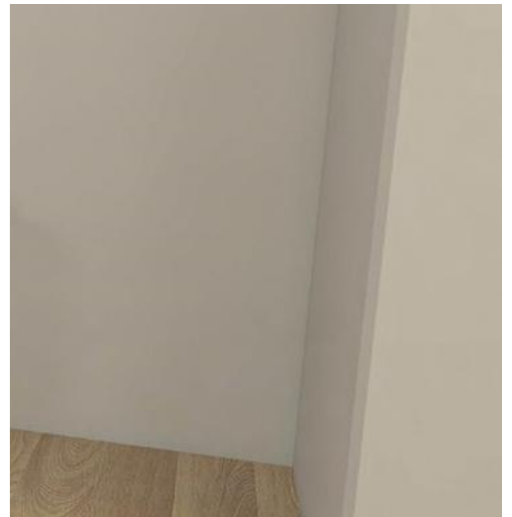


the future of space conditioning

Armis™

LST Radiator Covers





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Introduction



One of the most common ways of heating an area is via radiators at low wall level. Radiators can have surface temperatures of up to 80°C. At 60°C surface temperature, radiators can cause 3rd degree burns from only five seconds of skin contact and this poses a greater risk to the young, ill, or elderly. With the worst case scenario being that a person can get trapped next to the radiator and not have the strength to get up from the floor which could cause serious burns and injury.

The solution to the above potential situation would be to use ceiling mounted radiant panels (see other Frenger brochures) also freeing up wall spaces. Alternatively fit one of Frenger's Armis Low Surface Temperature (LST) Radiator covers over an existing radiator to create a gap between the radiator and LST whilst having negligible effect on the heat output of the radiator.

Frenger's Armis LST Covers can be manufactured any length to suit your project up to 3m long in one piece which covers most radiators. The cover can fit over the whole radiator or have apertures for the fitment of TRV or pipework. The casing is easily removable to allow access to the radiator for cleaning and maintenance.



Wall Mounted Armis LST Radiator Cover Detail

Key Features

- Guarantee safe surface temperatures in your work environment, minimising risk of injury.
- Easy to install with the supplied wall and floor mounting bracketry.
- Manufactured from 1.5mm thick Zintec.
- Available with either a square top or sloping top.
- Simple cover removal to allow cleaning & maintenance.
- Minimal amount of external fixings.
- Made to measure to suit site requirements (site dimensions by others).
- Finished in RAL 9016 white powder coat as standard. Other RAL colours are available.
- Can be supplied with Anti-Bacterial finish on request.
- Multiple perforation patterns available.
- Can be supplied with aperture to allow for Thermostatic Radiator Valves (TRV), which can also be supplied with or without the internal radiator - all available in the Controls & Ancillaries section (page 13).



Wall Mounted Armis LST Radiator Cover

Product Description (Armis LST)



Sloped Top Armis LST Radiator Cover With no TRV Aperture



LST Radiator Cover - Healthcare Option

In areas where the reduction in spread of infection is required, Frenger's Armis LST covers can be supplied with an Anti-Bacterial power coat finish in any Standard RAL colour.

The unit is manufactured from 1.5mm thick Zintec steel as standard with an option to manufacture from 2mm thick Zintec steel for greater robustness. Also available in 2mm thick Aluminium on request.

All of Frenger's Armis LST covers can be manufactured to any overall length (maximum single section length) is 3m with multiple sections used to make up longer continuous lengths. Frenger can also supply colour match Pipe Boxing to cover exposed pipework connecting to the internal radiator for a continuous appearance.

Material

As standard, manufactured from 1.5mm thick Zintec steel. 2mm Thick Zintec Steel or Aluminium available on request.

Construction

Two component system, the outer casing and the inner casing. Each component is manufactured from a single sheet of steel with minimal exposed fixings.

Shape

Available as either horizontal or vertical. The horizontal model is available with either square top or sloped top and can be designed as a bespoke continuous variant.

Finish

As standard, RAL 9016 powder coat. Other RAL colours and/or anti-bacterial finishes available on request.

Apertures

Apertures or cutouts can be allowed for in the design of the casing to allow for valves, pipework etc.

Perforation

Multiple perforation patterns available, 7mm Dot, Double Dot, Slot or Diamond.



Continuous LST Radiator Cover

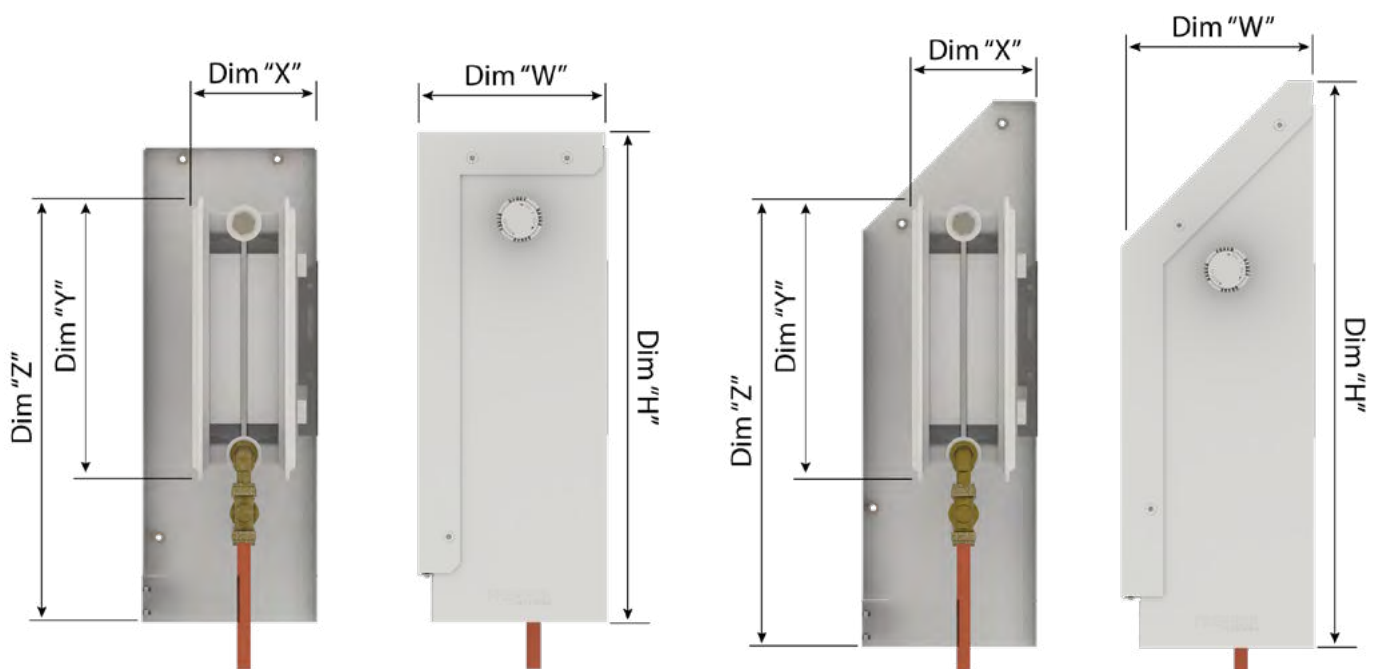


Vertical LST Radiator Cover

Product Dimensions (Armis LST)

Floor or Wall Mounted Horizontal Models

| Model Ref. | LST Cover Size (mm) | | | Maximum Radiator Installed Dimensions (mm) | | |
|-------------|---------------------|----------------------------|------------------------------|--|--------------------------|--|
| | Width "W" (mm) | Height "H" (Flat Top) (mm) | Height "H" (Sloped Top) (mm) | Overall Distance from Wall "X" (mm) | Radiator Height "Y" (mm) | Overall Radiator Install Height "Z" (mm) |
| ARM 145-520 | 145 | 520 | 600 | 80 | 300 | 475 |
| ARM 145-670 | 145 | 670 | 750 | 80 | 450 | 625 |
| ARM 145-820 | 145 | 820 | 900 | 80 | 600 | 775 |
| ARM 145-920 | 145 | 920 | 1000 | 80 | 700 | 875 |
| ARM 165-520 | 165 | 520 | 600 | 100 | 300 | 475 |
| ARM 165-670 | 165 | 670 | 750 | 100 | 450 | 625 |
| ARM 165-820 | 165 | 820 | 900 | 100 | 600 | 775 |
| ARM 165-920 | 165 | 920 | 1000 | 100 | 700 | 875 |
| ARM 180-520 | 180 | 520 | 600 | 115 | 300 | 475 |
| ARM 180-670 | 180 | 670 | 750 | 115 | 450 | 625 |
| ARM 180-820 | 180 | 820 | 900 | 115 | 600 | 775 |
| ARM 180-920 | 180 | 920 | 1000 | 115 | 700 | 875 |
| ARM 200-520 | 200 | 520 | 600 | 135 | 300 | 475 |
| ARM 200-670 | 200 | 670 | 750 | 135 | 450 | 625 |
| ARM 200-820 | 200 | 820 | 900 | 135 | 600 | 775 |
| ARM 200-920 | 200 | 920 | 1000 | 135 | 700 | 875 |



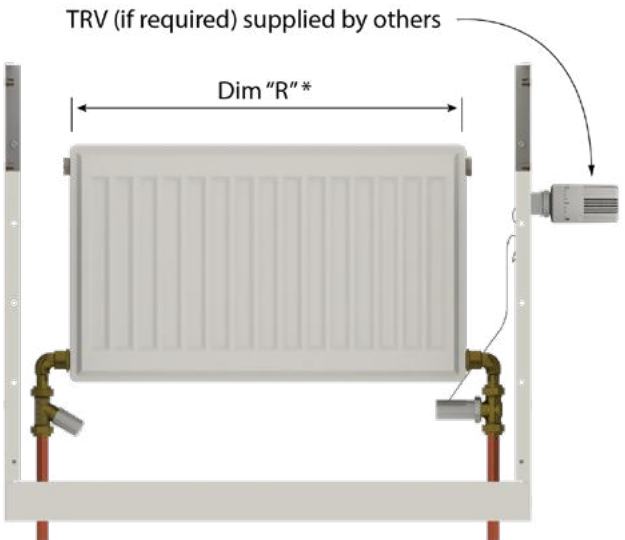
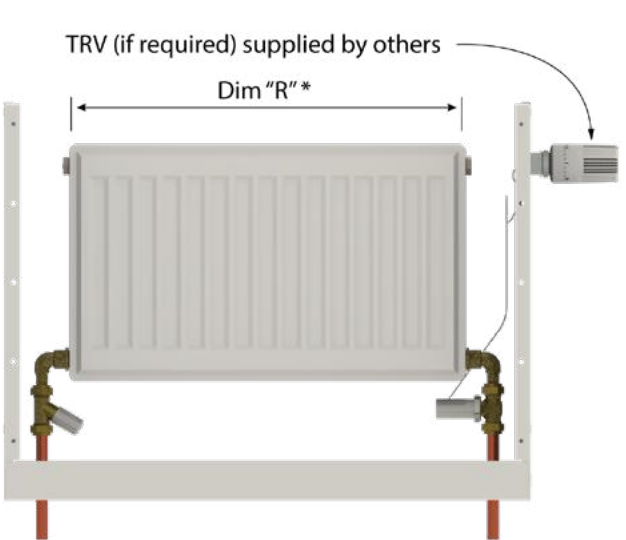
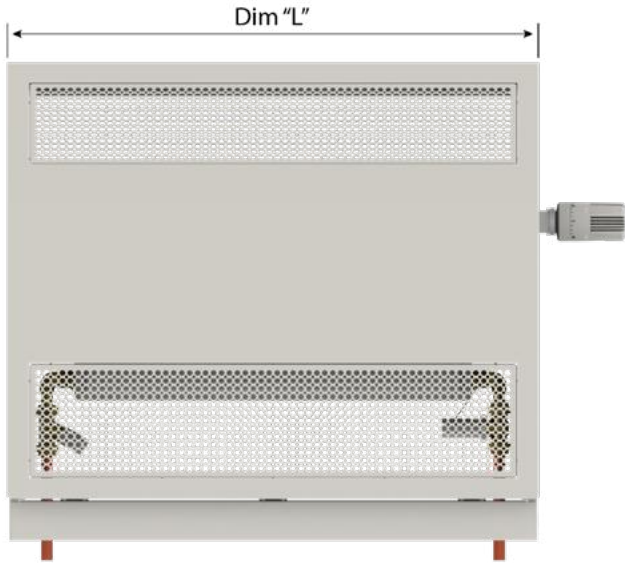
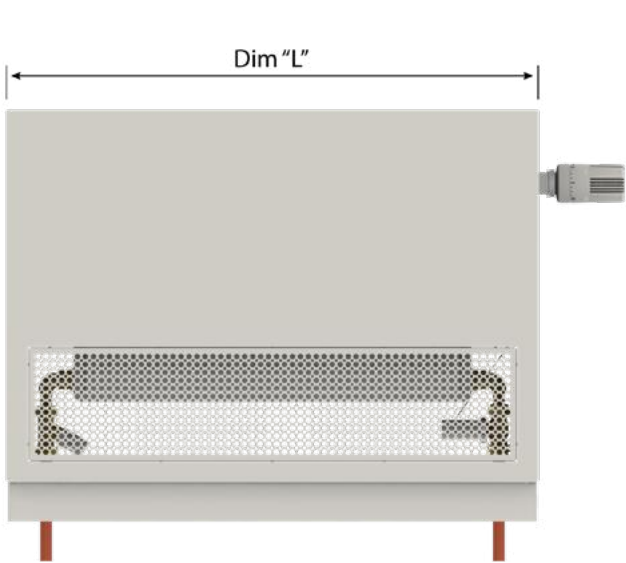
LST Radiator Cover with Flat Top

LST Radiator Cover with Sloped Top

Product Dimensions

| LST Cover Length "L" (mm) | *Max. Rad Length "R" (mm) | LST Cover Length "L" (mm) | *Max. Rad Length "R" (mm) |
|---------------------------|---------------------------|---------------------------|---------------------------|
| 675 | 500 | 1975 | 1800 |
| 775 | 600 | 2075 | 1900 |
| 875 | 700 | 2175 | 2000 |
| 975 | 800 | 2275 | 2100 |
| 1075 | 900 | 2375 | 2200 |
| 1175 | 1000 | 2475 | 2300 |
| 1275 | 1100 | 2575 | 2400 |
| 1375 | 1200 | 2675 | 2500 |
| 1475 | 1300 | 2775 | 2600 |
| 1575 | 1400 | 2875 | 2700 |
| 1675 | 1500 | 2975 | 2800 |
| 1775 | 1600 | 3075 | 2900 |
| 1875 | 1700 | 3175 | 3000 |

*Maximum recommended length based on typical valving arrangements, purchaser to determine length needed based on site plumbing dimensions.



LST Radiator Cover with Flat Top

LST Radiator Cover with Sloped Top

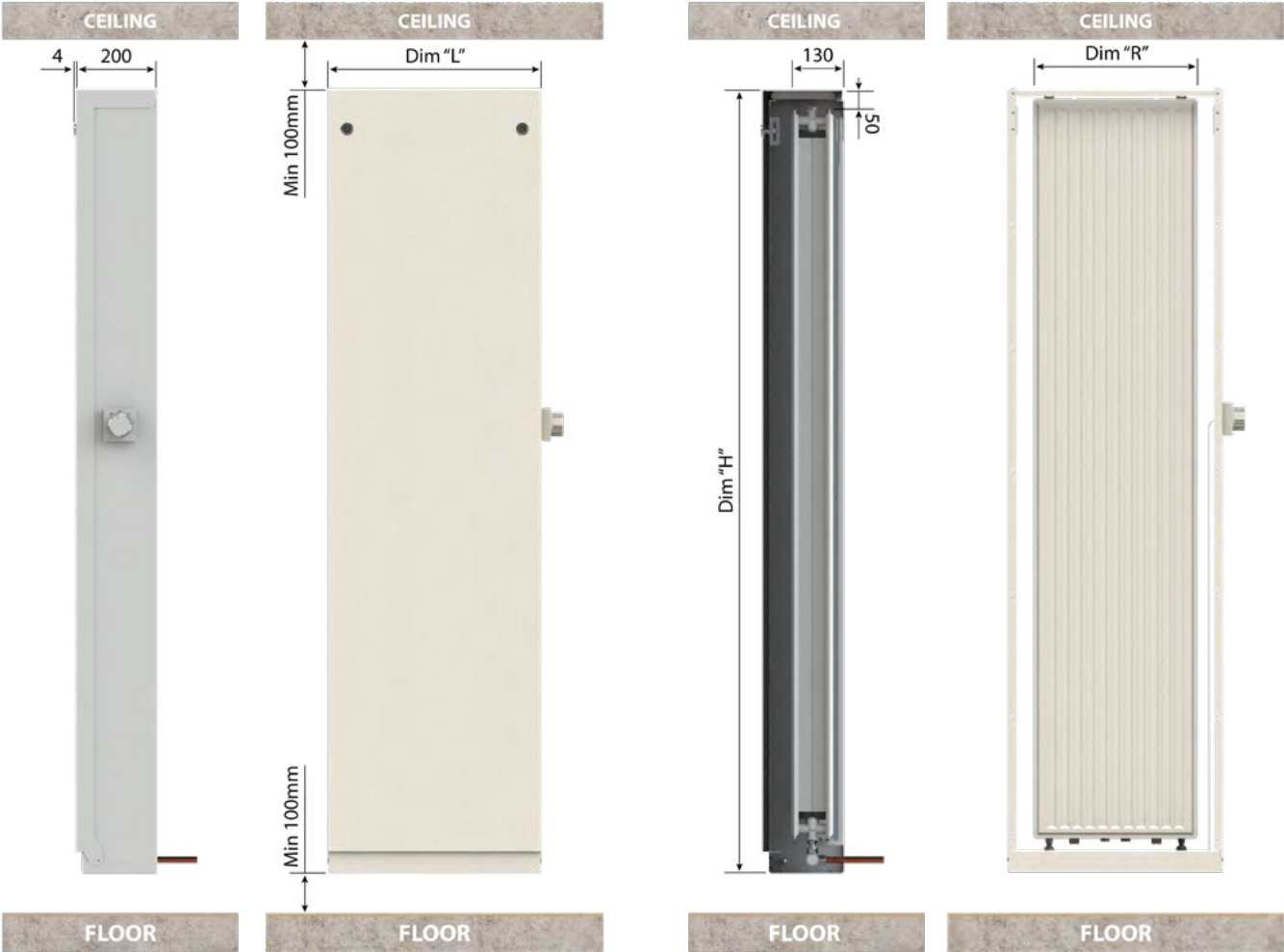
Product Dimensions

Armis Vertical

All dimensions in mm

| Model Ref. | LST Cover Size (mm) | | | Maximum Radiator Installed Dimensions (mm) | |
|-------------------|---------------------|-----------------|-----------------|--|-------------------------------|
| | Width "W" (mm) | Height "H" (mm) | Length "L" (mm) | *Max. Rad Length "R" (mm) | Max. Radiator Height "Y" (mm) |
| ARMV 200-1950-525 | 200 | 1950 | 525 | 400 | 1800 |
| ARMV 200-1950-625 | 200 | 1950 | 625 | 500 | 1800 |
| ARMV 200-1950-725 | 200 | 1950 | 725 | 600 | 1800 |
| ARMV 200-2050-525 | 200 | 2050 | 525 | 400 | 1900 |
| ARMV 200-2050-625 | 200 | 2050 | 625 | 500 | 1900 |
| ARMV 200-2050-725 | 200 | 2050 | 725 | 600 | 1900 |
| ARMV 200-2150-525 | 200 | 2150 | 525 | 400 | 2000 |
| ARMV 200-2150-625 | 200 | 2150 | 625 | 500 | 2000 |
| ARMV 200-2150-725 | 200 | 2150 | 725 | 600 | 2000 |

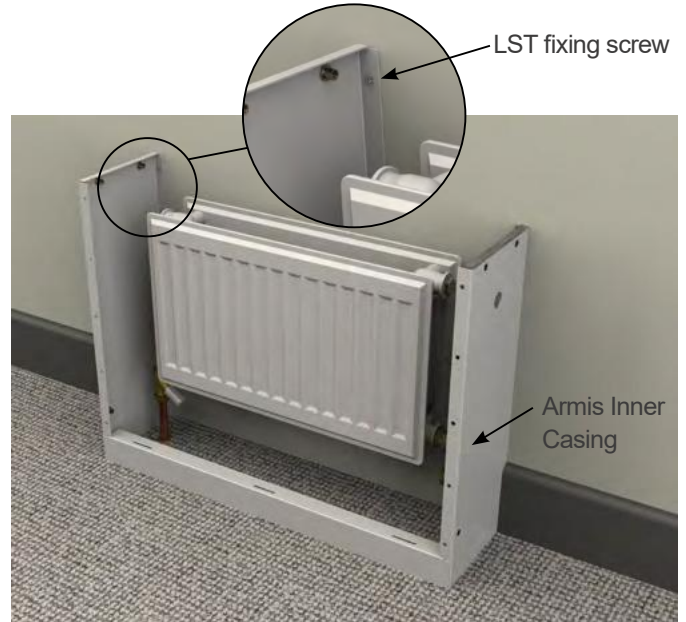
*Maximum recommended length based on typical valving arrangements, purchaser to determine length needed based on site plumbing dimensions.



Installation

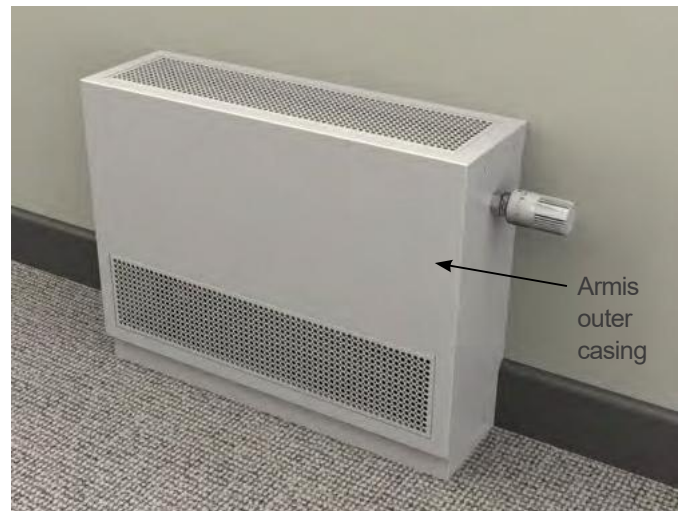
The Armis LST Radiator Cover is quick and easy to install, only requiring a few steps and no specialist equipment. The steps below show the method for fitting the Armis Horizontal and Armis Vertical to a generic radiator. The steps may vary depending on the installed radiator. Ensure the correctly sized Armis is selected before attempting installation.

Armis Horizontal



1. Prepare the area surrounding the radiator to allow fitment of the Armis. This includes cleaning the environment around the radiator and removing any obstructions, such as skirting boards that may clash with the Armis installation. Fit four suitable wall plugs to the wall the radiator is fixed to, in the locations indicated in the installation guide.

2. Carefully line up the wall plugs with the four corresponding holes on the Armis inner casing. The inner casing can now be secured to the wall using the LST wall fixing screws



3. Once the inner casing of the Armis is fixed to the wall, the Thermostatic Radiator Valve (supplied as an optional extra or by others) can be installed onto the case.

4. The outer casing of the Armis can now be secured to the inner casing with the supplied LST casing screws.

Installation

Armis Vertical



1. Prepare the area surrounding the radiator to allow fitment of the Armis. This includes cleaning the environment around the radiator and removing any obstructions that may clash with the Armis installation. Fit suitable wall plugs to the wall the radiator is fixed to, in the locations indicated in the installation guide.



2. Carefully line up the wall plugs with the corresponding holes on the LST wall frame. The wall frame can now be secured to the wall using the LST wall fixing screws. Once the LST wall frame is fixed to the wall, the Thermostatic Radiator Valve (supplied as an optional extra or by others) can be installed onto the frame.



3. Once the LST wall frame is fixed to the wall, the LST front cover can now be fitted to the LST wall frame by fixing the bracket at the bottom of the LST front cover to the corresponding section of the LST wall frame and connecting the safety cords at the top of the panel.



4. The LST front cover can now be pivoted onto the LST wall frame and secured by turning both the quarter turn locking latches.

Colour Options



Colour helps to create atmosphere within a space, the Armis LST Radiator Cover provides a unique way to integrate colour into different environments. Frenger's Armis LST Radiator Covers are powder coated in white or black as standard, Frenger also offer all RAL classic colour options to suit any architectural aesthetics (other colours available on request).

Research has been done into the effects different colours have on wellbeing and from this their suitability for different environments has been established. Blue has been found to induce calmness and improve concentration, it's mental benefits make it a perfect choice for learning environments such as classrooms, red has been shown to have more physical effects, encouraging activity, yellow is associated with creativity and is ideal for creative workspaces, neutral and cool tones are more suited for healthcare environments but depending on the purpose it can be useful to include colour such as for children's hospitals to provide stimulation.

Below are some examples of different LST Radiator Cover, RAL Colour options. Available in RAL Classic Colour (Other colours available on request):

RAL 9016 - Traffic White



RAL 9004 - Signal Black



Colour Options

RAL 5012 - Light Blue



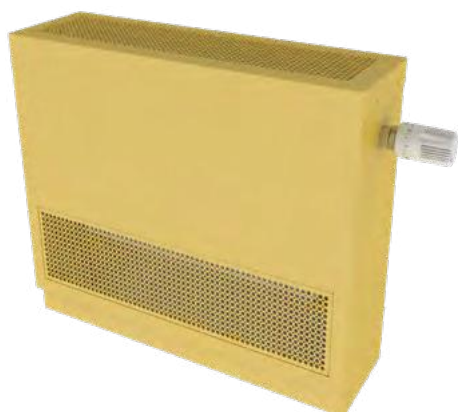
RAL 4008 - Signal Violet



RAL 3018 - Strawberry Red



RAL 1003 - Signal Yellow

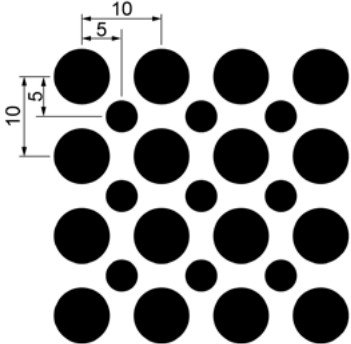
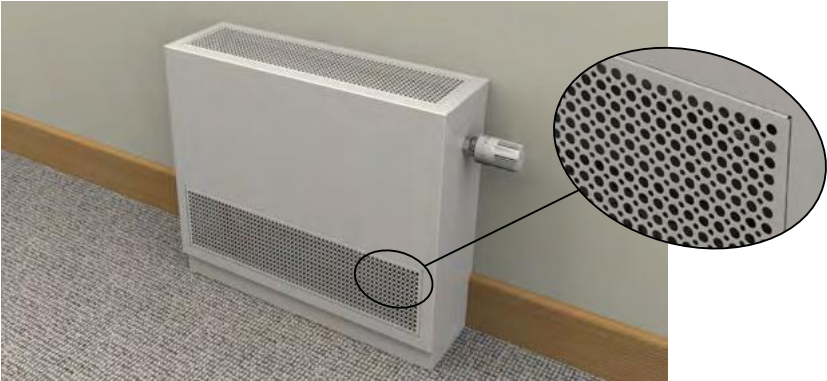


Perforation Options

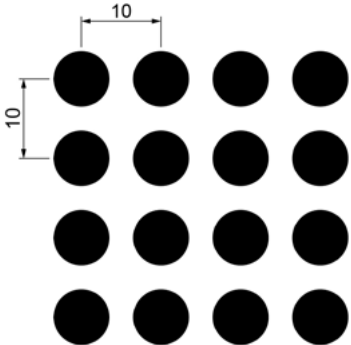
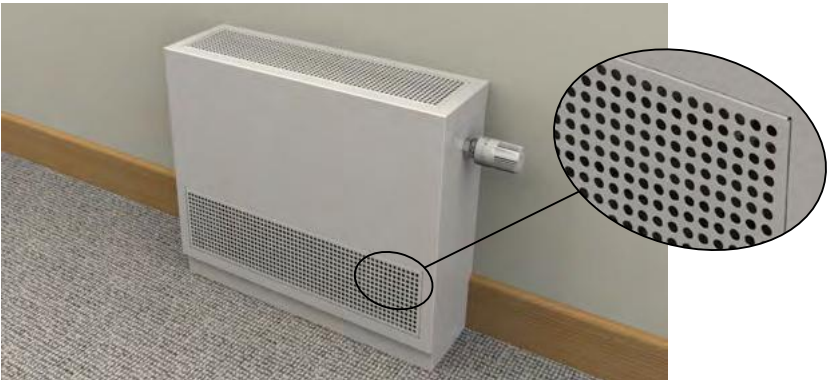
Frenger's Armis LST Radiator covers have perforated sections to allow air flow that is required to facilitate convective heating from the encased radiator. As standard Frenger offer four perforations and alternative perforation pattern orientations can be designed to fit different design aesthetics, please contact sales@frenger.co.uk for further information.

Detailed below are the four perforations offered as standard for Frenger's Armis LST Radiator Cover:

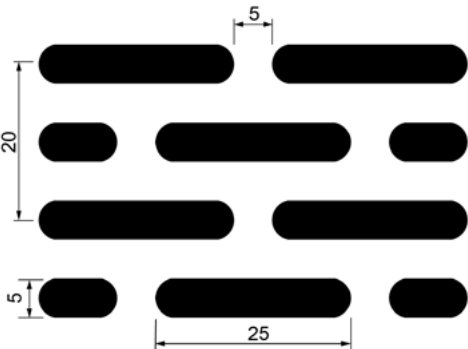
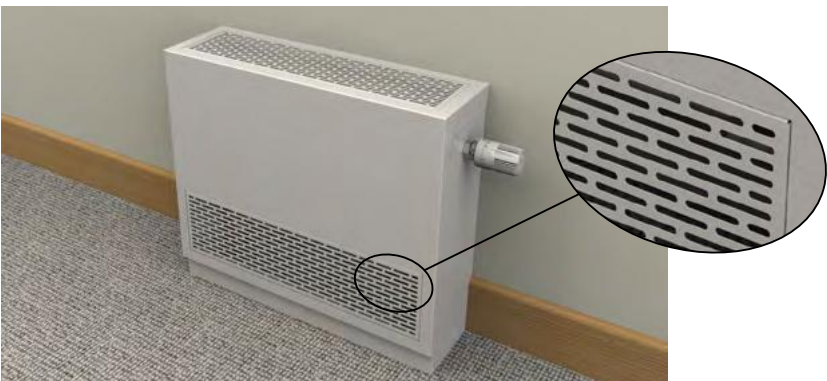
7mm and 4mm Double Dot Perforation - Order Code DD



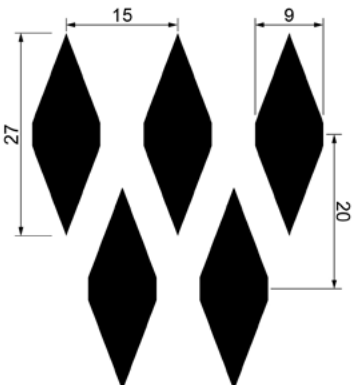
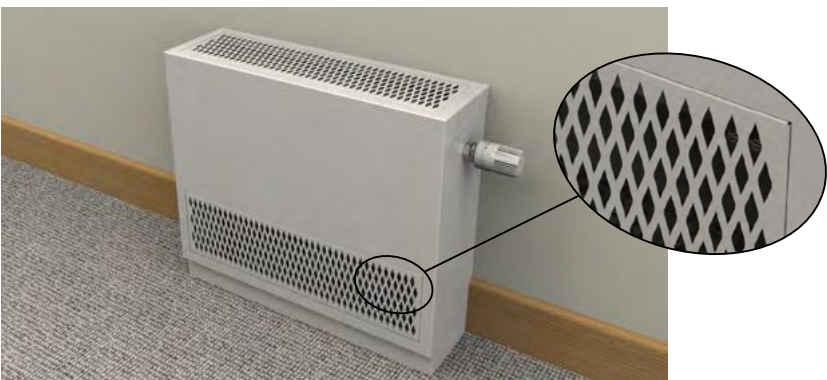
7mm Dot Perforation - Order Code 7D



Slot Perforation - Order Code 5S



Diamond Perforation - Order Code DMD



Controls & Ancillaries

Frenger's Armis is able to accommodate a number of third party valves, controls and other ancillary products (contact Frenger directly for details), alternatively Frenger offer a number of products / components to aid in the installation of Armis LSTs:

Lockshield Valve Angled - LSVA



Thermostatic Radiator Valve - TRV



Lockshield Valve Straight - LSVS



Thermostatic Radiator Valve Angled - TRVA



90° Integration Elbow - IE



Thermostatic Radiator Valve Straight - TRVS



Integration Straight - IS



Armis Continuous - Bespoke Perimeter System

As well as the standard Armis LST radiators, Frenger also have the capability to produce bespoke sizes to help overcome challenges encountered on projects. The Armis Continuous is available as both sloped and flat topped and can be custom designed to fit various room shapes.



The Armis Continuous LST Radiator Cover variant is designed to fit radiators of various sizes and shapes, effortlessly adapting to any room's unique dimensions. Whether you have a small alcove or a larger open space, this bespoke LST cover ensures an aesthetically pleasing fit.

Installing and maintaining these bespoke LST covers is made easy due to its user-friendly design that enables quick access to the radiator, simplifying the cleaning process and ensuring hassle-free maintenance.

Key Features

- Option of security screws/fixings or quarter turn locking latches to allow for quick removal of cover for access to the radiator for cleaning and maintenance.
- Bespoke designed to fit any room dimensions.
- As with the standard Armis, the Armis Continuous can be supplied in any RAL classic colour to suit any aesthetic and anti bacterial coated if required.
- Can be supplied with Frenger's TRV valves or with apertures to accommodate a variety of other valves.



Armis Healthcare



Typically Low Surface Temperature radiator covers are very useful items for preventing injuries which can be caused by the hot surface of the radiator however conventionally they have been manufactured to be installed fixed to a floor or the wall. Conventional LST Covers by others maybe suitable for many applications however it can make it difficult to clean the radiator and the internals of the case as the whole case needs to be removed and this can make cleaning of the radiator and case in buildings such as hospitals which require regular cleaning of all surfaces quite difficult. Some units may come in multiple parts, require complete disassemble or need multiple people to move for larger units.

Conventional LST Covers inevitably increases maintenance costs; staffing costs/requirements and increases the time to clean all radiators in a building leaning to a continuous schedule of cleaning the radiators and cases.

Also, radiator guards where the inside surfaces and the radiator have not been cleaned can become a haven for the growth of bacteria which can be distributed by the convective nature of a radiator which would be especially dangerous in healthcare environments.

To combat this, Frenger have introduced the Armis Healthcare LST radiator cover which not only helps prevent occupants from injuries due to hot radiator surface temperatures but is combined with a pivot down front cover which allows easy (Quarter turn key/entry locking) access to all internal surfaces of the radiator cover and the radiator. This enables easier access for cleaning of the case and the radiator but also the cleaning/maintenance can be performed by one person quickly and efficiently without having to disassemble the case or the use of Facilities/ Estates staff. This ultimately reduces maintenance time & staffing requirements which then reduces the overall maintenance costs and most importantly raises hygiene standard.

The cover is manufactured from 1.5mm thick Zintec steel and is finished with Anti-Bacterial RAL 9016 powder coat to all external & internal surfaces (other colour are available).

The Swing Down front cover hinges from the bottom and is fitted with a safety cord at the top on both sides to allow the front cover to swing down steadily and not to drop onto the floor. The front cover can also be completely removed to help with access for maintenance.

Covers can be manufactured up to 2.2m in length in a single section to accommodate most standard radiators. If longer covers are required, please contact Frenger to discuss your project requirements.

Key Features

- Swing Down front cover for easy access to internal surfaces and radiator. Cover is lockable via security fixings.
- All internal & external surfaces finished in RAL 9016 Antibacterial powder coat finish as standard. Other colours are available.
- Manufactured from 1.5mm thick Zintec Steel. 2mm thick Zintec casings available for secure applications.
- Perforated grilles to allow heated air to be circulated but also prevents objects and fingers touching the heated radiator surface.
- Can be provided with apertures to allow for fitment of TRVs or pipe pass through.
- Quarter turn key access / security locking.



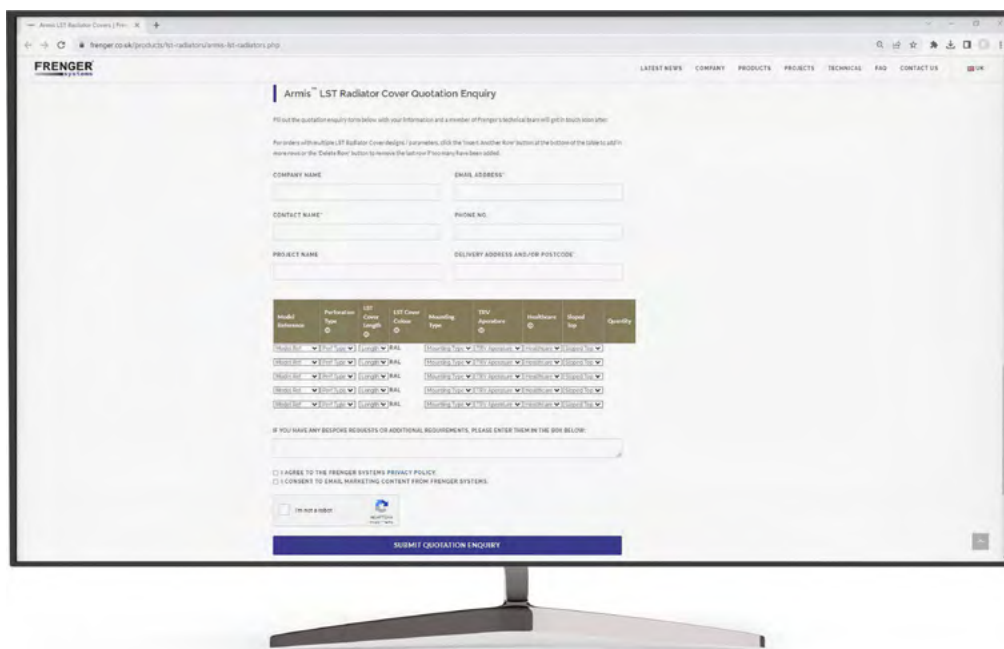
Armis Healthcare Radiator Cover



Wall Mounted Radiator Cover

Quotation Enquiry Form

To request a quotation for Frenger's Armis LST Radiator Cover please visit: www.frenger.co.uk/LST. The enquiry form will allow project selections to be sent to Frenger, allowing a quote to be produced. The table below will provide the information required to make the selections.



| | | Model Reference | Perforation Type | LST Cover Length | LST Cover Colour | Mounting Type | TRV Aperture | Healthcare | Sloped Top |
|------------------------------|----------------------|--|---|---|---|------------------------|---|---|--|
| Example Selection | | ARM 145-520 | 7D | 1075 | RAL 9016 | Floor | Yes | No | No |
| Selection Information | Description | Formulated with LST Product Model, LST Cover Width and LST Cover Height. | DD = Ø7mm & Ø4mm 'Double' Dot. 7D = Ø7mm Dot. 5S = 5mm x 20mm Wide Slot. DMD = Diamond Shaped. | Recommended at least 175mm longer than the radiator (depending on valve arrangement). | All Ral Classic colours available: www.ralcolorchart.com/ral-classic . For additional colours email: sales@frenger.co.uk | Floor or Wall mounted. | Is an aperture required to accommodate a Thermostatic Radiator Valve (TRV). TRV supplied by others. | Design altered to suit hospital walls, allow for easy access for cleaning, anti-bacterial finish. | Top of unit is sloped instead of flat. |
| | Brochure Page | 5-7 | 12 | 6-7 | 10-11 | 3-4 | 6 | 15 | 3 |

Frenger Radiator Options

Frenger's Armis is designed to accommodate most major radiator brands, but can also be supplied with Frenger's FRE and FREv ranges of wall mounted radiators.

Frenger's wall mounted radiators offer excellent quality with high heating performance and cover a wide selection of sizes. All Frenger's wall mounted radiators have RAL 9016 (Traffic White) waterproof coating.

The FRE range of horizontal radiators is available in three models (R1, R2 and R3). These provide options for radiator depths and heating performance. The FRE radiators are some of the slimmest on the market and can be mounted either "horizontally" or "Vertically", due to their symmetrical design that features heating converters welded onto the water ways of the radiator.

The FREv double panel vertical radiators are 1800mm in height and are available in 400, 500 and 600mm lengths with a 129mm installation depth.



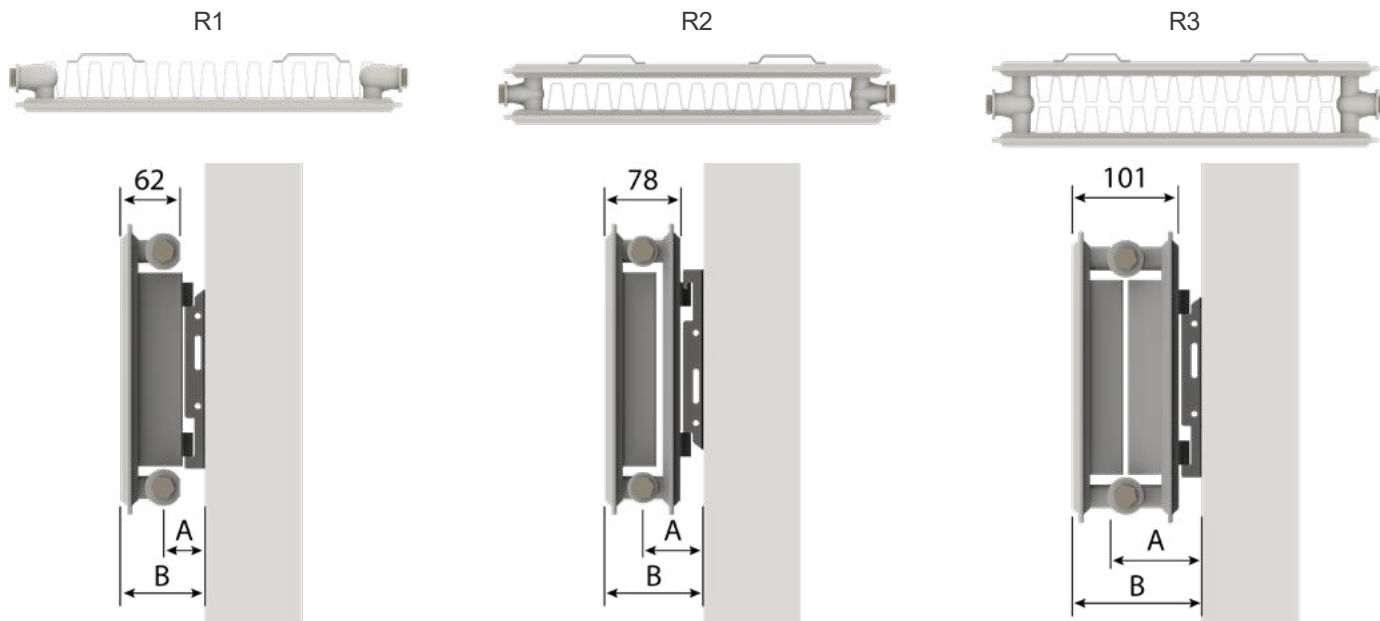
FRE - Horizontal Radiator



FREv - Vertical Radiator

Dimensions - Horizontal

All dimensions in mm



| Model Ref. | Dim "A" Minimum (mm) | Dim "A" Maximum (mm) | Dim "B" Minimum (mm) | Dim "B" Maximum (mm) |
|------------|----------------------|----------------------|----------------------|----------------------|
| R1 | 52 | 63 | 82 | 93 |
| R2 | 63 | 74 | 100 | 111 |
| R3 | 74 | 85 | 123 | 134 |

Note: All dimensions have a tolerance of ± 2 mm

LST Radiator Output - R1 - 50ΔtK

Horizontal Radiator Details - Outputs at 50ΔtK Mean Water Temperature - Room Temperature (75/65/20)

Model: R1



| Radiator ID Code | Height "H" (mm) | Length "L" (mm) | Width "W" (mm) | Output in LST Cover (W) | Output in LST Cover (Btu/hr) |
|------------------|-----------------|-----------------|----------------|-------------------------|------------------------------|
| FRE-R1-300-500 | 300 | 500 | 61 | 236 | 804 |
| FRE-R1-300-1000 | 300 | 1000 | 61 | 470 | 1605 |
| FRE-R1-300-1500 | 300 | 1500 | 61 | 706 | 2410 |
| FRE-R1-450-400 | 450 | 400 | 61 | 279 | 953 |
| FRE-R1-450-500 | 450 | 500 | 61 | 349 | 1192 |
| FRE-R1-450-600 | 450 | 600 | 61 | 420 | 1431 |
| FRE-R1-450-700 | 450 | 700 | 61 | 490 | 1671 |
| FRE-R1-450-800 | 450 | 800 | 61 | 559 | 1907 |
| FRE-R1-450-900 | 450 | 900 | 61 | 629 | 2146 |
| FRE-R1-450-1000 | 450 | 1000 | 61 | 699 | 2385 |
| FRE-R1-450-1100 | 450 | 1100 | 61 | 769 | 2624 |
| FRE-R1-450-1200 | 450 | 1200 | 61 | 839 | 2863 |
| FRE-R1-450-1400 | 450 | 1400 | 61 | 978 | 3338 |
| FRE-R1-450-1600 | 450 | 1600 | 61 | 1118 | 3816 |
| FRE-R1-450-1800 | 450 | 1800 | 61 | 1258 | 4291 |
| FRE-R1-450-2000 | 450 | 2000 | 61 | 1398 | 4769 |
| FRE-R1-600-400 | 600 | 400 | 61 | 364 | 1242 |
| FRE-R1-600-500 | 600 | 500 | 61 | 455 | 1553 |
| FRE-R1-600-600 | 600 | 600 | 61 | 546 | 1863 |
| FRE-R1-600-700 | 600 | 700 | 61 | 637 | 2174 |
| FRE-R1-600-800 | 600 | 800 | 61 | 728 | 2484 |
| FRE-R1-600-900 | 600 | 900 | 61 | 819 | 2795 |
| FRE-R1-600-1000 | 600 | 1000 | 61 | 910 | 3105 |
| FRE-R1-600-1100 | 600 | 1100 | 61 | 1001 | 3416 |
| FRE-R1-600-1200 | 600 | 1200 | 61 | 1092 | 3726 |
| FRE-R1-600-1400 | 600 | 1400 | 61 | 1274 | 4347 |
| FRE-R1-600-1600 | 600 | 1600 | 61 | 1456 | 4968 |
| FRE-R1-600-1800 | 600 | 1800 | 61 | 1638 | 5589 |
| FRE-R1-700-400 | 700 | 400 | 61 | 416 | 1419 |
| FRE-R1-700-500 | 700 | 500 | 61 | 520 | 1773 |
| FRE-R1-700-600 | 700 | 600 | 61 | 623 | 2127 |
| FRE-R1-700-700 | 700 | 700 | 61 | 727 | 2481 |
| FRE-R1-700-800 | 700 | 800 | 61 | 832 | 2838 |
| FRE-R1-700-900 | 700 | 900 | 61 | 935 | 3192 |
| FRE-R1-700-1000 | 700 | 1000 | 61 | 1039 | 3546 |
| FRE-R1-700-1100 | 700 | 1100 | 61 | 1143 | 3900 |
| FRE-R1-700-1200 | 700 | 1200 | 61 | 1247 | 4254 |
| FRE-R1-700-1400 | 700 | 1400 | 61 | 1455 | 4965 |
| FRE-R1-700-1600 | 700 | 1600 | 61 | 1663 | 5673 |
| FRE-R1-700-1800 | 700 | 1800 | 61 | 1871 | 6384 |
| FRE-R1-700-2000 | 700 | 2000 | 61 | 2078 | 7092 |

LST Radiator Output - R2 - 50ΔtK

Horizontal Radiator Details - Outputs at 50ΔtK Mean Water Temperature - Room Temperature (75/65/20)

Model: R2



| Radiator ID Code | Height "H" (mm) | Length "L" (mm) | Width "W" (mm) | Output in LST Cover (W) | Output in LST Cover (Btu/hr) |
|------------------|-----------------|-----------------|----------------|-------------------------|------------------------------|
| FRE-R2-300-500 | 300 | 500 | 77 | 338 | 1152 |
| FRE-R2-300-1000 | 300 | 1000 | 77 | 675 | 2304 |
| FRE-R2-300-1500 | 300 | 1500 | 77 | 1013 | 3455 |
| FRE-R2-450-400 | 450 | 400 | 77 | 385 | 1312 |
| FRE-R2-450-500 | 450 | 500 | 77 | 481 | 1642 |
| FRE-R2-450-600 | 450 | 600 | 77 | 578 | 1971 |
| FRE-R2-450-700 | 450 | 700 | 77 | 673 | 2298 |
| FRE-R2-450-800 | 450 | 800 | 77 | 770 | 2627 |
| FRE-R2-450-900 | 450 | 900 | 77 | 866 | 2954 |
| FRE-R2-450-1000 | 450 | 1000 | 77 | 962 | 3283 |
| FRE-R2-450-1100 | 450 | 1100 | 77 | 1059 | 3613 |
| FRE-R2-450-1200 | 450 | 1200 | 77 | 1154 | 3939 |
| FRE-R2-450-1400 | 450 | 1400 | 77 | 1347 | 4595 |
| FRE-R2-450-1600 | 450 | 1600 | 77 | 1540 | 5254 |
| FRE-R2-450-1800 | 450 | 1800 | 77 | 1732 | 5910 |
| FRE-R2-450-2000 | 450 | 2000 | 77 | 1924 | 6566 |
| FRE-R2-600-400 | 600 | 400 | 77 | 491 | 1674 |
| FRE-R2-600-500 | 600 | 500 | 77 | 613 | 2093 |
| FRE-R2-600-600 | 600 | 600 | 77 | 735 | 2508 |
| FRE-R2-600-700 | 600 | 700 | 77 | 858 | 2927 |
| FRE-R2-600-800 | 600 | 800 | 77 | 980 | 3346 |
| FRE-R2-600-900 | 600 | 900 | 77 | 1103 | 3764 |
| FRE-R2-600-1000 | 600 | 1000 | 77 | 1226 | 4183 |
| FRE-R2-600-1100 | 600 | 1100 | 77 | 1349 | 4601 |
| FRE-R2-600-1200 | 600 | 1200 | 77 | 1471 | 5020 |
| FRE-R2-600-1400 | 600 | 1400 | 77 | 1717 | 5857 |
| FRE-R2-600-1600 | 600 | 1600 | 77 | 1961 | 6691 |
| FRE-R2-600-1800 | 600 | 1800 | 77 | 2206 | 7528 |
| FRE-R2-600-2000 | 600 | 2000 | 77 | 2452 | 8365 |
| FRE-R2-700-400 | 700 | 400 | 77 | 556 | 1897 |
| FRE-R2-700-500 | 700 | 500 | 77 | 695 | 2372 |
| FRE-R2-700-600 | 700 | 600 | 77 | 833 | 2844 |
| FRE-R2-700-700 | 700 | 700 | 77 | 973 | 3319 |
| FRE-R2-700-800 | 700 | 800 | 77 | 1112 | 3794 |
| FRE-R2-700-900 | 700 | 900 | 77 | 1250 | 4266 |
| FRE-R2-700-1000 | 700 | 1000 | 77 | 1389 | 4741 |
| FRE-R2-700-1100 | 700 | 1100 | 77 | 1529 | 5216 |
| FRE-R2-700-1200 | 700 | 1200 | 77 | 1667 | 5688 |
| FRE-R2-700-1400 | 700 | 1400 | 77 | 1945 | 6638 |
| FRE-R2-700-1600 | 700 | 1600 | 77 | 2223 | 7585 |
| FRE-R2-700-1800 | 700 | 1800 | 77 | 2501 | 8535 |

LST Radiator Output - R3 - 50ΔtK

Horizontal Radiator Details - Outputs at 50ΔtK Mean Water Temperature - Room Temperature (75/65/20)

Model: R3



| Radiator ID Code | Height "H" (mm) | Length "L" (mm) | Width "W" (mm) | Output in LST Cover (W) | Output in LST Cover (Btu/hr) |
|------------------|-----------------|-----------------|----------------|-------------------------|------------------------------|
| FRE-R3-300-500 | 300 | 500 | 100 | 430 | 1468 |
| FRE-R3-300-1000 | 300 | 1000 | 100 | 860 | 2935 |
| FRE-R3-300-1500 | 300 | 1500 | 100 | 1290 | 4403 |
| FRE-R3-450-400 | 450 | 400 | 100 | 479 | 1636 |
| FRE-R3-450-500 | 450 | 500 | 100 | 599 | 2045 |
| FRE-R3-450-600 | 450 | 600 | 100 | 718 | 2451 |
| FRE-R3-450-700 | 450 | 700 | 100 | 838 | 2860 |
| FRE-R3-450-800 | 450 | 800 | 100 | 958 | 3269 |
| FRE-R3-450-900 | 450 | 900 | 100 | 1078 | 3678 |
| FRE-R3-450-1000 | 450 | 1000 | 100 | 1198 | 4087 |
| FRE-R3-450-1100 | 450 | 1100 | 100 | 1318 | 4495 |
| FRE-R3-450-1200 | 450 | 1200 | 100 | 1437 | 4904 |
| FRE-R3-450-1400 | 450 | 1400 | 100 | 1677 | 5722 |
| FRE-R3-450-1600 | 450 | 1600 | 100 | 1916 | 6537 |
| FRE-R3-450-1800 | 450 | 1800 | 100 | 2156 | 7355 |
| FRE-R3-450-2000 | 450 | 2000 | 100 | 2395 | 8173 |
| FRE-R3-600-400 | 600 | 400 | 100 | 604 | 2062 |
| FRE-R3-600-500 | 600 | 500 | 100 | 756 | 2578 |
| FRE-R3-600-600 | 600 | 600 | 100 | 907 | 3095 |
| FRE-R3-600-700 | 600 | 700 | 100 | 1058 | 3611 |
| FRE-R3-600-800 | 600 | 800 | 100 | 1209 | 4124 |
| FRE-R3-600-900 | 600 | 900 | 100 | 1360 | 4641 |
| FRE-R3-600-1000 | 600 | 1000 | 100 | 1511 | 5157 |
| FRE-R3-600-1100 | 600 | 1100 | 100 | 1663 | 5673 |
| FRE-R3-600-1200 | 600 | 1200 | 100 | 1814 | 6189 |
| FRE-R3-600-1400 | 600 | 1400 | 100 | 2116 | 7219 |
| FRE-R3-600-1600 | 600 | 1600 | 100 | 2418 | 8251 |
| FRE-R3-600-1800 | 600 | 1800 | 100 | 2720 | 9281 |
| FRE-R3-600-2000 | 600 | 2000 | 100 | 3023 | 10314 |
| FRE-R3-700-400 | 700 | 400 | 100 | 683 | 2332 |
| FRE-R3-700-500 | 700 | 500 | 100 | 855 | 2918 |
| FRE-R3-700-600 | 700 | 600 | 100 | 1026 | 3501 |
| FRE-R3-700-700 | 700 | 700 | 100 | 1197 | 4084 |
| FRE-R3-700-800 | 700 | 800 | 100 | 1368 | 4667 |
| FRE-R3-700-900 | 700 | 900 | 100 | 1539 | 5250 |
| FRE-R3-700-1000 | 700 | 1000 | 100 | 1709 | 5833 |
| FRE-R3-700-1100 | 700 | 1100 | 100 | 1880 | 6416 |
| FRE-R3-700-1200 | 700 | 1200 | 100 | 2051 | 6998 |
| FRE-R3-700-1400 | 700 | 1400 | 100 | 2393 | 8164 |
| FRE-R3-700-1600 | 700 | 1600 | 100 | 2735 | 9333 |
| FRE-R3-700-1800 | 700 | 1800 | 100 | 3077 | 10499 |
| FRE-R3-700-2000 | 700 | 2000 | 100 | 3419 | 11665 |

LST Radiator Output - R1 - 40ΔtK

Horizontal Radiator Details - Outputs at 40ΔtK Mean Water Temperature - Room Temperature (65/55/20)

Model: R1



| Radiator ID Code | Height "H" (mm) | Length "L" (mm) | Width "W" (mm) | Output in LST Cover (W) | Output in LST Cover (Btu/hr) |
|------------------|-----------------|-----------------|----------------|-------------------------|------------------------------|
| FRE-R1-300-500 | 300 | 500 | 61 | 177 | 602 |
| FRE-R1-300-1000 | 300 | 1000 | 61 | 352 | 1202 |
| FRE-R1-300-1500 | 300 | 1500 | 61 | 528 | 1801 |
| FRE-R1-450-400 | 450 | 400 | 61 | 209 | 714 |
| FRE-R1-450-500 | 450 | 500 | 61 | 261 | 891 |
| FRE-R1-450-600 | 450 | 600 | 61 | 314 | 1071 |
| FRE-R1-450-700 | 450 | 700 | 61 | 366 | 1248 |
| FRE-R1-450-800 | 450 | 800 | 61 | 418 | 1425 |
| FRE-R1-450-900 | 450 | 900 | 61 | 470 | 1605 |
| FRE-R1-450-1000 | 450 | 1000 | 61 | 522 | 1782 |
| FRE-R1-450-1100 | 450 | 1100 | 61 | 575 | 1962 |
| FRE-R1-450-1200 | 450 | 1200 | 61 | 628 | 2142 |
| FRE-R1-450-1400 | 450 | 1400 | 61 | 732 | 2496 |
| FRE-R1-450-1600 | 450 | 1600 | 61 | 836 | 2854 |
| FRE-R1-450-1800 | 450 | 1800 | 61 | 941 | 3211 |
| FRE-R1-450-2000 | 450 | 2000 | 61 | 1046 | 3568 |
| FRE-R1-600-400 | 600 | 400 | 61 | 272 | 928 |
| FRE-R1-600-500 | 600 | 500 | 61 | 340 | 1161 |
| FRE-R1-600-600 | 600 | 600 | 61 | 409 | 1394 |
| FRE-R1-600-700 | 600 | 700 | 61 | 477 | 1627 |
| FRE-R1-600-800 | 600 | 800 | 61 | 544 | 1857 |
| FRE-R1-600-900 | 600 | 900 | 61 | 612 | 2090 |
| FRE-R1-600-1000 | 600 | 1000 | 61 | 681 | 2323 |
| FRE-R1-600-1100 | 600 | 1100 | 61 | 749 | 2555 |
| FRE-R1-600-1200 | 600 | 1200 | 61 | 817 | 2788 |
| FRE-R1-600-1400 | 600 | 1400 | 61 | 953 | 3251 |
| FRE-R1-600-1600 | 600 | 1600 | 61 | 1089 | 3717 |
| FRE-R1-600-1800 | 600 | 1800 | 61 | 1225 | 4179 |
| FRE-R1-700-400 | 700 | 400 | 61 | 311 | 1062 |
| FRE-R1-700-500 | 700 | 500 | 61 | 389 | 1326 |
| FRE-R1-700-600 | 700 | 600 | 61 | 466 | 1590 |
| FRE-R1-700-700 | 700 | 700 | 61 | 544 | 1857 |
| FRE-R1-700-800 | 700 | 800 | 61 | 622 | 2124 |
| FRE-R1-700-900 | 700 | 900 | 61 | 700 | 2388 |
| FRE-R1-700-1000 | 700 | 1000 | 61 | 777 | 2652 |
| FRE-R1-700-1100 | 700 | 1100 | 61 | 854 | 2916 |
| FRE-R1-700-1200 | 700 | 1200 | 61 | 933 | 3183 |
| FRE-R1-700-1400 | 700 | 1400 | 61 | 1088 | 3714 |
| FRE-R1-700-1600 | 700 | 1600 | 61 | 1244 | 4245 |
| FRE-R1-700-1800 | 700 | 1800 | 61 | 1400 | 4776 |
| FRE-R1-700-2000 | 700 | 2000 | 61 | 1554 | 5303 |

LST Radiator Output - R2 - 40ΔtK

Horizontal Radiator Details - Outputs at 40ΔtK Mean Water Temperature - Room Temperature (65/55/20)

Model: R2



| Radiator ID Code | Height "H" (mm) | Length "L" (mm) | Width "W" (mm) | Output in LST Cover (W) | Output in LST Cover (Btu/hr) |
|------------------|-----------------|-----------------|----------------|-------------------------|------------------------------|
| FRE-R2-300-500 | 300 | 500 | 77 | 252 | 861 |
| FRE-R2-300-1000 | 300 | 1000 | 77 | 505 | 1722 |
| FRE-R2-300-1500 | 300 | 1500 | 77 | 758 | 2586 |
| FRE-R2-450-400 | 450 | 400 | 77 | 288 | 983 |
| FRE-R2-450-500 | 450 | 500 | 77 | 360 | 1229 |
| FRE-R2-450-600 | 450 | 600 | 77 | 432 | 1475 |
| FRE-R2-450-700 | 450 | 700 | 77 | 504 | 1719 |
| FRE-R2-450-800 | 450 | 800 | 77 | 576 | 1965 |
| FRE-R2-450-900 | 450 | 900 | 77 | 647 | 2209 |
| FRE-R2-450-1000 | 450 | 1000 | 77 | 719 | 2455 |
| FRE-R2-450-1100 | 450 | 1100 | 77 | 792 | 2701 |
| FRE-R2-450-1200 | 450 | 1200 | 77 | 864 | 2948 |
| FRE-R2-450-1400 | 450 | 1400 | 77 | 1007 | 3438 |
| FRE-R2-450-1600 | 450 | 1600 | 77 | 1152 | 3930 |
| FRE-R2-450-1800 | 450 | 1800 | 77 | 1295 | 4420 |
| FRE-R2-450-2000 | 450 | 2000 | 77 | 1440 | 4913 |
| FRE-R2-600-400 | 600 | 400 | 77 | 367 | 1253 |
| FRE-R2-600-500 | 600 | 500 | 77 | 458 | 1564 |
| FRE-R2-600-600 | 600 | 600 | 77 | 550 | 1876 |
| FRE-R2-600-700 | 600 | 700 | 77 | 642 | 2191 |
| FRE-R2-600-800 | 600 | 800 | 77 | 733 | 2502 |
| FRE-R2-600-900 | 600 | 900 | 77 | 825 | 2814 |
| FRE-R2-600-1000 | 600 | 1000 | 77 | 917 | 3129 |
| FRE-R2-600-1100 | 600 | 1100 | 77 | 1008 | 3441 |
| FRE-R2-600-1200 | 600 | 1200 | 77 | 1101 | 3755 |
| FRE-R2-600-1400 | 600 | 1400 | 77 | 1284 | 4382 |
| FRE-R2-600-1600 | 600 | 1600 | 77 | 1467 | 5005 |
| FRE-R2-600-1800 | 600 | 1800 | 77 | 1650 | 5631 |
| FRE-R2-600-2000 | 600 | 2000 | 77 | 1834 | 6258 |
| FRE-R2-700-400 | 700 | 400 | 77 | 416 | 1419 |
| FRE-R2-700-500 | 700 | 500 | 77 | 520 | 1775 |
| FRE-R2-700-600 | 700 | 600 | 77 | 624 | 2128 |
| FRE-R2-700-700 | 700 | 700 | 77 | 727 | 2482 |
| FRE-R2-700-800 | 700 | 800 | 77 | 832 | 2838 |
| FRE-R2-700-900 | 700 | 900 | 77 | 935 | 3191 |
| FRE-R2-700-1000 | 700 | 1000 | 77 | 1040 | 3547 |
| FRE-R2-700-1100 | 700 | 1100 | 77 | 1143 | 3901 |
| FRE-R2-700-1200 | 700 | 1200 | 77 | 1247 | 4254 |
| FRE-R2-700-1400 | 700 | 1400 | 77 | 1456 | 4966 |
| FRE-R2-700-1600 | 700 | 1600 | 77 | 1663 | 5673 |
| FRE-R2-700-1800 | 700 | 1800 | 77 | 1871 | 6385 |

LST Radiator Output - R3 - 40ΔtK

Horizontal Radiator Details - Outputs at 40ΔtK Mean Water Temperature - Room Temperature (65/55/20)

Model: R3



| Radiator ID Code | Height "H" (mm) | Length "L" (mm) | Width "W" (mm) | Output in LST Cover (W) | Output in LST Cover (Btu/hr) |
|------------------|-----------------|-----------------|----------------|-------------------------|------------------------------|
| FRE-R3-300-500 | 300 | 500 | 100 | 321 | 1096 |
| FRE-R3-300-1000 | 300 | 1000 | 100 | 643 | 2196 |
| FRE-R3-300-1500 | 300 | 1500 | 100 | 965 | 3292 |
| FRE-R3-450-400 | 450 | 400 | 100 | 359 | 1224 |
| FRE-R3-450-500 | 450 | 500 | 100 | 448 | 1528 |
| FRE-R3-450-600 | 450 | 600 | 100 | 537 | 1833 |
| FRE-R3-450-700 | 450 | 700 | 100 | 627 | 2140 |
| FRE-R3-450-800 | 450 | 800 | 100 | 717 | 2445 |
| FRE-R3-450-900 | 450 | 900 | 100 | 806 | 2750 |
| FRE-R3-450-1000 | 450 | 1000 | 100 | 896 | 3057 |
| FRE-R3-450-1100 | 450 | 1100 | 100 | 985 | 3361 |
| FRE-R3-450-1200 | 450 | 1200 | 100 | 1075 | 3669 |
| FRE-R3-450-1400 | 450 | 1400 | 100 | 1255 | 4281 |
| FRE-R3-450-1600 | 450 | 1600 | 100 | 1433 | 4890 |
| FRE-R3-450-1800 | 450 | 1800 | 100 | 1612 | 5502 |
| FRE-R3-450-2000 | 450 | 2000 | 100 | 1792 | 6114 |
| FRE-R3-600-400 | 600 | 400 | 100 | 452 | 1543 |
| FRE-R3-600-500 | 600 | 500 | 100 | 565 | 1929 |
| FRE-R3-600-600 | 600 | 600 | 100 | 678 | 2314 |
| FRE-R3-600-700 | 600 | 700 | 100 | 791 | 2700 |
| FRE-R3-600-800 | 600 | 800 | 100 | 904 | 3086 |
| FRE-R3-600-900 | 600 | 900 | 100 | 1017 | 3472 |
| FRE-R3-600-1000 | 600 | 1000 | 100 | 1131 | 3857 |
| FRE-R3-600-1100 | 600 | 1100 | 100 | 1244 | 4243 |
| FRE-R3-600-1200 | 600 | 1200 | 100 | 1357 | 4629 |
| FRE-R3-600-1400 | 600 | 1400 | 100 | 1583 | 5400 |
| FRE-R3-600-1600 | 600 | 1600 | 100 | 1809 | 6172 |
| FRE-R3-600-1800 | 600 | 1800 | 100 | 2035 | 6943 |
| FRE-R3-600-2000 | 600 | 2000 | 100 | 2261 | 7715 |
| FRE-R3-700-400 | 700 | 400 | 100 | 511 | 1743 |
| FRE-R3-700-500 | 700 | 500 | 100 | 639 | 2181 |
| FRE-R3-700-600 | 700 | 600 | 100 | 768 | 2619 |
| FRE-R3-700-700 | 700 | 700 | 100 | 895 | 3054 |
| FRE-R3-700-800 | 700 | 800 | 100 | 1023 | 3492 |
| FRE-R3-700-900 | 700 | 900 | 100 | 1151 | 3927 |
| FRE-R3-700-1000 | 700 | 1000 | 100 | 1278 | 4362 |
| FRE-R3-700-1100 | 700 | 1100 | 100 | 1407 | 4800 |
| FRE-R3-700-1200 | 700 | 1200 | 100 | 1534 | 5235 |
| FRE-R3-700-1400 | 700 | 1400 | 100 | 1790 | 6108 |
| FRE-R3-700-1600 | 700 | 1600 | 100 | 2046 | 6981 |
| FRE-R3-700-1800 | 700 | 1800 | 100 | 2302 | 7854 |
| FRE-R3-700-2000 | 700 | 2000 | 100 | 2557 | 8724 |

LST Radiator Output - R1 - 30ΔtK

Horizontal Radiator Details - Outputs at 30ΔtK Mean Water Temperature - Room Temperature (55/45/20)

Model: R1



| Radiator ID Code | Height "H" (mm) | Length "L" (mm) | Width "W" (mm) | Output in LST Cover (W) | Output in LST Cover (Btu/hr) |
|------------------|-----------------|-----------------|----------------|-------------------------|------------------------------|
| FRE-R1-300-500 | 300 | 500 | 61 | 121 | 413 |
| FRE-R1-300-1000 | 300 | 1000 | 61 | 242 | 826 |
| FRE-R1-300-1500 | 300 | 1500 | 61 | 364 | 1242 |
| FRE-R1-450-400 | 450 | 400 | 61 | 144 | 491 |
| FRE-R1-450-500 | 450 | 500 | 61 | 180 | 615 |
| FRE-R1-450-600 | 450 | 600 | 61 | 216 | 736 |
| FRE-R1-450-700 | 450 | 700 | 61 | 252 | 860 |
| FRE-R1-450-800 | 450 | 800 | 61 | 288 | 981 |
| FRE-R1-450-900 | 450 | 900 | 61 | 324 | 1105 |
| FRE-R1-450-1000 | 450 | 1000 | 61 | 360 | 1230 |
| FRE-R1-450-1100 | 450 | 1100 | 61 | 396 | 1351 |
| FRE-R1-450-1200 | 450 | 1200 | 61 | 432 | 1475 |
| FRE-R1-450-1400 | 450 | 1400 | 61 | 504 | 1720 |
| FRE-R1-450-1600 | 450 | 1600 | 61 | 576 | 1965 |
| FRE-R1-450-1800 | 450 | 1800 | 61 | 648 | 2211 |
| FRE-R1-450-2000 | 450 | 2000 | 61 | 720 | 2456 |
| FRE-R1-600-400 | 600 | 400 | 61 | 187 | 640 |
| FRE-R1-600-500 | 600 | 500 | 61 | 235 | 801 |
| FRE-R1-600-600 | 600 | 600 | 61 | 281 | 959 |
| FRE-R1-600-700 | 600 | 700 | 61 | 329 | 1121 |
| FRE-R1-600-800 | 600 | 800 | 61 | 375 | 1279 |
| FRE-R1-600-900 | 600 | 900 | 61 | 422 | 1441 |
| FRE-R1-600-1000 | 600 | 1000 | 61 | 469 | 1599 |
| FRE-R1-600-1100 | 600 | 1100 | 61 | 516 | 1761 |
| FRE-R1-600-1200 | 600 | 1200 | 61 | 562 | 1919 |
| FRE-R1-600-1400 | 600 | 1400 | 61 | 656 | 2239 |
| FRE-R1-600-1600 | 600 | 1600 | 61 | 750 | 2559 |
| FRE-R1-600-1800 | 600 | 1800 | 61 | 844 | 2878 |
| FRE-R1-700-400 | 700 | 400 | 61 | 214 | 730 |
| FRE-R1-700-500 | 700 | 500 | 61 | 268 | 913 |
| FRE-R1-700-600 | 700 | 600 | 61 | 321 | 1096 |
| FRE-R1-700-700 | 700 | 700 | 61 | 374 | 1276 |
| FRE-R1-700-800 | 700 | 800 | 61 | 429 | 1462 |
| FRE-R1-700-900 | 700 | 900 | 61 | 481 | 1643 |
| FRE-R1-700-1000 | 700 | 1000 | 61 | 535 | 1826 |
| FRE-R1-700-1100 | 700 | 1100 | 61 | 589 | 2009 |
| FRE-R1-700-1200 | 700 | 1200 | 61 | 642 | 2192 |
| FRE-R1-700-1400 | 700 | 1400 | 61 | 749 | 2555 |
| FRE-R1-700-1600 | 700 | 1600 | 61 | 856 | 2922 |
| FRE-R1-700-1800 | 700 | 1800 | 61 | 964 | 3288 |
| FRE-R1-700-2000 | 700 | 2000 | 61 | 1070 | 3652 |

LST Radiator Output - R2 - 30ΔtK

Horizontal Radiator Details - Outputs at 30ΔtK Mean Water Temperature - Room Temperature (55/45/20)

Model: R2



| Radiator ID Code | Height "H" (mm) | Length "L" (mm) | Width "W" (mm) | Output in LST Cover (W) | Output in LST Cover (Btu/hr) |
|------------------|-----------------|-----------------|----------------|-------------------------|------------------------------|
| FRE-R2-300-500 | 300 | 500 | 77 | 174 | 594 |
| FRE-R2-300-1000 | 300 | 1000 | 77 | 348 | 1187 |
| FRE-R2-300-1500 | 300 | 1500 | 77 | 521 | 1778 |
| FRE-R2-450-400 | 450 | 400 | 77 | 198 | 677 |
| FRE-R2-450-500 | 450 | 500 | 77 | 248 | 846 |
| FRE-R2-450-600 | 450 | 600 | 77 | 298 | 1015 |
| FRE-R2-450-700 | 450 | 700 | 77 | 347 | 1184 |
| FRE-R2-450-800 | 450 | 800 | 77 | 397 | 1354 |
| FRE-R2-450-900 | 450 | 900 | 77 | 445 | 1520 |
| FRE-R2-450-1000 | 450 | 1000 | 77 | 496 | 1692 |
| FRE-R2-450-1100 | 450 | 1100 | 77 | 545 | 1861 |
| FRE-R2-450-1200 | 450 | 1200 | 77 | 594 | 2028 |
| FRE-R2-450-1400 | 450 | 1400 | 77 | 693 | 2366 |
| FRE-R2-450-1600 | 450 | 1600 | 77 | 793 | 2707 |
| FRE-R2-450-1800 | 450 | 1800 | 77 | 892 | 3043 |
| FRE-R2-450-2000 | 450 | 2000 | 77 | 991 | 3381 |
| FRE-R2-600-400 | 600 | 400 | 77 | 252 | 861 |
| FRE-R2-600-500 | 600 | 500 | 77 | 316 | 1078 |
| FRE-R2-600-600 | 600 | 600 | 77 | 378 | 1291 |
| FRE-R2-600-700 | 600 | 700 | 77 | 442 | 1508 |
| FRE-R2-600-800 | 600 | 800 | 77 | 505 | 1722 |
| FRE-R2-600-900 | 600 | 900 | 77 | 568 | 1938 |
| FRE-R2-600-1000 | 600 | 1000 | 77 | 632 | 2155 |
| FRE-R2-600-1100 | 600 | 1100 | 77 | 694 | 2369 |
| FRE-R2-600-1200 | 600 | 1200 | 77 | 758 | 2586 |
| FRE-R2-600-1400 | 600 | 1400 | 77 | 884 | 3016 |
| FRE-R2-600-1600 | 600 | 1600 | 77 | 1010 | 3447 |
| FRE-R2-600-1800 | 600 | 1800 | 77 | 1136 | 3877 |
| FRE-R2-600-2000 | 600 | 2000 | 77 | 1262 | 4307 |
| FRE-R2-700-400 | 700 | 400 | 77 | 286 | 977 |
| FRE-R2-700-500 | 700 | 500 | 77 | 358 | 1220 |
| FRE-R2-700-600 | 700 | 600 | 77 | 429 | 1464 |
| FRE-R2-700-700 | 700 | 700 | 77 | 501 | 1710 |
| FRE-R2-700-800 | 700 | 800 | 77 | 572 | 1953 |
| FRE-R2-700-900 | 700 | 900 | 77 | 644 | 2197 |
| FRE-R2-700-1000 | 700 | 1000 | 77 | 715 | 2440 |
| FRE-R2-700-1100 | 700 | 1100 | 77 | 787 | 2687 |
| FRE-R2-700-1200 | 700 | 1200 | 77 | 859 | 2930 |
| FRE-R2-700-1400 | 700 | 1400 | 77 | 1002 | 3420 |
| FRE-R2-700-1600 | 700 | 1600 | 77 | 1145 | 3907 |
| FRE-R2-700-1800 | 700 | 1800 | 77 | 1288 | 4396 |

LST Radiator Output - R3 - 30ΔtK

Horizontal Radiator Details - Outputs at 30ΔtK Mean Water Temperature - Room Temperature (55/45/20)

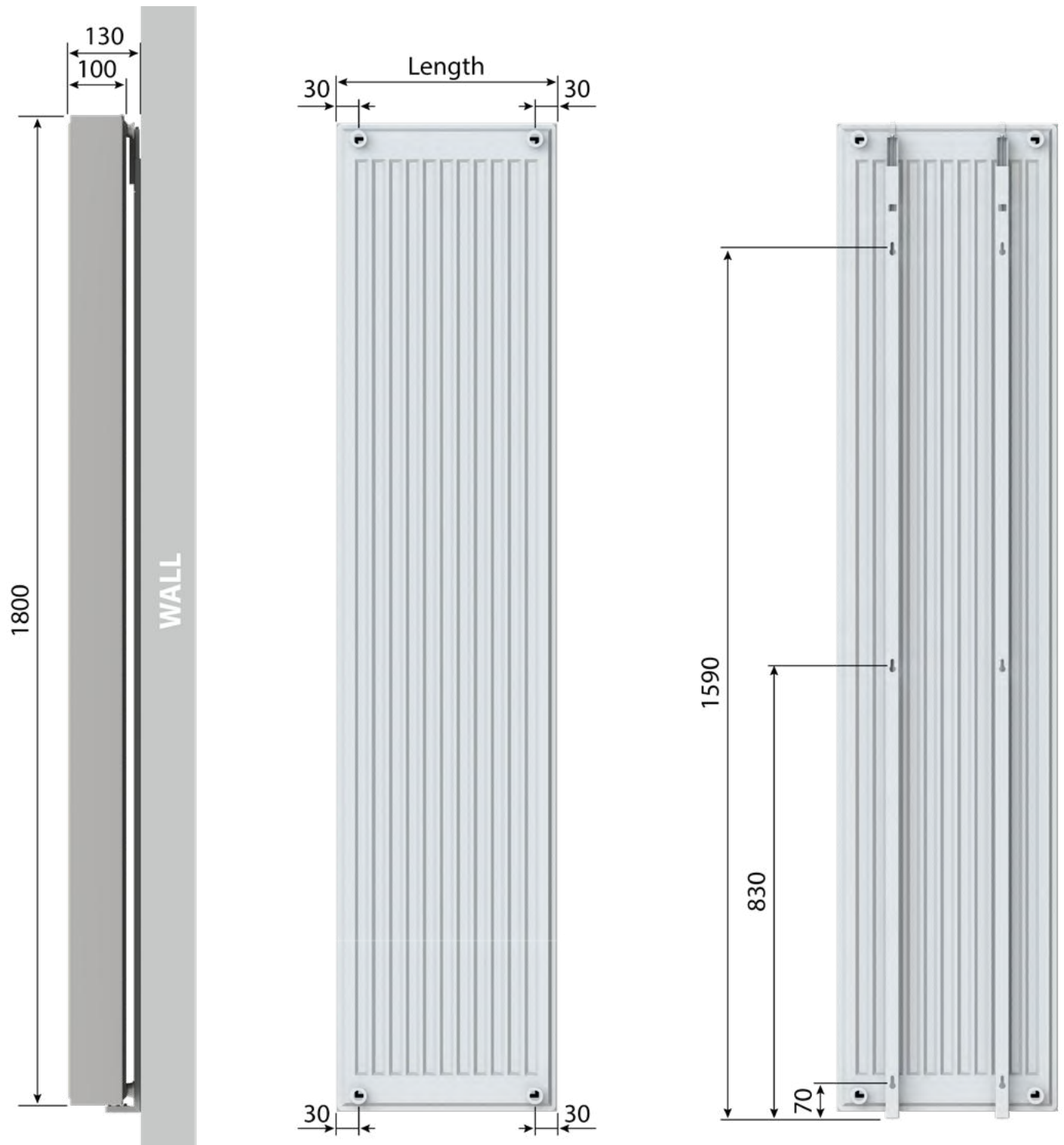
Model: R3



| Radiator ID Code | Height "H" (mm) | Length "L" (mm) | Width "W" (mm) | Output in LST Cover (W) | Output in LST Cover (Btu/hr) |
|------------------|-----------------|-----------------|----------------|-------------------------|------------------------------|
| FRE-R3-300-500 | 300 | 500 | 100 | 222 | 757 |
| FRE-R3-300-1000 | 300 | 1000 | 100 | 443 | 1511 |
| FRE-R3-300-1500 | 300 | 1500 | 100 | 665 | 2268 |
| FRE-R3-450-400 | 450 | 400 | 100 | 247 | 841 |
| FRE-R3-450-500 | 450 | 500 | 100 | 309 | 1053 |
| FRE-R3-450-600 | 450 | 600 | 100 | 370 | 1262 |
| FRE-R3-450-700 | 450 | 700 | 100 | 432 | 1473 |
| FRE-R3-450-800 | 450 | 800 | 100 | 493 | 1682 |
| FRE-R3-450-900 | 450 | 900 | 100 | 555 | 1894 |
| FRE-R3-450-1000 | 450 | 1000 | 100 | 617 | 2106 |
| FRE-R3-450-1100 | 450 | 1100 | 100 | 678 | 2314 |
| FRE-R3-450-1200 | 450 | 1200 | 100 | 740 | 2526 |
| FRE-R3-450-1400 | 450 | 1400 | 100 | 864 | 2947 |
| FRE-R3-450-1600 | 450 | 1600 | 100 | 987 | 3367 |
| FRE-R3-450-1800 | 450 | 1800 | 100 | 1110 | 3788 |
| FRE-R3-450-2000 | 450 | 2000 | 100 | 1233 | 4208 |
| FRE-R3-600-400 | 600 | 400 | 100 | 311 | 1062 |
| FRE-R3-600-500 | 600 | 500 | 100 | 389 | 1328 |
| FRE-R3-600-600 | 600 | 600 | 100 | 468 | 1595 |
| FRE-R3-600-700 | 600 | 700 | 100 | 545 | 1859 |
| FRE-R3-600-800 | 600 | 800 | 100 | 622 | 2123 |
| FRE-R3-600-900 | 600 | 900 | 100 | 700 | 2390 |
| FRE-R3-600-1000 | 600 | 1000 | 100 | 779 | 2657 |
| FRE-R3-600-1100 | 600 | 1100 | 100 | 856 | 2921 |
| FRE-R3-600-1200 | 600 | 1200 | 100 | 934 | 3187 |
| FRE-R3-600-1400 | 600 | 1400 | 100 | 1090 | 3718 |
| FRE-R3-600-1600 | 600 | 1600 | 100 | 1245 | 4249 |
| FRE-R3-600-1800 | 600 | 1800 | 100 | 1401 | 4780 |
| FRE-R3-600-2000 | 600 | 2000 | 100 | 1556 | 5310 |
| FRE-R3-700-400 | 700 | 400 | 100 | 352 | 1201 |
| FRE-R3-700-500 | 700 | 500 | 100 | 440 | 1502 |
| FRE-R3-700-600 | 700 | 600 | 100 | 529 | 1804 |
| FRE-R3-700-700 | 700 | 700 | 100 | 616 | 2103 |
| FRE-R3-700-800 | 700 | 800 | 100 | 705 | 2404 |
| FRE-R3-700-900 | 700 | 900 | 100 | 792 | 2703 |
| FRE-R3-700-1000 | 700 | 1000 | 100 | 881 | 3005 |
| FRE-R3-700-1100 | 700 | 1100 | 100 | 968 | 3303 |
| FRE-R3-700-1200 | 700 | 1200 | 100 | 1057 | 3605 |
| FRE-R3-700-1400 | 700 | 1400 | 100 | 1233 | 4205 |
| FRE-R3-700-1600 | 700 | 1600 | 100 | 1408 | 4806 |
| FRE-R3-700-1800 | 700 | 1800 | 100 | 1584 | 5406 |
| FRE-R3-700-2000 | 700 | 2000 | 100 | 1760 | 6007 |

Vertical Radiator Details

Dimensions - Vertical (All dimensions in mm)



Note: All dimensions have a tolerance of ± 2 mm

Vertical LST Radiator Outputs

Model: RV

| Radiator ID Code | Height "H" (mm) | Length "L" (mm) | Width "W" (mm) | 50 Δ t (75/65/20°C) | | 40 Δ t (65/55/20°C) | | 30 Δ t (55/45/20°C) | |
|------------------|-----------------|-----------------|----------------|----------------------------|------------------------------|----------------------------|------------------------------|----------------------------|------------------------------|
| | | | | Output in LST Cover (W) | Output in LST Cover (Btu/hr) | Output in LST Cover (W) | Output in LST Cover (Btu/hr) | Output in LST Cover (W) | Output in LST Cover (Btu/hr) |
| FRE-RV-1800-400 | 1800 | 400 | 102 | 1204 | 4108 | 901 | 3073 | 620 | 2116 |
| FRE-RV-1800-500 | 1800 | 500 | 102 | 1505 | 5135 | 1126 | 3841 | 775 | 2645 |
| FRE-RV-1800-600 | 1800 | 600 | 102 | 1806 | 6162 | 1351 | 4608 | 930 | 3174 |

Frenger 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).

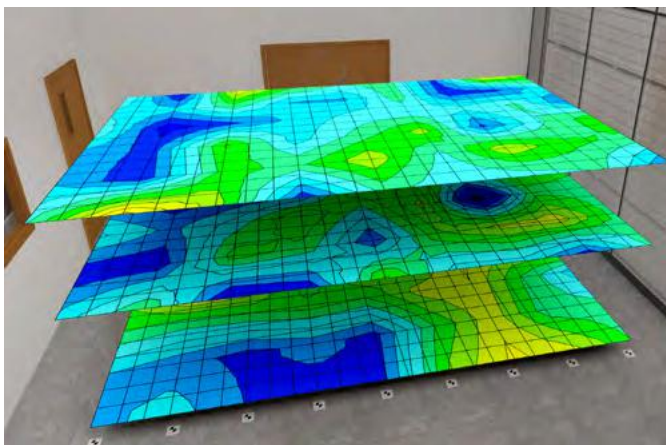
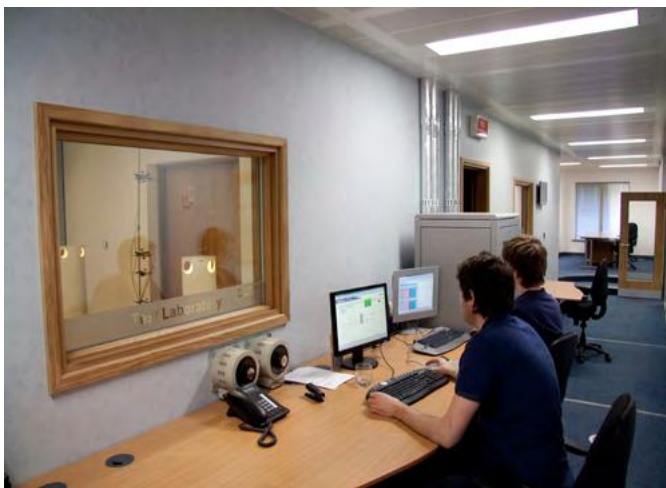
The installed mock-up enables the client to verify the following:

- 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 optimised.



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



Frenger 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 integration chamber is used to measure LED luminance efficacy.

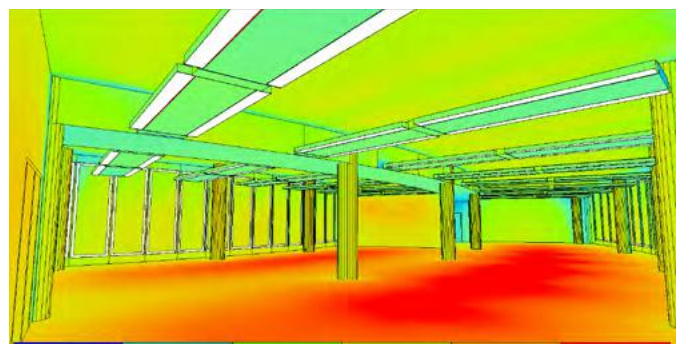
The intensity distribution is obtained by the use of a Goniophotometer to measure the intensity of light emitted from the surface of the fitting at pre-determined angles. The light intensity is measured using either a photometer with a corrective spectral response filter to match the CIE standard observer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



Frenger Acoustic Testing Facility

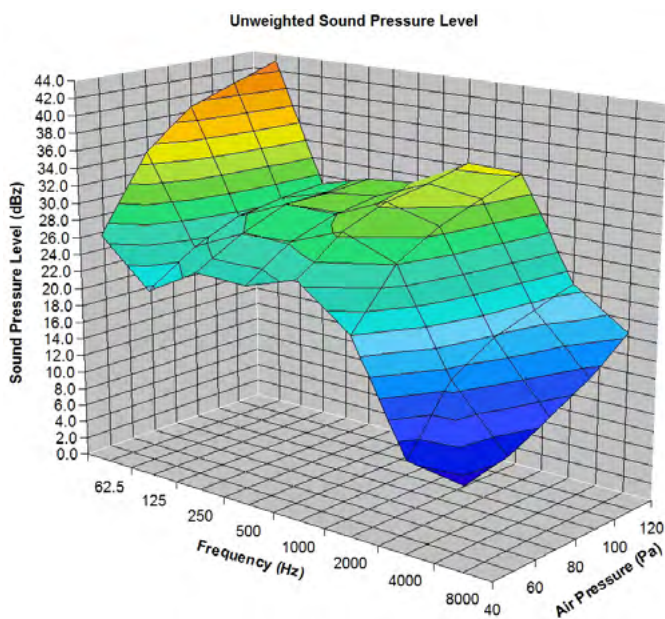
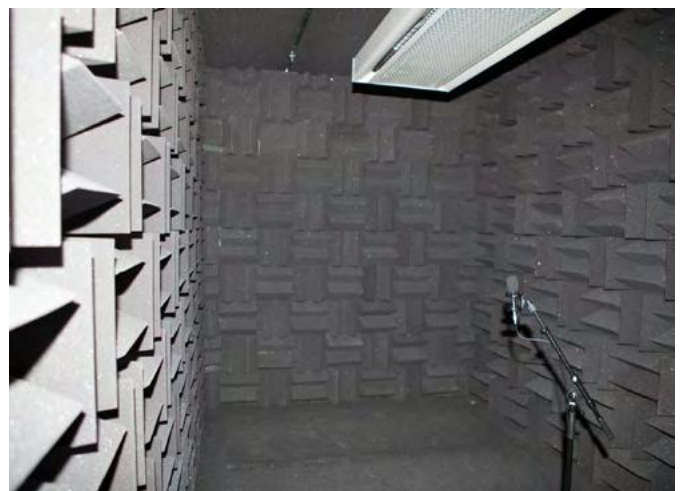
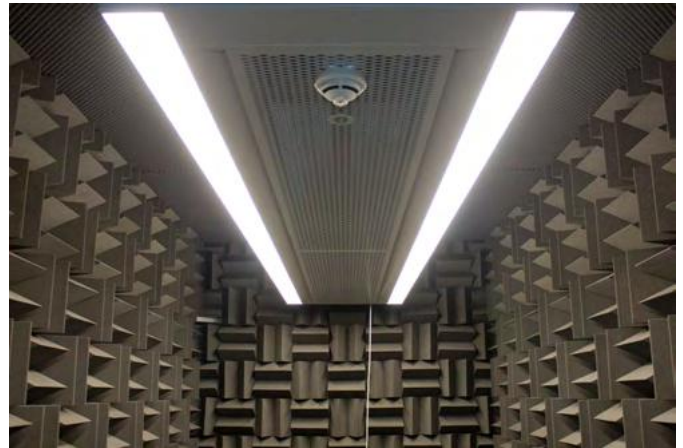
The Acoustic Test Room at Frenger is a hemi-anechoic chamber which utilises sound absorbing acoustic foam material in the shape of wedges to provide an echo free zone for acoustic measurements; the height of the acoustic foam wedge has a direct relationship with the maximum absorption frequency, hence 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 $\frac{1}{3}$ octave bands between 16 Hz to 16 kHz, with A, C and Z (un-weighted) simultaneous weightings.

In addition to the above, 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.



Frenger 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 



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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