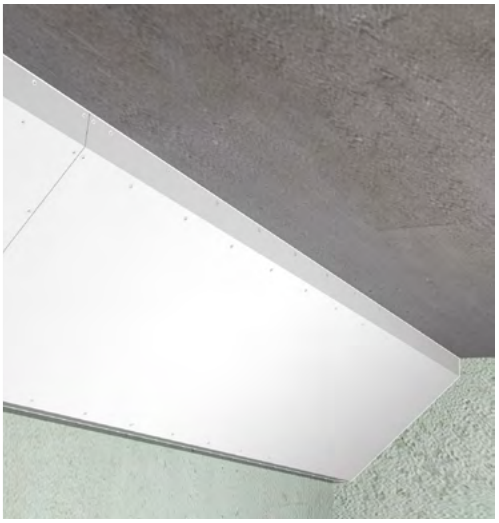
the future of space conditioning

NOMS Compliant products for use in Safer Cells

Secure Environment

heating design guide



www.frenger.co.uk
an FTF Group Company

FRENGER® systems

Contents

Why Choose Frenger?

Based in Derby, UK, Frenger has experience of the design development and manufacture of radiant heating systems dating back some 90 years.

Frenger has maintained its position at the forefront of the radiant heating industry through continued quality attainment, innovation and product reliability along with the ability to deliver complex projects on time, within budget and to specification.

Some 15 years ago, Frenger recognised and responded to the needs of the market to introduce and develop a range of products specifically designed to meet the demanding requirements of 'secure' facilities such as MHU Environments, Prisons and other Custodial Environments.

The range features three core radiant panel products that are designed to fit the needs of any secure environment: -

- PCP Frengerwarm Ceiling Mounted Horizontal Panel
- PNP Frengerwarm Cornice Mounted Panel
- PR Frengerwarm Low Level Wall Mounted Panel

Each type of radiant panel (**PCP**, **PNP** and **PR**) has been fully performance tested in accordance with the latest appropriate standards (EN 14037 / BS EN 442) and installed into a number of projects such as: -

- **HMP Belmarsh**
- **HMP Durham**
- **Franklands DSPDU**
- **HMP North Wales**
- **HMP Lowdham Grange**
- **HMP Dovegate**
- **Highbury Hospital**
- **Calderstones MSU**
- **HMP Nottingham**
- **HMP Liverpool Healthcare Unit**
- **HMP North Sea Camp**
- **HMP Liverpool - Wing H**
- **HMP Preston**
- **HMP Bure**
- **HMP Leeds**
- **HMP Preston**
- **HMP Ranby**
- **HMP Edinburgh**
- **HMP Dover**
- **HMP Norwich**
- **HMP Coldingley**
- **HMP Albany**
- **HMP Wayland**
- **Ilkeston Hospital**

More recently after continued product development and destruction testing each product is considered by **NOMS** (National Offenders Management Service) to be **fully compliant with the Custodial Property Specification** (STD/M/SPEC 040) for radiant heating panels for use within Safer Cells.

PCP Frengerwarm Ceiling Panel

Introduction

The **NOMS Approved** PCP Frengerwarm Ceiling Panel is a secure and efficient space heating product which is predominantly water driven heating LTHW or can be supplied as electrical heated up to 580W/m². LTHW is available with heating capacities of up to
378 Watts per linear metre @ 57.5 dTk - performance data in accordance with the latest European Standard EN14037.

The PCP panel heats via water - carrying copper coils which are fixed within extruded Aluminium pipe seats. In turn, the pipe seats are securely bonded to the robust 2.0mm thick Steel outer casing. To optimise heat emission the heat is directed into the room by a layer of mineral wool insulation fitted to the reverse of the panel over the Copper coil. The units are made up into sets comprising at least one active section and a number of 'dummy' sections all to suit any particular environment and to simplify the installation process. All panels are finished in a tough polyester paint finish.

Installation

The PCP Frengerwarm ceiling panel is designed to be installed utilising the pre-drilled mounting rails supplied within the kit. For maximum security and to ensure full NOMS custodial property compliance it is important to install the product level and that any gaps due to building tolerance concealed are with suitable NOMS approved non-pickable sealant.

All fixing joints between the panel and pre-drilled rail should be secured using suitable NOMS approved (M6 x 20 Stainless Steel countersunk screw) secure fixings and loctite compound.

Key Product Features

- Manufactured from robust 2.0mm thick Steel plate.
- Interleaf joints and angles side profiles with pre-drilled holes to allow for secure fixing using suitable NOMS approved (M6 x 20 Stainless Steel countersunk screw) fixings and Loctite compound.
- Standardised active sections are integrated with 'manufactured to suit' dummy sections-each installation tailored to meet the requirements of the selected environment.
- Three standardised panel widths to match most project requirements.
- Slimline panel depth of just 61mm.
- Simple to clean and hygienic.
- Maintenance panel allows for simple but secure access to connection details and valve arrangements.

Dimensions

Panel Widths

The PCP Ceiling panel is available in three widths as standard 420mm, 560mm and 70mm. The width selected depend on room aesthetics and heating capacity requirements.

Panel Lengths

The PCP Ceiling panel sections are supplied with heating circuit (active sections) or without heating circuit (dummy sections).

A panel set is usually a combination of at least one active section and a number of dummy sections tailored to suit the particular environment.

Active panel sections are available in any length up to 3000mm and are sized to meet the heating requirements. Each panel set may include more than one active section dependant on space and capacity requirements.

Dummy panels provided to finish a set and gain access to the pipe connections are available in lengths from 150mm up to 3000mm as required.

Panel Depth

All panel variants are 61mm deep as standard.

Surface finish

Each PCP Ceiling panel section is powder coat finished to RAL 9010 (25% Gloss ±5%) as standard - with an emissivity of 0.94.

Connections

All active sections will arrive complete with 15mm Dia EN12449 / EN 12735 - 2 Copper pipework circuits ready for on site connection to the mains flow and return water services.

Insulation

Each active section is supplied complete with up to 50mm thick - up to 45kg/m³ density mineral wool Class 'O' foil backed insulation with a thermal conductivity of 0.040 W/mk @ 10°C as standard.

	Panel Type		
	PCP 420	**PCP 560**	**PCP 700**
Panel Width	420mm	560mm	700mm
Dry Weight	20.5 kg/m	24.8 kg/m	29.1 kg/m
Water Content	0.64 l/m	0.96 l/m	1.28 l/m
Minimum Distance Between Fixings	100mm	100mm	100mm
Maximum Working Pressure	8.7 BAR	8.7 BAR	8.7 BAR
Hydraulic Test Pressure	13.0 BAR	13.0 BAR	13.0 BAR

Components

1. Ceiling Rails
3mm thick angles Zintec Steel rail with M6 Hex nutcerts fitted to the reverse.

2. Casing
Panel casing manufactured from 2.0mm thick Zintec Steel sheet - Outer face powder coated RAL9010 (25% Gloss ± 5%).

3. Pipe work
Individual Pipework circuits manufactured from 15mm Dia EN12449 / EN12735 - 2 Copper Tube. All joints completed via standard solder fittings.

4. Pipe Seats
Manufactured from cut-to-length heat treated aluminium 6000 series alloy die extrusion.

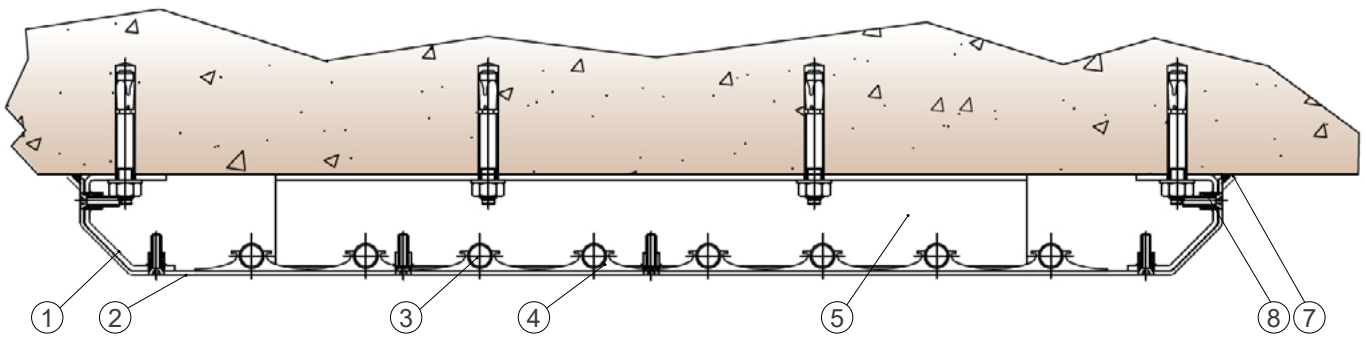
5. End Wall Support Rail
3mm thick Zintec Steel rail with M6 Hex nutcerts fitted to the reverse.

6. Insulation
Manufactured from factory clad up to 50mm thick Class 'O' foil backed mineral wool quilt - upto 45kg/m³ density mineral wool.

7. Sealant
NOMS approved non pickable sealant to be applied to all exposed gaps (Sealant supplied and applied by others).

8. Security fixings
NOMS approved M6 x 20 Stainless Steel coutersunk security screw (Torx Head or similar) to be used to fix all joints (Suitable screw to be supplied and fitted by others) - A suitable thread locking compound should be used in con junction with any fixings.

The amount of fixings per panel run will be determined by the actual panel set length - however hole centres will be uniform to provide maximum strength and security.



(6) Insulation not shown for clarity.
Wall and ceiling fixings to be supplied by others.

Installation Guide

1. Site measurement as necessary for wall to wall installation to be provided (by others). Active sections to be standard length ‘Dummy’ sections to be sized to complete overall panel set dimensions within the given space.

2. Install purpose made ‘cut-to-length’ ceiling mounting rails and end support rails at the required centers. Ensure rails are level and true to ensure secure panel interconnections.

3. Install and fix **NOMS Approved** Active panel sections to the pre-installed level and true mounting rails using NOMS approved (M6 x 20 Stainless Steel countersunk screws) security fixings and thread locking compound.

4. Once **NOMS Approved** Active panel sections are in position make mains connections and install purpose made dummy sections. Use NOMS approved (M6 x 20 Stainless Steel countersunk screws) security fixings and suitable thread locking compound.

5. Apply NOMS approved non pickable sealant to all exposed gaps that may be created due to building tolerances.

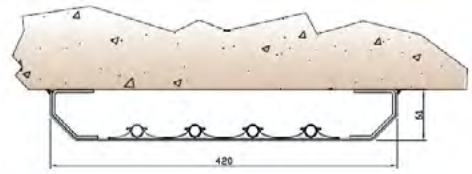
6. Remove ‘low-tack’ protective covering and clean exposed panel set surfaces.

Installation instructions are provided for guidance purposes only and may need to be modified dependant on the given environment. Always ensure that mandatory and appropriate health and safety procedures are applied during the installation process and that appropriate protective equipment worn.

Product Performance

Product performance based on and in accordance with EN14037.

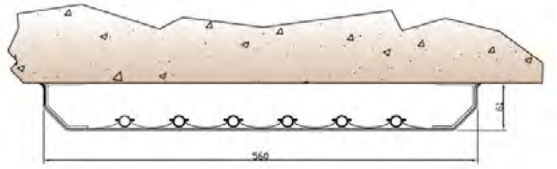
PCP420 Panel



4 - pipe unit, assuming water flow @ 82°C and water return @ 71°C

PCP420 / 4 Pipe	
Room Temp °C	Capacity (W/lm)
21	178
20	181
19	185
18	189
k = 1.528	

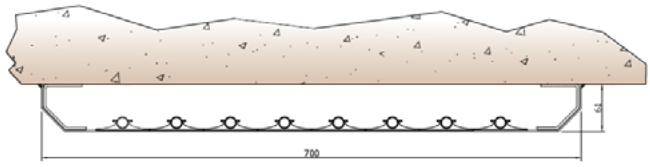
PCP560 Panel



6 - pipe unit, assuming water flow @ 82°C and water return @ 71°C

PCP560 / 6 Pipe	
Room Temp °C	Capacity (W/lm)
21	267
20	272
19	278
18	284
k = 2.295	

PCP700 Panel



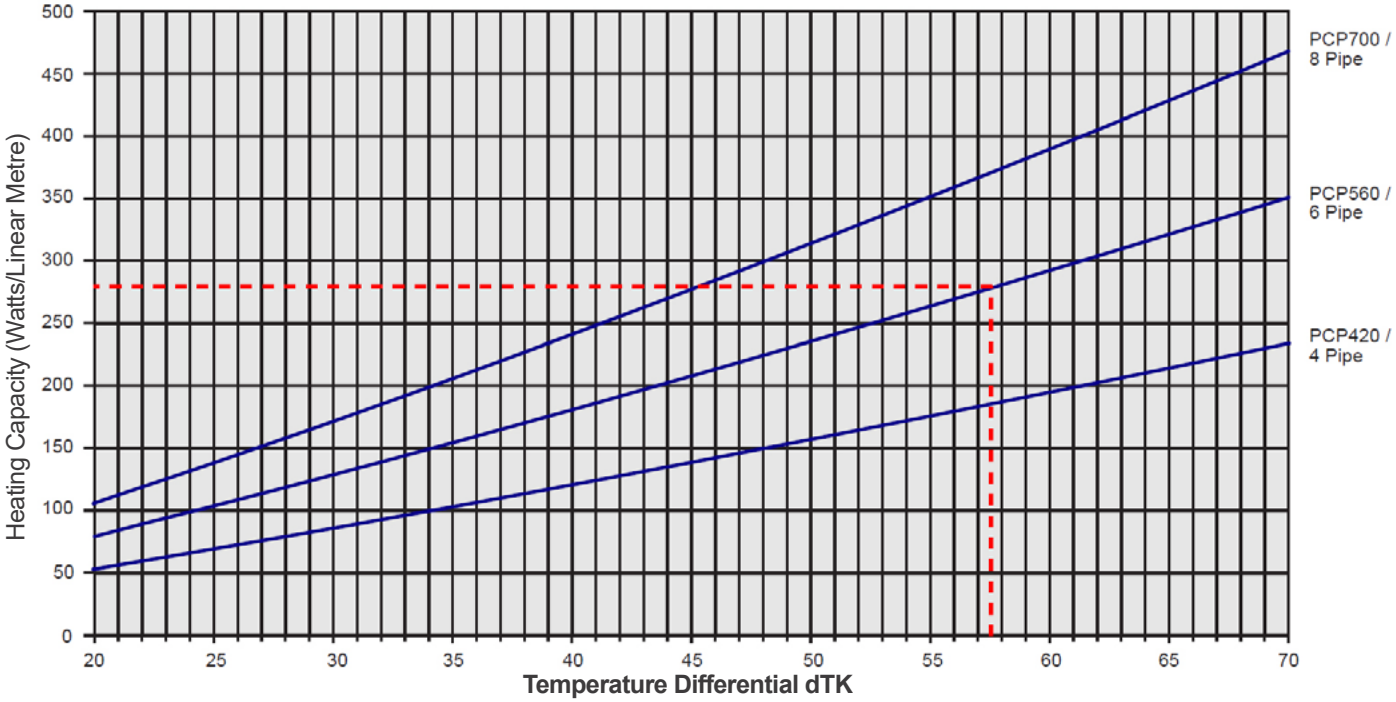
8 - pipe unit, assuming water flow @ 82°C and water return @ 71°C

PCP700 / 8 Pipe	
Room Temp °C	Capacity (W/lm)
21	355
20	363
19	371
18	378
k = 3.056*	

$$Q = K (\Delta T)^{n}$$

Q = Output W/m 'Active Section
n = 1.1842
k = Constant see table '*'

Prison Ceiling Panel - Heating Capacity



The thermal performance of Frenger's Prison Ceiling Panel has been tested in accordance with the European Standard EN14037.
Example: at water flow 82°C and return 71°C with a room temperature of 19°C, the PCP560 panel provides 278 W/lm heating capacity.
Please contact our Technical Services Department for advice on flow rates and pressure drops.
Pressure drop <5.0 kPa based on 3.0m panel with maximum flow rate of 0.08 kg/s.

PNP Frengerwarm Cornice Panel

Introduction

The **NOMS Approved** PNP Frengerwarm Cornice Panel is a secure and efficient space heating product with achievable capacities of up to 378 W/m @ 57.5 dTk - performance data in accordance with the latest European Standard EN 14037.

The PNP panel heats via water-carrying copper coils which are fixed within extruded Aluminium pipe seats. In turn, the pipe seats are securely bonded to the robust 2.0mm thick Steel outer casing to optimise heat emission. The heat is directed into the room by a layer of mineral wool insulation fitted to the reverse of the panel over the Copper coil. The units are made up into sets comprising at least one active section and a number of 'dummy' sections all to suit any particular environment and to simplify the installation process. All panels are finished in a tough polyester paint finish.

Installation

The PNP Frengerwam Cornice panel is designed to be installed utilising the pre-drilled mounting rails supplied with the kit. For maximum security and to ensure full NOMS custodial property compliance it is important to install the product level and that any gaps due to building tolerance concealed are with suitable NOMS approved non-pickable sealant.

All fixing joints between the panel and pre-drilled rail should be secured using suitable NOMS approved (M6 x 20 Stainless steel countersunk screws) secure fixings and loctite compound.

Key Product Features

- Manufactured from robust 2.0mm thick Steel plate.
- Interleaf joints and angled side profiles with pre-drilled holes to allow for secure fixing using suitable NOMS approved fixings (M6 x 20 Stainless steel countersunk screws) and Loctite compound.
- Standardised active sections are integrated with manufactured to suit dummy sections - each installation tailored to meet the requirements of the selected environment.
- Three standardised panel widths to match most project requirements.
- Simple to clean and hygienic.
- Maintenance panels allows for simple but secure access to connection details and valve arrangements.

Dimensions

Panel Widths

The PNP Cornice panel is available in three variants as standard: 335mm, 434mm and 533mm. The variant selected will depend on room aesthetics and heating capacity requirements.

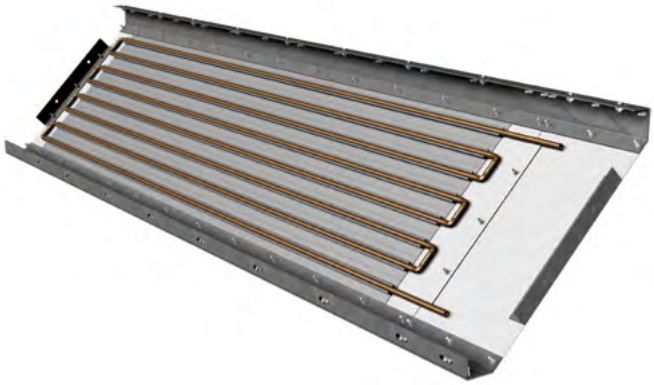
Panel Lengths

The PCP Cornice panel sections are supplied with heating circuit (active sections) or without heating circuit (dummy sections).

A panel set is usually a combination of at least one active section and a number of dummy sections tailored to suit the particular environment.

Active panel sections are available in any length up to 3000mm and are sized to meet the heating requirements. Each panel set may include more than one active section dependant on space and capacity requirements.

Dummy panels provided to finish a set and gain access to the pipe connections are available in lengths from 150mm up to 3000mm as required.



Panel Depth

The Cornice panel variants are available in three overall product depths as standard - 335mm, 434mm and 533mm.

Surface Finish

Each PNP Cornice panel section is powder coat finished to RAL9010 (25% Gloss ±5%) as standard - with an emissivity of 0.94.

Connections

All active sections will arrive complete with 15mm Dia EN12449 / EN12735 - 2 Copper pipework circuits ready for on site connection to the mains flow and return water services.

Insulation

Each active section is supplied complete with up to 50mm thick - upto 45 kg/m³ density mineral wool Class ‘O’ foil backed insulation with a thermal conductivity of 0.040 W/mk @ 10°C as standard.

	Panel Type		
	PNP 335	**PNP 434**	**PNP 533**
Panel Depth	335mm	434mm	533mm
Dry Weight	21.9 kg/m	26.2 kg/m	29.9 kg/m
Water Content	0.64 l/m	0.96 l/m	1.28 l/m
Minimum Distance Between Fixings	100mm	100mm	100mm
Maximum Working Pressure	8.7 BAR	8.7 BAR	8.7 BAR
Hydraulic Test Pressure	13.0 BAR	13.0 BAR	13.0 BAR

Components

1. Ceiling / Wall Rails
3mm thick angled Zintec Steel rail with M6 Hex nutcerts fitted to the reverse

2. Casing
Panel casing manufactured from 2.0mm thick Zintec Steel sheet - Outer face powder coated to RAL9010 (25% Gloss ±5%).

3. Pipe Work
Individual Pipe work circuits manufactured from 15mm Dia EN12449 / EN12735 - 2 Copper tube. All joints completed via standard solder fittings.

4. Pipe Seats
Manufactured from cut-to-length heat treated aluminium 6000 series alloy die extrusion.

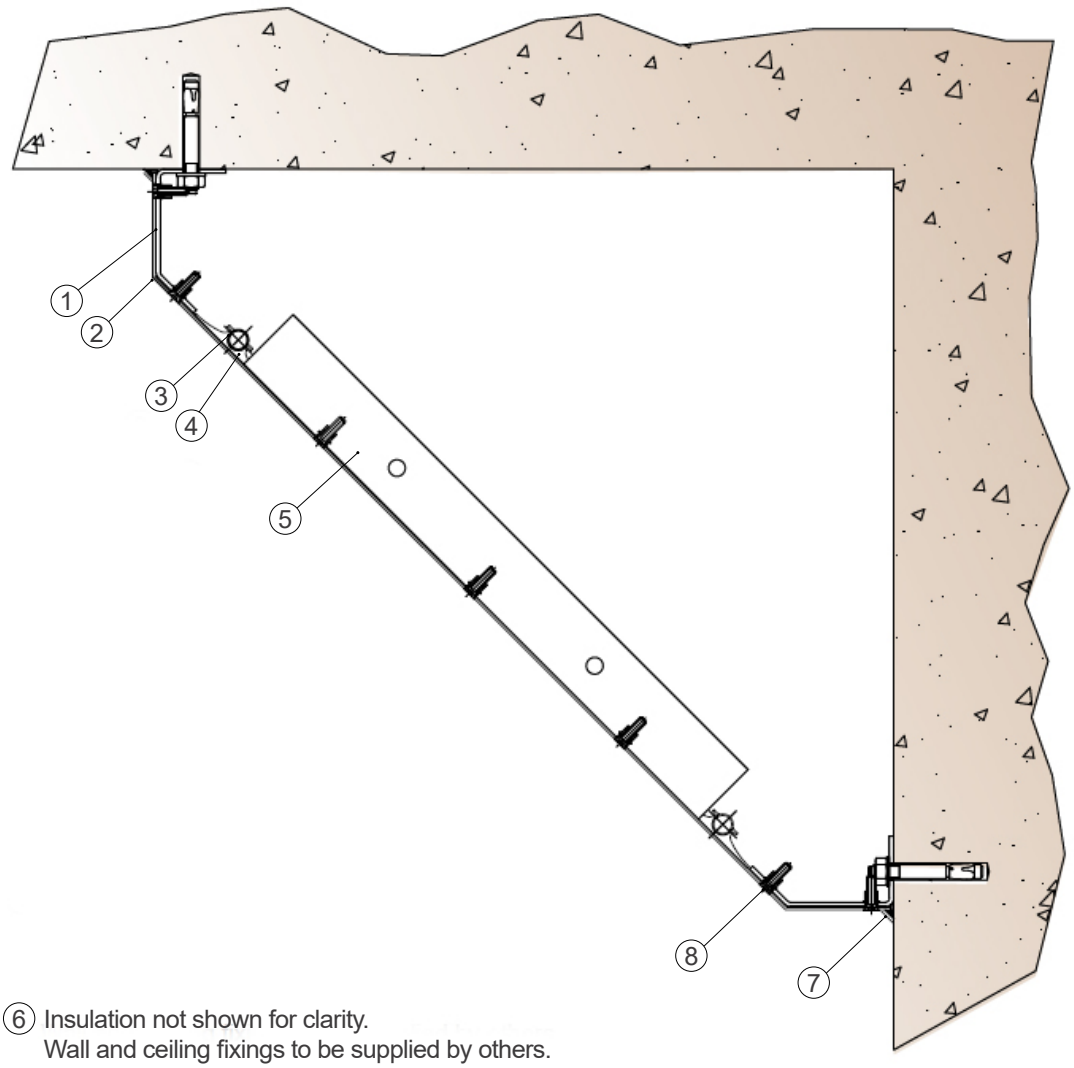
5. End Wall Support Rail
3mm thick Zintec Steel rail with M6 Hex nutcerts fitted to the reverse.

6. Insulation
Manufactured from factory clad up to 50mm thick Class 'O' foil backed mineral wool quilt - upto 45 kg/m³ density mineral wool.

7. Sealant
NOMS approved non pickable sealant to be applied to all exposed gaps (Sealant supplied and applied by others).

8. Security Fixings
NOMS approved M6 x 20 Stainless Steel countersunk security screws (Torx Head or similar) to be used to fix all joints (Suitable screws to be supplied and fitted by others) - A suitable thread locking compound should be used in conjunction with any fixings.

The amount of fixings per panel run will be determined by the actual panel set length-however hole centres will be uniform to provide maximum strength and security.



⑥ Insulation not shown for clarity.
Wall and ceiling fixings to be supplied by others.

Installation Guide

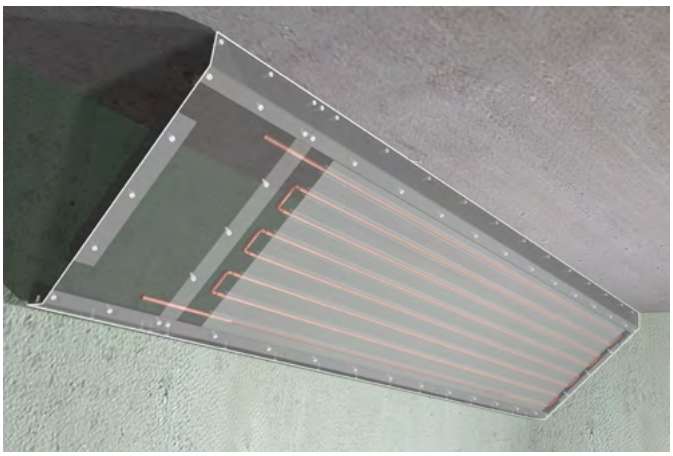
1. Site measurement as necessary for wall to wall installation to be provided (by others). Active sections to be standard length ‘Dummy’ sections to be sized to complete overall panel set dimensions within the given space.

2. Install purpose made ‘cut-to-length’ ceiling mounting rails and end support rails at the required centers. Ensure rails are level and true to ensure secure panel interconnections.

3. Install and fix **NOMS Approved** Active panel sections to the pre-installed level and true mounting rails using NOMS approved (M6 x 20 Stainless steel countersunk screws) security fixings and thread locking compound.

4. Once **NOMS Approved** Active panel sections are in position make mains connections and install purpose made dummy sections. Use NOMS approved (M6 x 20 Stainless steel countersunk screws) security fixings and suitable thread locking compound.

5. Apply NOMS approved non-pickable sealant to all exposed gaps that may be created due to building tolerances.



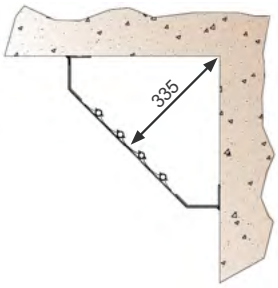
6. Remove ‘low-tack’ protective covering and clean exposed panel set surfaces.

Installation instruction are provided for guidance purposes only and may need to be modified dependant on the given environment. Always ensure that mandatory and appropriate health and safety procedures are applied during the installation process and that appropriate protective equipment worn.

Product Performance

Product performance based on and in accordance with BS EN442-2:1997

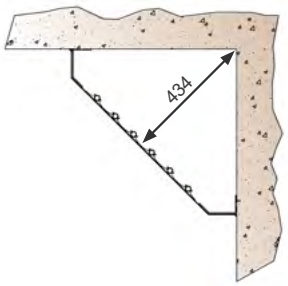
PNP335 Panel



4 - pipe unit, assuming waterflo
@ 82°C and water return @ 71

PNP335 / 4 Pipe	
Room Temp °C	Capacity (W/lm)
21	186
20	190
19	193
18	197
k = 1.653*	

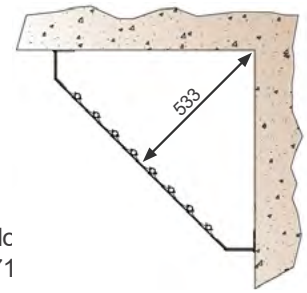
PNP434 Panel



6 - pipe unit, assuming waterfl
@ 82°C and water return @ 7

PNP434 / 6 Pipe	
Room Temp °C	Capacity (W/lm)
21	279
20	285
19	291
18	297
k = 2.483*	

PNP533 Panel



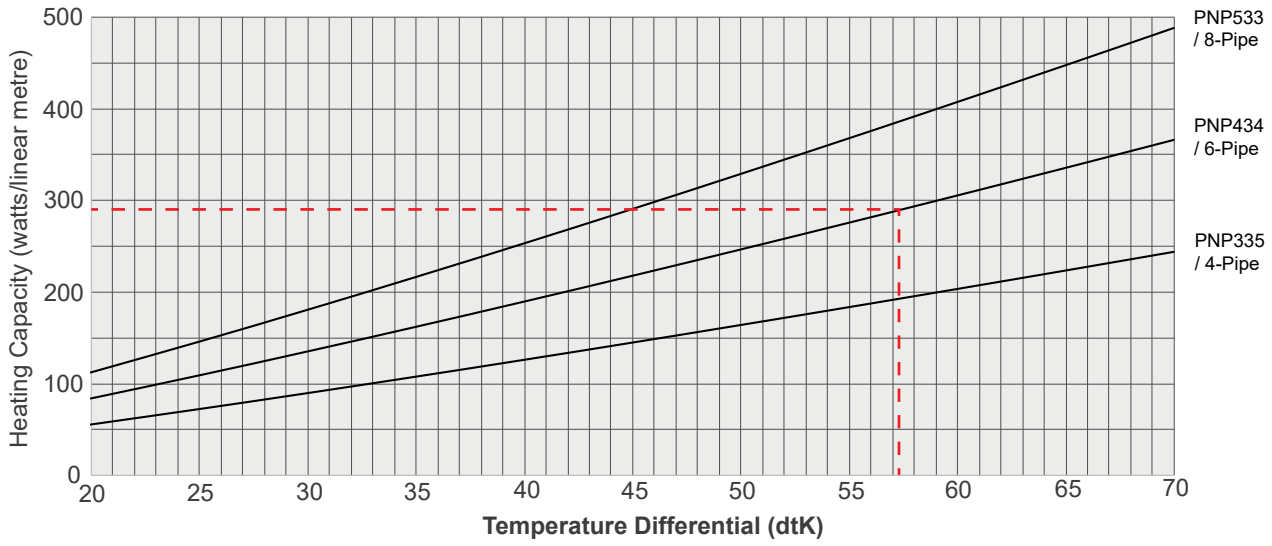
8 - pipe unit, assuming waterflc
@ 82°C and water return @ 71

PNP533 / 8 Pipe	
Room Temp °C	Capacity (W/lm)
21	371
20	379
19	387
18	395
k = 3.309*	

$$Q = K (\Delta T)^n$$

Q = Output W/m 'Active Section
n = 1.1754
k = Constant see table '*'

Prison Cornice Panel - Heating Capacity



The thermal performance of Frenger's Prison Ceiling Panel has been tested in accordance with the European Standard EN14037.
Example: at water flow 82°C and return 71°C with a room temperature of 19°C, the PNP434 panel provides 291 W/lm heating capacity.
Please contact our Technical Services Department for advice on flow rates and pressure drops.
Pressure drop <5.0 kPa based on 3.0m panel with maximum flow rate of 0.08 kg / s.

PR Frengerwarm Wall Mounted Panel Radiator

Introduction

The **NOMS Approved** PR Frengerwarm Radiator is a secure and efficient space heating product with achievable capacities of up to
560 W/m @ 57.5 dTk - performance data in accordance with BS EN 442-2:1997 test data.

The PR Frengerwarm Radiator heats via water-carrying Copper coils which are fixed within extruded Aluminium pipe seats. In turn, the pipe seats are securely bonded to the robust 3.0mm thick Steel outer casing to optimise heat emission. The heat is directed into the room by a layer of mineral wool insulation fitted to the reverse of the panel over the Copper coil. The units are made into sets comprising at least one active section and a number of 'Dummy' sections all to suit any particular environment. All panels are finished in a tough polyester paint finish.

Installation

The PR Frengerwarm Radiator is designed to be installed utilising the pre-drilled mounting rails and to simplify the installation process. For maximum security and to ensure full NOMS custodial property compliance it is important to install the product level utilising the purpose made floor and wall rails with any gaps due to building tolerance concealed are with suitable NOMS approved non-pickable sealant.

All fixings joints between the panel and pre-drilled rail should be secured using suitable NOMS approved (M6 x 20 Stainless steel countersunk screws) secure fixings and Loctite compound.

Key Product Features

- Manufactured from robust 3.0mm thick Steel plate.
- Interleaf joints and angled side profiles with pre-drilled holes to allow for the secure fixing using suitable NOMS approved (M6 x 20 Stainless steel countersunk screws) secure fixings and Loctite compound.
- Sets comprise standardised active sections are integrated with manufactured to suit dummy sections - each installation tailored to meet the requirements of any environment.
- Three standardised panel heights to match most project requirements.
- Slimline panel depth of just 150mm.
- Simple to clean and hygienic.
- Maintenance panel allows for simple but secure access to connection details and valve arrangements.

Dimensions

Panel Widths

The PR Radiator is available in three heights as standard: 395mm, 535mm and 675mm. The width selected will depend on room aesthetics and heating capacity requirements.

Panel Lengths

The PR Radiator sections are supplied with heating circuit (active sections) or without heating circuit (dummy sections).

A radiator set is usually a combination of at least one active section and a number of dummy sections tailored to suit the particular environment.

Active radiator sections are available in any length up to 3000mm long and are sized to meet the heating requirements. Each panel set may include more than one active section dependent on space and capacity requirements.

Dummy radiator sections provided to finish a set and gain access to the pipe connections are available in lengths from 150mm up to 3000mm as required.

Panel Depth

All radiators are 150mm deep as standard.

Surface Finish

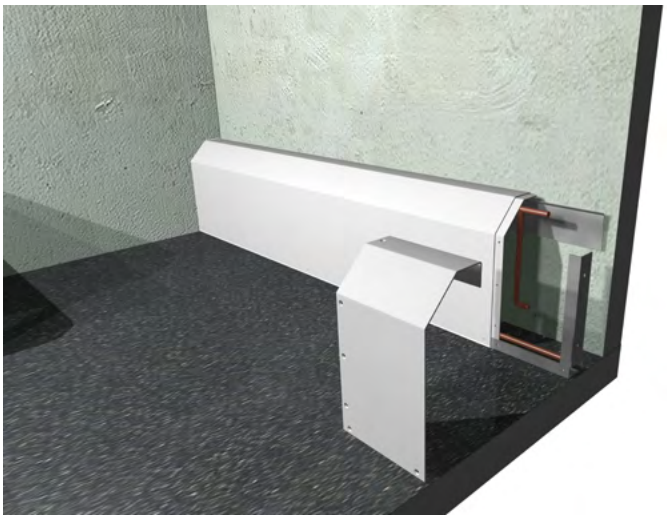
Each PR Radiator section is powder coat finished to RAL9010 (25% Gloss ±5%) as standard - with an emissivity of 0.94.

Connections

All active sections will arrive complete with 15mm Dia EN12449 / EN12735 - 2 Copper pipework circuits ready for on site connection to the mains flow and return water services.

Insulation

Each active section is supplied complete with up to 50mm thick - upto 45 kg/m³ density mineral wool Class 'O' foil backed insulation with a thermal conductivity of 0.040 W/mk @ 10°C as standard.



	Panel Type			
	PR395-4	**PR395-6**	**PR535-8**	**PR675-10**
Panel Height	395mm	395mm	535mm	675mm
Dry Weight	26.45 kg/m	28.1 kg/m	33.61 kg/m	39.1 kg/m,
Water Content	0.7 l/m	1.0 l/m	1.3 l/m	1.6 l/m
Minimum Distance Between Fixings	100mm	100mm	100mm	100mm
Maximum Working Pressure	8.7 BAR	8.7 BAR	8.7 BAR	8.7 BAR
Hydraulic Test Pressure	13.0 BAR	13.0 BAR	13.0 BAR	13.0 BAR

Components

1. Floor Rails
3mm thick angles Zintec Steel rail with M6 Hex nutcerts fitted to the reverse.

2. Casing
Panel casing manufactured from 3.0mm thick Zintec Steel sheet - Outer face powder coated to RAL9010 (25% Gloss ±5%).

3. Pipe Work
Individual Pipe work circuits manufactured from 15mm Dia EN12449 / EN12735 - 2 Copper tube. All joints completed via standard solder fittings.

4. Pipe Seats
Manufactured from cut-to-length heat treated aluminium 6000 series alloy die extrusion

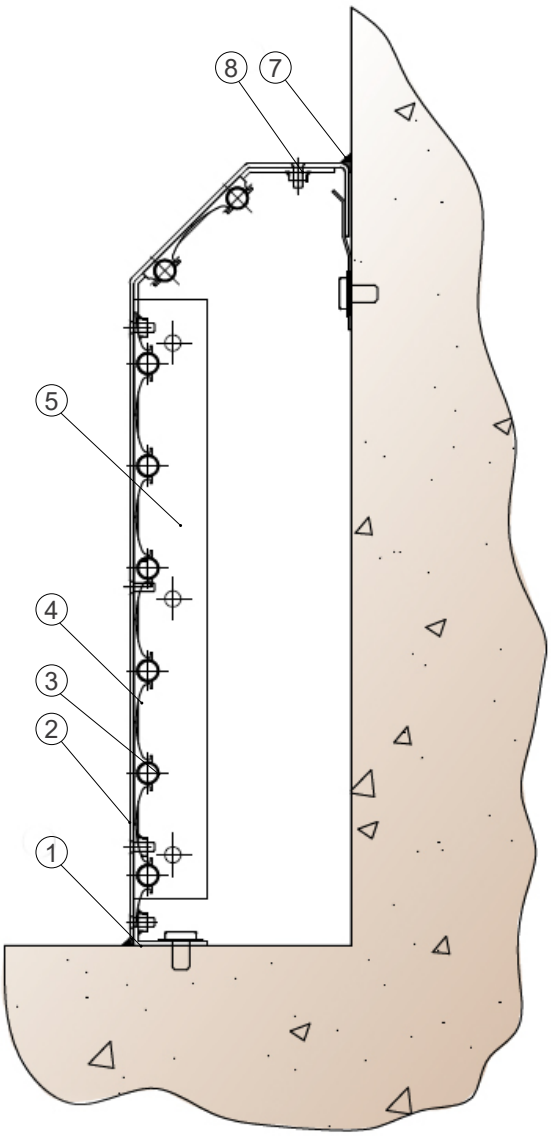
5. End Wall Support Rail
3mm thick Zintec Steel rail with M6 Hex nutcerts fitted to the reverse.

6. Insulation
Manufactured from factory clad upto 50mm thick Class 'O' foil backed mineral wool quilt - upto 45 kg/m³ density mineral wool.

7. Sealant
NOMS approved non pickable sealant to be applied to all exposed gaps (Sealant supplied and applied by others).

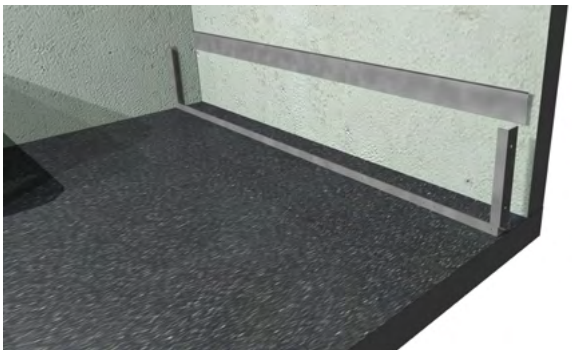
8. Security Fixings
NOMS approved M6 x 20 Stainless steel countersunk security screws (Torx Head or similar) to be used to fix all joints (Suitable screws to be supplied and fitted by others) - A suitable thread locking compound should be used in conjunction with any fixings.

The amount of fixings per panel run will be determined by the actual panel set length-however hole centres will be uniform to profile maximum strength and security.



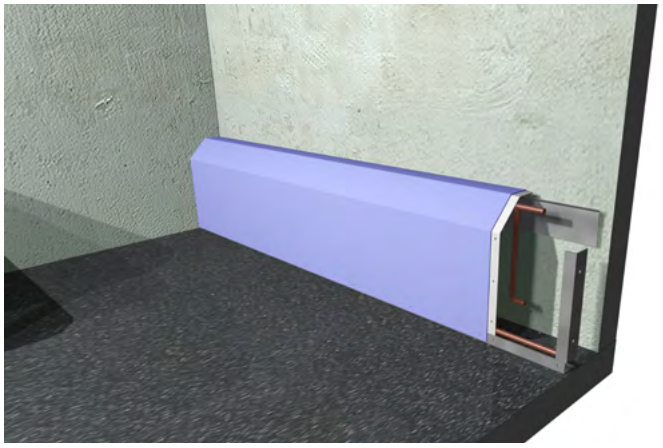
(6) Insulation not shown for clarity.
Wall and ceiling fixings to be supplied by others.

1. Site measurement as necessary for wall to wall installation to be provided (by others). **NOMS Approved** Active panel sections to be standardised lengths, and the 'Dummy' sections to be bespoke sized to complete the overall panel run dimensions within the given space.

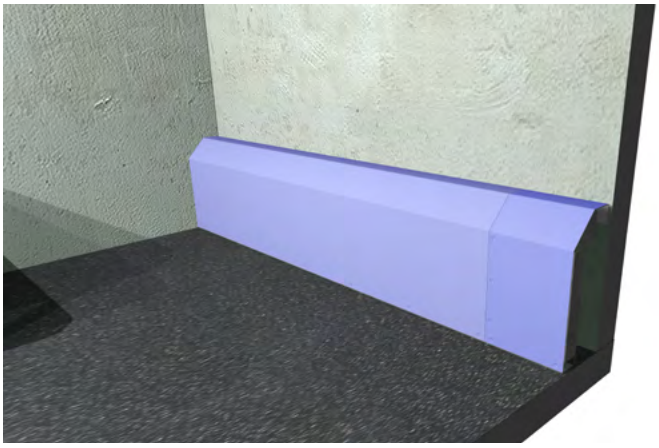


2. Install purpose made (supplied to exact run length less 3mm at each end) wall & floor mounting rails. Install side mounting rails on vertical walls to align with hole centres on the panels. Ensure rails are installed level and true to ensure active panel and dummy panel fixings align correctly.

   Note: Installation contractor to utilise appropriate types of fixings to walls and floors and to ensure a fixing in each factory formed hole in the mounting rails.



3. Install and fix **NOMS Approved** Active panel sections to the preinstalled level and true mounting rails using NOMS approved security fixings and thread locking compound (Security fixings and thread locking compound to be supplied and fitted by others).



4. Once **NOMS Approved** Active panel sections are in position make appropriate water connections to the heat exchange coil. Once installer is satisfied that their heating water connections are fit for purpose, install purpose made Dummy panel sections. Use NOMS approved security fixings and thread locking compound (Security fixings and thread locking compound to be supplied and fitted by others).

5. Remove 'low-tack' protective covering film and clean walls and exposed panel surfaces as appropriate.

6. Apply NOMS approved non-pickable sealant to all gaps that may be created due to building tolerances/inconsistences in walls (sealant to be supplied and fitted by others). We recommend that gaps between walls and panels be kept to a minimum distance wherever possible (Typically 3mm from walls, this may increase if walls are not true). Gaps should be equalized (to be similar) at opposite ends of the panel run.

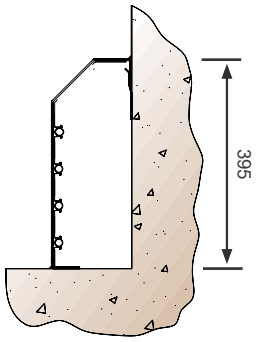
   Note:
   Installation instructions are provided for guidance purposes only and may need to be modified dependent on the given environment. Refer to Manufacturing Drawings for more details, these are issued at the start of any contract before manufacture is commenced. Always ensure that mandatory and appropriate health and safety procedures are applied during the installation process and that appropriate personal protective equipment (PPE) worn.

Product Performance

Product performance based on and in accordance with BS EN442 - 2:1997.

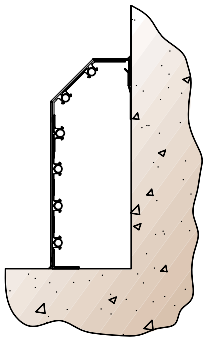
PR395-4 Panel

4 - pipe unit, assuming waterflow @ 82°C and water return @ 71°C.



PR395-6 Panel

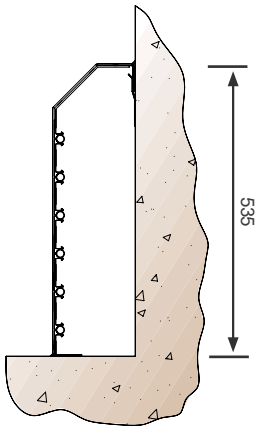
6 - pipe unit, assuming waterflow @ 82°C and water return @ 71°C.



PR395		
Room Temp °C	**PR395-4**	**PR395-6**
21	202	302
20	206	308
19	210	315
18	214	321
k =	1.934	2.897

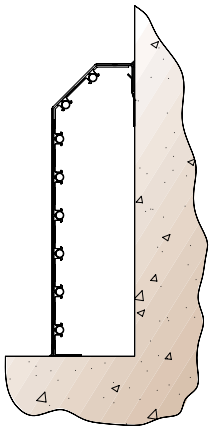
PR535-6 Panel

6 - pipe unit, assuming waterflow @ 82°C and water return @ 71°C.



PR535-8 Panel

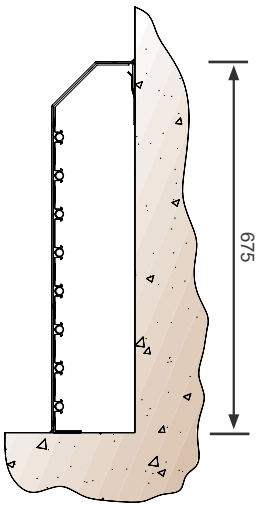
8 - pipe unit, assuming waterflow @ 82°C and water return @ 71°C.



PR535		
Room Temp °C	**PR535-6**	**PR535-8**
21	313	416
20	320	425
19	327	433
18	333	442
k =	3.005	3.988

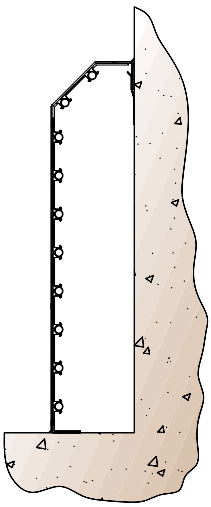
PR675-8 Panel

8 - pipe unit, assuming waterflow @ 82°C and water return @ 71°C.



PR675-10 Panel

10 - pipe unit, assuming waterflow @ 82°C and water return @ 71°C.

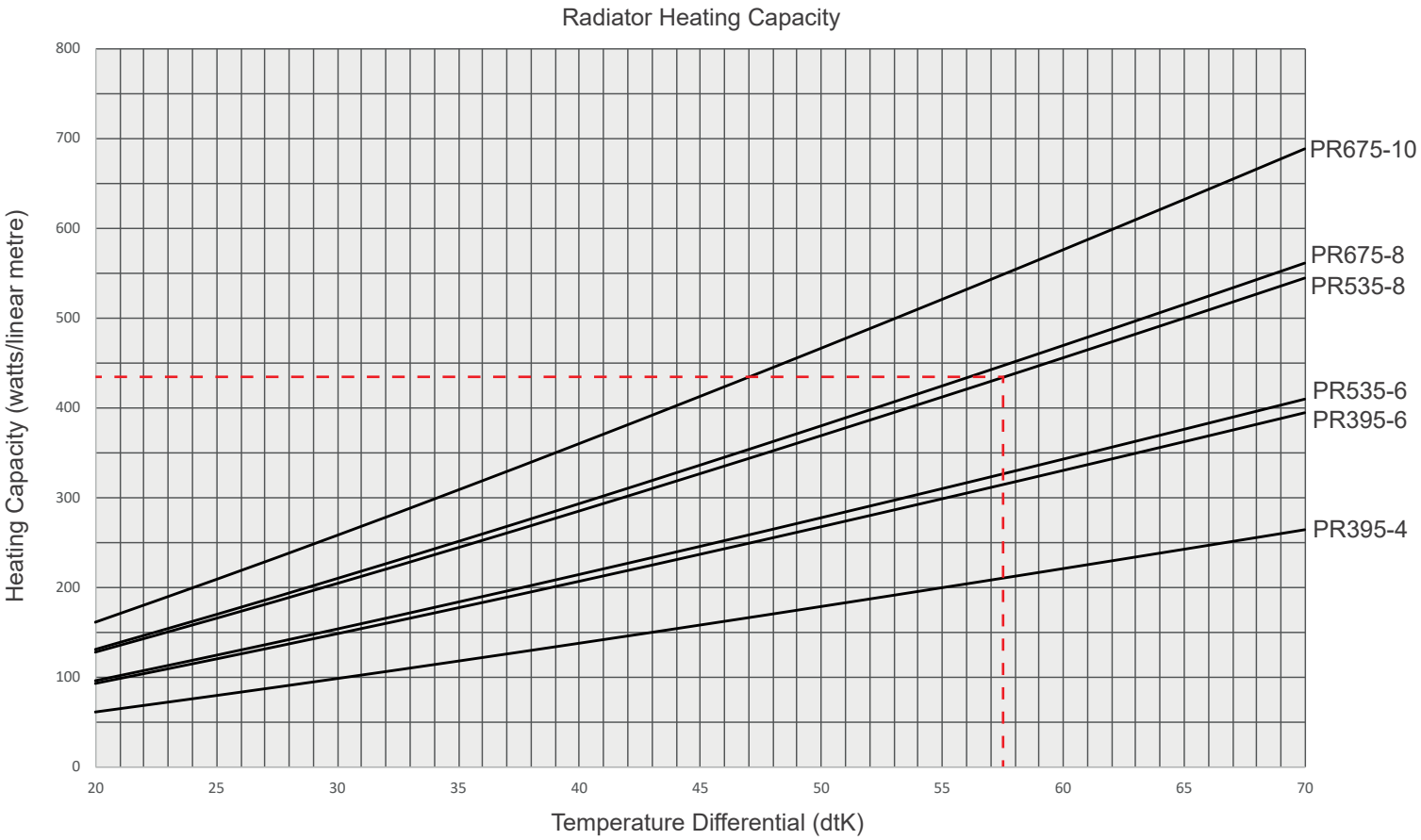


PR675		
Room Temp °C	**PR675-8**	**PR675-10**
21	430	526
20	439	537
19	448	548
18	457	559
k =	4.120	5.042

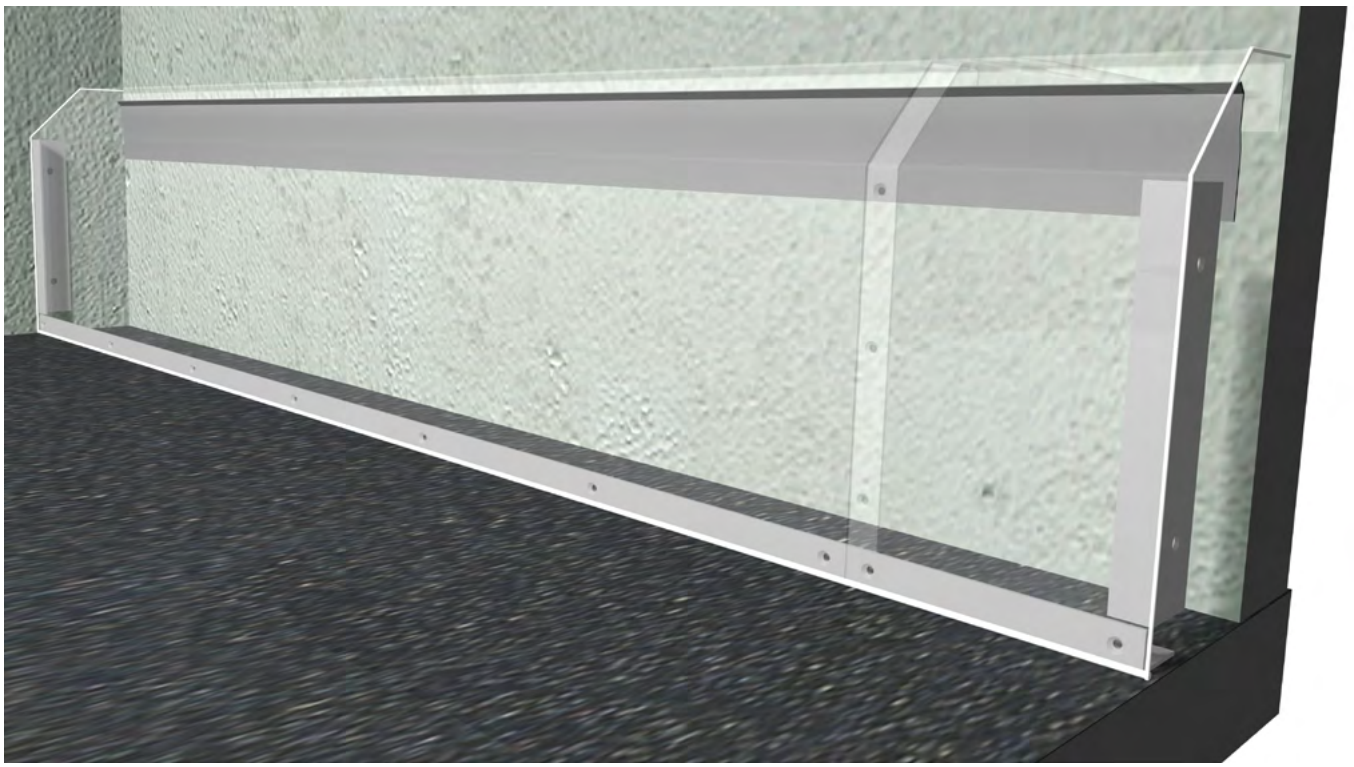
$$Q = K (\Delta T)^{n}$$

Q = Output W/m 'Active Section'
n = 1.1571
k = Constant see table '*'

The thermal performance characteristics of Frenger's Prison Radiator has been tested at BSRIA's radiator test facility in accordance with BS EN 442 - 2:1997.



Example: at water flow 82°C and return 71°C with a room temp of 19°C, the PR535 radiator provides 433 W/lm heating capacity.
Pressure drop <5.0 kPa based on 3.0m panel with maximum flowrate of 0.08 kg/s.
Please contact our Technical Services Department for advice on flowrates and pressure drops.



Operations and Maintenance

Application and Suitability
All secure **NOMS** compliant radiant heating panels are suitable for internal use only.

Operation, Performance, Control & Testing
Product Control
For temperature control, refer to the operation and maintenance guidelines specific to the building management system (BMS) - as such the control system is not supplied with the radiant panels and is not within Frenger Systems Ltd remit of works.

Performance Accreditation
Heating effect is measured in accordance with the relevant testing protocols.

PCP/PNP panels - All in accordance with EN14037 European radiant heating panel test standard.
PR Radiators - All in accordance with BS EN-442-2:1997.

Pressure Testing
Maximum test pressure: 10 bar.

Connections
Each panel will be supplied with 15mm Dia
EN12449 / EN12735-2 Copper pipework coils - Water connections should be either of Tectite or compressing coupling.

NB: If compression coupling is used, a support sleeve is to be fitted in the products connection pipe.

DO NOT SOLDER; DO NOT TWIST THE PIPES.

Water Quality
A specialist water treatment contractor should carry out water preparation and maintenance.

The heating water system must be air tight to prevent oxygen entering the pipework. The pipework must also be equipped with automatic air vents (supplied and fitted by others) to prevent air entering the system.

The water quality must have a pH - value of approximately 6-9.

The water velocities should not exceed 1 m/s.

In-line strainers are to be used to remove particles from the water.

Product Labelling
All panel sections have an identification label positioned on the inside of the product, indication the product type, reference and/or size etc. - project specific labelling to include cell/room reference number etc. can be provided on request.

Clearance & Maintenance
The PCP/PNP panel should be cleaned as required. The frequency of cleaning depends on the cleanliness of the indoor environment where the panel is positioned. The cleanliness of the panel should be inspected every 6 months and cleaned as necessary to prevent any reduction in the heating performance.

Access to the copper coil connections is normally gained from the removal of necessary dummy sections. Access is gained by the clearing of any non-pickable sealant and the removal of any fixings (NB - utilise the necessary tool required for the type of Security Screw employed):

a. Use suitable access equipment to allow safe and comfortable operation.
b. Whilst supporting the dummy piece as necessary remove all fixings.
c. Remove the dummy sections by either gently sliding away from or by holding to one side of the positioned active panel.

It is now possible to inspect the Copper coil connection assembly.

Location of faults
Any secure panel function is to supply heat to counter any losses within a given environment. Should you become aware that the product is not working, fault - find as follows:

No heat:
Is there any hot water?
- Measure the temperature on inlet pipe.

Is there water flow?
- Measure the temperature on the return pipe. (It should be approx the same as the specified water return temperature for the panel / system).

Product Packaging
All products are palletised and packaged suitable for delivery direct to site with pallets containing panels / radiators of a common size where appropriate.

Panels will be neatly and securely stacked on wooden pallets suitable for forklift truck unloading.

Number of product / panels per pallet will be dependent on actual lengths and height of the ordered product.

All delivery products should be stored in dry conditions, off the floor on pallets.

All panels are covered with a low-tack film protective film to protect the product during the installation process.

Typical Packaging photo detailed below:

Project Specific Testing Facility

The 3 number state-of-the-art Climatic Testing Laboratories at Frenger's technical facility in Derby (UK) have internal dimensions of 6.3m (L) x 5.7m (W) x 3.3m (H) high and includes a thermal wall so that both internal and perimeter zones can be simulated. Project specific testing validates product / solution performance (outputs) and resultant Room Comfort Conditions for compliance category grading in accordance with BS EN ISO 7730. All of Frenger's chilled beams have also been independently tested and certified by Eurovent in terms of product performance (output), as Eurovent can not test for thermal comfort; hence the need for Frenger's own laboratories.

Project Specific Testing

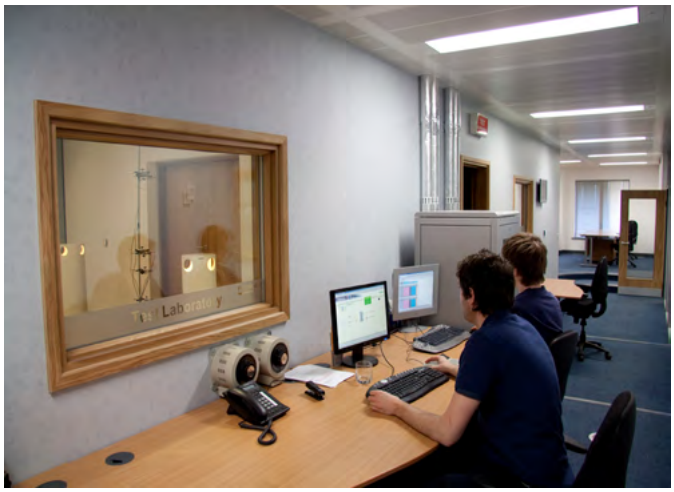
Project specific mock-up testing is a valuable tool which allows the Client to fully assess the proposed system and determine the resulting room occupancy Thermal Comfort conditions. The physical modelling is achieved by installing a full scale representation of a building zone complete with internal & external heat gains (Lighting, Small Power, Occupancy & Solar Gains).

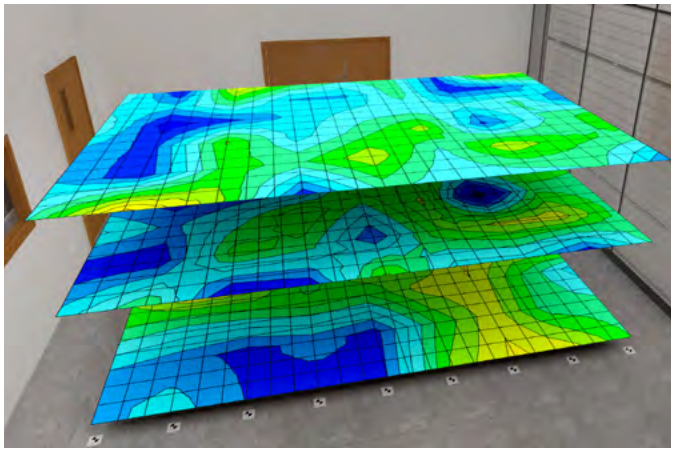
The installed mock-up enables the client to verify the following:

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

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

- Product capacity under design conditions.
- Comfort levels - air temperature distribution.
  - thermal stratification.
  - draft risk.
  - radiant temperature analysis.
- Smoke test video illustrating air movement.
- Live Thermal Imaging





Photometric Testing Facility

The in-house Photometric test laboratories at Frenger are used to evaluate the performance of luminaires. To measure the performance, it is necessary to obtain values of light intensity distribution from the luminaire. These light intensity distributions are used to mathematically model the lighting distribution envelope of a particular luminaire. This distribution along with the luminaires efficacy allows for the generation of a digital distribution that is the basis of the usual industry standard electronic file format. In order to assess the efficacy of the luminaire it is a requirement to compare the performance of the luminaire against either a calibrated light source for absolute output or against the “bare” light source for a relative performance ratio.

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

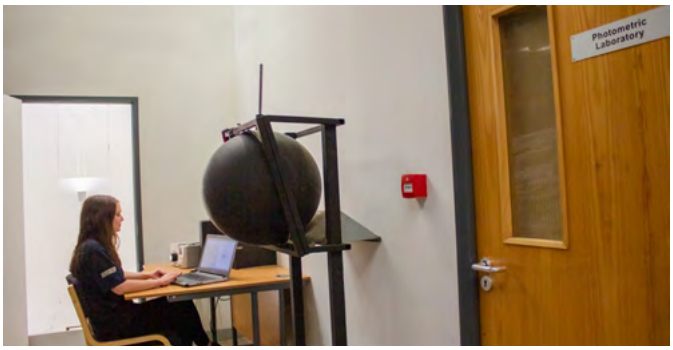
The intensity distribution is obtained by the use of a Goniophotometer to measure the intensity of light emitted from the surface of the fitting at pre-determined angles. The light intensity is measured using either a photometer with a corrective spectral response filter to match the CIE standard observer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

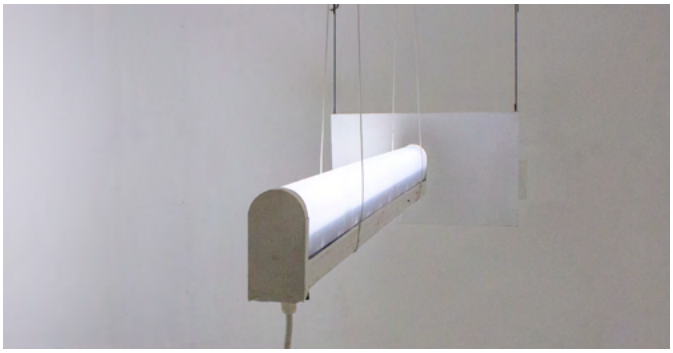
Luminaire outputs are measured using our integrating sphere for smaller luminaires or our large integrator room for large fittings and Multi Service Chilled Beams. For both methods we can use traceable calibrated radiant flux standards for absolute comparisons.

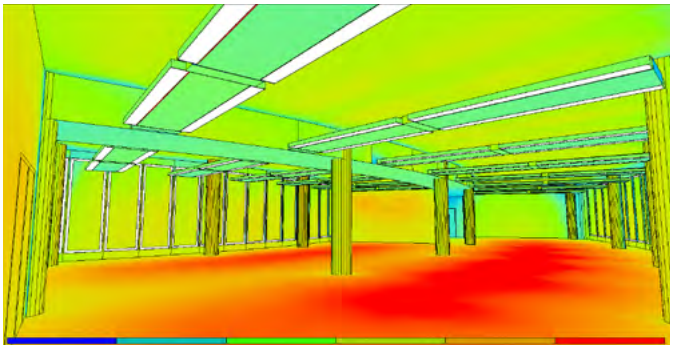
All tests use appropriate equipment to measure and control the characteristics of the luminaire and include air temperature measurements, luminaire supply voltage, luminaire current and power. Thermal characteristics of luminaire components can be recorded during the testing process as required.

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

Frenger conduct photometric tests in accordance with CIE 127:2007 and BS EN 13032-1 and sound engineering practice as applicable. During the course of these tests suitable temperature measurements of parts of LED’s can be recorded. These recorded and plotted temperature distributions can be used to provide feedback and help optimise the light output of solid state light source based luminaires which are often found to be sensitive to junction temperatures.







Acoustic Testing Facility

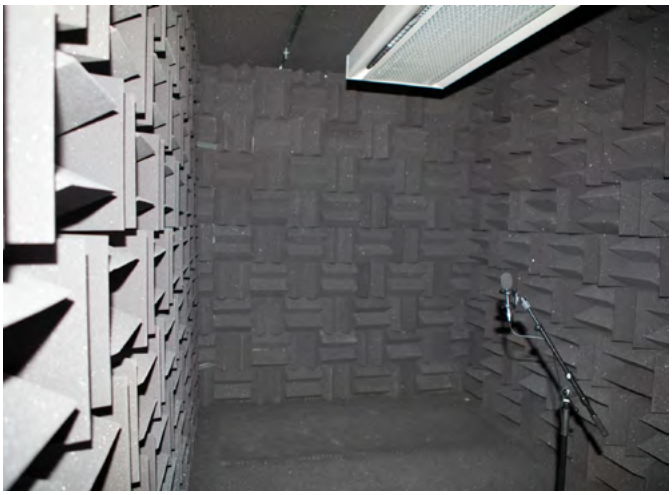
The Acoustic Test Room at Frenger is a hemi-anechoic chamber which utilises sound absorbing acoustic foam material in the shape of wedges to provide an echo free zone for acoustic measurements; the height of the acoustic foam wedge has a direct relationship with the maximum absorption frequency, hence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

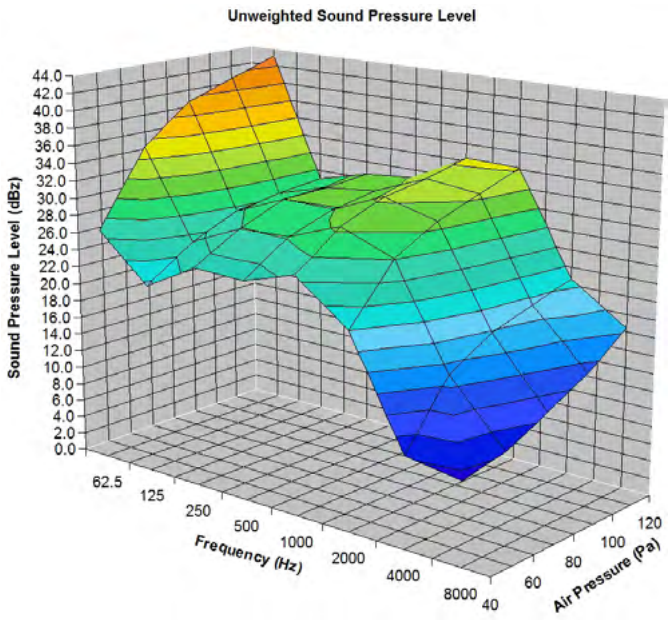
The use of acoustic absorbing material within the test room provides the simulation of a quiet open space without “reflections” which helps to ensure sound measurements from the sound source are accurate, in addition the acoustic material also helps reduce external noise entering the test room meaning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

The acoustic facilities allow Frenger to provide express in-house sound evaluation so that all products, even project specific designs can be quickly and easily assessed and optimised.

To ensure accuracy, Frenger only use Class 1 measurement equipment which allows sound level measurements to be taken at 11 different ⅓ octave bands between 16 Hz to 16 kHz, with A, C and Z (un-weighted) simultaneous weightings.

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





Industry Associations

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

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

BSI EN ISO 9001:2015

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

Eurovent

Frenger Systems participate in the EC programme for Chilled Beams. Check ongoing validity of certificate: www.eurovent-certification.com or www.certiflash.com Certiflash. The heat exchanger for the Recepto HRU is a Klingenburg Eurovent Certified aluminium static heat exchanger.

Chilled Beam and Ceiling Association

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

HEVAC Member

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

Federation of Environment Trade Association

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

UK Trade & Investment

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

Certified CIBSE CPD

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

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

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