	5.9
	10.0	4004	1.600	C4	4.0	4824	1.928	C4	5.6	5685	2.270	C4	7.4	6270	2.503	C5	4.9
	11.8	4396	1.757	C4	5.6	5289	2.113	C4	7.7	5982	2.389	C5	5.3	6871	2.743	C5	6.7
84	6.0	3007	1.202	C3	3.1	3668	1.466	C3	4.4	4359	1.741	C3	6.0	5131	2.049	C3	7.7
	8.0	4093	1.636	C3	7.1	4639	1.854	C4	4.1	5492	2.193	C4	5.5	6411	2.560	C4	7.1
	10.0	4651	1.859	C4	5.1	5668	2.265	C4	7.2	6345	2.534	C5	4.8	7355	2.937	C5	6.2
	11.8	5221	2.086	C4	7.3	6035	2.411	C5	5.2	7131	2.848	C5	6.9	8359	3.337	C5	8.9
106	8.0	4305	1.720	C3	7.6	4855	1.940	C4	4.4	5765	2.302	C4	5.9	6304	2.517	C5	3.8
	10.0	5039	2.014	C4	5.8	5813	2.322	C5	4.1	6882	2.748	C5	5.5	8036	3.208	C5	7.1
	11.8	5512	2.203	C5	4.3	6706	2.679	C5	6.1	8018	3.202	C5	8.2	9595	3.831	C5	10.5

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.4 ft H_2O, 1 x Ø5" air connection.
For green values, a Ø¾" manifold connection size is required.
Please refer to FTF Group's Technical Department for selections not covered within these tables.

Cooling & Heating at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 in H_2O		Water															
(CFM)	Eco HQ	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1544	0.617	C2	1.7	1893	0.756	C2	2.4	2229	0.890	C2	3.2	2557	1.021	C2	4.2
	6.0	2187	0.874	C2	4.6	2713	1.084	C2	6.5	2855	1.140	C3	2.6	3305	1.320	C3	3.4
	8.0	2394	0.957	C3	2.6	2900	1.159	C3	3.6	3431	1.370	C3	4.8	4025	1.607	C3	6.2
	10.0	2715	1.085	C3	4.0	3285	1.312	C3	5.6	3921	1.566	C3	7.4	4210	1.681	C4	3.8
	11.8	2934	1.173	C3	5.4	3559	1.422	C3	7.4	3954	1.579	C4	4.0	4551	1.817	C4	5.0
62	6.0	2512	1.004	C2	6.0	2829	1.130	C3	2.5	3332	1.331	C3	3.4	3824	1.527	C3	4.4
	8.0	2984	1.192	C3	3.7	3642	1.455	C3	5.2	4388	1.752	C3	6.9	4644	1.854	C4	3.5
	10.0	3506	1.401	C3	6.0	3956	1.581	C4	3.3	4693	1.874	C4	4.4	5524	2.206	C4	5.7
	11.8	3583	1.432	C4	3.3	4352	1.739	C4	4.5	5220	2.085	C4	6.1	6303	2.517	C4	7.9
84	8.0	3308	1.322	C3	4.4	3966	1.585	C3	6.2	4459	1.781	C4	3.3	5115	2.042	C4	4.2
	10.0	4108	1.642	C3	7.8	4617	1.845	C4	4.3	5491	2.193	C4	5.7	6496	2.594	C4	7.4
	11.8	4287	1.713	C4	4.4	5292	2.114	C4	6.1	5858	2.339	C5	4.1	6856	2.737	C5	5.3
106	10.0	4100	1.638	C4	3.5	4927	1.969	C4	4.9	5758	2.300	C4	6.4	6407	2.558	C5	4.2
	11.8	4714	1.884	C4	5.1	5771	2.306	C4	7.2	6433	2.569	C5	4.8	7483	2.988	C5	6.2

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.24 ft H_2O, 1 x Ø5” air connection.
For green values, a Ø¾” manifold connection size is required.
Please refer to FTF Group’s Technical Department for selections not covered within these tables.

Cooling & Heating at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 in H_2O		Water															
(CFM)	Eco HQ	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1625	0.649	C2	1.8	1991	0.769	C2	2.6	2356	0.941	C2	3.5	2734	1.092	C2	4.6
	6.0	2357	0.942	C2	5.3	2890	1.155	C2	7.4	3094	1.236	C3	3.0	3572	1.426	C3	3.8
	8.0	2630	1.051	C3	3.0	3163	1.264	C3	4.2	3698	1.477	C3	5.5	4265	1.703	C3	7.0
	10.0	3001	1.199	C3	4.8	3581	1.431	C3	6.6	4055	1.619	C4	3.5	4628	1.848	C4	4.5
	11.8	3255	1.301	C3	6.5	3795	1.516	C4	3.7	4404	1.759	C4	4.8	5016	2.003	C4	6.1
62	6.0	2714	1.085	C2	6.6	2977	1.189	C3	2.7	3522	1.406	C3	3.7	4086	1.631	C3	4.8
	8.0	3219	1.286	C3	4.2	3922	1.567	C3	5.9	4715	1.883	C3	7.8	5007	1.999	C4	4.0
	10.0	3748	1.498	C3	6.9	4291	1.714	C4	3.8	5042	2.014	C4	5.1	5845	2.334	C4	6.5
	11.8	3917	1.565	C4	3.8	4701	1.878	C4	5.3	5531	2.209	C4	6.9	6112	2.440	C5	4.6
84	6.0	2874	1.149	C2	7.1	3121	1.247	C3	3.0	3698	1.477	C3	4.0	4308	1.720	C3	5.2
	8.0	3507	1.401	C3	4.8	4311	1.723	C3	6.8	4712	1.882	C4	3.5	5468	2.183	C4	4.6
	10.0	4070	1.627	C4	3.4	4952	1.987	C4	4.8	5910	2.360	C4	6.4	6429	2.567	C5	4.1
	11.8	4628	1.849	C4	5.0	5664	2.263	C4	6.9	6315	2.522	C5	4.7	7345	2.933	C5	6.0
106	8.0	3649	1.458	C3	5.1	4520	1.806	C3	7.2	4899	1.957	C4	3.8	5704	2.277	C4	4.9
	10.0	4325	1.728	C4	3.8	5279	2.109	C4	5.3	6366	2.542	C4	7.1	6851	2.735	C5	4.6
	11.8	5048	2.017	C4	5.7	6280	2.509	C4	8.0	6903	2.757	C5	5.4	8128	3.245	C5	6.9

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.32 ft H_2O, 1 x Ø5” air connection.
For green values, a Ø¾” manifold connection size is required.
Please refer to FTF Group’s Technical Department for selections not covered within these tables.

Cooling & Heating at 0.4 Nozzle Pressure

Nozzle Pressure 0.24 in H_2O		Water															
(CFM)	Eco HQ	ΔtK - 12.5°F				ΔtK - 14.5°F				ΔtK - 16.5°F				ΔtK - 18.5°F			
	L (ft)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)	Q̇ (BTU/hr)	ṁ (gpm)	Manifold	Δp (ft H_2O)
42	4.0	1772	0.708	C2	2.1	2170	0.867	C2	3.0	2567	1.025	C2	4.1	2982	1.190	C2	5.3
	6.0	2490	0.995	C2	5.8	3051	1.219	C2	8.0	3276	1.308	C3	3.3	3775	1.507	C3	4.2
	8.0	2781	1.111	C3	3.3	3340	1.335	C3	4.6	3907	1.560	C3	6.1	4516	1.803	C3	7.7
	10.0	3173	1.268	C3	5.3	3793	1.515	C3	7.2	4286	1.712	C4	3.9	4895	1.954	C4	5.0
	11.8	3460	1.383	C3	7.2	4027	1.609	C4	4.1	4677	1.868	C4	5.3	5342	2.133	C4	6.8
62	4.0	1890	0.755	C2	2.3	2311	0.923	C2	3.4	2741	1.095	C2	4.5	3206	1.280	C2	5.8
	6.0	2962	1.184	C2	7.5	3243	1.296	C3	3.1	3836	1.532	C3	4.2	4454	1.778	C3	5.5
	8.0	3416	1.365	C3	4.6	4154	1.660	C3	6.5	4597	1.836	C4	3.4	5309	2.119	C4	4.4
	10.0	3958	1.582	C3	7.5	4533	1.811	C4	4.2	5323	2.126	C4	5.6	6177	2.466	C4	7.1
	11.8	4137	1.653	C4	4.2	4966	1.984	C4	5.8	5855	2.338	C4	7.6	6455	2.577	C5	5.0
84	6.0	2806	1.121	C3	2.4	3431	1.371	C3	3.5	4066	1.624	C3	4.7	4748	1.896	C3	6.0
	8.0	3822	1.528	C3	5.5	4710	1.882	C3	7.8	5135	2.051	C4	4.1	5964	2.381	C4	5.3
	10.0	4357	1.741	C4	3.8	5294	2.115	C4	5.4	6319	2.523	C4	7.1	6873	2.744	C5	4.6
	11.8	4889	1.954	C4	5.5	5978	2.388	C4	7.6	6669	2.663	C5	5.2	7752	3.095	C5	6.6
106	8.0	4009	1.602	C3	6.0	4541	1.814	C4	3.3	5380	2.149	C4	4.4	6276	2.506	C4	5.7
	10.0	4714	1.884	C4	4.3	5761	2.302	C4	6.1	6435	2.570	C5	4.1	7474	2.984	C5	5.3
	11.8	5446	2.176	C4	6.5	6273	2.506	C5	4.6	7448	2.974	C5	6.1	8785	3.507	C5	7.8

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.4 ft H_2O, 1 x Ø5” air connection.
For green values, a Ø¾” manifold connection size is required.
Please refer to FTF Group’s Technical Department for selections not covered within these tables.

Heating Selection Tables

Heating at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 in H_2O		Water											
(CFM)	Eco HQ	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
42	4.0	1643	0.190	0.2	2138	0.238	0.2	2682	0.298	0.3	3229	0.359	0.5
	6.0	2261	0.252	0.4	2950	0.328	0.6	3641	0.405	0.9	4324	0.481	1.2
	8.0	2721	0.303	0.7	3516	0.391	1.2	4303	0.479	1.7	5079	0.565	2.2
	10.0	3106	0.346	1.2	3985	0.443	1.8	4851	0.540	2.6	5705	0.635	3.4
	11.8	3395	0.378	1.6	4335	0.482	2.5	5261	0.585	3.5	6177	0.687	4.6
62	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	2669	0.297	0.5	3485	0.388	0.8	4291	0.477	1.2	5082	0.566	1.6
	8.0	3346	0.372	1.1	4305	0.479	1.7	5247	0.584	2.3	6178	0.687	3.1
	10.0	3848	0.428	1.7	4912	0.547	2.6	5959	0.663	3.7	7001	0.779	4.9
	11.8	4200	0.467	2.3	5338	0.594	3.5	6461	0.719	5.0	7583	0.844	6.6
84	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	3773	0.420	1.3	4842	0.539	2.0	5889	0.655	2.9	6925	0.771	3.8
	10.0	4463	0.497	2.2	5676	0.632	3.4	6878	0.765	4.7	8085	0.900	6.3
	11.8	4917	0.547	3.1	6231	0.693	4.7	7543	0.839	6.5	8869	0.987	8.6
106	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	-	-	-	-	-	-	-	-	-	-	-	-
	10.0	4855	0.540	2.6	6164	0.686	3.9	7464	0.831	5.4	8773	0.976	7.2
	11.8	5444	0.606	3.7	6889	0.767	5.5	8341	0.928	7.7	9807	1.091	10.3

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.24 in H_2O, 1 x Ø5” air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 in H_2O		Water											
(CFM)	Eco HQ	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
42	4.0	1743	0.194	0.2	2318	0.258	0.3	2904	0.323	0.4	3493	0.389	0.6
	6.0	2399	0.267	0.4	3125	0.348	0.7	3849	0.428	1.0	4564	0.508	1.4
	8.0	2877	0.320	0.8	3709	0.413	1.3	4529	0.504	1.8	5336	0.594	2.4
	10.0	3289	0.366	1.3	4209	0.468	2.0	5110	0.569	2.8	5999	0.668	3.7
	11.8	3604	0.401	1.8	4589	0.511	2.7	5553	0.618	3.8	6507	0.724	5.1
62	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	2886	0.321	0.6	3762	0.419	1.0	4625	0.515	1.4	5474	0.609	1.9
	8.0	3551	0.395	1.2	4559	0.507	1.8	5551	0.618	2.6	6539	0.728	3.5
	10.0	4045	0.452	1.9	5168	0.575	2.9	6263	0.697	4.0	7362	0.819	5.4
	11.8	4422	0.492	2.6	5606	0.624	3.9	6779	0.755	5.4	7959	0.886	7.2
84	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	3140	0.350	0.7	4109	0.457	1.1	5057	0.563	1.6	5981	0.666	2.2
	8.0	4077	0.454	1.5	5225	0.582	2.3	6352	0.707	3.3	7473	0.832	4.4
	10.0	4741	0.528	2.5	6026	0.671	3.8	7309	0.813	5.3	8606	0.958	7.0
	11.8	5190	0.578	3.4	6577	0.732	5.2	7976	0.888	7.2	9392	1.045	9.6
106	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	4384	0.488	1.7	5618	0.625	2.7	6820	0.759	3.7	8012	0.892	4.9
	10.0	5245	0.584	3.0	6656	0.741	4.5	8064	0.898	6.3	9485	1.056	8.4
	11.8	5804	0.646	4.1	7351	0.818	6.3	8914	0.992	8.8	10488	1.167	11.7

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.32 in H_2O, 1 x Ø5” air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.4 Nozzle Pressure

Nozzle Pressure 0.4 in H_2O		Water											
(CFM)	Eco HQ	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
42	4.0	1825	0.203	0.2	2410	0.268	0.3	3005	0.335	0.4	3601	0.401	0.6
	6.0	2446	0.272	0.5	3182	0.354	0.7	3914	0.436	1.0	4638	0.516	1.4
	8.0	2930	0.326	0.8	3779	0.421	1.3	4615	0.514	1.9	5439	0.605	2.5
	10.0	3363	0.374	1.4	4308	0.480	2.1	5236	0.583	3.0	6151	0.685	3.9
	11.8	3702	0.412	1.9	4721	0.525	2.9	5720	0.637	4.0	6709	0.747	5.3
62	4.0	2034	0.226	0.2	2722	0.303	0.4	3418	0.380	0.5	4108	0.457	0.7
	6.0	2984	0.332	0.7	3870	0.431	1.0	4743	0.528	1.5	5601	0.623	2.0
	8.0	3616	0.403	1.2	4634	0.516	1.9	5635	0.627	2.7	6628	0.738	3.5
	10.0	4126	0.459	1.9	5253	0.585	3.0	6363	0.708	4.2	7473	0.832	5.5
	11.8	4505	0.501	2.7	5713	0.636	4.0	6908	0.769	5.6	8109	0.903	7.4
84	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	3341	0.372	0.8	4343	0.483	1.3	5321	0.592	1.8	6275	0.698	2.4
	8.0	4193	0.467	1.6	5354	0.596	2.4	6495	0.723	3.4	7631	0.849	4.5
	10.0	4824	0.537	2.6	6119	0.681	3.9	7409	0.825	5.4	8710	0.969	7.2
	11.8	5270	0.587	3.5	6668	0.742	5.3	8072	0.898	7.4	9492	1.056	9.8
106	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	4594	0.511	1.9	5861	0.652	2.9	7100	0.790	4.0	8336	0.928	5.3
	10.0	5377	0.598	3.1	6807	0.758	4.7	8236	0.917	6.5	9679	1.077	8.7
	11.8	5905	0.657	4.3	7463	0.831	6.4	9036	1.006	9.0	10620	1.182	11.9

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.4 in H_2O, 1 x Ø5" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.48 Nozzle Pressure

Nozzle Pressure 0.48 in H_2O		Water											
(CFM)	Eco HQ	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)	Q̇(BTU/hr)	ṁ(gpm)	Δ(ft H_2O)
42	4.0	1907	0.212	0.2	2502	0.278	0.3	3105	0.346	0.5	3708	0.413	0.6
	6.0	2493	0.278	0.5	3237	0.360	0.8	3978	0.443	1.1	4710	0.524	1.4
	8.0	2984	0.332	0.9	3849	0.428	1.4	4702	0.523	1.9	5543	0.617	2.6
	10.0	3438	0.383	1.4	4410	0.491	2.2	5365	0.597	3.1	6307	0.702	4.1
	11.8	-	-	-	-	-	-	-	-	-	-	-	-
62	4.0	2215	0.247	0.3	2944	0.328	0.4	3675	0.409	0.6	4395	0.489	0.8
	6.0	3081	0.343	0.7	3976	0.443	1.1	4857	0.541	1.5	5723	0.637	2.0
	8.0	3681	0.410	1.3	4708	0.524	1.9	5716	0.636	2.7	6714	0.747	3.6
	10.0	4195	0.467	2.0	5337	0.594	3.1	6462	0.719	4.3	7582	0.844	5.6
	11.8	4589	0.511	2.7	5820	0.648	4.2	7037	0.783	5.8	8258	0.919	7.7
84	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	3539	0.394	0.9	4572	0.509	1.4	5578	0.621	1.9	6564	0.731	2.6
	8.0	4305	0.479	1.7	5478	0.610	2.5	6632	0.738	3.5	7783	0.866	4.7
	10.0	4905	0.546	2.6	6208	0.691	4.0	7502	0.835	5.5	8806	0.980	7.3
	11.8	-	-	-	-	-	-	-	-	-	-	-	-
106	4.0	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	3814	0.425	1.0	4937	0.549	1.6	6022	0.670	2.2	7083	0.788	3.0
	8.0	4799	0.534	2.0	6098	0.679	3.1	7376	0.821	4.3	8657	0.964	5.7
	10.0	5504	0.613	3.2	6952	0.774	4.9	8400	0.935	6.8	9865	1.098	8.9
	11.8	-	-	-	-	-	-	-	-	-	-	-	-

Flow-adjust waterside heating effect table. Heating circuit Δt = 18°F (Water in-out), nozzle pressure of 0.48 in H_2O, 1 x Ø5" air connection.

For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

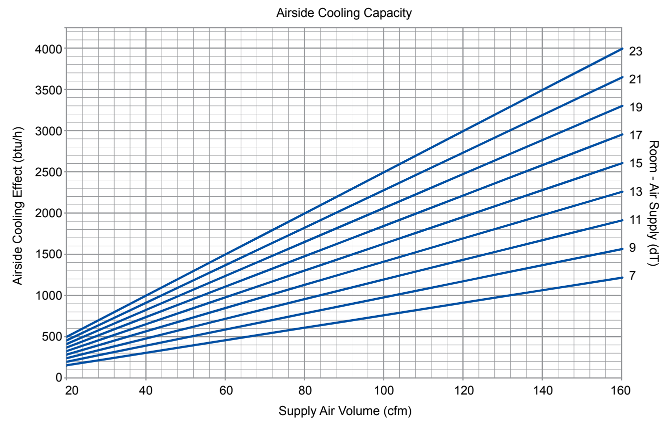
Air Cooling Effect

Cooling effect supplied in the ventilation air

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.

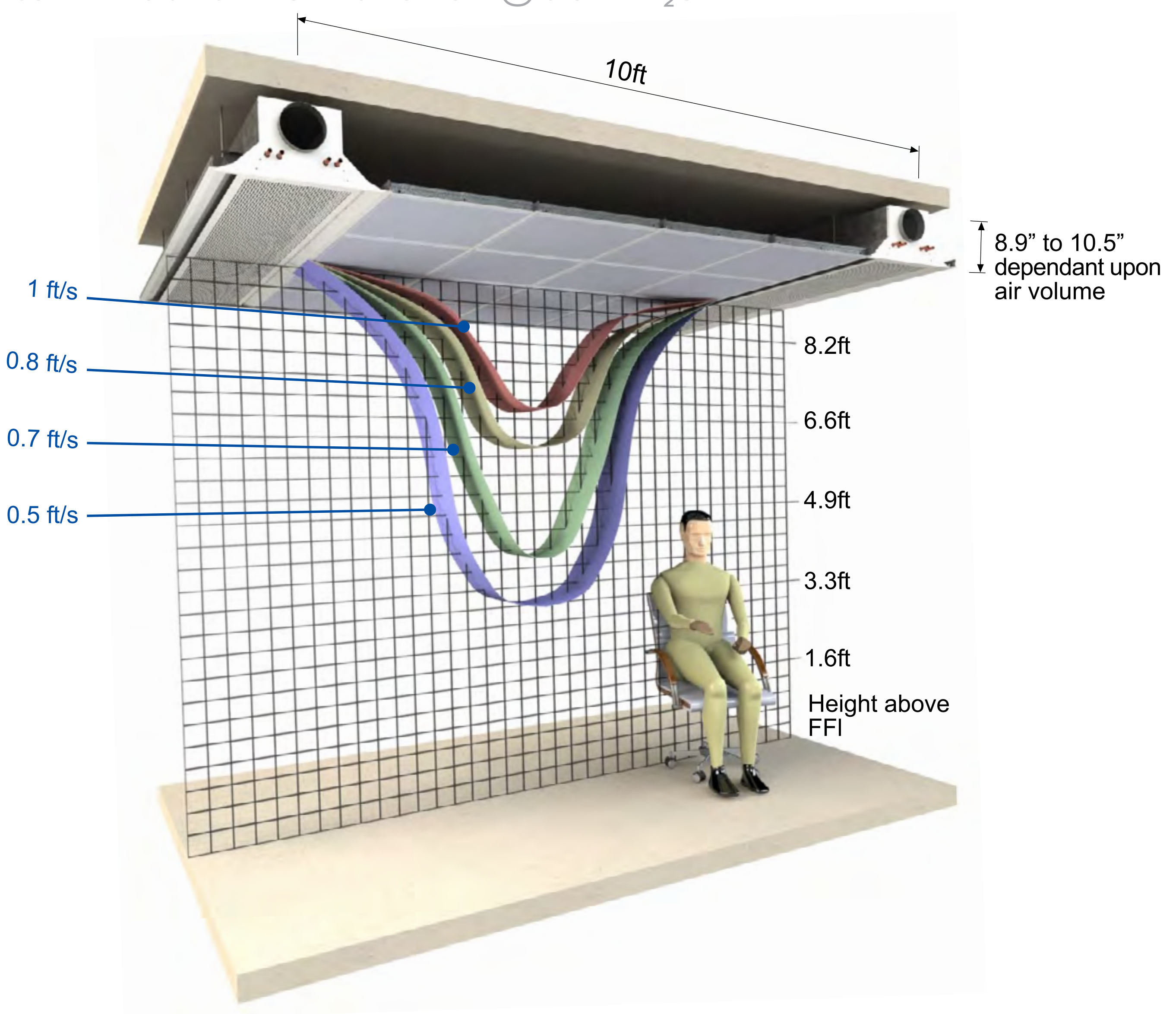
3. The remaining cooling effect has to be supplied by the beam.



Air cooling effect as a function of airflow.

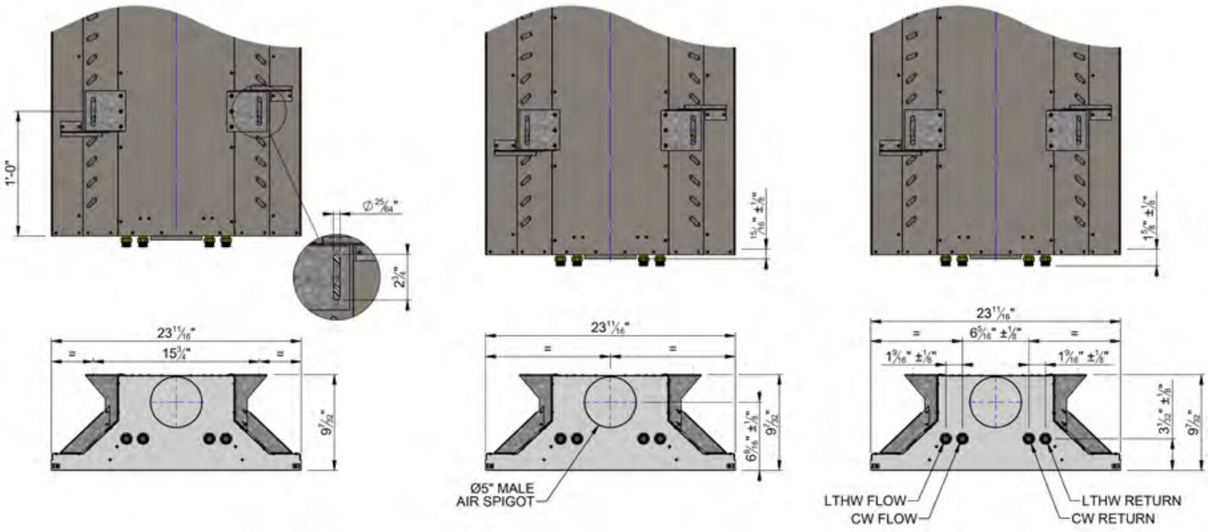
Scatter Diagram

Fresh Air Volume 47 CFM / Active ft @ 0.3” in H_2O

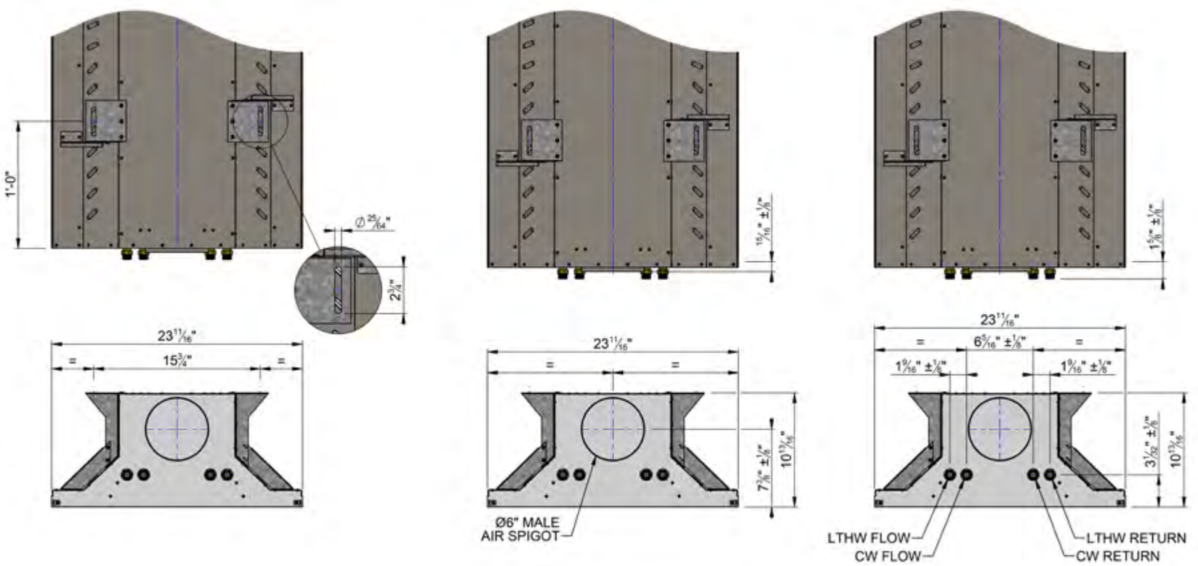


Product Dimensions

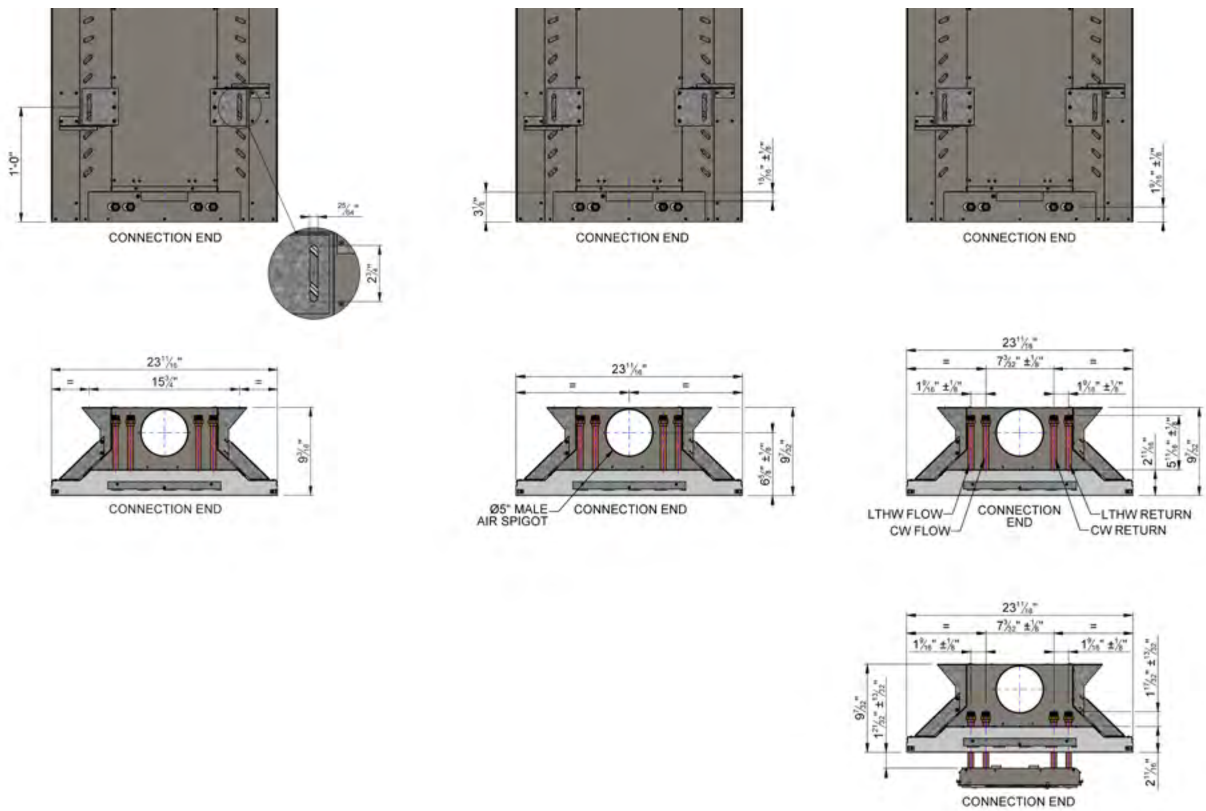
Eco™ 5"



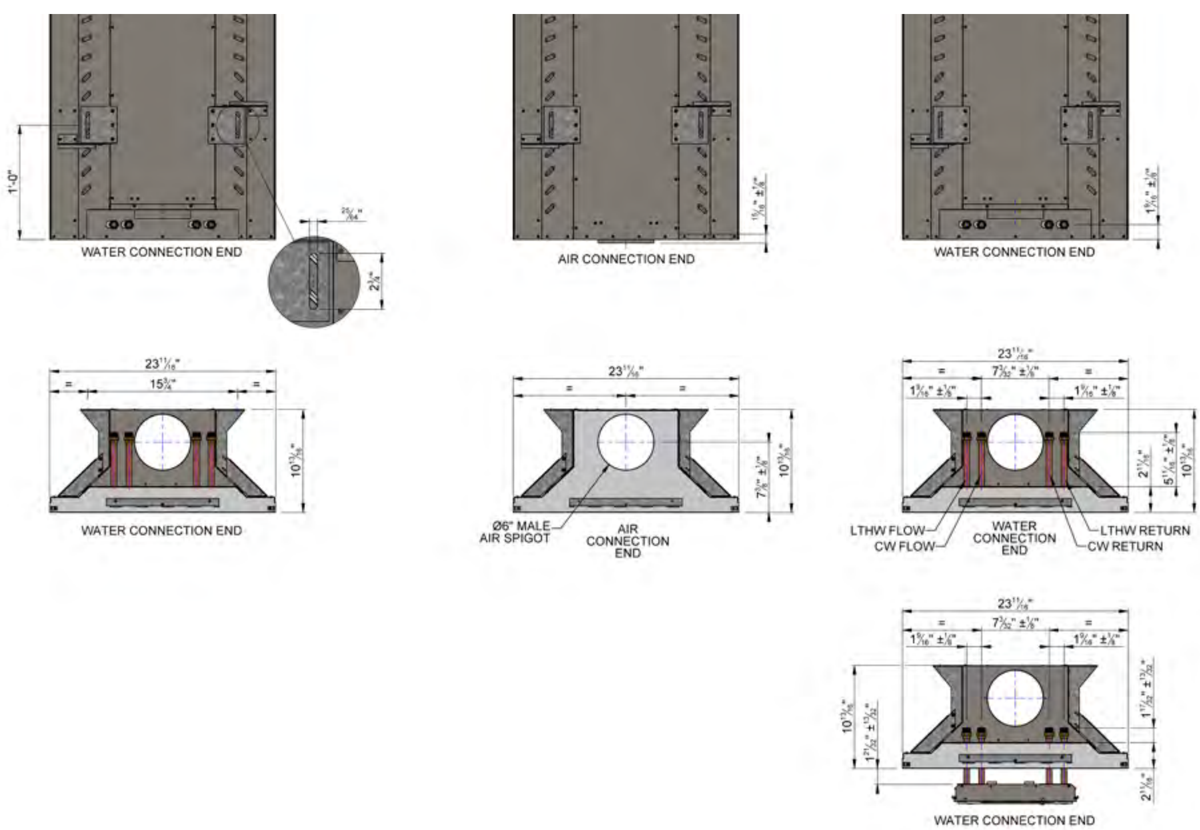
Eco™ 6"



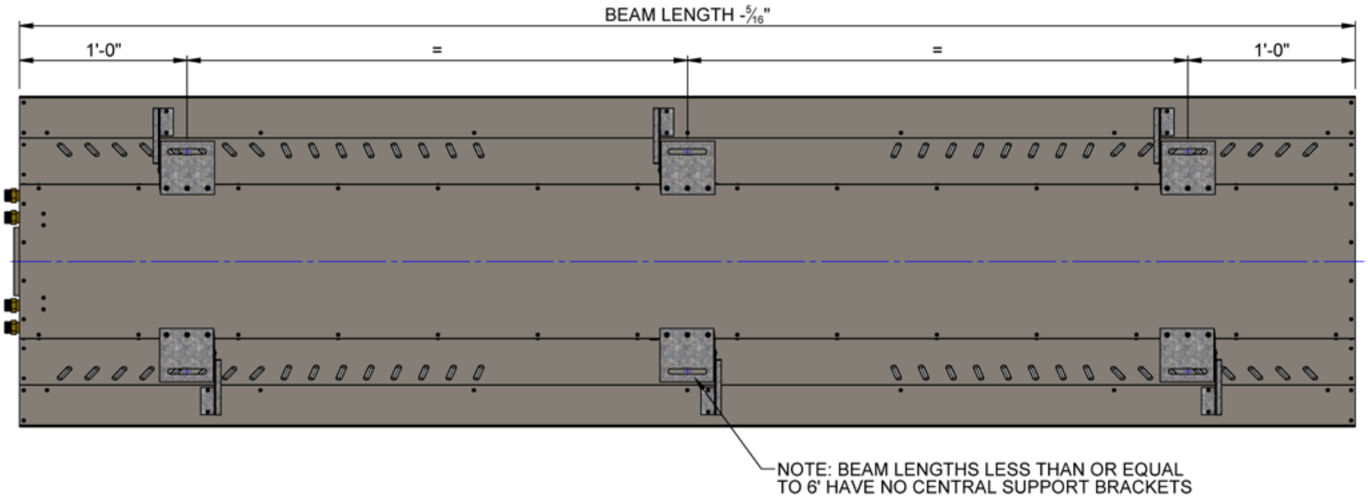
Eco-Healthcare™ HQ 5”



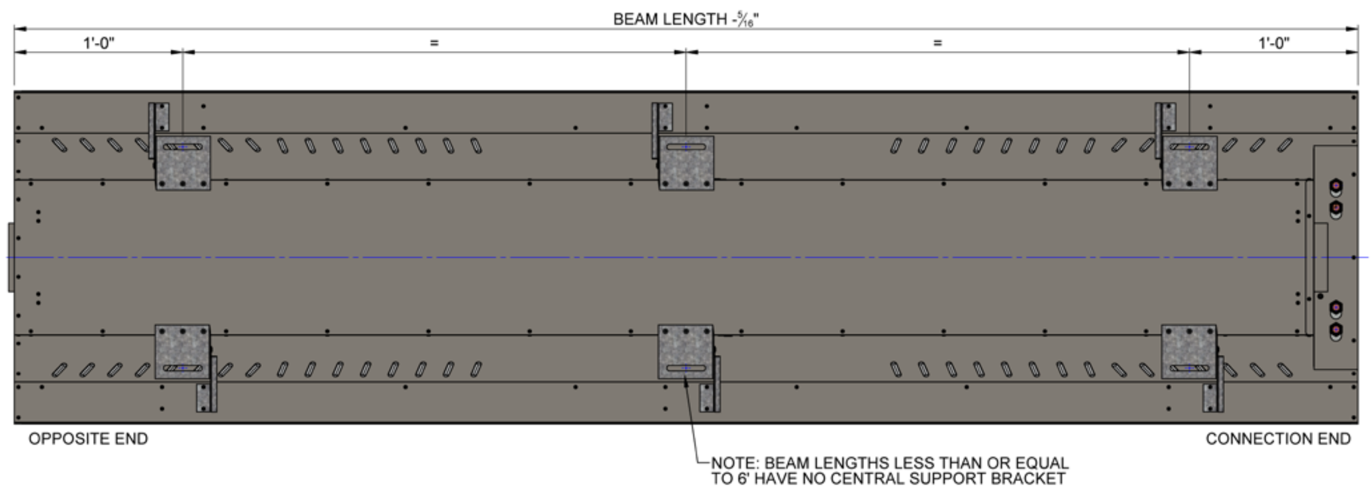
Eco-Healthcare™ HQ 6”



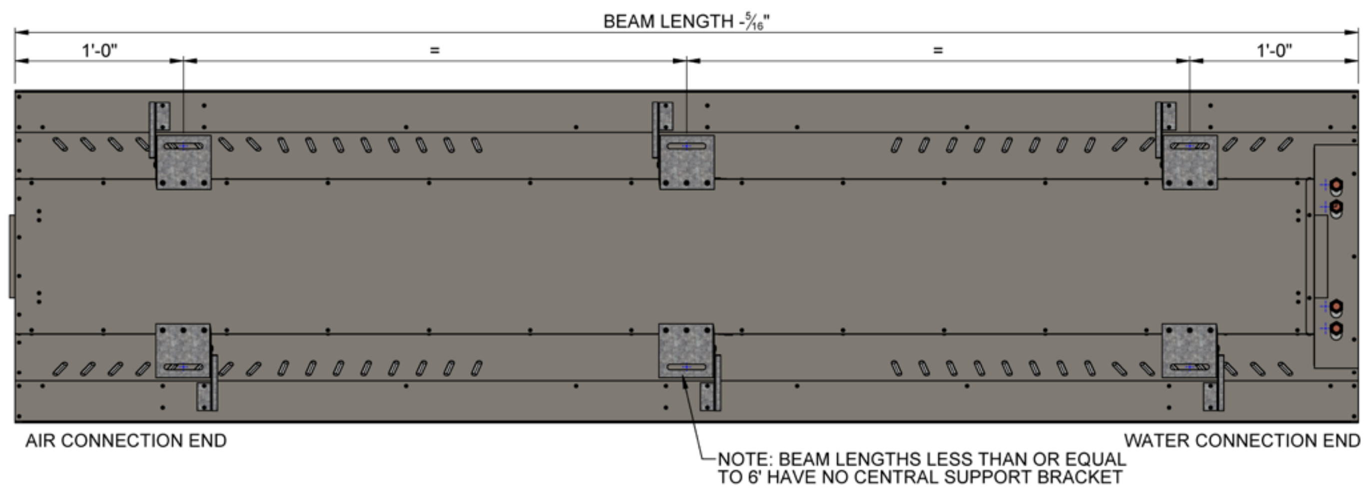
Eco HQ™ 5” & 6”



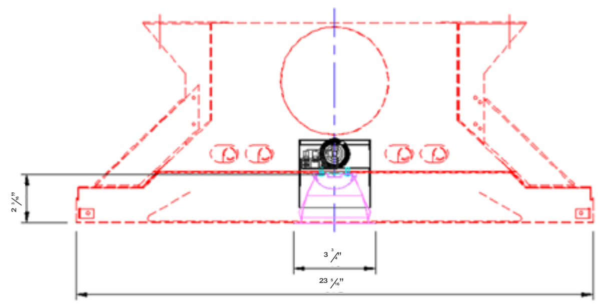
Eco-Healthcare™ HQ 5”



Eco-Healthcare™ HQ 6”



Lighting Options



LED Performance

Luminaire Nom. Length (in)	Lumens (lm)	Nom. Current (mA)	Power (W)
11 13/16	1100	234	8.2
23 5/8	2200	234	16.4
35 7/16	3300	234	24.7
47 1/4	4400	234	32.8
59 1/16	5500	234	41.1

Integrated Lighting

Lighting can be integrated into Frenger's Eco™ HQ Chilled Beam to provide a 100% downlight solution. There are different lighting options that can be integrated, which include: T5 or LED options, both of which with numerous optic solutions such as louvres as illustrated, MMP Diffusers etc.

All lighting factory fitted by Frenger are 100% tested for electrical safety and functionality in accordance with BS EN 60598-1 prior to packaging and dispatch of the Eco™ HQ Chilled Beam unit.

Tests include:

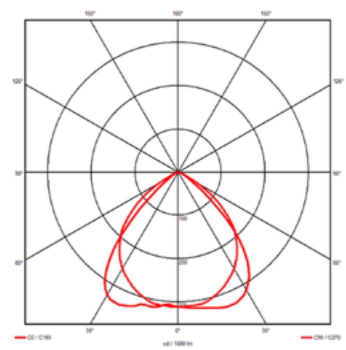
- Earth Continuity Test.
- Insulation Resistance Test.
- Polarity Check.
- Function Test.

For full lighting possibilities and performances for the Eco™ HQ Chilled Beam with integrated lighting, please contact Frenger's technical department.

Luminaire

- DALI Dimmable Control Gear
- Direct lighting via extruded opal diffuser and low glare Zero iridescence MIRO 5 semi-specular symmetric louvre
- LED Color Temperatures: 3000 & 4000K
- Color Rendering Index: Min 80.
- Standard Deviation Color Matching: 3
- LED Luminous Efficacy: Up to 165 lm/W
- Lumen Maintenance Test Results According to IESNA LM-80 = B50L70
- ESD Withstand Voltage: Up to 8kV direct contact

Photometric Distribution: C-Planes & Polar Curve Diagram



	C0	C30	C60	C90	C120	C150	C180
0	310	310	310	310	310	310	310
10	318	316	313	308	306	308	315
20	330	324	304	288	295	315	328
30	313	310	286	256	277	322	326
40	235	245	245	209	251	266	229
50	91.4	111	158	139	166	115	65.5
60	23.4	27	44.9	52.1	46	21.7	16.7
70	6.5	6.4	5.4	6.3	5	5.1	5.1
80	2.2	1.9	1.6	1.6	1.5	1.6	1.8
90	0.6	0.6	0.6	1	0.6	0.6	0.4
100	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0
130	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0
160	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0
	cd/1000lm						

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

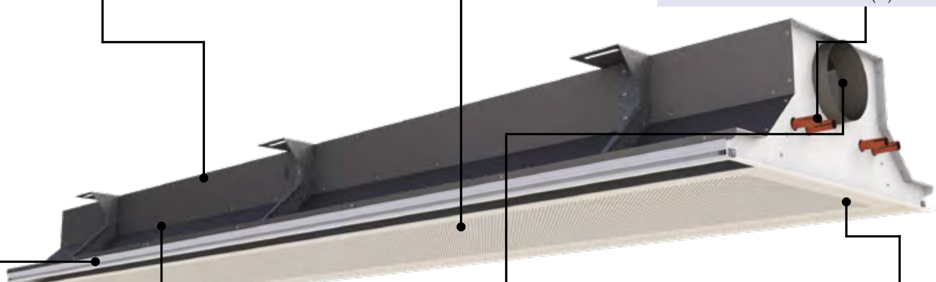
7D - 7Ø & 4Ø Double Dot / 51% Free Area
4D - 4Ø Dot / 33% Free Area
5S - 5 X 35 Slot / 45% Free Area

6. Waterside Connection

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

1/2 | C3 | H — Orientation - H: Horizontal

Chilled Water Connection Size (in) 1/2" or 3/4"



1. Beam Type

ECHQ - Eco

3. Nominal Beam Length (ft/in)

5. Airside Connection

Air Connection Qty

1 x 5 | H — Orientation - H: Horizontal

Air Connection Spigot Size (in) 5" / 6"

7. Air Supply / Discharge

Air Supply Volume (CFM)

Air Discharge Characteristic -
L: Long Throw - No Discharge Vanes
M: Medium Thrown - 18° Discharge Vanes
S: Short Throw - 35° Discharge Vanes

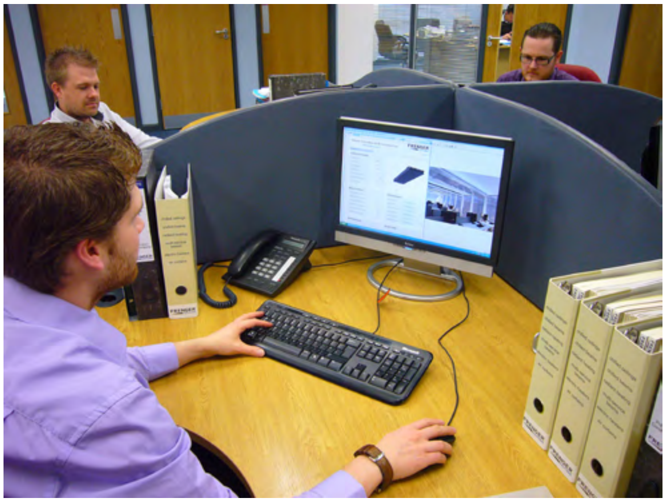
46 | 04 | M

Air Supply Nozzle Pressure (in H_2O)

Example:

ECHQ	CH	8'00"	7D	-	1 x 5H	1/2C3H	-	4604M
1	2	3	4		5	6		7

Calculation Program



Active Chilled Beam Calculation Tool

Is this the latest version?

imperial version 1.3.3

Selection ID / Ref.

ECO HQ Active Beam Data		
Beam Variant	Standard	
Air Connection	1 x 5”	
Product Overall Length	8’ 0”	ft inches
Manifold Type	C3	
Air Discharge Throw	M	
Nozzle Static Pressure	0.4	” H_2O
Fresh Air Supply Volume	46	CFM
Heating Function	2 Pipe	
Underplate Perforation Type	51% DOT	

Design Conditions	*Cooling*		*Winter*	
Flow Water Temperature	56.0	°F	140.0	°F
Return Water Temperature	60.5	°F	100.0	°F
Air Supply Temperature	58.0	°F	60.0	°F
Average Room Condition	75.0	°F	60.0	°F
“Air On” Thermal Gradient	1.3	°F		
Room Relative Humidity	50.0	%		

Dimensional Data		
Width x Depth	2ft x 0.76ft	
Water Volume	0.8	gal
Dry Weight	102.0	lb
CW Connection	Ø¾	inch
LTHW Connection	Ø½	inch

Performance Data	*Cooling*		*Heating*	
Room - Mean Water dT	16.75	°F	60.00	°F
Waterside Performance	5175	BTU/Hr	6857	BTU/Hr
Water Mass Flowrate	2.296	gpm	0.343	gpm
Waterside Pressure Drop	10.6	ft H_2O	0.2	ft H_2O
Airside Performance	904	BTU/Hr	0	BTU/Hr
Total Sensible Performance	**6079**	**BTU/Hr**	6857	BTU/Hr
Sound Effect Lw	< 35	dB(A)		

Design Check (Warnings)		
Supply Air	OK	
Cooling Circuit	OK	
Heating Circuit	OK	
Calculated Dew Point	55.1	°F

Model Ref: ECCH / 8’ 0” / 7D / 1x5”H / Ø¾C32 Pipe / 46 / 0.4m

Notes:
1) Performance calculations are based upon normal clean potable water; it is the system engineer’s responsibility to allow for any reduction in cooling or heating performance due to additives that may reduce the water systems heat transfer coefficient.
2) Pressure drop calculations are based upon ASHRAE guides using clean potable water and exclude any additional losses associated with entry / exit losses, pipe fouling or changes in water quality; it is the system engineer’s responsibility to use good engineering practice.
3) Air discharge throw guidance based on beams on 10ft centers for alternative layouts contact FTF Group Technical Dept for throw settings.

ECO HQ Active Beam Data		
Beam Variant	Standard	
Air Connection	1 x 5”	
Product Overall Length	8’ 0”	ft inches
Manifold Type	C3	
Air Discharge Throw	M	
Nozzle Static Pressure	0.4	” H_2O
Fresh Air Supply Volume	46	CFM
Heating Function	2 Pipe	
Underplate Perforation Type	51% OBR	

The FTF Group’s calculation program for Eco™ HQ is extremely user friendly.

Simply select from the drop down menu the “Air Connection” configuration. Air volumes in excess of 102 CFM and up to 210 CFM should be 1 x 6” 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 99.

Design Conditions	*Cooling*		*Heating*	
Flow Water Temperature	56.0	°F	140.0	°F
Return Water Temperature	60.5	°F	100.0	°F
Air Supply Temperature	58.0	°F	60.0	°F
Average Room Condition	75.0	°F	60.0	°F
“Air On” Thermal Gradient	1.3	°F		
Room Relative Humidity	50.0	%		

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	16.0	°F	44.0	°F
Waterside Performance	5185	BTU/Hr	4481	BTU/Hr
Water Mass Flowrate	1.726	gpm	0.499	gpm
Waterside Pressure Drop	6.0	ft H_2O	3.3	ft H_2O
Airside Performance	1802	BTU/Hr	-155	BTU/Hr
Total Sensible Performance	**6987**	**BTU/Hr**	**4237**	**BTU/Hr**
Sound Effect Lw	< 35	dB(A)		

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

Finally, the “Design Check” should read “Ok” in green, or detail some warnings in red.
Calculation program’s for Eco™ HQ are available upon request.

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

Halo™ & Halo-Healthcare™

Product Description

Halo™ is one of 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.

Halo™ is only 10" deep and can achieve up to **5158 BTU/hr total cooling** (based on a 4ft long beam with a 18 dTF between room and mean water temperature and 94 CFM of air 60°F with a 0.4inH$_2$0).

The Halo™ beam contains a number of **Patented performance enhancing features** and Registered Designs for aesthetic enhancements, all as can be expected from the FTF Group's 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, true 360° air discharge characteristic 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 improve the 360° diffusion pattern it also vastly improves the products aesthetics. This latest development is a Registered Design in addition to the Patent-ed 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.

Halo™ is also available with a **drop down heat exchange battery** for easy cleaning to all 4 sides of the heat exchanger - contact FTF Group's technical department for further information.

At a glance

- Halo is only 10" deep and can achieve up to 5158 BTU/hr total cooling.
- High-capacity active chilled beams with a small footprint.
- True 360° air discharge characteristic.
- 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" and "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 / ASHRAE 55.

Construction

Halo™ is offered in 3 standard models; "I", "C" and "F".

Halo™ "I" models are for integrated ceiling installation in standard 0.6" or 0.9" exposed tee bar grids (Lay-In grid systems) replacing 23.6" x 23.6"or 47.2" x 23.6" tile modules and can be used for integration with either "mineral fiber" 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 addition factory fitted architectural frame enhancement kit that can be finished in white to match the Halo™ beam, or provided as a different color to make a feature of the extruded aluminum outer frame.

Fig 2. Halo™ Active Chilled Beam 4ft x 4ft Module.

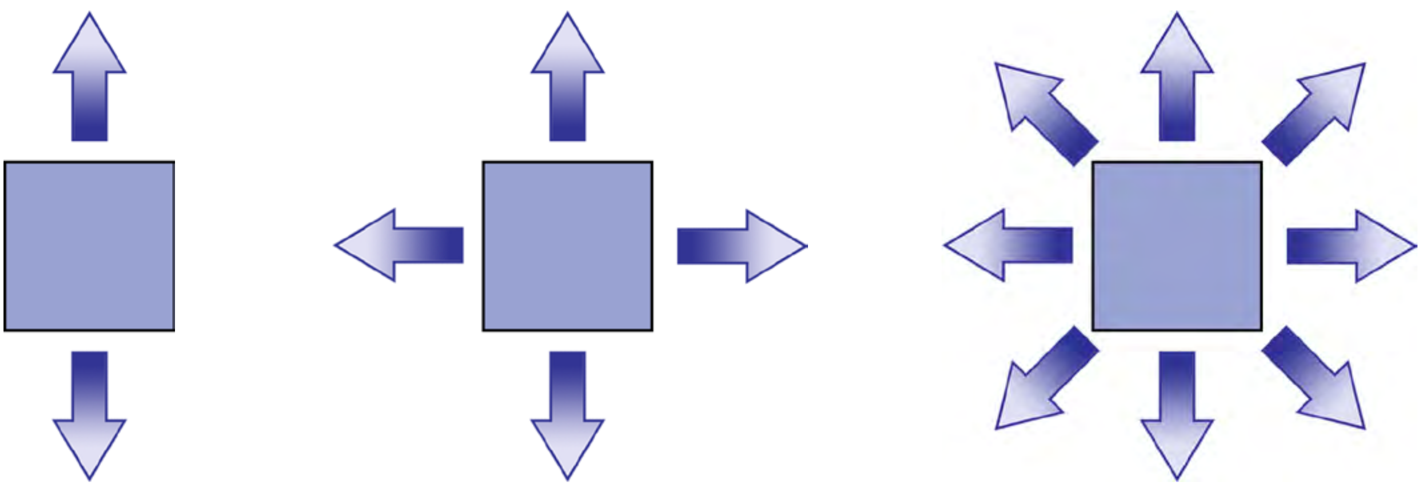
Introduction

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 a 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 with a 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 substantially 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 drafts and providing a comfortable environment, compliant to BS EN ISO 7730 / ASHRAE 55.

Fig 3. Halo™ Active Chilled Beam 4ft x 2ft Module fitted with architectural frame enhancement kit.



Traditional 2-way discharge beam

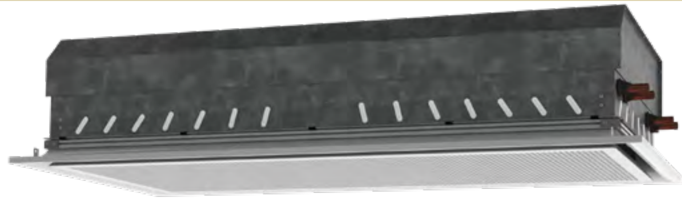
More recent 4-way discharge beam

Halo™ "True 360°" discharge beam

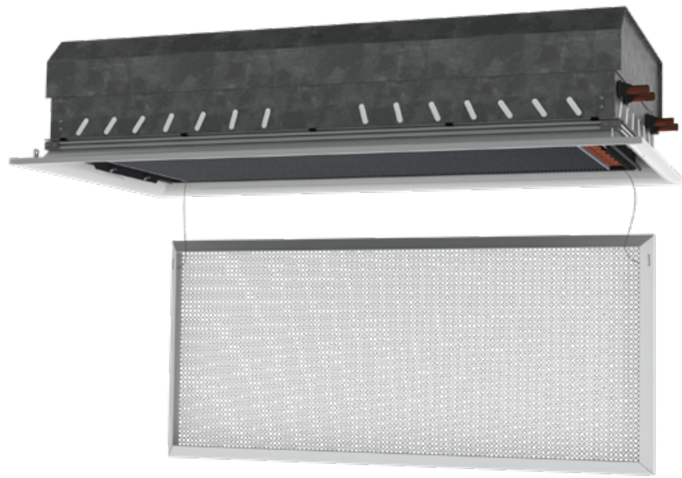
Halo™ distributes air in a 360° pattern for shorter air throws and optimum comfort.

Hygiene

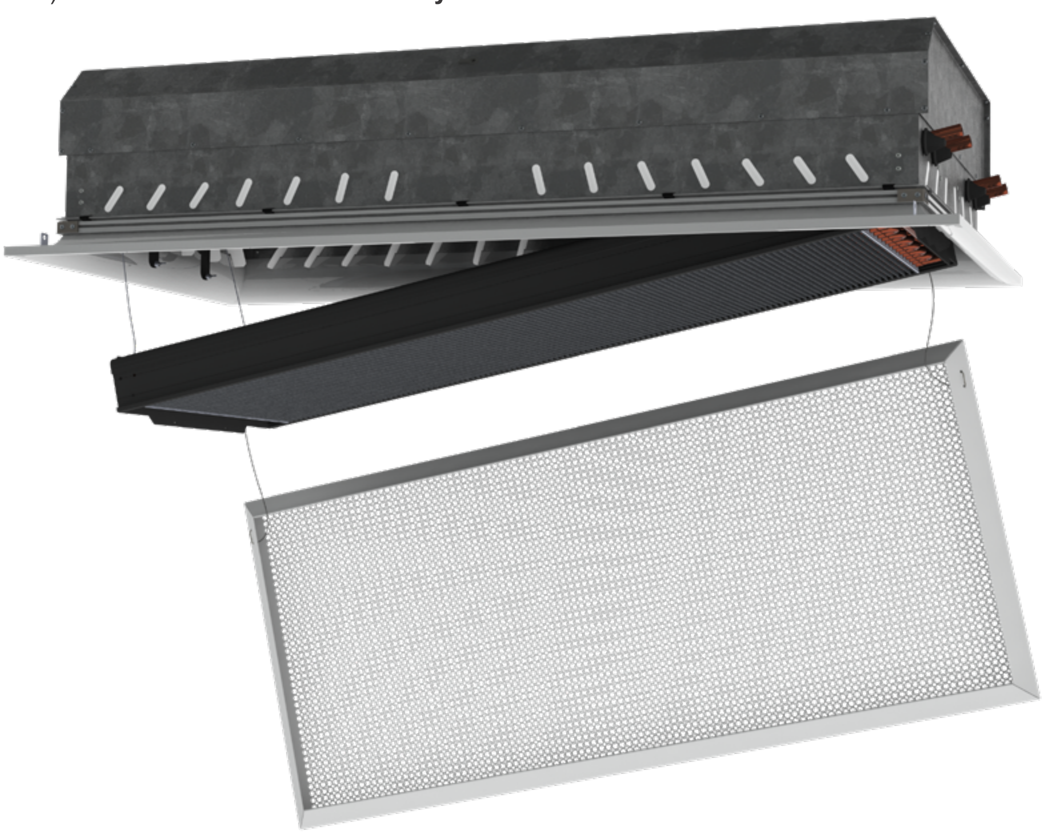
It is important to clean the product to ensure that it looks its best, that it operates at an optimum level, that it will last as long as possible and that it does not present an infection control risk. During development of the Frenger Halo™-Healthcare chilled beam the ease of cleaning was of the highest priority.



The underplate to Halo™- Healthcare is simple to lower or totally remove. The underplate hooks onto a patented extruded aluminium section which is part of the fin coil battery. When "joggled" off the extrusion the underplate can hang on the factory fitted safety cords.

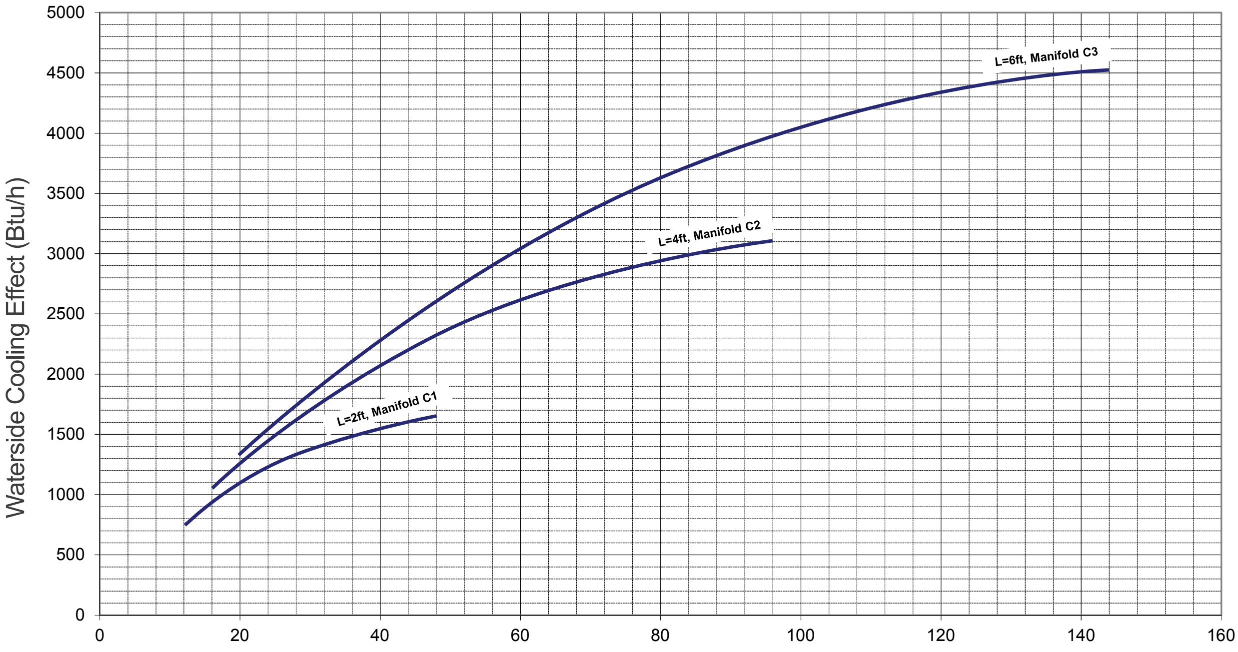


When the underplate is either hanging down on the safety cords or totally removed, the fin coil battery is accessible from below. The fin coil battery can be easily lowered at one end by the removal of four retaining screws (pozi headed screwdriver) to enable a clearance behind one end of the fin coil battery (typically 4 ¾" ±½") **to enable all 4 sides of the battery to be cleaned.**



Cooling Performance

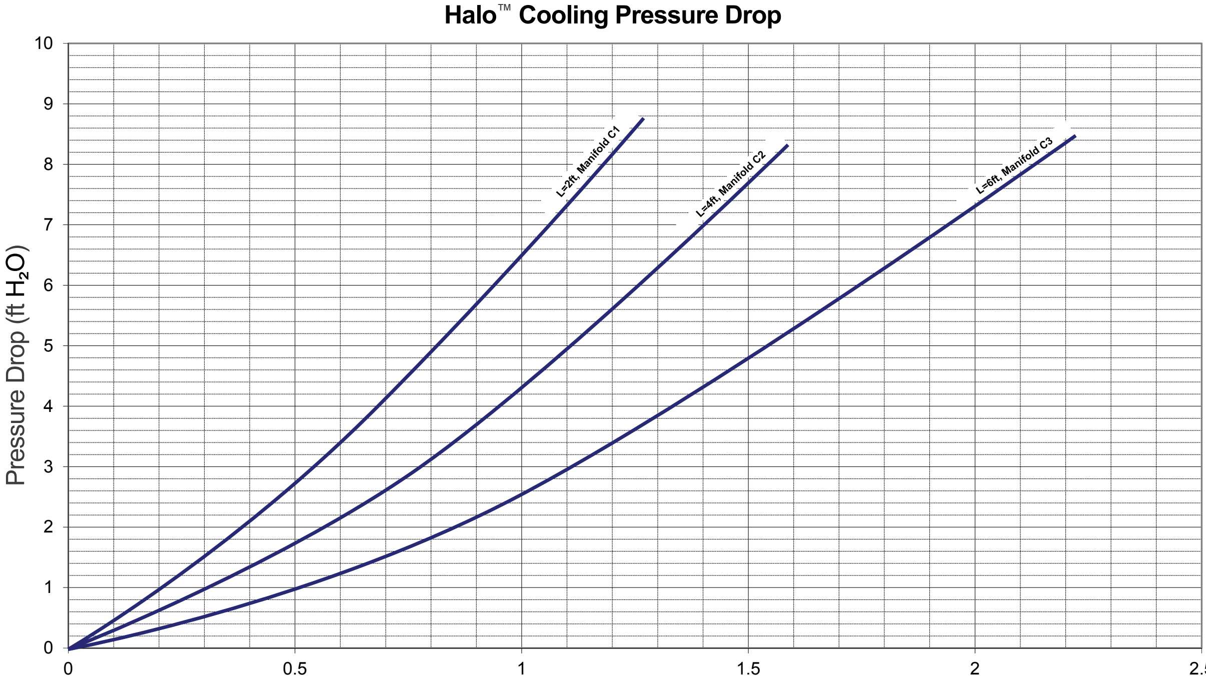
Halo™ Waterside Cooling Effect at 16.5dTF
(Primary Air = 0.3 in H_2O, Heating Water = 57/62°F, Room Condition = 76.0°F)



Primary Air Volume (cfm)

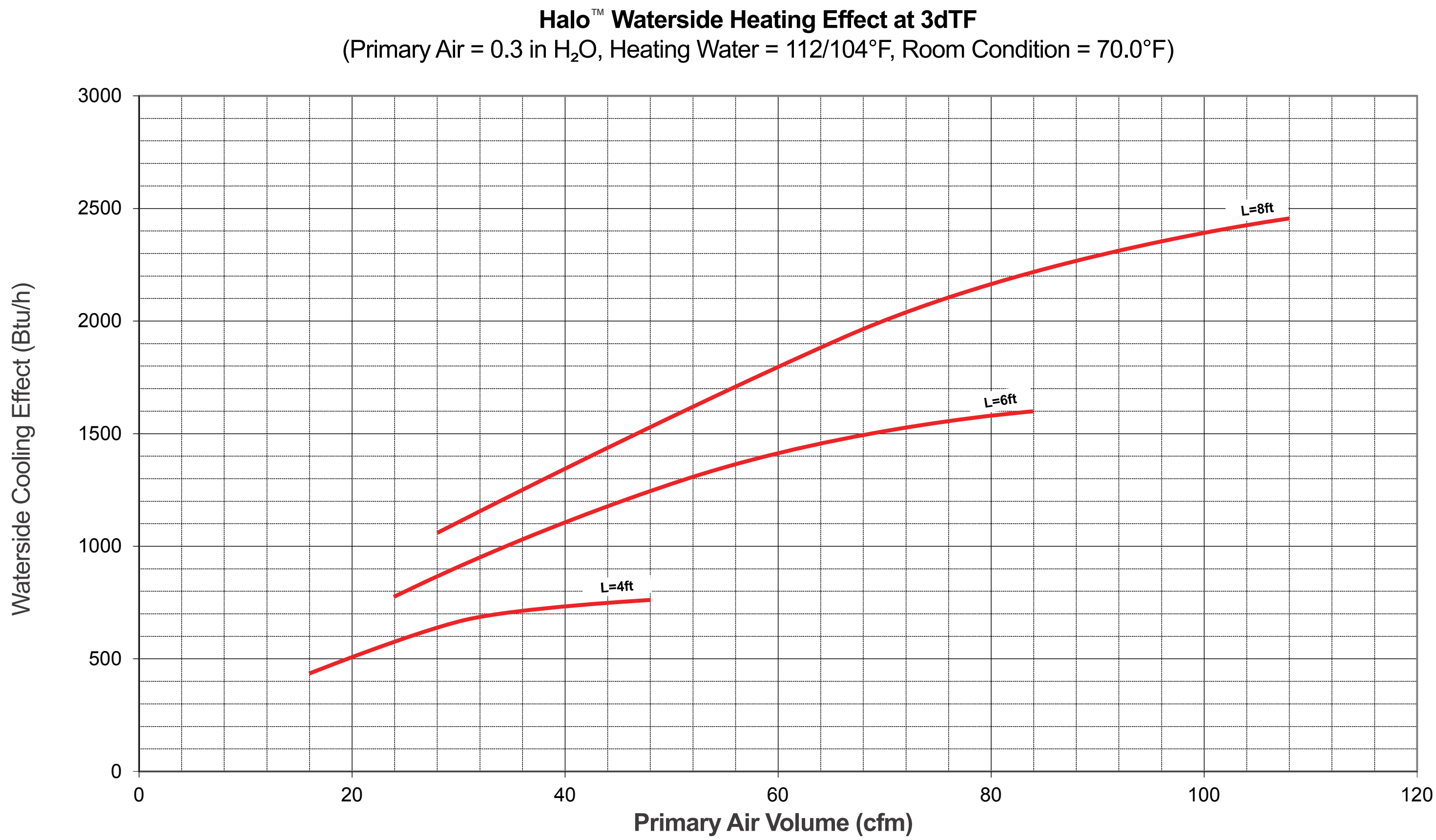
Pressure Drop

Halo™ Cooling Pressure Drop

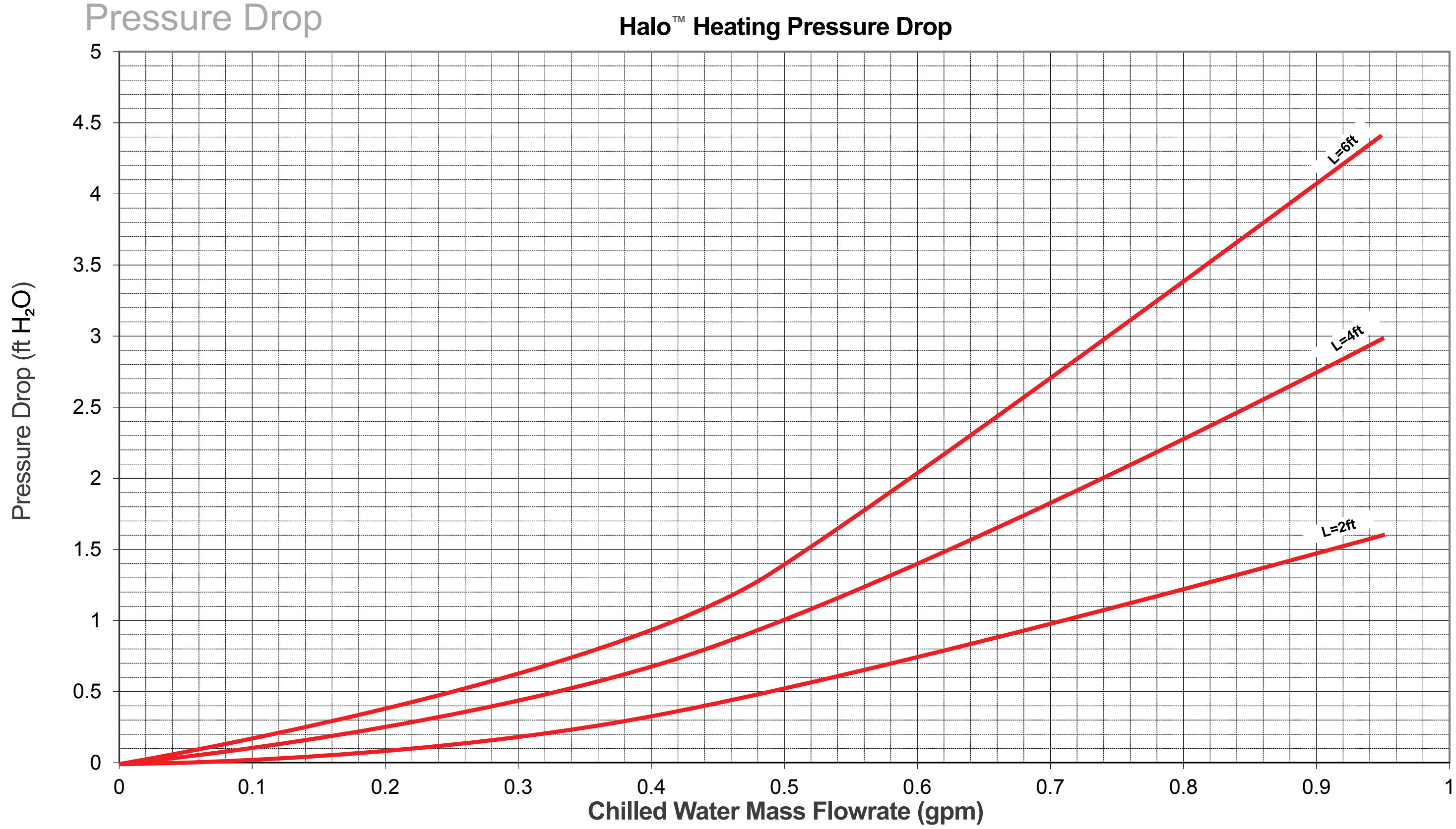


Chilled Water Mass Flowrate (gpm)

Heating Performance



Pressure Drop



Cooling Selection Tables

Cooling at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 H_2O	Halo	Water											
		ΔtK - 12.5°F			ΔtK - 14.5°F			ΔtK - 16.5°F			ΔtK - 18.5°F		
Q (CFM)	L (ft)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)
10	2.0	452	0.190	0.97	525	0.210	1.17	603	0.242	1.49	682	0.273	1.84
20	2.0	674	0.270	1.81	793	0.318	2.39	911	0.365	3.04	1026	0.411	3.75
30	2.0	827	0.331	2.58	976	0.391	3.44	1119	0.448	4.37	1259	0.504	5.36
40	2.0	902	0.361	3.00	1062	0.426	3.99	1214	0.486	5.04	1363	0.546	6.16

Nozzle Pressure 0.24 H_2O	Halo	Water											
		ΔtK - 12.5°F			ΔtK - 14.5°F			ΔtK - 16.5°F			ΔtK - 18.5°F		
Q (CFM)	L (ft)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)
20	4.0	860	0.345	1.12	1014	0.406	1.49	1167	0.468	1.90	1321	0.529	2.36
30	4.0	1097	0.439	1.71	1294	0.518	2.28	1489	0.597	2.91	1683	0.674	3.60
40	4.0	1262	0.505	2.19	1488	0.596	2.91	1711	0.685	3.71	1930	0.773	4.58
50	4.0	1423	0.570	2.70	1684	0.674	3.61	1938	0.776	4.61	2186	0.876	5.69
60	4.0	1552	0.621	3.14	1839	0.737	4.21	2116	0.847	5.37	2383	0.955	6.61
70	4.0	1647	0.660	3.48	1951	0.781	4.66	2240	0.897	5.93	2518	1.009	7.28
80	4.0	1697	0.680	3.67	2006	0.803	4.89	2299	0.921	6.21	2581	1.034	7.61

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.24 in H_2O, 1 x Ø5" air connection.

Cooling at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 H_2O	Halo	Water											
		ΔtK - 12.5°F			ΔtK - 14.5°F			ΔtK - 16.5°F			ΔtK - 18.5°F		
Q (CFM)	L (ft)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)
10	2.0	506	0.203	1.10	595	0.238	1.45	684	0.274	1.85	772	0.309	2.28
20	2.0	760	0.304	2.22	892	0.357	2.94	1022	0.409	3.72	1148	0.460	4.57
30	2.0	956	0.383	3.31	1117	0.447	4.35	1275	0.511	5.48	1434	0.574	6.73
40	2.0	1068	0.428	4.02	1242	0.497	5.24	1415	0.567	6.58	1601	0.641	8.15

Nozzle Pressure 0.32 H_2O	Halo	Water											
		ΔtK - 12.5°F			ΔtK - 14.5°F			ΔtK - 16.5°F			ΔtK - 18.5°F		
Q (CFM)	L (ft)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)
20	4.0	976	0.391	1.39	1149	0.460	1.85	1321	0.529	2.36	1493	0.598	2.92
30	4.0	1235	0.495	2.10	1455	0.583	2.80	1673	0.670	3.56	1886	0.756	4.39
40	4.0	1423	0.570	2.69	1676	0.671	3.58	1923	0.770	4.54	2164	0.867	5.59
50	4.0	1631	0.653	3.42	1917	0.768	4.52	2194	0.879	5.72	2466	0.988	7.02
60	4.0	1808	0.724	4.09	2119	0.849	5.38	2420	0.969	6.79	2719	1.089	8.33
70	4.0	1954	0.783	4.67	2280	0.913	6.12	2598	1.041	7.69	2921	1.170	9.44
80	4.0	2043	0.818	5.05	2378	0.953	6.59	2707	1.084	8.27	3048	1.221	10.16
90	4.0	2122	0.850	5.40	2464	0.987	7.01	2803	1.123	8.79	3163	1.267	10.83

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.32 in H_2O, 1 x Ø5" air connection.

Cooling at 0.4 Nozzle Pressure

Nozzle Pressure 0.4 H_2O		Water											
Q (CFM)	Halo	ΔtK - 12.5°F			ΔtK - 14.5°F			ΔtK - 16.5°F			ΔtK - 18.5°F		
	L (ft)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)
10	2.0	570	0.228	1.35	671	0.269	1.79	771	0.309	2.28	869	0.348	2.81
20	2.0	826	0.331	2.57	967	0.387	3.38	1105	0.442	4.27	1240	0.497	5.23
30	2.0	1021	0.409	3.72	1190	0.476	4.86	1358	0.544	6.12	1536	0.615	7.58
40	2.0	1132	0.453	4.45	1316	0.527	5.80	1509	0.604	7.35	1741	0.697	9.29
50	2.0	1212	0.486	5.02	1411	0.565	6.54	1635	0.655	8.40	1957	0.784	10.93

Nozzle Pressure 0.4 H_2O		Water											
Q (CFM)	Halo	ΔtK - 12.5°F			ΔtK - 14.5°F			ΔtK - 16.5°F			ΔtK - 18.5°F		
	L (ft)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)
20	4.0	1093	0.438	1.70	1289	0.516	2.26	1483	0.594	2.89	1675	0.671	3.57
30	4.0	1357	0.544	2.48	1598	0.640	3.29	1833	0.734	4.18	2063	0.826	5.14
40	4.0	1548	0.620	3.11	1818	0.728	4.12	2080	0.833	5.21	2337	0.936	6.39
50	4.0	1756	0.704	3.88	2056	0.824	5.11	2348	0.940	6.44	2638	1.057	7.90
60	4.0	1932	0.774	4.58	2256	0.904	6.01	2573	1.031	7.56	2900	1.161	9.31
70	4.0	2075	0.831	5.19	2416	0.968	6.78	2758	1.105	8.53	3125	1.252	10.58
80	4.0	2163	0.867	5.58	2516	1.008	7.27	2876	1.152	9.18	3281	1.314	11.47
90	4.0	2243	0.899	5.95	2608	1.044	7.74	2987	1.196	9.80	3371	1.298	11.24
100	4.0	2289	0.917	6.16	2661	1.066	8.02	3055	1.224	10.18	3430	1.296	11.20

Flow-adjusted waterside cooling effect table. Cooling circuit Δt = 5°F (Water in-out), nozzle pressure of 0.4 in H_2O, 1 x Ø5" air connection.

Heating at 0.24 Nozzle Pressure

Nozzle Pressure 0.24 H_2O		Water											
Q (CFM)	Halo	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)
10	2.0	344	0.190	0.15	428	0.190	0.15	518	0.190	0.15	604	0.190	0.15
20	2.0	498	0.190	0.15	619	0.190	0.15	750	0.190	0.15	878	0.196	0.15
30	2.0	598	0.190	0.15	744	0.190	0.15	915	0.204	0.16	1129	0.252	0.23
40	2.0	643	0.190	0.15	797	0.190	0.15	1010	0.226	0.19	1248	0.278	0.28

Nozzle Pressure 0.24 H_2O		Water											
Q (CFM)	Halo	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)
20	4.0	640	0.190	0.28	793	0.190	0.28	1004	0.224	0.36	1240	0.277	0.51
30	4.0	788	0.190	0.28	1035	0.231	0.39	1348	0.301	0.60	1664	0.371	0.86
40	4.0	900	0.201	0.31	1223	0.273	0.52	1594	0.356	0.81	1963	0.438	1.15
50	4.0	1047	0.234	0.41	1425	0.318	0.69	1854	0.414	1.05	2277	0.508	1.49
60	4.0	1162	0.260	0.49	1583	0.353	0.82	2057	0.459	1.26	2519	0.562	1.78
70	4.0	1244	0.278	0.55	1695	0.378	0.93	2199	0.491	1.42	2688	0.600	1.99
80	4.0	1284	0.287	0.58	1794	0.391	0.98	2268	0.506	1.50	2769	0.618	2.10

Flow-adjust waterside heating effect table. Heating circuit Δt = 9°F (Water in-out), nozzle pressure of 0.24 in H_2O, 1 x Ø5" air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating at 0.32 Nozzle Pressure

Nozzle Pressure 0.32 H_2O		Water											
Q (CFM)	Halo	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)
10	2.0	384	0.190	0.15	476	0.190	0.15	577	0.190	0.15	673	0.190	0.15
20	2.0	551	0.190	0.15	686	0.190	0.15	827	0.190	0.15	1009	0.225	0.19
30	2.0	673	0.190	0.15	833	0.190	0.15	1076	0.240	0.22	1329	0.297	0.31
40	2.0	738	0.190	0.15	943	0.211	0.18	1228	0.274	0.27	1516	0.338	0.39

Nozzle Pressure 0.32 H_2O		Water											
Q (CFM)	Halo	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)	Q̇ (btu/h)	ṁ (gpm)	Δp (ft H_2O)
20	4.0	709	0.190	0.28	890	0.199	0.30	1159	0.259	0.46	1431	0.319	0.66
30	4.0	873	0.195	0.30	1186	0.265	0.50	1546	0.345	0.77	1904	0.425	1.09
40	4.0	1034	0.231	0.40	1407	0.314	0.67	1831	0.409	1.03	2249	0.502	1.46
50	4.0	1215	0.271	0.53	1656	0.370	0.89	2149	0.480	1.36	2629	0.587	1.91
60	4.0	1372	0.306	0.66	1868	0.417	1.10	2418	0.540	1.68	2946	0.658	2.34
70	4.0	1500	0.335	0.77	2042	0.456	1.29	2635	0.588	1.95	3200	0.714	2.70
80	4.0	1581	0.353	0.84	2151	0.480	1.41	2770	0.618	2.13	3357	0.749	2.94
90	4.0	1654	0.369	0.91	2248	0.502	1.52	2890	0.645	2.29	3497	0.780	3.15

Flow-adjust waterside heating effect table. Heating circuit Δt = 9°F (Water in-out), nozzle pressure of 0.32 inH_2O, 1 x Ø5" air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

Heating Selection Tables

Heating at 0.4 Nozzle Pressure

Nozzle Pressure 0.4 H_2O		Water											
Q (CFM)	Halo	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	$\dot{Q}$ (btu/h)	$\dot{m}$ (gpm)	Δp (ft H_2O)	$\dot{Q}$ (btu/h)	$\dot{m}$ (gpm)	Δp (ft H_2O)	$\dot{Q}$ (btu/h)	$\dot{m}$ (gpm)	Δp (ft H_2O)	$\dot{Q}$ (btu/h)	$\dot{m}$ (gpm)	Δp (ft H_2O)
10	2.0	426	0.190	0.15	531	0.190	0.15	643	0.190	0.15	749	0.190	0.15
20	2.0	591	0.190	0.15	736	0.190	0.15	900	0.201	0.16	1111	0.248	0.23
30	2.0	710	0.190	0.15	893	0.199	0.16	1162	0.259	0.25	1435	0.320	0.35
40	2.0	774	0.190	0.15	1011	0.226	0.20	1317	0.294	0.31	1625	0.363	0.44
50	2.0	821	0.190	0.15	1100	0.246	0.23	1434	0.320	0.36	1768	0.395	0.51

Nozzle Pressure 0.4 H_2O		Water											
Q (CFM)	Halo	ΔtK - 36°F			ΔtK - 45°F			ΔtK - 54°F			ΔtK - 63°F		
	L (ft)	$\dot{Q}$ (btu/h)	$\dot{m}$ (gpm)	Δp (ft H_2O)	$\dot{Q}$ (btu/h)	$\dot{m}$ (gpm)	Δp (ft H_2O)	$\dot{Q}$ (btu/h)	$\dot{m}$ (gpm)	Δp (ft H_2O)	$\dot{Q}$ (btu/h)	$\dot{m}$ (gpm)	Δp (ft H_2O)
20	4.0	780	0.190	0.28	1023	0.228	0.38	1333	0.298	0.59	1645	0.367	0.84
30	4.0	973	0.217	0.36	1324	0.296	0.60	1724	0.385	0.93	2121	0.473	1.31
40	4.0	1136	0.254	0.47	1548	0.346	0.79	2012	0.449	1.22	2465	0.550	1.71
50	4.0	1321	0.295	0.61	1799	0.402	1.03	2331	0.520	1.57	2843	0.635	2.20
60	4.0	1480	0.330	0.75	2014	0.450	1.26	2601	0.581	1.90	3160	0.705	2.64
70	4.0	1611	0.360	0.87	2190	0.489	1.45	2819	0.629	2.19	3415	0.762	3.02
80	4.0	1694	0.378	0.95	2302	0.514	1.59	2957	0.660	2.38	3556	0.776	3.12
90	4.0	1771	0.395	1.03	2403	0.537	1.71	3081	0.688	2.56	3672	0.776	3.12
100	4.0	1815	0.405	1.07	2462	0.550	1.78	3152	0.704	2.67	3736	0.776	3.12

Flow-adjust waterside heating effect table. Heating circuit Δt = 9°F (Water in-out), nozzle pressure of 0.4 in H_2O, 1 x Ø5" air connection.
For red values, the flow rate has been adjusted to the recommended minimum flow of 0.19 gpm.

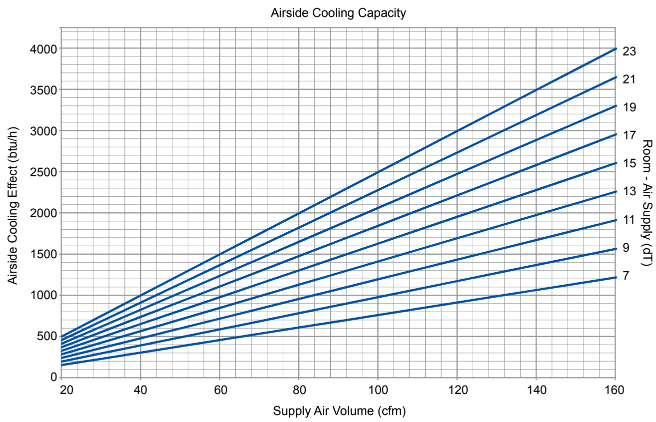
Air Cooling Effect

Cooling effect supplied in the ventilation air

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.

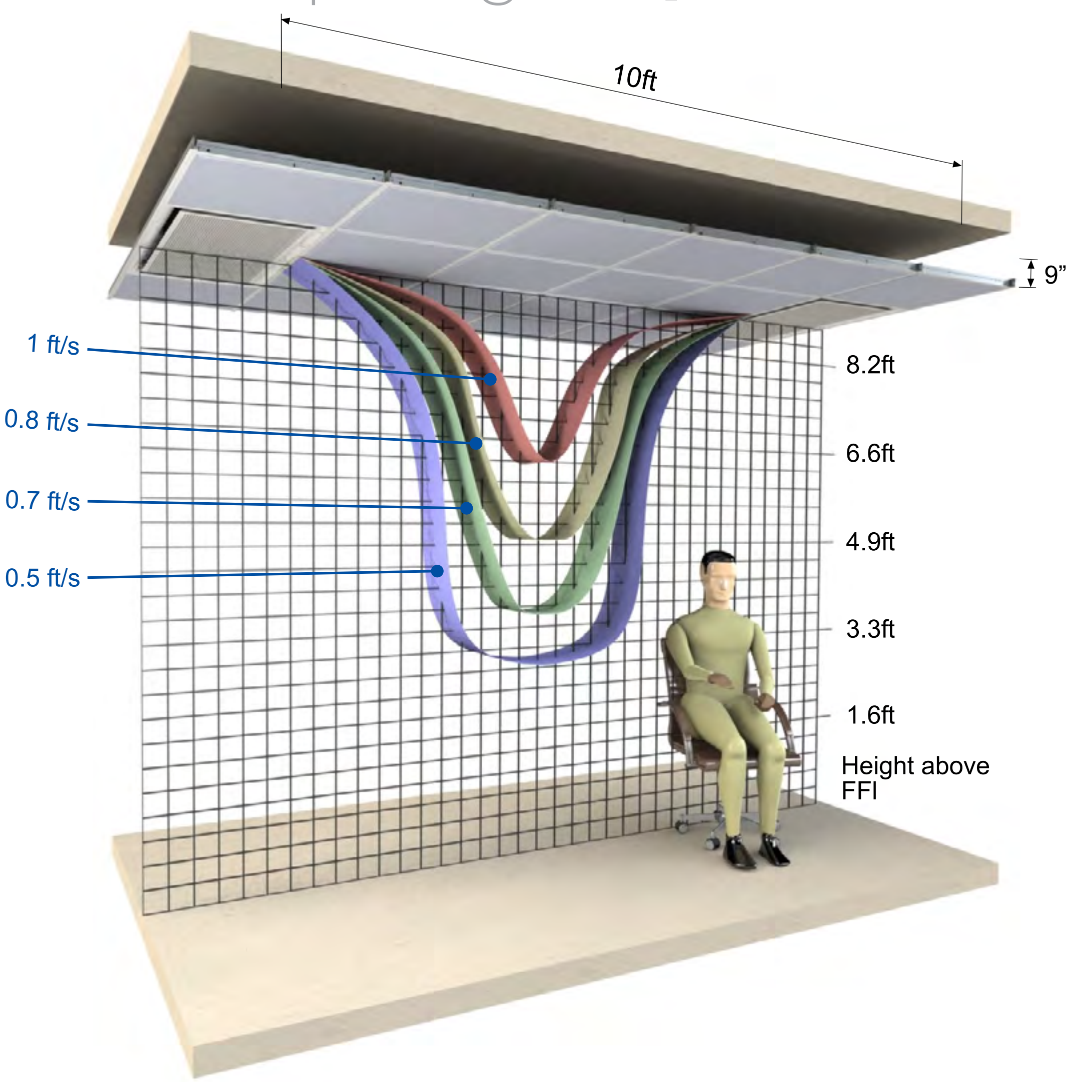
3. The remaining cooling effect has to be supplied by the beam.



Air cooling effect as a function of airflow.

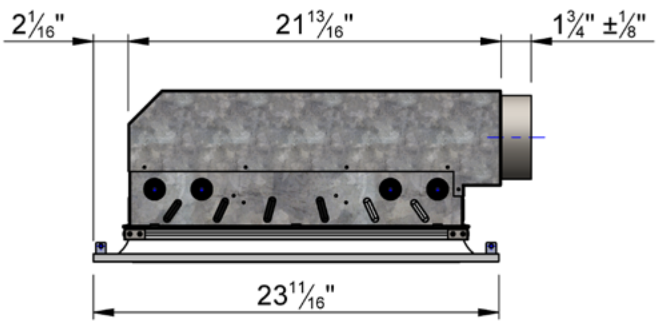
Scatter Diagram

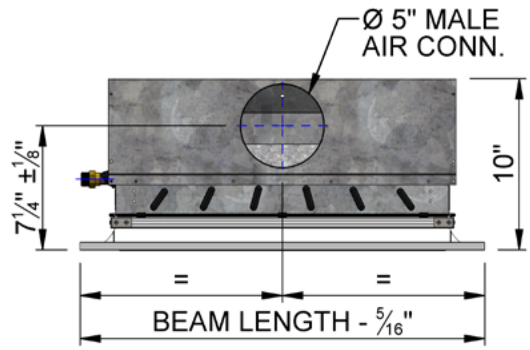
Fresh Air Volume 67.8 CFM per beam @ 0.32in $H_2$0



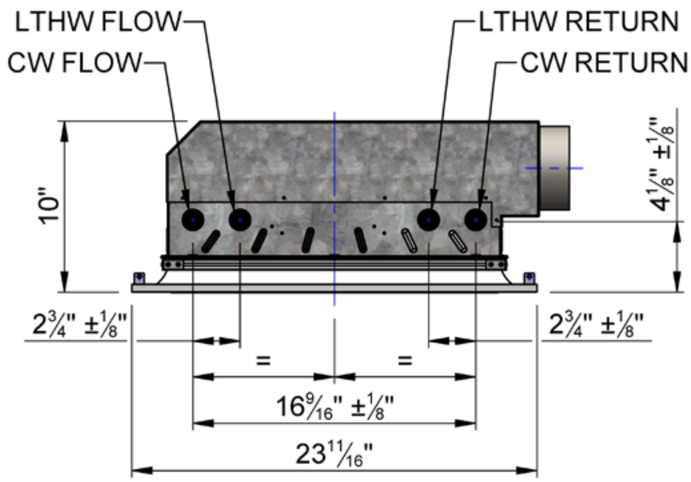
Product Dimensions

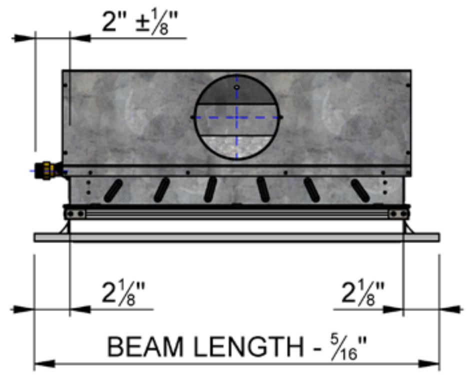
Air Connection



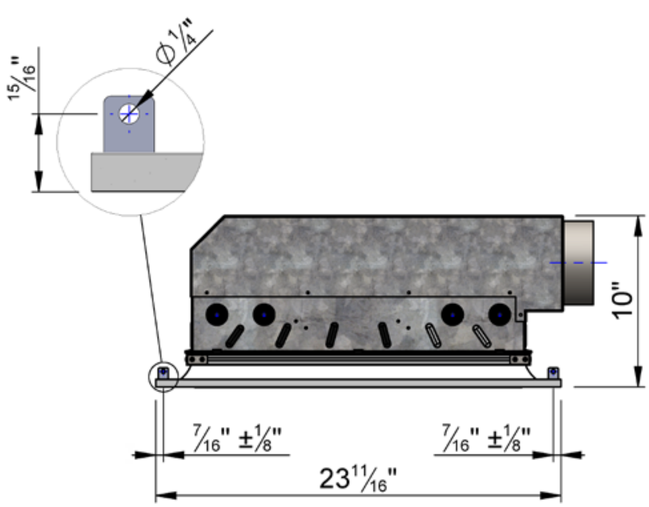


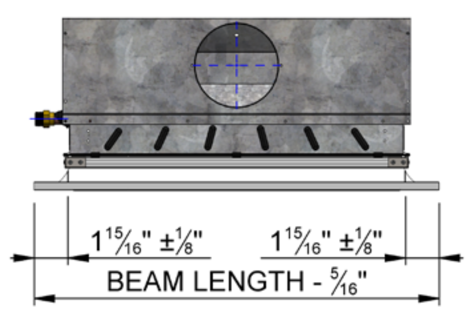
Water Connections



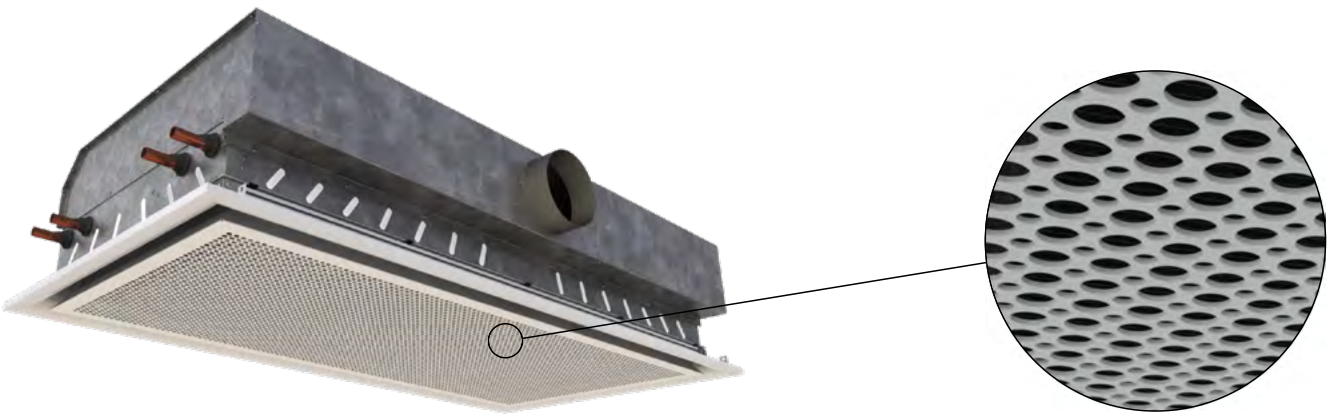


Mounting Details





Perforation Pattern Options



Note: Other aesthetic options are available on request.

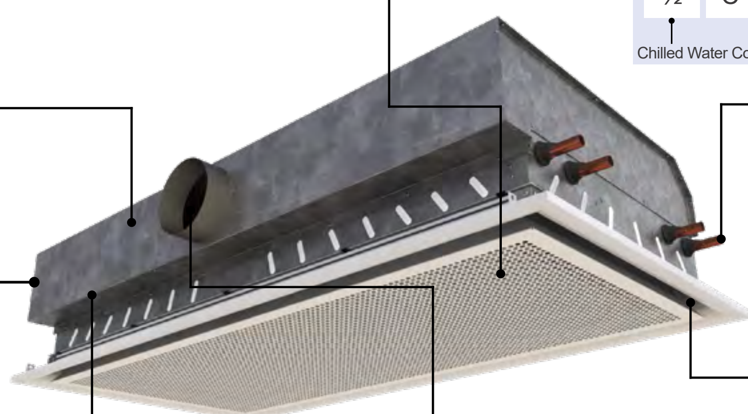
Double Dot Perforation
51% Free Area

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

6. Waterside Connection
Battery Manifold Types - C1/C2/C3/C4/C5
½ C³ H — Orientation - H: Horizontal
Chilled Water Connection Size (in) 1/2" or 3/4"



1. Beam Type
HAI - Halo "Integrated"
HAC - Halo "Clip in"
HAF - Halo "Free Hanging"

3. Nominal Beam Length (ft)

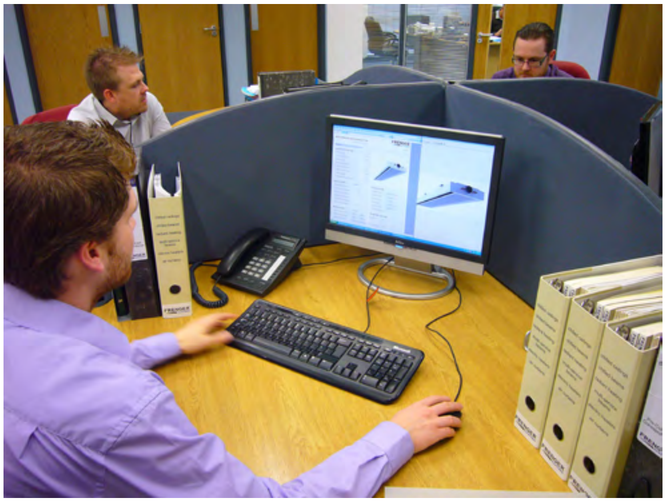
5. Airside Connection
Air Connection Qty
1 x 15" H — Orientation - H: Horizontal
Air Connection Spigot Size (in) 5"

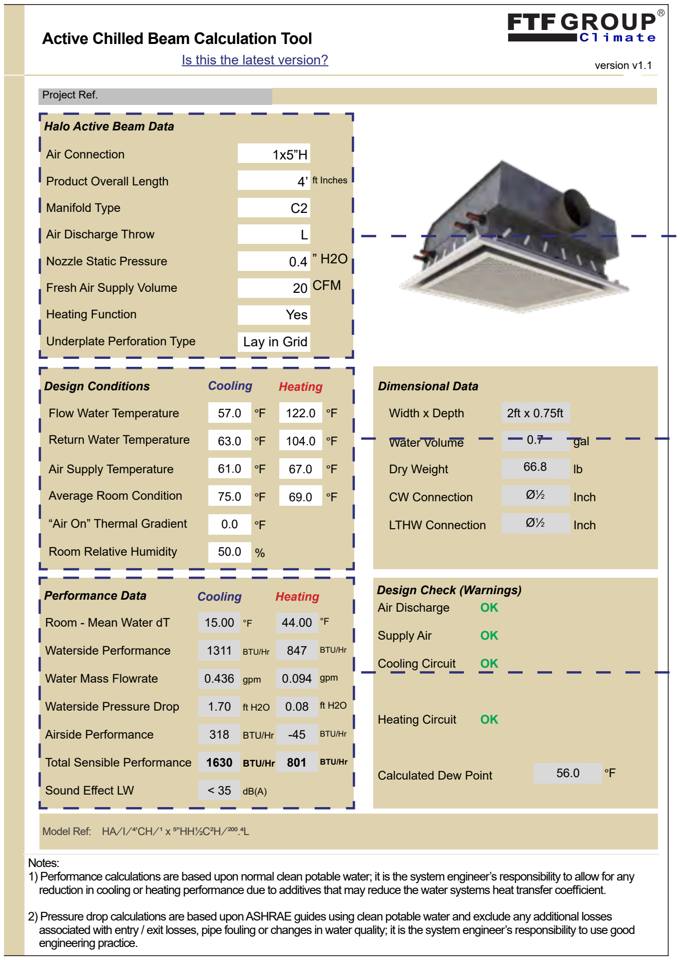
7. Air Supply / Discharge
Air Supply Volume (CFM)
21 04 L
Air Discharge Characteristics
L: Long Throw - No Discharge Vanes
M: Medium Throw - 18° Discharge Vanes
S: Short Throw - 35° Discharge Vanes
Air Supply Nozzle Pressure (in H_2O)

Example:

HAI	CH	2.0	7D	-	1 x 5"H	½C³H	-	2104L
1	2	3	4		5	6		7

Calculation Program





Active Chilled Beam Calculation Tool

Is this the latest version?

FTF GROUP® Climate

version v1.1

Project Ref.

Halo Active Beam Data

Air Connection	1x5"H	
Product Overall Length	4'	ft Inches
Manifold Type	C2	
Air Discharge Throw	L	
Nozzle Static Pressure	0.4	" H2O
Fresh Air Supply Volume	20	CFM
Heating Function	Yes	
Underplate Perforation Type	Lay in Grid	

Design Conditions	*Cooling*		*Heating*	
Flow Water Temperature	57.0	°F	122.0	°F
Return Water Temperature	63.0	°F	104.0	°F
Air Supply Temperature	61.0	°F	67.0	°F
Average Room Condition	75.0	°F	69.0	°F
"Air On" Thermal Gradient	0.0	°F		
Room Relative Humidity	50.0	%		

Dimensional Data

Width x Depth	2ft x 0.75ft	
Water Volume	0.7	gal
Dry Weight	66.8	lb
CW Connection	Ø½	Inch
LTHW Connection	Ø½	Inch

Performance Data	*Cooling*		*Heating*	
Room - Mean Water dT	15.00	°F	44.00	°F
Waterside Performance	1311	BTU/Hr	847	BTU/Hr
Water Mass Flowrate	0.436	gpm	0.094	gpm
Waterside Pressure Drop	1.70	ft H2O	0.08	ft H2O
Airside Performance	318	BTU/Hr	-45	BTU/Hr
Total Sensible Performance	**1630**	**BTU/Hr**	**801**	**BTU/Hr**
Sound Effect LW	< 35	dB(A)		

Design Check (Warnings)

Air Discharge	OK
Supply Air	OK
Cooling Circuit	OK
Heating Circuit	OK
Calculated Dew Point	56.0 °F

Model Ref: HA/I/4'CH/1 x 5"HH½C2H/200.4L

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

2) Pressure drop calculations are based upon ASHRAE guides using clean potable water and exclude any additional losses 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	1x5"H	
Product Overall Length	4'	ft Inches
Manifold Type	C2	
Air Discharge Throw	L	
Nozzle Static Pressure	0.4	" H2O
Fresh Air Supply Volume	20	CFM
Heating Function	Yes	
Underplate Perforation Type	Lay in Grid	

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

Simply select from the drop down menu the "Air Connection" configuration. Air volumes in excess of 84.8 CFM and up to 106 CFM 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, chose 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 Perorated" options can be found on page 113.

Design Conditions	*Cooling*		*Heating*	
Flow Water Temperature	57.0	°F	122.0	°F
Return Water Temperature	63.0	°F	104.0	°F
Air Supply Temperature	61.0	°F	67.0	°F
Average Room Condition	75.0	°F	69.0	°F
"Air On" Thermal Gradient	0.0	°F		
Room Relative Humidity	50.0	%		

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	15.00	°F	44.00	°F
Waterside Performance	1311	BTU/Hr	847	BTU/Hr
Waterside Mass Flowrate	0.436	gpm	0.094	gpm
Waterside Pressure Drop	1.70	ft H2O	0.08	ft H2O
Airside Performance	318	BTU/Hr	-45	BTU/Hr
Total Sensible Performance	**1630**	**BTU/Hr**	**801**	**BTU/Hr**
Sound Effect Lw	<35	dB(A)		

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

Finally, the "Design Check" should read "Ok" in green, or detail some warnings in red.
Calculation program's for Halo™ are available upon request.

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

Active Chilled Beams for Healthcare and Patient Rooms

Introduction

Chilled Beams are a tried and tested technology (circa 50 years) and over more recent years have further developed for a wide range of applications, especially given the ever increasing awareness for 'Energy Efficient' solutions.

Chilled Beam technology is predominantly used in 'owner occupied' buildings or buildings where the persons paying the energy and/or maintenance bills are influential in the HEVAC equipment selection / solution.

One such sector is 'Healthcare'. Frenger have a great deal of awareness of 'Healthcare' applications stemming back some 80 years when Frenger Troughton Young pioneered the supply and installation of Frenger heated ceilings to most if not all hospitals in the UK.

Currently Frenger mainly utilise active chilled beam technology to provide the heating as an integral part of the water driven cooling and fresh (filtered) air ventilation system, with shallow depth constructed active chilled beam (ACB) units that are purposely designed for 'Healthcare' applications.

Detailed below are some of the 'Plus Points' for ACB technology and some 'Project References' for Frenger supplied ACB units for healthcare / hospital applications.

Eco HQ Healthcare

Eco HQ Healthcare - Battery Removal Tool

Chilled Beam Technology Plus Points

- Long Life Expectancy (30 Year extended Warranty available) as ACBs have no moving parts, there are no components to wear out or replace.
- Low Maintenance, (only a bi-annual clean is recommended as ACBs have no moving parts, no filters to replace and all access for simple cleaning is from the room side, not the ceiling void).
- Energy Efficient (Typically 22 % lower than top tier Fan Coil Units - see energy study TFS 004 on Feta / HEVAC website for details).
- Optimum in room occupancy Thermal Comfort (compliance to all categories of BS EN ISO7730 'ergonomics of the indoor thermal environment').
- Low noise levels (less than 25 dB sound pressure levels are possible).
- Low Construction Depth (typically 300mm ceiling void is possible, reduced building heights available or more floor levels for same building height in building towers).
- Simple System to Control - soft landings not an issue and system performance is as design (no hidden energy usage as recently discovered with other HVAC equipment not factored into the total energy consumption).
- Best overall 25-year life cycle cost (see BISRIA Blue Book).

Eco HQ Healthcare - Lowered Battery

Reduced risk of cross-contamination

Mechanical filtration at the air handling unit (AHU) can be effective in producing virtually bacteria-free supply (primary) fresh air in hospitals. Viruses and many gases, however, cannot be filtered.

By introducing filtered primary (fresh) air from the AHU to a patient rooms with healthcare Active chilled beam (ACB) units, coupled with all recirculated room air via the ACB closed back design and extract air not being reused avoids ‘cross contamination’ with ceiling voids and/or other patient rooms.

It is best practice to extract air from the corridors to yield a more positive air pressure in the patient room and under pressure in the corridor where old air is extracted.

Dependent upon patient room size / loads, one or more healthcare ACB units (each compact in design and no need for separate grills taking up valuable ceiling space) can keep all fresh and recirculated air within the room space which prevents the conditioned clean air coming into contact with the ceiling void and/or other rooms.

Healthcare ACB units are extremely low maintenance (because of no moving parts and all filters and controls being at the AHU / plant room and / corridors), but even so the healthcare ACB units are fully accessible from the room space below (inspection and cleaning of the coil and induction grille can be performed from the lower face of the ACB unit) without having to remove any ceiling tiles and/or accessing the ceiling void.

Additionally, healthcare ACB units are designed so they operate above dew point, hence avoiding condensation on the fin coil and preventing any need for drip trays as associated with FCU’s. Coils that run wet (below dew point) such as FCU’s collect dust and dirt and so require special maintenance (treatment of coils and regular dosing of drip trays with chemicals to avoid mould growth etc...) and inspection / replacement of other moving parts.

This simplistic but highly effective design approach is not possible with other systems such Fan coil units (FCUs) unless you have at least 3 grilles per patient room (one to supply fresh air from the AHU, another for recirculated room air ducted into the FCU and another for the conditioned air supplied from the FCU, all which takes up precious ceiling area and the FCU only serving the one patient room that it is located.

Halo Healthcare

Halo Healthcare - Lowered Battery

Good Hope Hospital - Birmingham, UK

Optimum comfort and IAQ (indoor air quality)

An Active chilled beam (ACB) system will typically control temperature and humidity in the occupied space via the air handling unit (AHU) with a constant supply of primary air (minimum fresh-air ventilation requirements are met at all times) and chilled water (above dew point) for sensible loads.

With the elevated chilled water (above dew point) providing the sensible cooling the space temperature is well regulated and thus allows constant-volume delivery of supply fresh filtered air, with comfortable recirculated room air temperatures and low air speeds for compliance to BS EN ISO7730 (ergonomics of the indoor thermal environment).

Air from the Active chilled beams is distributed evenly throughout a space (5:1 induction ratio) in a controlled manner with use of the Coanda effect to entrain conditioned air against the ceiling rather than cold air dumping which is more associated with FCU's given the much colder air off coil temperatures result in denser, less buoyant air.

Quiet Operation

High ambient-noise levels in patient rooms is believed to have negative impacts upon patients, ranging from loss of sleep, elevated blood pressure to extended recovery times. Properly designed Active Chilled Beam (ACB) systems contribute virtually no detectable noise to occupied spaces, with sound pressure levels which can be below 25 dB. Fan Coil units (FCU's) typically create more noise (higher sound pressure) levels, typically 38 dB which can be detrimental to patient recovery / occupancy room comfort.

Minimal Maintenance

Chilled beams have no internal moving parts and have little to no maintenance requirements. However, as large amounts of bedding are used in patient-care areas of hospitals. Lint from this bedding can become airborne, although chilled beams do not usually attract large amounts of lint as the velocity of the recirculated air moving through the fin coil battery heat exchanger element is too low, it still is a good practice to perform routine maintenance on them.

Healthcare Chilled-beams offer removable under plates and drop down fin coil heat exchangers battery's to enable for full access to the recirculation air chamber all cleaning of the battery to all 4 sides.

Ordinarily cleaning of the battery for lint is bi annually along with a wipe down of visual surfaces with a damp cloth with mild detergent and/or anti-bacterial cleanser.

Royal Sussex Hospital - Brighton, UK

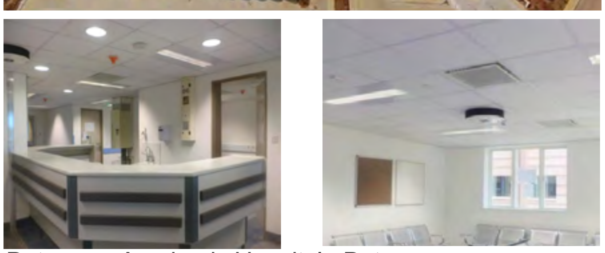
Queens Medical Centre - Nottingham, UK

Royal London Hospital - London, UK

Active Chilled Beam Healthcare projects include:

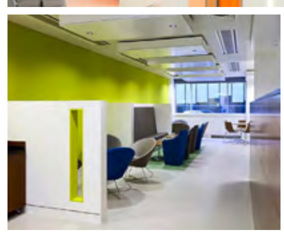
- ANTHC - Skywalk, Anchorage, Alaska
- New Victoria Hospital - Glasgow, UK
- Monash Children's Hospital - Victoria, Australia
- South Bucks Hospice - Buckingham, UK
- Kidderminster Hospital - Kidderminster, UK
- Albury Wogonga Cancer Centre - Wangaratta, Australia
- Kent & Cantebury Hospital - UK
- Glasgow Royal Infirmary, Gynae - UK
- Kingston Aged Care - Australia
- KSAU Medical Health Science - Riyadh, Saudi Arabia
- KSAU Medical Health Science - Jeddah, Saudi Arabia
- KSAU Medical Health Science - Riyadh, Saudi Arabia
- KSAU Medical Health Science - Al Ahsa, Saudi Arabia
- Enhanced Bio Bank Medical Research - Saudi Arabia
- Royal Children's Hospital - Melbourne, Australia
- Great Ormond Street Hospital - London, UK
- Gartnavel General Hospital - Glasgow, UK
- Alder Hay New Research Centre - Liverpool, UK
- St Lukes Hospital - UK
- Beatson Oncology - Glasgow, UK
- Macmillan Hospital - UK
- Macmillan Hospital - UK
- KHUH - Oncology Centre - Bahrain
- Walsall Hospital - Walsall, UK

Royal Hospital - Australia



Botswana Academic Hospital - Botswana

New Stobhill Hospital - Glasgow, UK



Meridian Court - Glasgow, UK

MSCB's

Introduction to MSCB's

FTF Group manufactures and supplies multiservice chilled beams (MSCBs). These integrated building services units provide flexible space conditioning that can be tailored in terms of appearance and the services provided, in order to meet project specific requirements. In this way they help to create attractive, comfortable and productive working environments.

Flexible building service units

A full range of building services can be incorporated within a FTF Group multiservice chilled beam, including:

- Cooling & heating
- Fresh air supply
- Uplighting, downlighting and emergency lighting
- BMS sensors, control valves & condensation detectors
- Accommodate fire alarms and sprinkler systems
- Acoustic insulation
- Pipework, ductwork & compartmental trunking
- Accommodate PA and VA speaker systems

Bringing several services together in an integrated MSCB unit means that the physical dimensions of the unit can be optimized to enable use in spaces where the floor-to-slab height is minimal. The concept also provides the specifier with a single source of responsibility for the design, supply and integration of all services "pre fabricated" offsite in a controlled environment, reducing costs and on-site time.

Operation

MSCB's can utilize either "Radiant" passive or Active chilled beam technologies. The cooling units are integrated into perforated architectural casings with either central or side-mounted lighting. Lighting options are varied and could be direct, indirect, a combination direct and indirect,T5 fluorescent, LED's or continuous extruded lighting optics of any shape and size to suit the architectural aspirations of the project. Completed MSCB's are factory tested and delivered to site for "plug and play" mechanical and electrical connection / installation.

FTF Group's passive MSCB utilize the company's "Radiant"/ convective products to provide comfortable cooling through a combination of convective and radiant heat transfer processes; warm room air is cooled through contact with the chilled beam and diffused into the space through the perforated underplate, the beam casing is also cooled via secondary radiation and thus absorbing heat from the warmer occupants. This type of passive cooling provides the best possible combination of high cooling capacities and exception levels of occupancy comfort with minimal maintenance.

Where there is a need to use the MSCB to deliver fresh air into the space, then FTF Group's Slim Line or High Output Active beam products will form the basis for the company's active MSCB's. Active beams utilize the delivery of supply air to induce warmer room air through the unit's cooling battery. The technology employed in FTF Group's active chilled beams ensures high cooling capacity with low supply air volumes, coupled with a quiet and controlled delivery of air for optimal comfort.

Both types of MSCB are designed for simple installation; electrical, water and air connections can be inter-linked from unit to unit by simple "Plug and Play" connections to reduce on-site time to a minimum.

Active MSCB

Radiant Passive MSCB

Radiant Passive MSCB

Active MSCB

Operation Continued

Frenger's passive MSCB utilise the company's "Radiant" / Convective products to provide comfortable cooling through a combination of convective and radiant heat transfer processes; warm room air is cooled through contact with the Chilled Beam and diffused into the space through the perforated underplate, the beam casing is also cooled via secondary radiation and thus absorbing heat from the warmer occupants. This type of passive cooling provides the best possible combination of high cooling capacities and exception levels of occupancy comfort with minimal maintenance.

Where there is a need to use the MSCB to deliver fresh air into the space, then Frenger's Slim Line or High Output Active beam products will form the basis for the company's Active MSCB's. Active Beams utilise the delivery of supply air to induce warmer room air through the unit's cooling battery. The technology employed in Frenger's Active Chilled Beams ensures high cooling capacity with low supply air volumes, coupled with a quiet and controlled delivery of air for optimal comfort.

Both types of MSCB are designed for simple installation; electrical, water and air connections can be inter-linked from unit to unit by simple "Plug and Play" connections to reduce on-site time to a minimum.

Finish and appearance

MSCB's offer an alternative to the monolithic ceilings that have become commonplace in office developments, providing attractive yet functional building services installations. The appearance of each beam can be customised in terms of shape, dimensions, lighting options, colour and perforation pattern to meet the client's particular requirements.

Technical Support

Frenger can draw upon many years experience in the design and manufacture of cooling systems which combine the highest levels of occupancy comfort with class-leading design. Frenger has a "proven track record" for delivering the highest performing and largest Multi Service Chilled Beam projects in the World, in-house specialist manufacturing, state-of-the-art test facilities and various design operations for all aspects of every service within their MSCB units.

Frenger can offer clients a range of support services here in the UK at their Pride Park Facility;

- Full Climate Testing to predict comfort levels.
- Full lighting design including light level calculations and luminaire development to LG3 / LG7 requirements.
- CAD drafting and 3D rendering of MSCB units in the given environment.
- Solidworks.
- CFD Modelling.
- Energy Modelling.
- BIM Software (Project Specific parabolic models available).
- Revit.


Active MSCB


Radiant Passive MSCB


Radiant Passive MSCB


Active MSCB

Benefits of MSCB's

- Ideal where floor-to-slab height is minimal.
- Low running costs with minimal maintenance requirements.
- Integration of several services in a single unit reduces costs and site programme requirements ("pre-fabricated" off site).
- High cooling / heating capacities.
- Low noise and low draught risk makes for high comfort levels.
- Beam aesthetic can be customised to client requirements.
- Single point of responsibility for the design, integration, manufacture and testing of all services ("Plug and Play").

Frenger's unique benefits

- 'In-house' lighting design and luminaire development.
- Passive MSCBs deliver cooling via radiant absorption and convection.
- Active MSCBs deliver high cooling capacities with minimal supply air volume.
- Considerable experience in the design and supply of both active and passive types of MSCB.
- **Only company whom manufacture inhouse the services offered and to also have the inhouse test facilities for all the services offered.**

In-house Testing Facilities

Frenger also has the following in-house test facilities which enable us to develop and offer clients with bespoke MSCB designs;

- 3 number state of the art Climatic Test Laboratories (BSRIA calibrated) generally in accordance with BS EN 14518:2005, BS EN 15116:2008 and BS EN 14240:2004.
- 1 number Photometric Test Labs along with lighting design in accordance with BS EN 13032 and sound engineerin practice.
- 1 number Integration laboratory for establishing Light Output Ratios (LOR) in accordance with BS EN 13032. All data manipulation, correlation and presentation in accordance with CIE 117, CIE 121, CIE 127, BS 5225, BS 354, TM4, TM10, LG7 and EN 60598
- Acoustic testing semi-anechoic chamber which measures Class 1 measurements at 11 different one third octave bands between 16Hz to 16kHz.

Radiant Passive MSCB

Active MSCB

Radiant Passive MSCB

Active MSCB

Radiant Passive MSCB

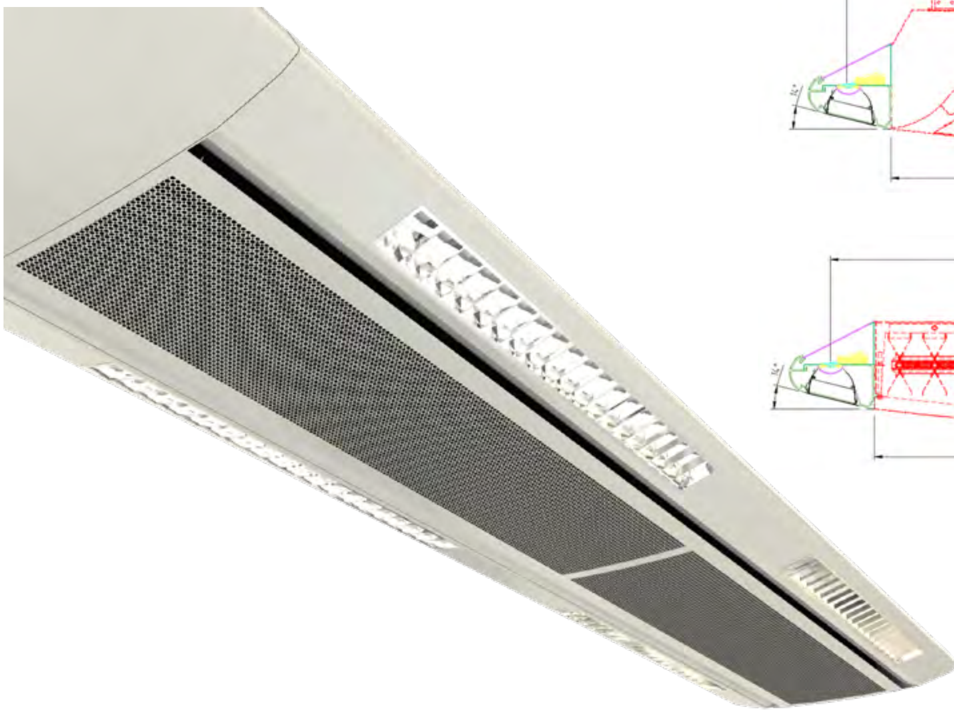
Active MSCB

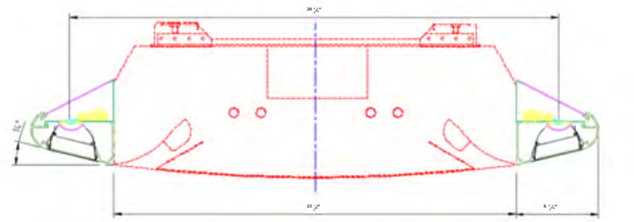
Radiant Passive MSCB

Lighting Options

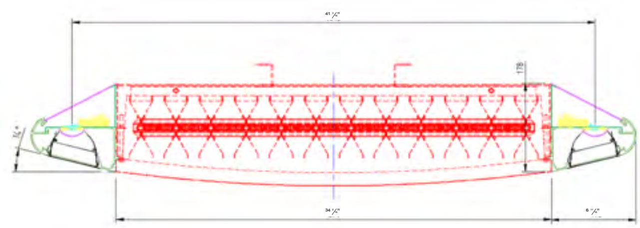
PLED-CD-ASML & PLED-IND

Direct LED luminaire with optional emergency conversion &
Indirect LED Luminaire





Active MSCB



Passice MSCB

Standard LED Boards

Luminaire Nom. Length (in)	Lumens @ 300K	Lumens @ 4000K	Nom. Current	Power (W)
11 13⁄16	640	660	137 mA	4.6
23 5⁄8	1280	1320	137 mA	9.3
35 7⁄16	1920	1975	137 mA	14.0
47 1⁄4	2560	2645	137 mA	18.9
59 1⁄16	3200	3280	137 mA	23.2

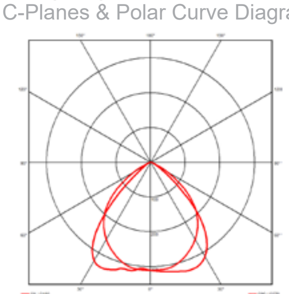
High Output LED Boards (250 mA) are also available, please contact Frenger's technical department for further information.

Note: Intermediate performance figures are available based on different nominal current supplied by the driver; note the nominal current is factory set during electrical testing.

Luminaire

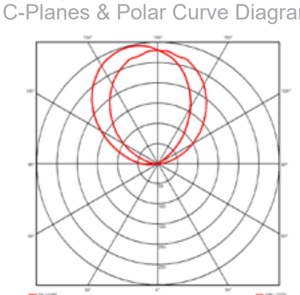
- LED Line Gen3
- Direct lighting via Multi-Layered Micro-Linear Prismatic Diffuser
- Indirect lighting (optional) via full length Satinice Diffuser top cover.
- LED Color Temperatures: 3000, 4000K
- Color Rendering Index: Min 80.
- Standard Deviation Color Matching: 3
- LED Luminous Efficacy: Up to 165lm/W
- Lumen Maintenance Test Results According to IESNA LM-80 = B50L70
- ESD Withstand Voltage: Up to 8kV direct contact

Direct Lighting Photometric Distribution: C-Planes & Polar Curve Diagram



	C0	C30	C60	C90	C120	C150	C180
0	285	285	285	285	285	285	285
10	300	297	287	280	276	273	273
20	338	325	281	257	254	215	282
30	315	314	281	231	240	287	306
40	161	202	267	228	262	242	242
50	19.4	39.9	225	155	227	111	97.2
60	8.2	11.3	32.4	44.5	219	10.1	8.9
70	3.9	6.3	6.1	3.5	3.3	4.2	2.8
80	0.7	2	1.4	1.2	1	0.7	0.6
90	0.8	0.7	0.7	0.6	0.4	0.3	0.3
100	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0
130	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0
160	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0
	cd/1000lm						

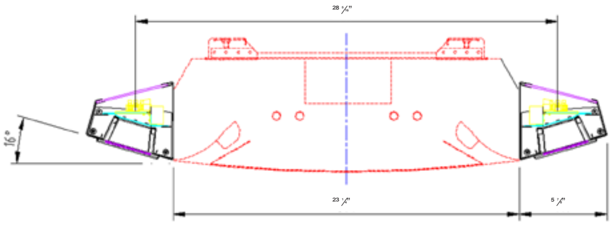
Indirect Lighting Photometric Distribution: C-Planes & Polar Curve Diagram



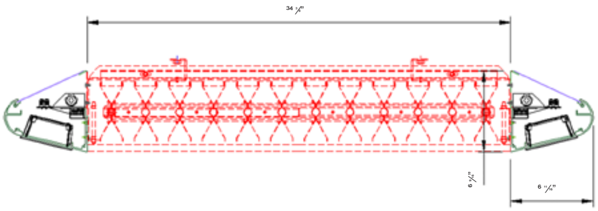
	C0	C30	C60	C90	C120	C150	C180
0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0
80	0	0	0	0	2.4	13.9	17.8
90	0.5	0.5	0.6	0.8	27	37.3	40.9
100	0.5	0.5	0.7	19.8	52.4	67.9	72.8
110	0.6	0.8	5.3	56	89.4	108	114
120	1	2.9	53.7	97.6	132	155	163
130	39.2	62.3	135	142	178	202	210
140	102	116	148	186	221	243	250
150	161	170	195	226	255	273	280
160	213	220	236	256	277	291	295
170	256	258	266	270	286	293	296
180	281	281	281	281	281	281	281
	cd/1000lm						

FLED-MMPD & PLED-IND

Direct LED luminaire with optional emergency conversion &
Indirect LED Luminaire



Active MSCB

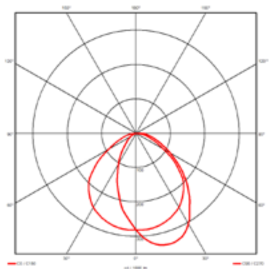


Passice MSCB

LED Performance

Luminaire Nom. Length (in)	Lumens @ 300K	Lumens @ 4000K	Nom. Current	Power (W)
11 13⁄16	605	650	137 mA	4.8
23 5⁄8	1210	1300	137 mA	9.6
35 7⁄16	1815	1950	137 mA	14.4
47 1⁄4	2420	2600	137 mA	19.2
59 1⁄16	3025	3250	137 mA	24.0

Direct Lighting Photometric Distribution: C-Planes & Polar Curve Diagram



	C0	C30	C60	C90	C120	C150	C180
0	281	281	281	281	281	281	281
10	327	323	305	280	251	230	225
20	335	332	310	269	216	177	160
30	304	309	298	248	177	124	103
40	241	255	266	214	130	77.6	60.6
50	177	196	212	162	80.5	42.4	33.1
60	114	134	141	92.6	42.2	22.3	17.5
70	67.8	76.3	73.4	46.5	20.7	8.6	5.4
80	36.9	38.5	34.5	19.8	3.3	0.4	0.3
90	19.4	19	13.7	0.9	0.5	0.4	0.4
100	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0
130	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0
160	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0
	cd/1000lm						

Indirect Lighting Photometric Distribution: C-Planes & Polar Curve Diagram

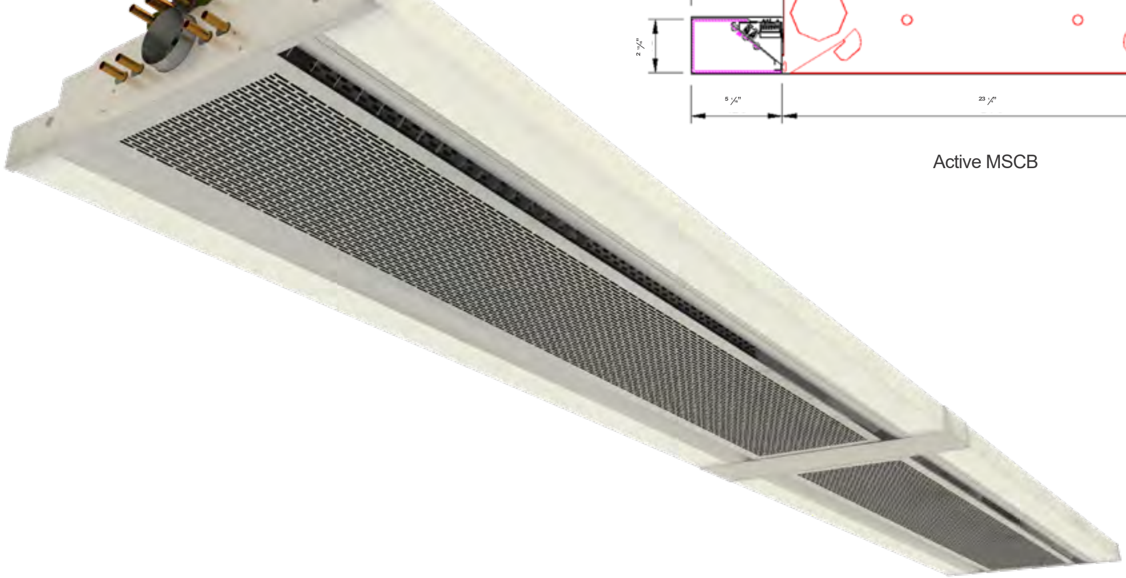
	C0	C30	C60	C90	C120	C150	C180
0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0
80	0	0	0	0	2.4	13.9	17.8
90	0.5	0.5	0.6	0.8	27	37.3	40.9
100	0.5	0.5	0.7	19.8	52.4	67.9	72.8
110	0.6	0.8	5.3	56	89.4	108	114
120	1	2.9	53.7	97.6	132	155	163
130	39.2	62.3	135	142	178	202	210
140	102	116	148	186	221	243	250
150	161	170	195	226	255	273	280
160	213	220	236	256	277	291	295
170	256	258	266	270	286	293	296
180	281	281	281	281	281	281	281
	cd/1000lm						

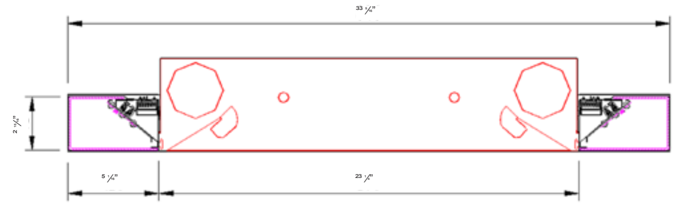
Luminaire

- LED Line Gen3
- Direct lighting via Multi-Layered Micro-Linear Prismatic Diffuser
- Indirect lighting (optional) via full length Satinice Diffuser top cover.
- LED Color Temperatures: 3000, 4000K
- Color Rendering Index: Min 80.
- Standard Deviation Color Matching: 3
- LED Luminous Efficacy: Up to 165lm/W
- Lumen Maintenance Test Results According to IESNA LM-80 = B50L70
- ESD Withstand Voltage: Up to 8kV direct contact

FSL-PSD-LED (GEN 3)

Continuous Direct and Indirect LED luminaire with optional emergency conversion





Active MSCB

LED Performance

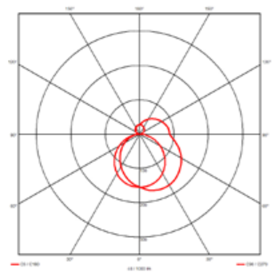
Luminaire Length* (in)	LED Board Qty	Max Lumens @ 3000K**	Max Lumens @ 4000K**	Power (W)**
35 7/16	3	1815	1950	14.9
47 1/4	4	2420	2600	19.9
59 1/16	5	3025	3250	24.9
68 7/8	6	3630	3900	29.9
80 11/16	7	4235	4550	34.9
92 9/16	8	4840	5200	39.9
102 3/8	9	5445	5850	44.8
114 3/16	10	6050	6500	49.9
125 15/16	11	6655	7150	54.8
137 13/16	12	7260	7800	59.8

Notes:
* Other luminaire lengths available but some shadowing at the ends of the luminaire may occur.
** Power and lumen output figures based on 137mA supply, alternative supply outputs available.

Luminaire

- LED Line Gen3
- Direct / Indirect lighting via extruded Opal Diffuser
- LED Colour Temperatures: 3000, 4000K
- Colour Rendering Index: Min 80.
- Standard Deviation Color Matching: 3
- LED Luminous Efficacy: Up to 165lm/W
- Lumen Maintenance Test Results According to IESNA LM-80 = B50L70
- ESD Withstand Voltage: Up to 8kV direct contact.

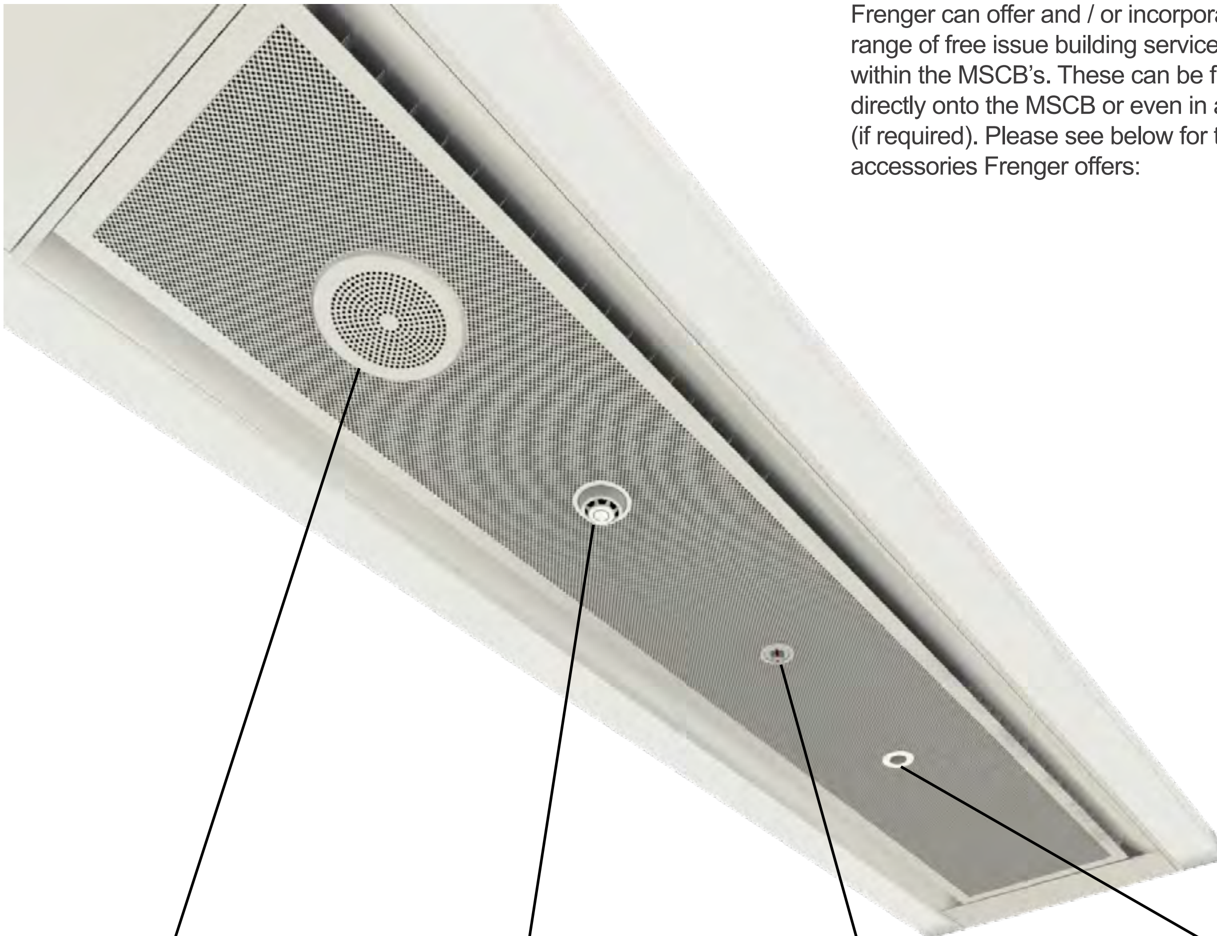
Direct Lighting Photometric Distribution: C-Planes & Polar Curve Diagram

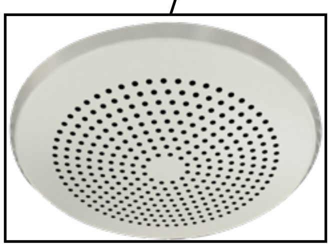


0	154	154	154	154	154	154	154
10	166	164	159	153	148	144	143
20	172	169	158	145	137	130	127
30	172	167	151	132	110	113	109
40	165	159	132	114	105	93.8	89.6
50	154	146	122	92.8	84.4	74	70.2
60	139	129	101	69.1	62.9	54.1	51
70	121	101	77	44	40.3	33.9	31.6
80	101	87	52.5	18.5	18.5	14.9	14
90	87.4	71.6	36	1.7	1.6	1.8	1.8
100	85.4	70.8	36.9	4.8	4.5	4.5	4.5
110	80.7	68.1	38.1	9.1	8.7	8.3	8.1
120	74.3	63.7	38.4	13.5	12.7	12.1	12
130	66.9	58.4	37.5	17.5	16.6	16.1	15.6
140	58.9	52.2	36.2	20.9	20.1	19.6	16.3
150	50.6	45.5	34.2	23.9	23.3	22.7	22.1
160	41.8	38.5	31.7	25.9	25.8	25.6	25.8
170	33.5	31.6	29.1	27.1	27.3	27.4	27.4
180	28.1	27.5	27.2	27.4	28.2	29.1	29.3
	cd/1000lm						

MSCB Building Service Accessories

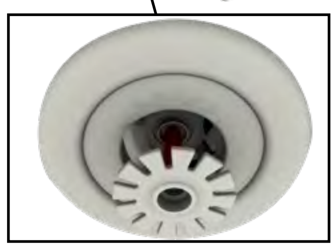
Frenger can offer and / or incorporate a wide range of free issue building service accessories within the MSCB's. These can be fitted directly onto the MSCB or even in a joining strip (if required). Please see below for the standard accessories Frenger offers:



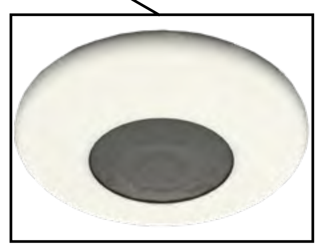


PA/VA Speaker Systems

Smoke Detector



Sprinkler Systems



PIR Sensors

Building Services built into a joining strip

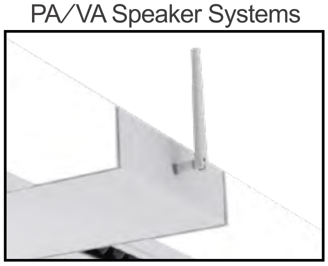
PA/VA Speaker Systems

Smoke Detector

Sprinkler Systems

PIR Sensors

For further building service accessories that may not have been mentioned above please contact Frenger's technical department for further information / possibilities.



WIFI Antenna

Large Project Experience

55 Baker Street





The iconic 55 Baker Street building in London has been completely refurbished and redeveloped by London & Regional. The project's well-regarded success proves that 21st Century design can be applied just as well to existing buildings as it can to new buildings.

Frenger's order value was £7.6 million for the Supply and Installation of 4,500 Active Multiservice Chilled Beams (this equates to in excess of 11km of Multiservice Chilled Beams). The total refurbishment costs for this project were in the region of £200 million for HBG Construction (BAM) and this is still the world's largest MSCB project to date.

Frenger designed, developed and in-house Climatic tested the MSCB solution at the Derby facility to validate cooling and heating performance compliance to BS EN ISO 7730 (Technical data available to download from Frenger's website under 'Technical Downloads', TDS 004A & TDS 245) for room occupancy comfort.

65 Southwark Street

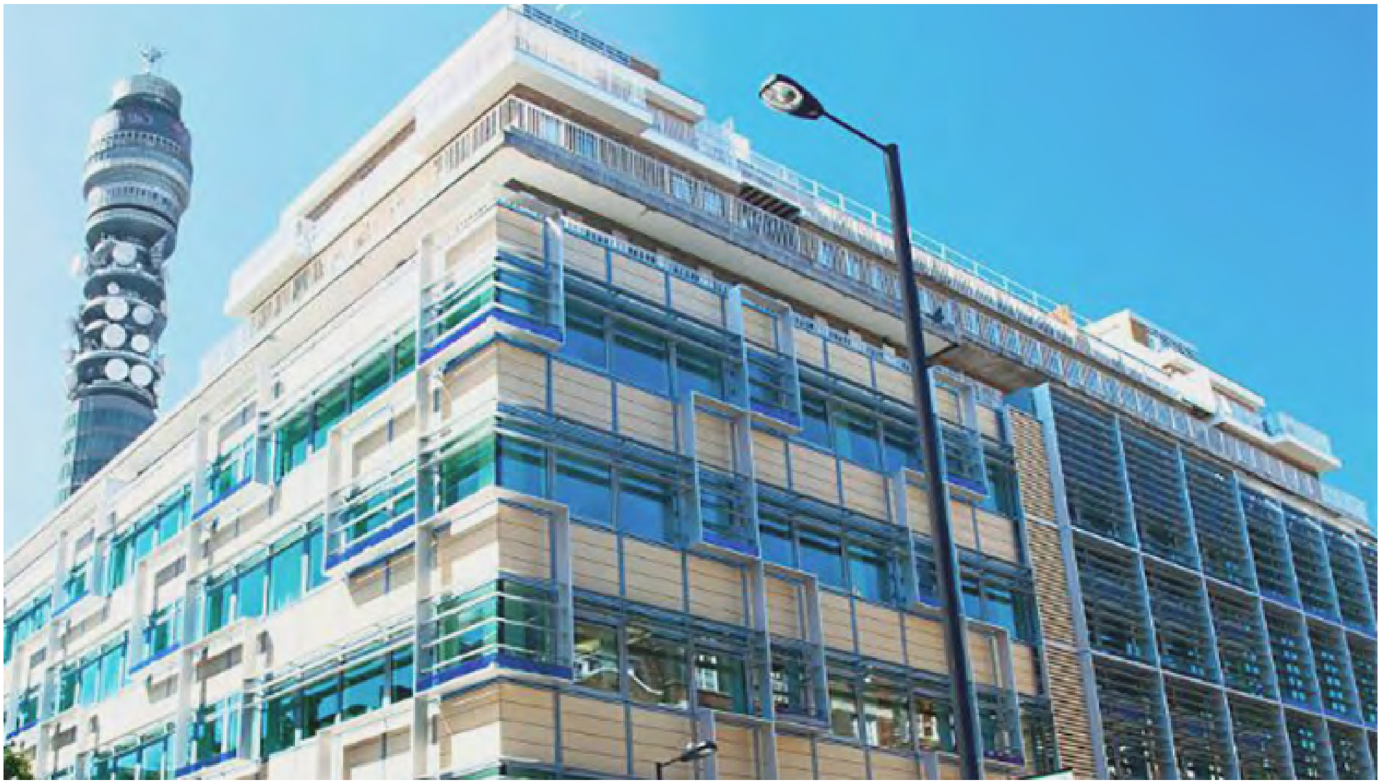
“Frenger successfully designed and supplied over 1,200 linear meters of active chilled beams to 65 Southwark Street, London as part of a major refurbishment.

This solution incorporates extruded polycarbonate side mounted lighting diffusers and LED technology. All luminaires manufactured by Frenger utilise first tier electrical components

The ‘slim line’ Multiservice Chilled Beams (MSCB’s) that are only 133mm deep and that provide in excess of 500 watts waterside cooling per meter with minimum fresh air for the respiratory requirements of the occupants to enable the most energy efficient air conditioning solution.

The ‘slim line’ construction of the MSCB were required given the buildings 2.65m slab to slab construction. The building was awarded BREEAM ‘Excellent’.

101 New Cavendish Street



The extensive refurbishment of 101 New Cavendish Street has been a most impressive and distinguished project incorporating nearly 2-kilometers of Active Multiservice Chilled Beams over 4-floor levels.

The Multiservice Chilled Beams on this project provide the main architectural feature within the office space, therefore they were designed to enhance the building by using state of the art space conditioning technology whilst providing striking aesthetics. To achieve a continuous linear aesthetic the Chilled Beams were series linked together to form run lengths of upto 19-meters long.

To achieve runs of this length with 100% off site pre-fabrication, Frenger manufactured each beam MSCB section at 3m long complete with 'plug and play' system for the Mechanical and Electrical services interconnected behind a 0.5m long plain removable joining infill profile. All 3m long master and slave MSCB sections were factory set and tested both electrically and mechanically saving on site commissioning time.

In addition to the high cooling and energy efficient performance, the integrated luminaires were designed with full daylight dimming and presence detection ensuring that the total MSCB system continually operated with minimal energy consumption.

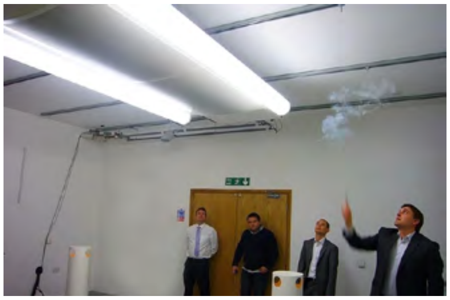
Skipton Building Society

Skipton Building Society's subsidiary HLM (Home Loan Management) new headquarters on the edge of Skipton, the gateway to the Yorkshire Dales, cost £18 million to construct and stands at an impressive 120,000 sq ft over 3 floor levels.

The 850 staff based at Skipton HLM are spread predominantly across open plan office space air conditioned by over 1,100 linear meters of Frenger's "Radiant" cooling Multiservice Chilled Beams (MSCB's) which provide room thermal comfort to the standard of Category A of ISO 7730. (Technical data available to download from Frenger's website under 'Technical Downloads', TDS 004A & TDS 245).

Frenger also in house manufactured the integral luminaires of the MSCB's with asymmetric louvres providing a lighting scheme compliant to LG7. The building achieved a BREEAM "Very Good" rating based upon its green credentials and also received a Commercial Award in 2011 - RICS Pro-Yorkshire Award.

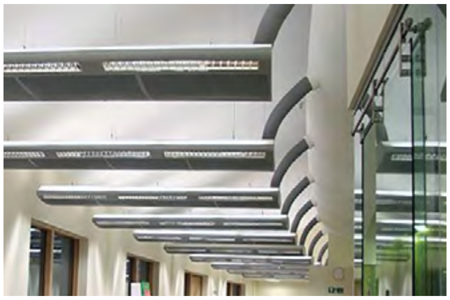
Grosvenor Hill



*This Central London project included "Radiant" Passive Multiservice Chilled Beams (MSCB's) technology operating in conjunction with "sustainable" ground source energy and achieved a **BREEAM "Excellent"** rating and also provided Grade 'A' office spaces across 5 floor levels.*

To further enhance the energy perforamance of the building, **Frenger's MSCB's were combined with an open loop ground source renewable energy system which provided 100% of the buildings heating and cooling requirements.** *This innovative approach to comfort cooling meant that no chillers or boilers were required on the project, freeing up valuable space and providing an Energy Performance Certificate (ECP) rating of only 36.* ***This development also won the London and South East Regional award from the British Council for Offices (BCO).***

National Farmers Union



Multiservice Passive Chilled Beams were used to provide the "wow" factor to this highly prestigious new build headquarters development. The beams were carefully designed to complement the curved floor-plan of the building and provide a light and airy feel for the building occupants.

The beam casing is provided with a metallic silver finish for an industrial futuristic appearance, especially the way in which they are linked to the services bulkhead in such a way that they appear to float in free space.

Frenger also provided Passive and Active Chilled Beams for integration in areas with suspended ceilings, and worked closely with the project engineers to ensure optimal room comfort levels to all locations.

Project References

Building R7, King Cross
London, UK - 2016/17
Active Multiservice

KHUH, Oncology Centre
Bahrain - 2016
Active Chilled Beams

Sensor City
Liverpool, UK - 2016
Active Multiservice

Barangaroo C2
Sydney, Australia - 2016
Passive Chilled Beams

National Film & TV School
Beaconsfield, UK - 2016
Active MSCB's & Chilled Beams

South Bucks Hospice
High Wycombe, UK - 2016
Active Chilled Beams

Uni of Cantebury
New Zealand - 2016
Active Chilled Beams

Newcastle Civic Centre
Newcaslte, UK - 2016
Active Chilled Beams

Skyline Hills Library
San Diego, USA - 2016
Active Chilled Beams

Skywalk
Anchorage, Alaska - 2015
Active Multiservice

Ocean City School
New Jersey, USA - 2015
Active Chilled Beams

Gatwick Airport
Gatwick, UK - 2015
Passive Chilled Beams

Queens University
Belfast, UK - 2015
Passive Chilled Beams

Sports Direct Head Office
Derbyshire, UK - 2015
Active Chilled Beams

Great Ormond Street Hospital
London, UK - 2015
Active Chilled Beams

Charles Street, Sheffield University
Sheffield, UK - 2015
Passive Chilled Beams

Monash Children's Hospital
Australia - 2014
Active Chilled Beams

Alder Hay Research & Education
Liverpool, UK - 2014
Active Chilled Beams

High Holborn
London, UK - 2014
Active MSCB's & Chilled Beams

Northbrook College
Worthing, UK - 2014
Active Multiservice

50 Flinders Street
Adelaide, Australia - 2014
Passive Chilled Beams

Barclaycard Arena
Birmingham, UK - 2014
Passive Chilled Beams

Northwick Park Hospital
Harrow, UK - 2014
Active Chilled Beams

West Suffolk House
Ipswich, UK - 2014
Passive Chilled Beams

240 Blackfriars Road
London, UK - 2014
Active Chilled Beams

West Yorkshire Police
Wakefield, UK - 2014
Passive Chilled Beams

18-20 Grosvenor Street
London, UK - 2014
Active Chilled Beams

Great West House
London, UK - 2013/14
Active Multiservice

1 Canberra Avenue
Australia - 2013
Passive Chilled Beams

BBC Grafton House
Middlesex, UK - 2012
Active Chilled Beams

Box Hill Hospital
Australia - 2007
Active Chilled Beams

Frimley Park Hospital
Frimley, UK - 2011
Active Chilled Beams

HDTI
Coventry, UK - 2008
Active Chilled Beams

Holmesglen Institute
Australia - 2010
Active Chilled Beams

SIEC Tonsley House
Australia - 2013
Active & Passive Chilled Beams

ANU
Australia - 2013
Active Chilled Beams

Anglia Ruskin University
Cambridge, UK - 2013
Passive Multiservice

IMAS Hobart
Australia - 2012
Passive Chilled Beams

Beaufort House
London, UK - 2012
Passive Multiservice

Neo Bankside
London, UK - 2012
Active Multiservice

5 Murray Rose Avenue
Sydney, Australia - 2012
Passive Chilled Beams

Exeter University
Exeter, UK - 2012
Active Chilled Beams

Stafford College
Stafford, UK - 2012
Active Chilled Beams

Wyre Forest
Kidderminster, UK - 2012
Active Multiservice

Trinity Grammer
Trinidad & Tobago - 2012
Passive Chilled Beams

Cambridge Metallurgy
Cambridge, UK - 2012
Passive Chilled Beams

Tate Modern
London, UK - 2012
Passive Chilled Beams

65 Southwark Street
London, UK - 2012
Active Multiservice

700 Bourke Street
Australia - 2012
Passive Chilled Beams

Veolia Environmental
Cannock, UK - 2012
Passive Chilled Beams

Grosvenor Hill
London, UK - 2012
Passive Multiservice

CISCO
Reading, UK - 2012
Active Multiservice

Langley Point
Birmingham, UK - 2012
Passive Chilled Beams

Common Wealth Bank
of Australia, Sydney - 2012
Passive Chilled Beams

Southampton Civic Centre
Southampton UK - 2011
Active Multiservice

Trinidad School
Trinidad & Tobago - 2011
Passive Chilled Beams

Domino's Pizza HQ
Milton Keynes, UK - 2011
Passive Multiservice

Eskom, Megawatt Park
South Africa - 2011
Passive Chilled Beams

Vodafone Innovation
South Africa - 2011
Passive Chilled Beams

World Park
Adelaide, Australia - 2011
Passive Chilled Beams


Walthamstow Station
Walthamstow, UK - 2011
Passive Chilled Beams


King Saud Bin Abdul
Saudi Arabia - 2011
Active Chilled Beams


Gatwick Search Area
London, UK - 2011
Passive Chilled Beams


All Saints Academy
Cheltenham, UK - 2011
Passive Chilled Beams


24 Britton Street
London, UK - 2011
Passive Multiservice


University of Botswana
Botswana - 2011
Active Chilled Beams


Royal London Hospital
London, UK - 2011
Active Multiservice


City Centre Tower 8
Australia - 2011
Passive Chilled Beams


Wollongong University
NSW. Australia - 2011
Passive Chilled Beams


Melbourne University
Australia - 2010
Active Chilled Beams


Walsall Hospital
Walsall, UK - 2010
Active Chilled Beams


Macmillan Renton Unit
Hereford, UK - 2010
Active Chilled Beams


Kangan Batman Tafe
Australia - 2010
Active & Passive Chilled Beams


HML Headquarters
Skipton, UK - 2010
Active Multiservice


123 Albert Street
Brisbane, Australia - 2010
Passive Chilled Beams


500 Collins Street
Australia - 2010
Active Multiservice


Google Headoffice
Sydney, Australia - 2010
Passive Chilled Beams


Royal Hobart Hospital
Hobart, Tasmania - 2010
Active Chilled Beams


RMIT 9
Australia - 2010
Active Chilled Beams


Belconnen Police
Australia - 2010
Passive Chilled Beams


Five Rivers
Trinidad - 2010
Passive Chilled Beams


Good Hope Hospital
Sutton, UK - 2010
Active Chilled Beams


1 Lancaster Circus
Birmingham, UK - 2010
Passive Multiservice


Kingswood Lakeside
Cannock, UK - 2010
Passive Chilled Beams


Meridian Court
Edinburgh, UK - 2010
Active Chilled Beams


Sudima Hotel
New Zealand - 2010
Active Chilled Beams

New Scotland Yard
London, UK - 2010
Passive Chilled Beams


CIT
Canberra, Australia - 2010
Active Multiservice


Telcom Square
New Zealand - 2010
Passive Chilled Beams


Anglia University
Cambridge, UK - 2010
Passive Multiservice


Liverpool College
Liverpool, UK - 2010
Active Chilled Beams


Knightsbridge Hotel
London, UK - 2010
Passive Chilled Beams


Loxford School
London, UK - 2009
Active Chilled Beams


Cheshire Police
Cheshire, UK - 2009
Active Chilled Beams


New Cavendish Street
London, UK - 2009
Active Multiservice

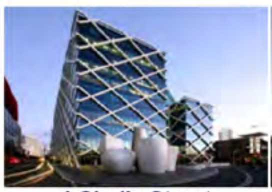

Transport House
Sydney, Australia - 2009
Active Multiservice


Civic Offices
Southampton, UK - 2009
Active Chilled Beams


Kingston Aged Care
Australia - 2009
Active Chilled Beams


Monash University
Australia - 2009
Active Chilled Beams


Warnambool Hospital
Australia - 2009
Active Chilled Beams


1 Shelly Street
Sydney, Australia - 2009
Passive Chilled Beams


South Australia Police
Adelaide, Australia - 2009
Passive Chilled Beams


Kings College
London, UK - 2009
Passive Chilled Beams


Batman Street
Australia - 2009
Passive Chilled Beams


St Barts Hospital
London, UK - 2009
Active Chilled Beams


Edmund Barton
Canberra, Australia - 2009
Active Chilled Beams


ACAD Hospitals - Stobhill
Glasgow, UK - 2008
Active Chilled Beams


King Street Wharf
Australia - 2008
Passive Chilled Beams


55 Baker Street
London, UK - 2008
Active Multiservice


Sydney Water House
Australia - 2008
Passive Chilled Beams


Wrexham A&E
Wrexham, UK - 2008
Active Chilled Beams


Coventry University
Coventry, UK - 2008
Active Chilled Beams


Gatwick Terminal
London, UK - 2008
Passive Chilled Beams


Suffolk County Council
Suffolk, UK - 2008
Passive Chilled Beams


Bidborough House
London, UK - 2008
Active Chilled Beams


Hallward Library
Nottingham, UK - 2008
Active Multiservice


One East Melbourne
Victoria, Australia - 2008
Passive Chilled Beams


Kings Cross
London, UK - 2008
Active Chilled Beams


Cambridge Library
Cambridge, UK - 2008
Active Chilled Beams


QMC Hospital
Nottingham, UK - 2008
Active Chilled Beams


GRI Gynae
Glasgow, UK - 2008
Active Chilled Beams


Business Centre
Liverpool, UK - 2008
Active Chilled Beams


Wesley House
Brisbane, Australia - 2008
Passive Chilled Beams


Liverpool Int. Business Park
Liverpool, UK - 2007
Active Chilled Beams


64 Allara Street
Australia - 2007
Passive Chilled Beams


Sydney Olympic Park
Sydney, Australia - 2007
Passive Chilled Beams


Duke Street
London, UK - 2007
Active Multiservice


University of Sydney
Sydney, Australia - 2007
Passive Chilled Beams


413 George Street
Sydney, Australia - 2007
Passive Chilled Beams


Hills Science Park
Malvern, UK - 2006
Active Chilled Beams


London Circuit
Canberra, Australia - 2006
Passive Chilled Beams


Edinburgh Council
Edinburgh, UK - 2006
Passive Multiservice


National Farmers Union
Warwickshire, UK - 2006
Passive Multiservice


Project Vauxhall
UK - 2006
Passive Chilled Beams


Parramatta Justice
Sydney, Australia - 2006
Passive Chilled Beams


National Audit Office
London, UK - 2005
Active Multiservice


500 Collins Street
Australia - 2005
Active Multiservice


City Central Tower
Adelaide, Australia - 2005
Passive Chilled Beams


Merck Sharp & Dohme
London, UK - 2004
Active Multiservice


10 Green Coat Place
London, UK - 2004
Active Multiservice


Saffron Hill
London, UK - 2004
Active Multiservice


Experian
Nottingham, UK - 2004
Passive Multiservice


Woolworth House
London, UK - 2003
Active Multiservice


The Bond
Australia - 2003
Passive Chilled Beams


BT Leavesden
Watford - 2002
Passive Chilled Beams


Ealing Studios
London, UK - 2002
Passive Multiservice


Royal Sussex Hospital
Brighton, UK - 2002
Active Chilled Beams


Vodafone
London, UK - 2001
Passive Chilled Beams


Gordon House
London, UK - 2001
Active Multiservice


BT Nottingham
Nottingham - 1998
Passive Chilled Beams

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 recognized 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 organizations 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 9001:2008

Frenger Systems are registered by BSI for operating a Quality Management System which complies with the requirements of BS EN 9001:2008.

Eurovent

Frenger Systems participate in the EC program 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 recognized 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 of 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@ftfgroup.us

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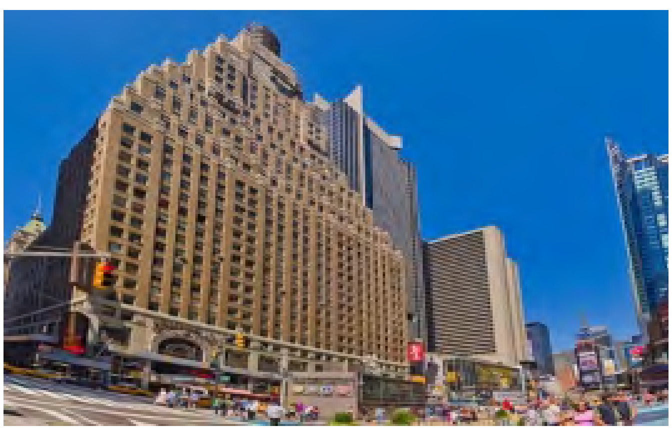

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www.ftfgroup.us

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