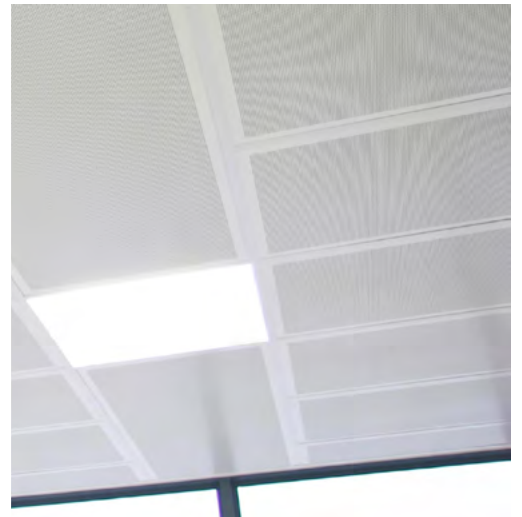


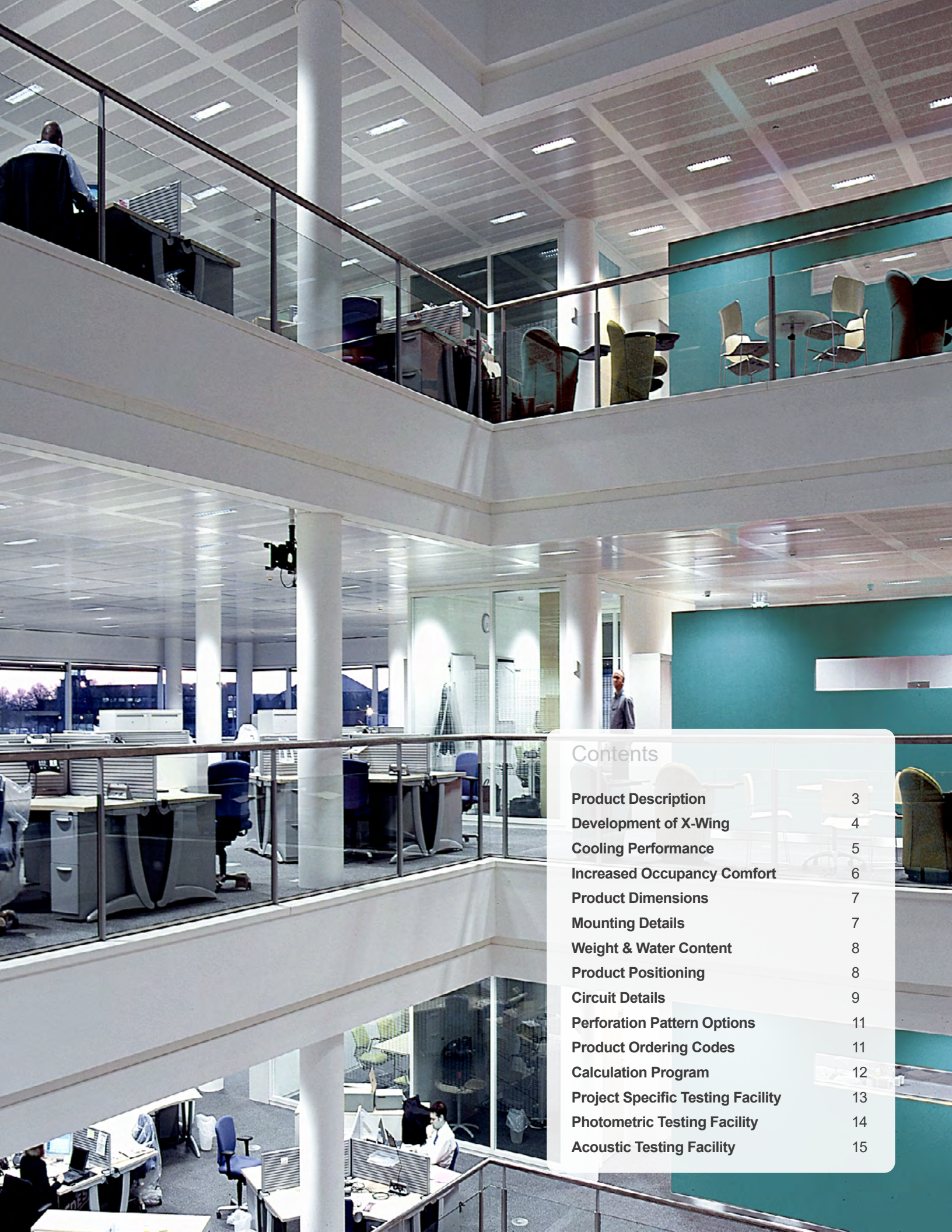
*the future of space conditioning*

# X-Wing®

## passive “Radiant” chilled beam







## Contents

Product Description	3
Development of X-Wing	4
Cooling Performance	5
Increased Occupancy Comfort	6
Product Dimensions	7
Mounting Details	7
Weight & Water Content	8
Product Positioning	8
Circuit Details	9
Perforation Pattern Options	11
Product Ordering Codes	11
Calculation Program	12
Project Specific Testing Facility	13
Photometric Testing Facility	14
Acoustic Testing Facility	15



# 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 5/16" deep and can achieve up to 384 Btu / hr / ft as an exposed passive "Radiant" / convective cooling unit and up to 50 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 **Patent pending performance enhancing features**, as can be expected from the FTF Group brand.

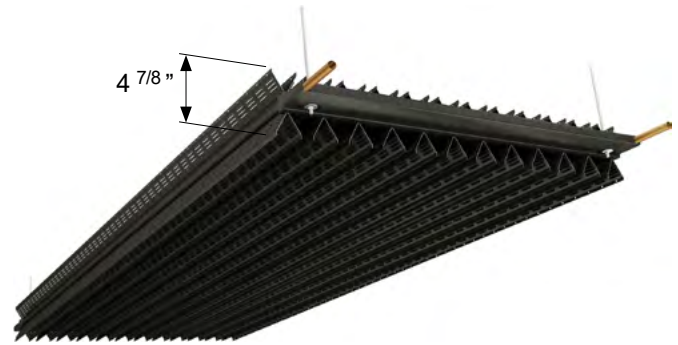
X-Wing is constructed from copper and aluminum and is 100 percent recyclable. The copper coil is produced by the FTF Group's in house fully automatic bespoke "state of the art" serpentine bending machine. This produces seamless sinusoidal copper coils (without any joins) up to 18 3/4ft in length, with up to 12 water passes at 2 3/4" 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 louvers 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 15/16").**
- Only 1/4" clearance required behind unit and as little as 9 15/16" total ceiling construction (see page 8).
- Widths available 1' 3 3/4", 1' 9 5/16", 2' 2 13/16" and 2' 8 5/16".
- Lengths available 3' 11 3/16" up to 19' 8 3/16" in increments of 3 1/8".
- 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' 1 3/16" long and up to 19' 8" 3/16" long for up to 1' 9 5/16" wide models (only 2 joints for 2' 3" and 2' 8" wide models over 13' 1 3/16" 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.**

# Development of X-Wing

Shell Centre - London - 1962



## X-Wing delivers the best of both worlds

Static cooling systems (chilled ceilings and chilled beams) have, over the past 40 years, proven themselves capable of delivering high levels of occupancy comfort at reduced running costs. The FTF Group was at the vanguard of this technology when, in 1962, we supplied 1,900,000ft<sup>2</sup> of chilled ceilings to the Shell HQ building in London (Europe's first fully - sealed air conditioned building!).

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

However, this mixture of systems was not without its problems. The chilled ceiling part of the system requires careful co-ordination with a bespoke ceiling system, offers no flexibility to increase cooling capacity when office use changes (e.g. when creating meeting areas), is difficult to access for maintenance and carries a premium supply / install cost. Where finned tube batteries are used they are generally placed above metal ceilings with large perforation holes (at least 5mm in diameter) and with an excessive open area (typically 50% clear); requiring the "blacking out" of the ceiling void and resulting in an inconsistent ceiling aesthetic. The challenge was to provide a one-system solution that delivered the higher cooling capacity and lower cost of a chilled beam system, whilst maintaining the comfort and aesthetic advantages of chilled ceilings.

The introduction of "Radiant Chilled Beams" is arguably the perfect marriage of these two technologies; the beam delivers high cooling capacities (up to 49.6BTU / hr / ft<sup>2</sup>) and high comfort levels (lower air velocities and lower perceived temperature due to the radiant effect) in a package that can look no different to a contemporary high-spec ceiling system. All this at the substantially lower costs associated with chilled beam installations.

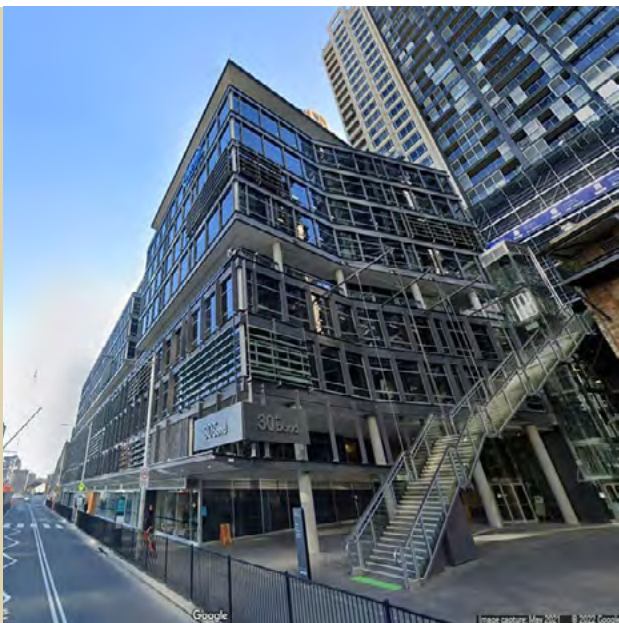
This natural progression for chilled ceilings has been employed successfully on many high - profile projects - from the 270,000ft<sup>2</sup> call center for BT in Watford to Bovis Lend Lease's HQ building in Sydney, Australia - and many other projects of note throughout Europe.

The FTF Group has further developed this chilled beam / chilled ceiling hybrid to incorporate an increased radiant surface area within a shallower depth and narrower width than ever before, for such levels of cooling (now even more cooling performance!).

BT Levensden Park - Watford - 2001



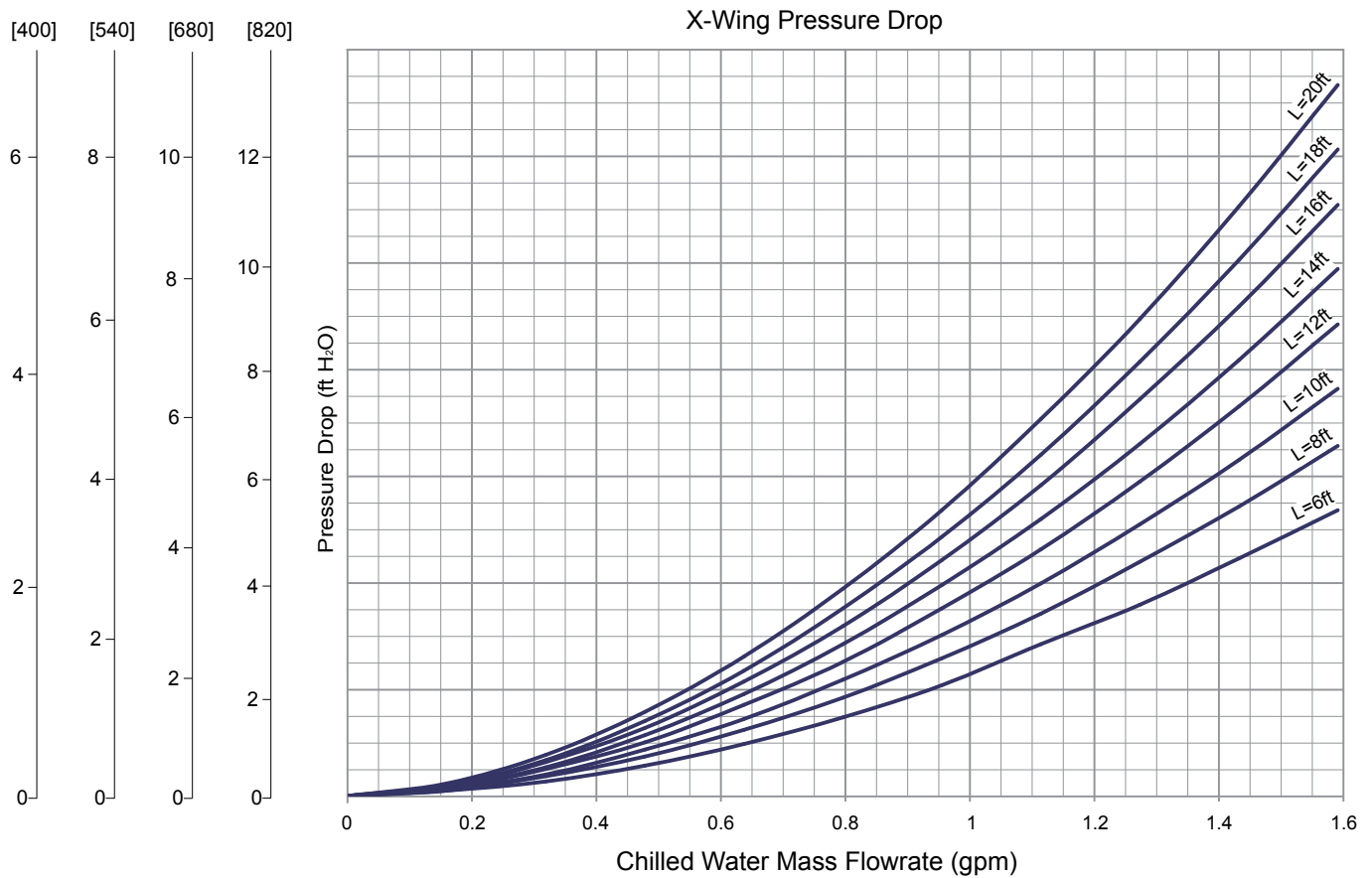
The Bond - Sydney - Australia - 2004



# 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

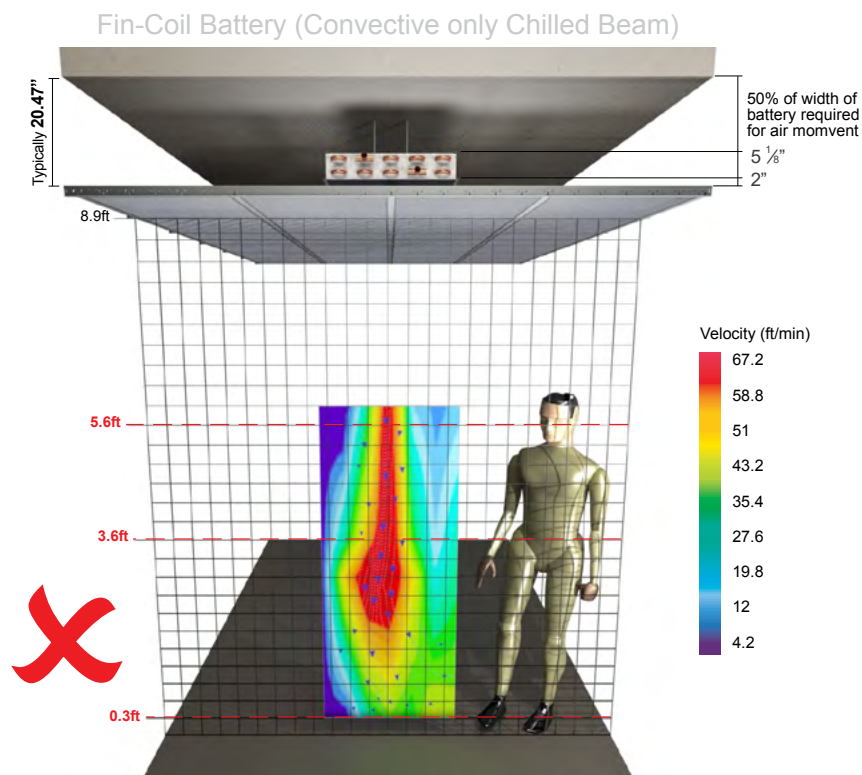
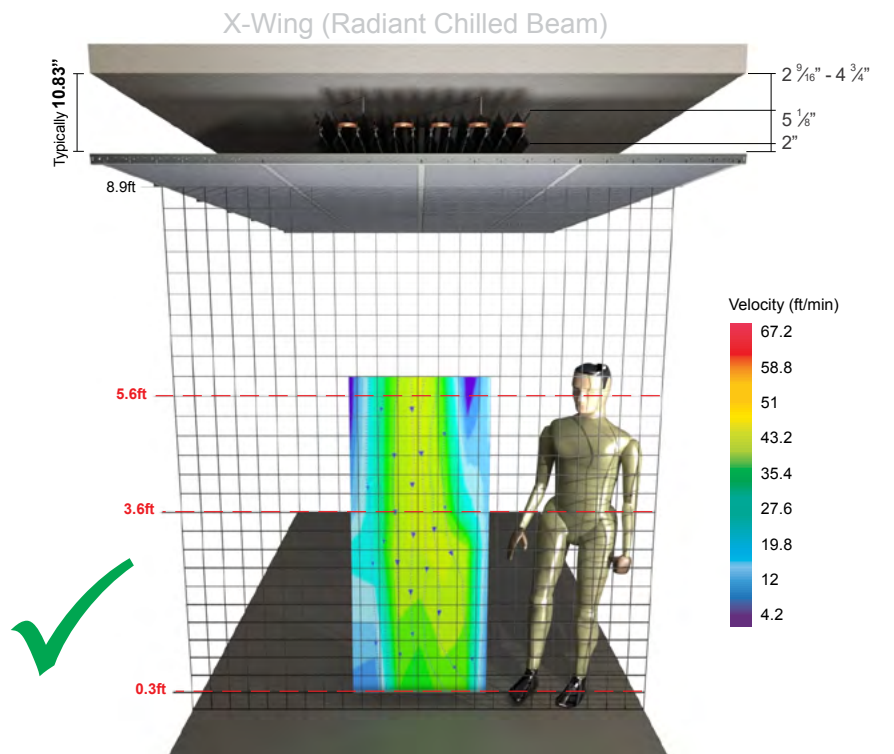
## Pressure Drop



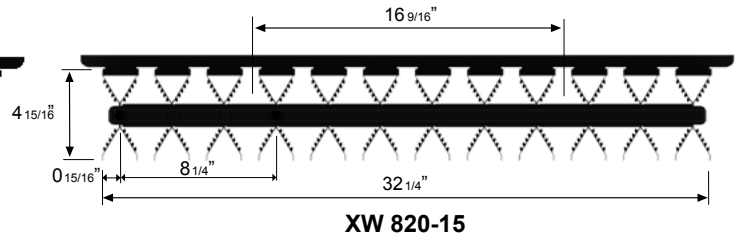
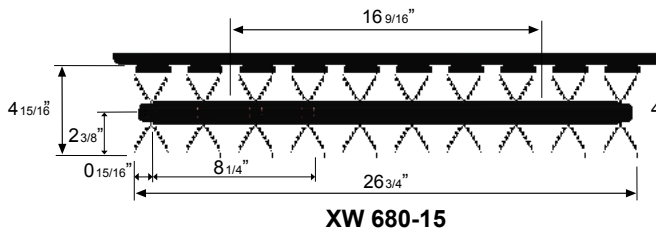
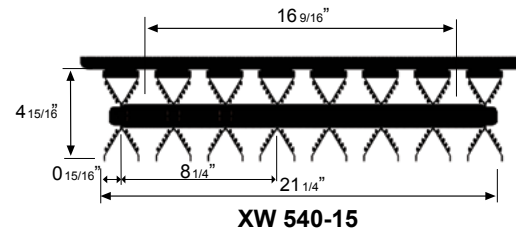
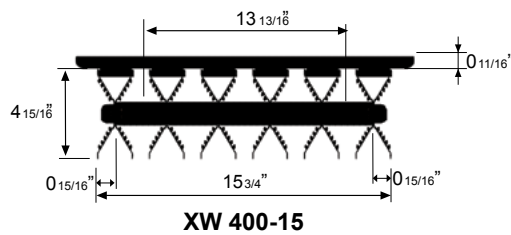
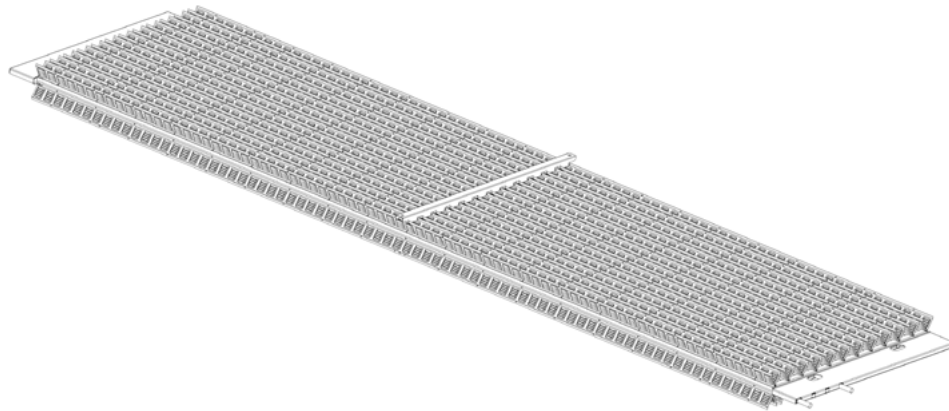


# Increased Occupancy Comfort

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.

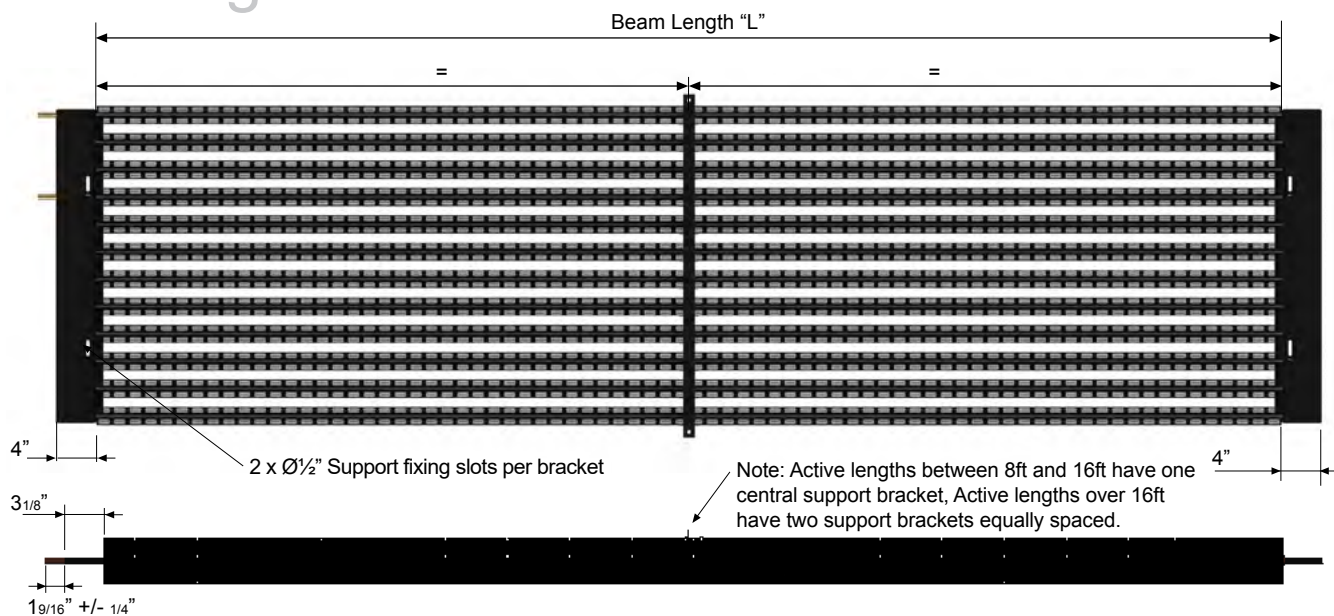


# Product Dimensions



\* Note all dimensions are  $\pm 0.3/4$ "

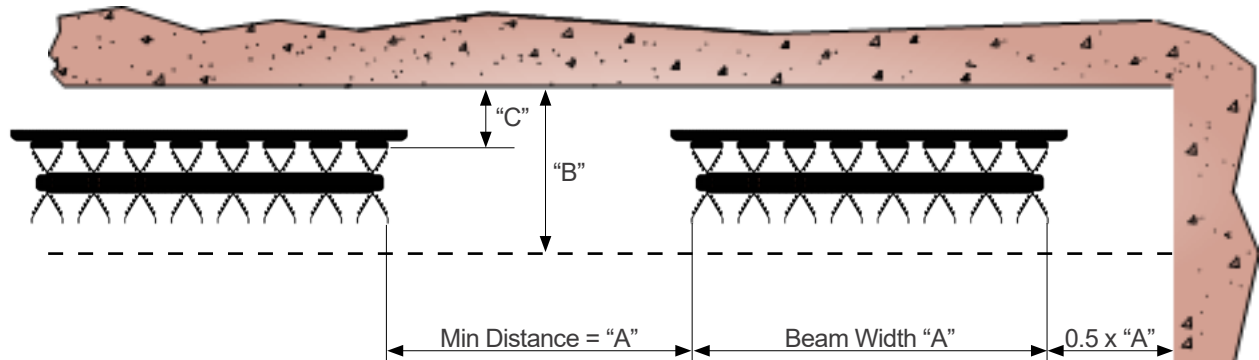
## Mounting Details



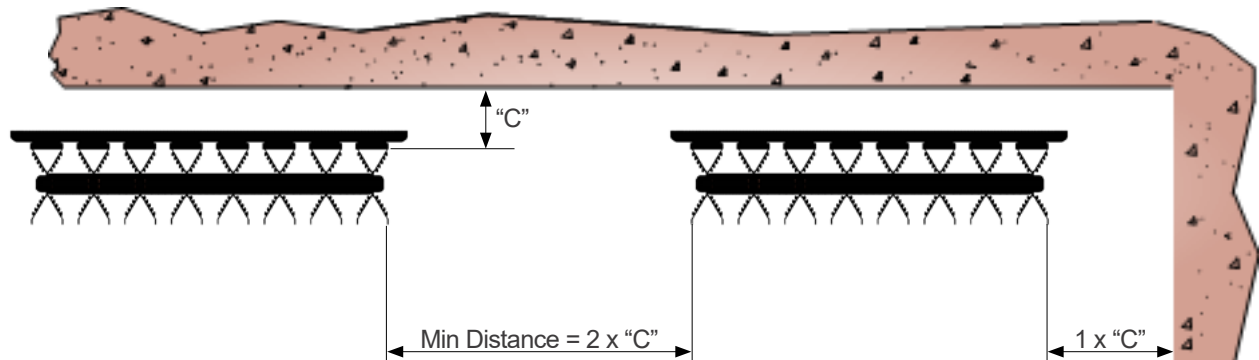
# Weight & Water Content

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

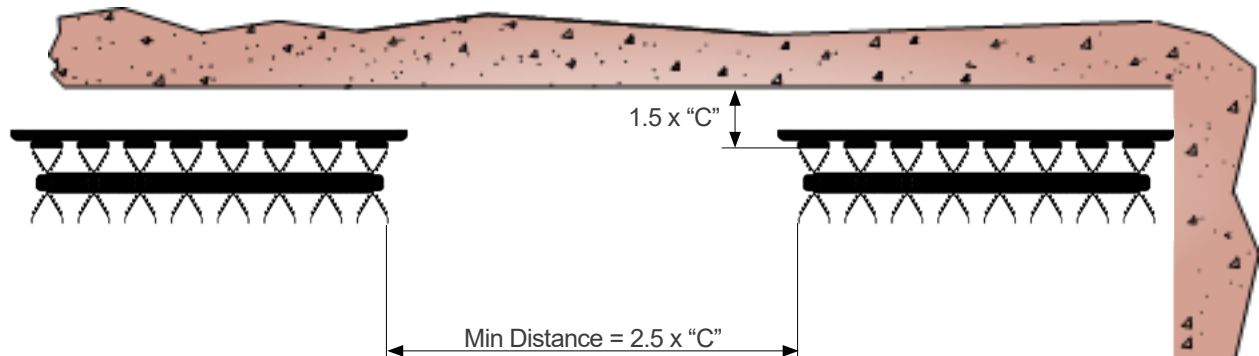
## Product Positioning



XW Above Perforated Ceiling



XW Exposed



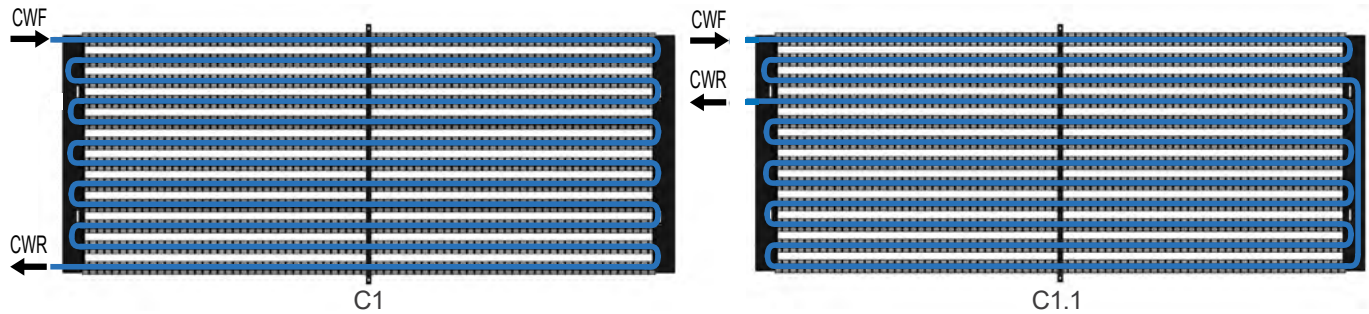
XW Exposed

Model Ref.	Dim "B"	Dim "C"
XW 400-15	9 15/16"	2 9/16"
XW 540-15	10 1/2"	3 1/8"
XW 680-15	11 7/8"	3 15/16"
XW 820-15	12 11/16"	4 3/4"



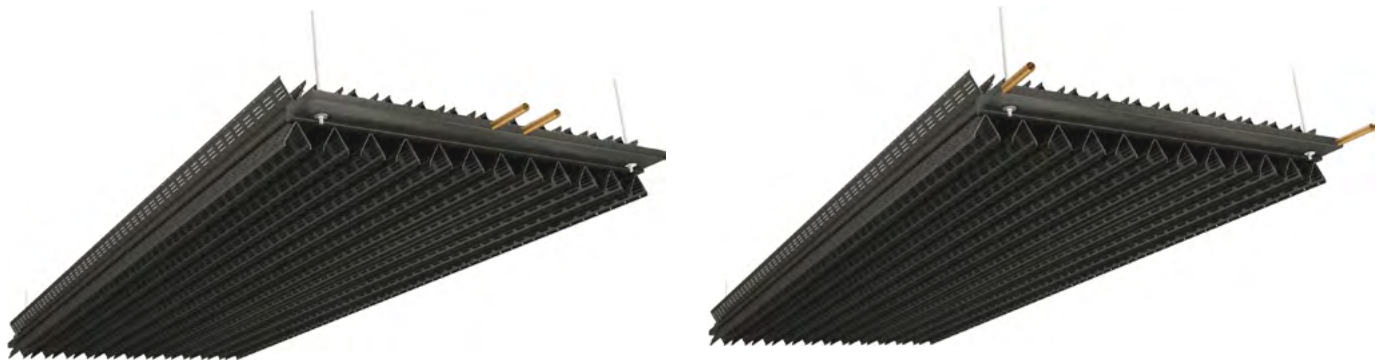
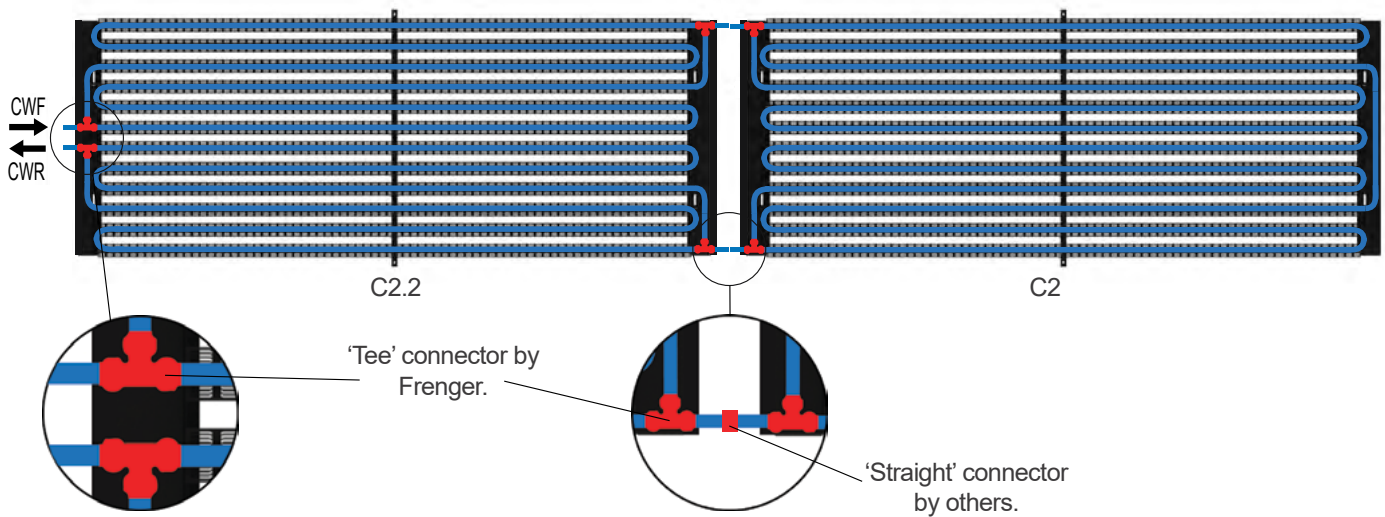
# Circuit Details

## X-Wing 820 Manifold Type C1 and C1.1



Type C1 and is the standard X-Wing and is good for all single beam lengths upto 15ft, anything over 15ft C2 can be used.

## X-Wing 820 Manifold Type C2 and C2.2



Type C2 manifold is 'Special' and can be used for parallel circuits for high mass flowrates only.

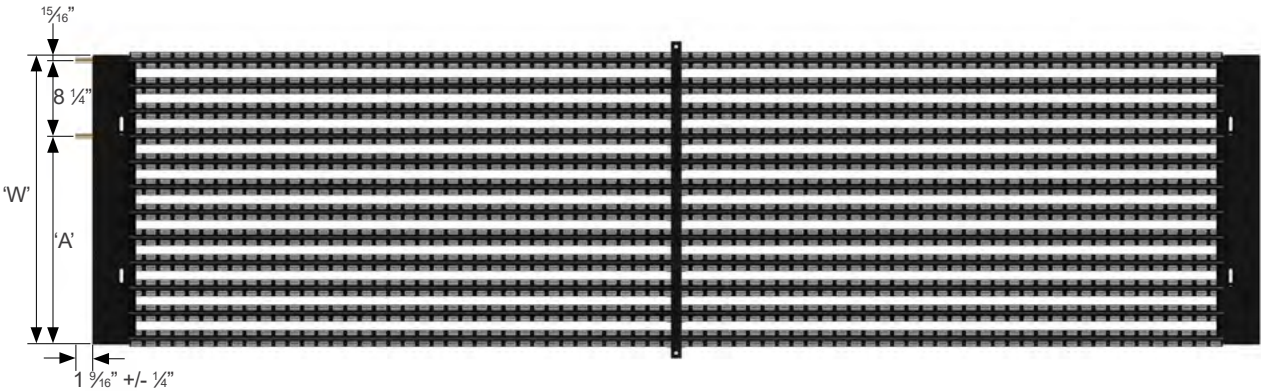
X-Wing 820 Type C1 Maximum Mass Flowrate based on a 10.1ftH <sub>2</sub> O maximum pressure drop **				
Nominal Active Length (in)	<141 3/4"	165 3/8"	189"	212 1/8"
Maximum Mass Flowrate (gpm)	1.632*	1.601	1.506	1.426

Note:

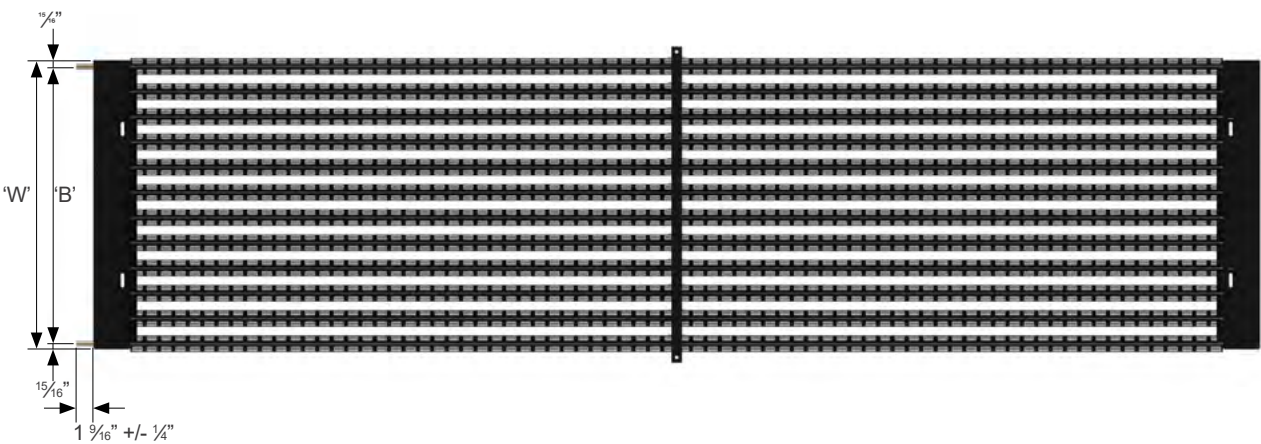
\* Maximum mass flowrate limited to ensure tubeside velocity is less than 3.3 ft / s.

\*\* Although not normally required the X-Wing unit can be specially supplied with either C2 or C2.2 manifold enabling higher mass flowrates and connection in series; however these options should be selected on an as needed basis given the C2 and C2.2 X-Wing units would have a longer lead time than C1, increased cost and introduction of internal tee connections within the manifold.

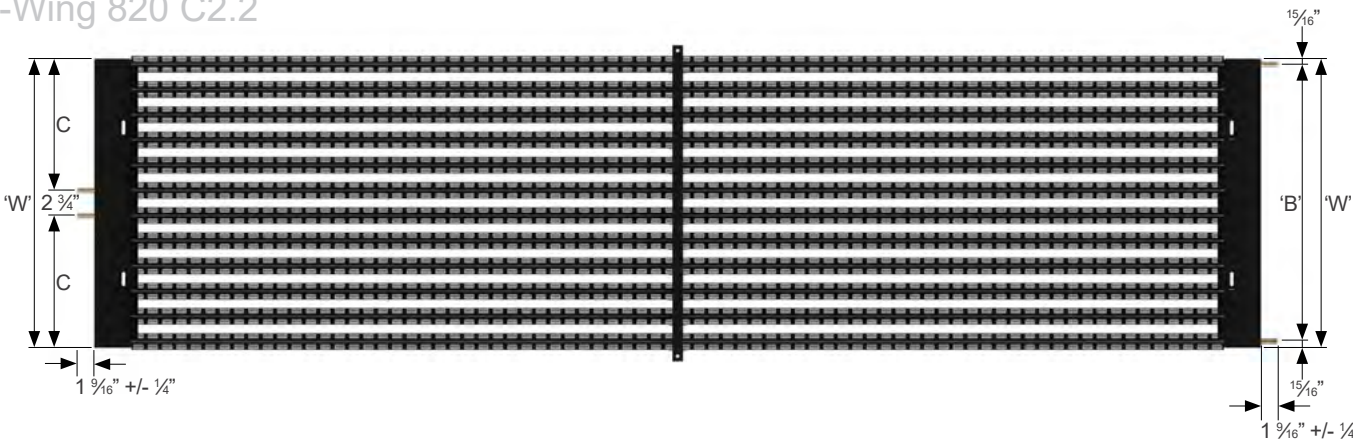
X-Wing 820 C1.1



X-Wing 820 C1 and C2



X-Wing 820 C2.2

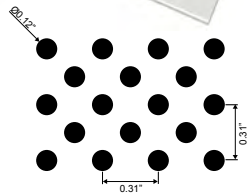


Model Ref.	Width 'W'	Dim 'A'	Dim 'B'	Dim 'C'
XW 400-15	15 3/4"	7 1/2"	11"	6 1/2"
XW 540-15	21 1/4"	13"	19 1/4"	9 1/4"
XW 680-15	26 3/4"	18 1/2"	24 3/4"	12"
XW 820-15	32 1/4"	24"	30 1/4"	14 3/4"

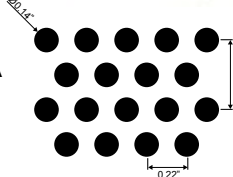
All dimensions ± 1/6"

# Perforation Pattern Options

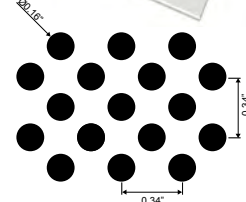
## Diagonal Pitch



0.12" hole  
3.1" pitch  
22% open area  
**D0.12"/22%FA**

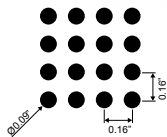


0.14" hole  
0.22" x 0.39" pitch  
34% open area  
**D0.14"/34%FA**

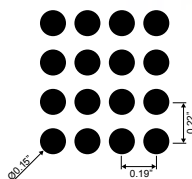


0.16" hole  
0.34" pitch  
33% open area  
**D0.16"/33%FA**

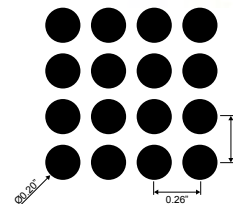
## Square Pitch



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

## 2. Nominal Beam Length (ft/in)

## 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

## 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) 3/8"

## 4. RAL Color - Nom. 20% Gloss

Example: **XW400** - **11'08"** - **5/8C1SE** - **RAL9005**

1

2

3

4



# Calculation Program



## X-Wing Selection Data

System Type	CICB
Model Ref.	XW820
Active Length	5' 3"
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 8) to the underside of roof slab.

## Design Conditions

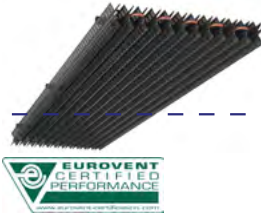
Flow Water Temperature	57.0	°F
Return Water Temperature	64.5	°F
Air Supply Temperature	60.0	°F
Average Room Condition	75.0	°F
"Air On" Thermal Gradient	1.2	°F
Room Relative Humidity	50.0	%

Complete your project data in the "Design Conditions" section. Please note that the "Air On" Thermal Gradient can be used up to 33.8°F 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.

**"Radiant" Chilled Beam (RPCB) Calculation Tool**  
[Is this the latest version?](#)  
version 2.9.2

**X-Wing Selection Data**

System Type	CICB
Model Ref.	XW820
Active Length	5' 3"
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	64.5	°F
Air Supply Temperature	60.0	°F
Average Room Condition	75.0	°F
"Air On" Thermal Gradient	1.2	°F
Room Relative Humidity	50.0	%

**Dimensional Data**

Beam Depth	5.75"
Beam Width	2' 8"
G/A Beam Length	5' 10.9"
CW Connection	Ø1/2-SE
Water Volume	0.8 gal
Total Dry Weight	42.8 lb

**Performance Data**

Room - Mean Water dT	14.25	°F
Air On - Mean Water dT	15.45	°F
Waterside Performance	1135	BTU/hr
Water Mass Flowrate	0.301	gpm
Waterside Pressure Drop	0.2	ft H <sub>2</sub> O

**Design Check**

Cooling Circuit OK

Cooling Function OK

**Model Ref:** XW820-5' 3"-1/2C1SE-RAL9005

Notes:

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

2) Pressure drop calculations are based upon CIBSE guides using clean potable water and exclude any additional 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.

## Performance Data

Room - Mean Water dT	14.25	°F
Air On - Mean Water dT	15.45	°F
Waterside Performance	1135	BTU/hr
Water Mass Flowrate	0.301	gpm
Waterside Pressure Drop	0.2	ft H <sub>2</sub> O

"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](http://www.ftfgroup.us) from the relevant link on our home page.

# Project Specific Testing Facility

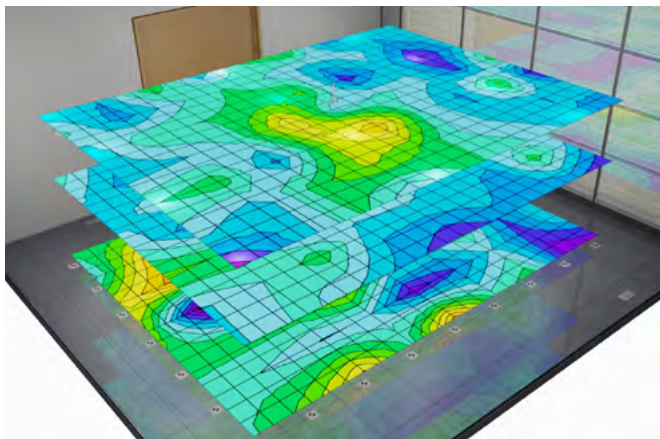
The FTF Group have 3 number state - of - the - art Climatic Testing Laboratories at one if its subsidiary companies predominantly situated at the prestigious Pride Park. Each laboratory has internal dimensions of 20.7ft x 18.7ft x 10.8ft high and includes a thermal wall so that both core and perimeter zones can be modeled. The test facilities are fixed in overall size and construction therefore simulation of a buildings specific thermal mass cannot be completed, it should, however be noted that a specific project can be simulated more accurately by recessing the floor and reducing the height at necessary.

## Project Specific Testing

Project specific mock - up testing is a valuable tool which allows the Client to fully asses the proposed system and determine the resulting indoor quality and comfort conditions; the physical 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.





# Photometric Testing Facility

The FTF Group's technical facility at Pride Park, Derby also has two Photometric test laboratories which are used to evaluate the performance of luminaires. To measure the performance, it is necessary to obtain values of light intensity distribution from the luminaire. These light intensity distributions are used to mathematically model the lighting distribution envelope of a particular luminaire. This distribution along with the luminaires efficacy allows for the generation of a digital distribution that is the basis of the usual industry standard electronic file format. In order to assess the efficacy of the luminaire it is a requirement to compare the performance of the luminaire against either a calibrated light source for absolute output 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.

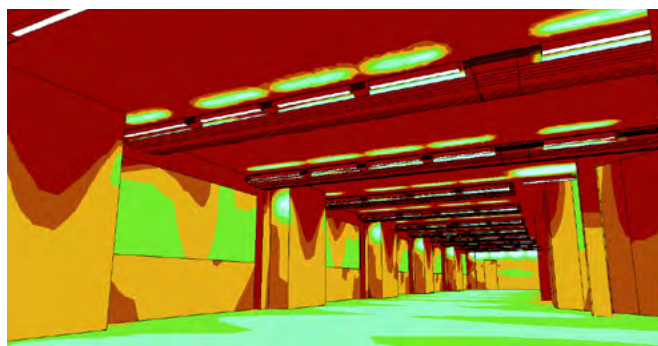
The intensity distribution is obtained by the use of a Goniophotometer to measure the intensity of light emitted from the surface of the fitting at pre-determined angles. The light intensity is measured using either a photometer with a corrective spectral response filter to match the CIE standard observer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

Luminaire outputs are measured using out integrating sphere for small luminaires or out large integrator room for large fittings and Multi Service Chilled Beam. 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.

The FTF Groups technically facility also conducts photometric tests in accordance with CIE 127:2007 and BS EN 13032-1 and sound engineering practice as applicable. During the course of these tests suitable temperature measurements of parts of 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 temperature.





# Acoustic Testing Facility

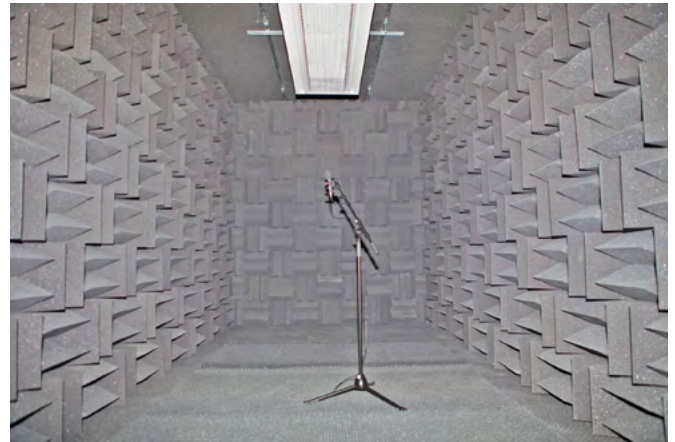
The Acoustic Test Room at the FTF Groups Technical Facility is a hemi-anechoic chamber which utilizes sound absorbing acoustic foam material in the shape of wedges to provide an echo free zone for acoustic measurement; the height of the acoustic foam wedges has a direct relationship with the maximum absorption frequency, hence the FTF Group has 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 noise levels of sound can be accurately measured.

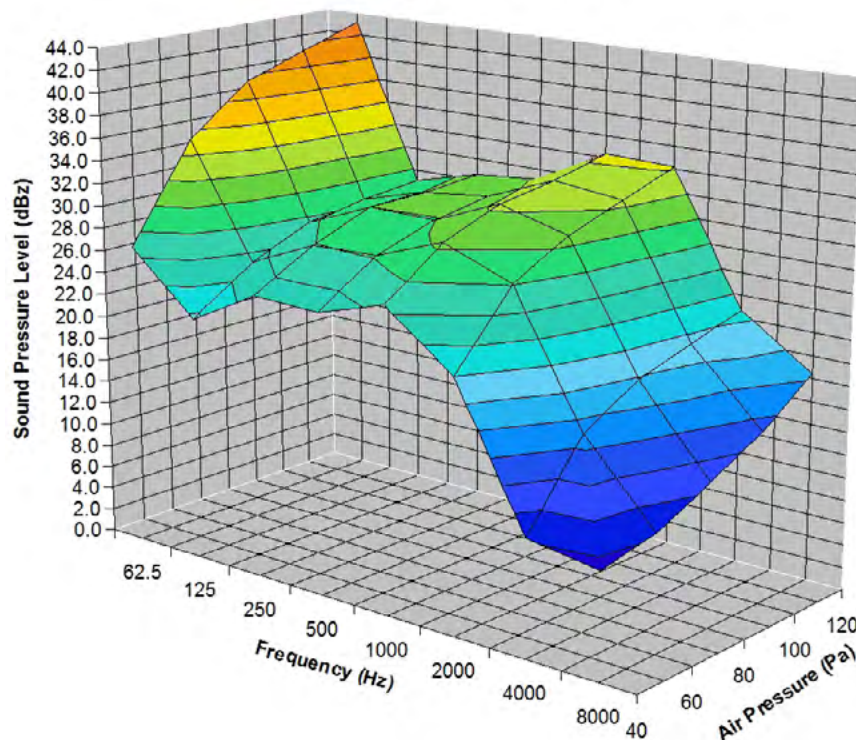
The acoustic facilities allow the FTF Group to provide express in - house sound evaluation so that all products, even project specific designs can be assessed and optimized.

To ensure accuracy the FTF Group only use Class 1 measurement equipment which allows sound level measurements to be taken at 11 different  $\frac{1}{3}$  octave bands between 16 Hz to 16 kHz, with A, C and Z (un-weighted) simultaneous weightings.

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



**Unweighted Sound Pressure Level**





Frenger Systems (trading as FTF Group Climate)  
participates in the ECC program for Chilled Beams.  
Check ongoing validity of certificate:  
[www.eurovent-certification.com](http://www.eurovent-certification.com) or  
[www.certiflash.com](http://www.certiflash.com) Certiflash

In accordance with our policy of continuous improvement, we reserve the right to amend any specification without prior notice.  
Details produced in this brochure may not be copied and are not drawn to scale. E&OE. © FTF Group Climate V1.8

## **FTF GROUP**<sup>®</sup> **Climate**

### American Office

FTF Group Climate  
1501 Broadway, Times Square  
12th Floor  
New York  
NY 10036  
United States of America

tel: +00 1 646 571 2151  
fax: +00 1 646 571 2001  
[sales@ftfgroup.us](mailto:sales@ftfgroup.us)  
[www.ftfgroup.us](http://www.ftfgroup.us)

### UK Head Office

Frenger System Ltd  
Riverside Road  
Pride Park  
Derby  
DE24 8HY

tel: +44 0 1332 295 678  
fax: +44 0 1332 381 054  
[sales@frenger.co.uk](mailto:sales@frenger.co.uk)  
[www.frenger.co.uk](http://www.frenger.co.uk)

### Australian Office

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

tel: +61 2 9006 1147  
fax: +61 2 9006 1010  
[sales@frenger.com.au](mailto:sales@frenger.com.au)  
[www.frenger.com.au](http://www.frenger.com.au)

Frenger Systems is a wholly owned  
subsidiary of the **FTF Group Ltd.**  
Registered No. 646 6229 20

# [www.FTFgroup.us](http://www.FTFgroup.us)