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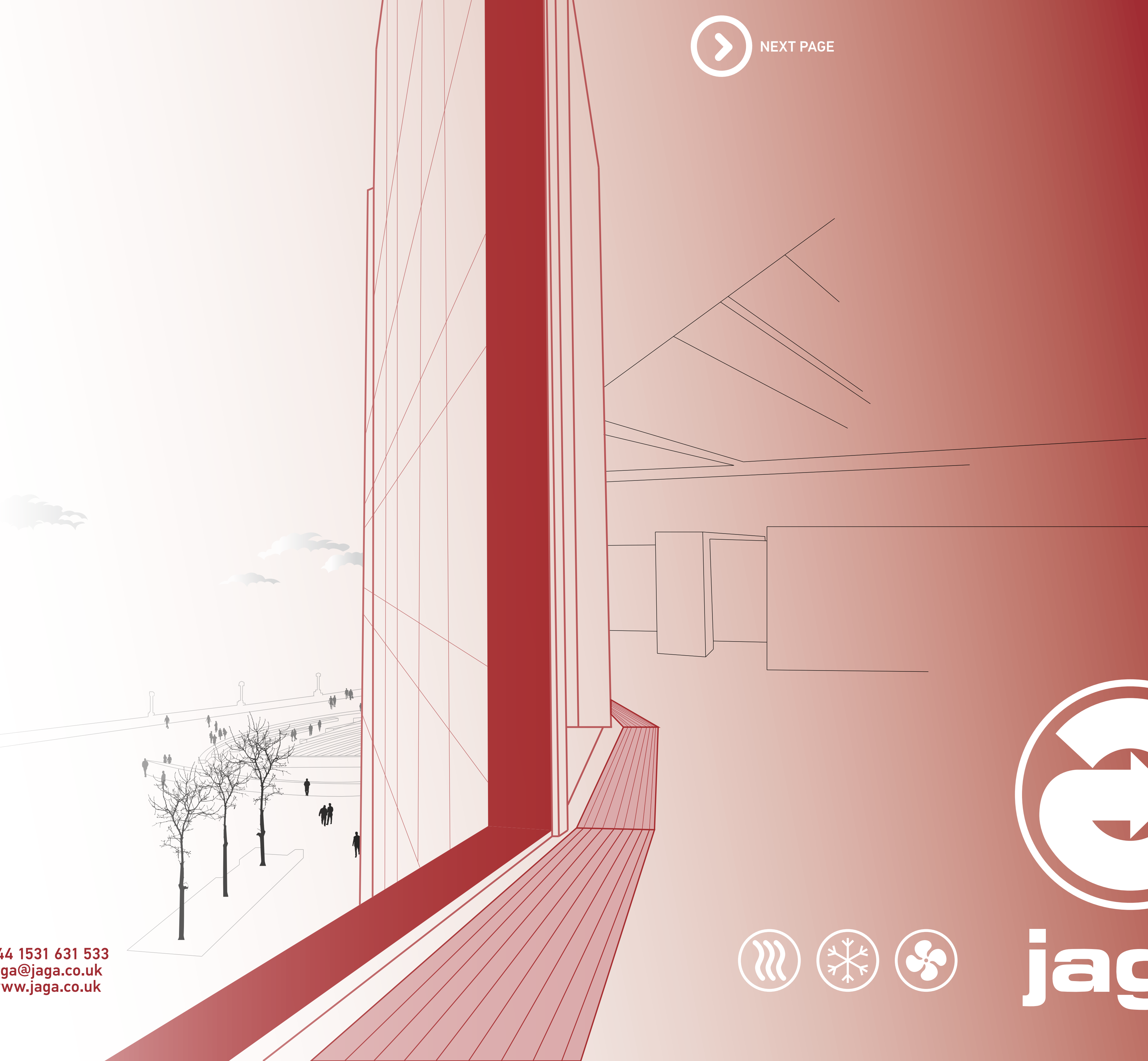
A GUIDE TO FAÇADE HEATING



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Introduction: The growth in use of glazed facades

During the second half of the 20th century, global climatic changes and diminishing resources forever changed the way the building industry approaches new-build or refurbishment projects. Architecture is now a complicated concept that considers not only the appearance of a building, but how it fulfils environmental, social and economic requirements – resulting in the drive for low-energy, sustainable buildings.

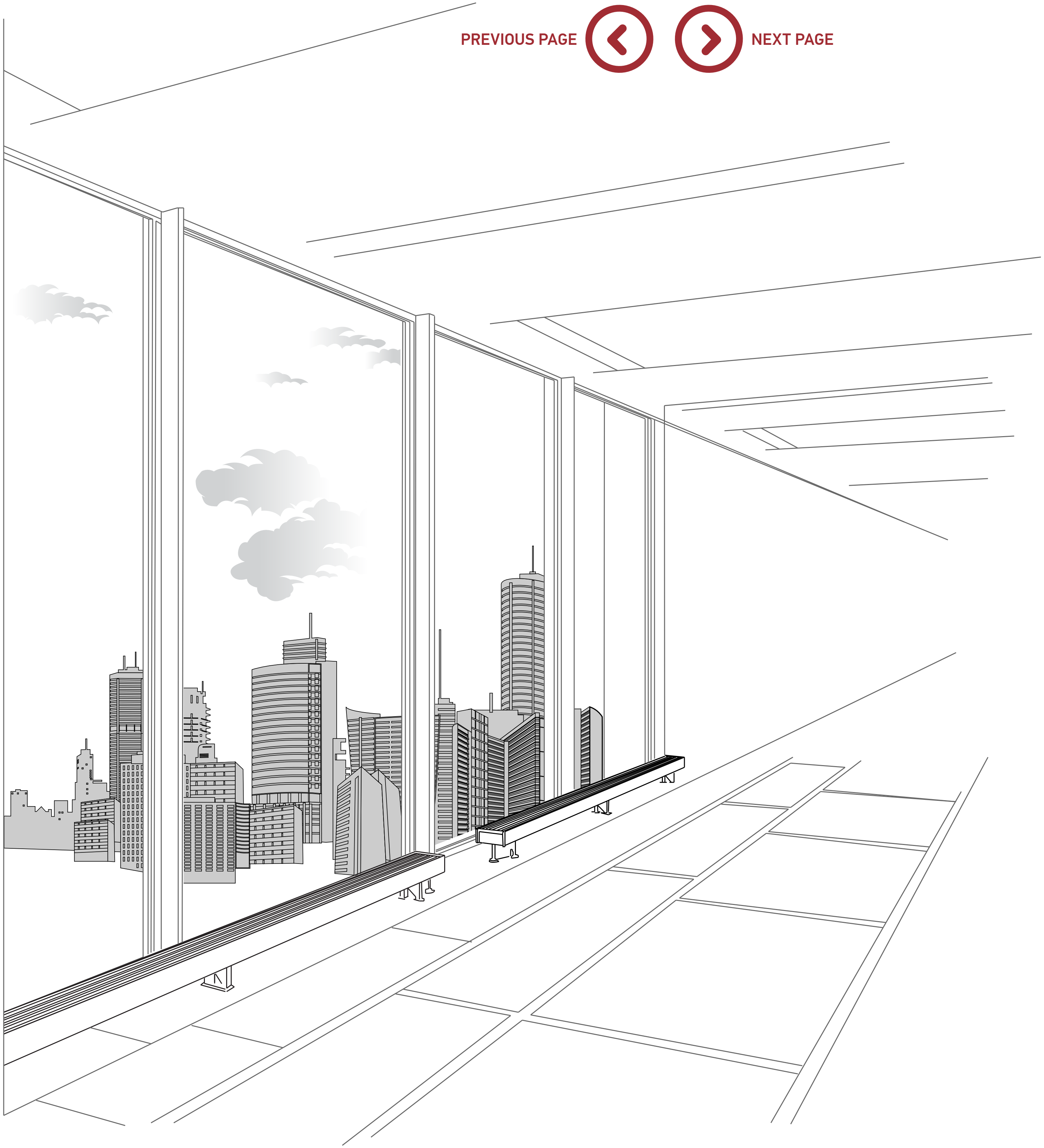
Virtually, no other building trend has seen such a substantial increase as the architectural use of glass and glazed façades. The initial intention of use was to emit a feeling of 'transparency' from an organisation, glazed façades soon offered practical benefits as well. These included increased use of natural daylight therefore reducing the energy consumption of electrical lighting, providing solar thermal comfort, insulation from noise pollution, along with the pleasing aesthetics and appearance of clean glass lines.

However, there are also several challenges to using glazed façades in both commercial and domestic projects.

The first is its susceptibility to solar heat gain and loss. Glass does not have the same resistance to hot and cold temperatures as walls do, therefore the more glazed façades are used, the higher the expense of heating and cooling to maintain a steady interior temperature.

Secondly, glazed façades are extremely vulnerable to condensation build up. The principle cause of condensation on the inside of glazed façades is due to high internal humidity levels coupled with low outside temperatures – common in tall, multi-level commercial builds. It can also build up on all areas of double-glazed façades.

In order to control and prevent condensation, the heating and ventilation in the areas where glazed façades are used, need to be thoroughly considered. This guide is therefore designed to help you through the process of designing, installing and maintaining a glazed façade heating system.

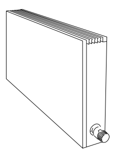


Purpose of facade heating and the options

With the increase in use of glazed façades in buildings, comes the growth of glazed façade heating technologies.

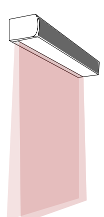
Glazed façade heating systems are now available in a varied selection of solutions, purpose built to counteract condensation on glazed façades, prevent heat loss through the glass, eliminate draughts, facilitate ventilation and provide both façade as well as space heating. However some are more effective in different areas than others.

Wall-mounted radiator



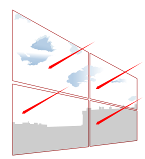
The traditional, wall-mounted radiator can be a popular choice for heating around glazed façades, due to its 'proven track record' in heating, and the fact that most people understand what it does and how it does it. However, conventional radiators pose several problems when used to heat glazed façades; often they are not aesthetically pleasing, they can be obtrusive and can obscure façades. Furthermore, they use up floor space and can be susceptible to damage.

Air curtain



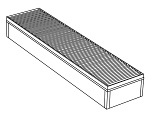
Air curtains are specifically designed to provide a resistance to airflow through an opening, without having any physical barrier there – creating a seal and preventing warm air from escaping. While air curtains are very effective when glazed façades, like glass doors, are constantly open, they are limited to simply stopping warm air from escaping the space – they do not heat the space, so an additional heating system would be required.

Solar façades



An innovative solution combining glass with solar energy, solar façades are an impressive ecological building material. However, there are a number of issues with this form of façade heating including its high-costs and the fact that many sites do not receive enough solar energy to make them cost effective – so have to rely on supplementary heating systems.

Trench Heating

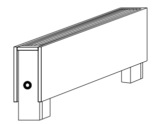


Trench heating – a radiator set in a floor trench and covered by a grille – is the most practical form of glazed façade heating and offers the most options.

Through creating convection currents, it can be designed to mitigate heat loss through façades and prevent condensation, as well as provide effective space heating.

Trench radiators are also the discreet as they are in the floor, so do not use valuable floor space or obstruct façades. While electric trenches are available, the running costs are very high and should only be considered for use if there is no hot water connection available.

Low-profile radiator



In full height glazed areas, where heating is required without obscuring the visual benefits of large windows, low-profile radiators are ideal and offer high heat outputs and an attractive output kW/£ ratio. Supporting legs hide the pipe work, yet while low-profile radiators are less visually obtrusive than many forms of heating, they do still take up floor space.

Comparison chart

	WALL RADIATORS		AIR CURTAIN	SOLAR FAÇADES	LOW PROFILE RADIATORS		TRENCH	
	'radiant'	'convective'			'radiant'	'convective'	Low temperature hot water - LTHW	electric
Easily Installed in front of full height glazing			✓		✓	✓	✓	✓
Discreet			✓	✓	✓	✓	✓	✓
Easily controllable	✓	✓	✓		✓	✓	✓	
Energy-efficient				✓	✓	✓	✓	
Suitable for various heat sources	✓	✓	✓		✓	✓	✓	
Easy to install	✓	✓	✓		✓	✓	✓	✓
Range of finishes	✓	✓	✓	✓	✓	✓	✓	✓
Allows for ventilation			✓				✓	✓
Option for cooling			✓				✓	
Easy maintenance	✓	✓	✓	✓	✓	✓	✓	✓
Low capital cost	✓	✓	✓		✓	✓		
Low running costs		✓		✓	✓	✓	✓	

The requirements

When selecting your façade heating system, there are several aspects of design that need to be considered: The purpose of the façade heater, the total heat loss for the façade (or the space if the heater is providing all of the heat for the space), the water temperature (for LTHW Systems), size limitations and aesthetics.

Purpose of the façade heating

Façade heating systems have the ability to be designed for the specific purpose of mitigating heat loss through glazed façades and eliminate condensation. Alternatively, they can be designed to provide effective spacing heating, and depending on the product selected, can provide cooling and ventilation. The intention of use will affect the preferred solution and will need to be considered at early design stages

If the desired purpose of a façade heating system is to primarily focus on the façade and eliminate condensation, cold draughts and heat loss, a trench radiator or low level perimeter heater is often used to supplement a separate space heating system, such as wall mounted radiators, underfloor heating or air conditioning.

Heat loss – façade only

If the façade heating system is only providing the offset for the façade heat loss, then the heat loss (in Watts) is calculated as follows:

Surface area of the façade (measured in m^2)

×

U Value of the façade (measured in Watts per m^2 per degree Kelvin temperature difference - $W/m^2 \bullet K$)

×

Temperature difference between the inside and outside.

While the temperature difference between inside and out is in Kelvin, it is the same as the temperature difference in Celsius so this is commonly substituted.

Also, the U value of a glazed façade would generally be between 1.3 and 2.5 $W/m^2 \bullet K$, although to meet current building regulation this value for new build must not exceed 2.00 $W/m^2 \bullet K$.

Heat loss – total space

If the purpose of the façade heating system is to also heat the space, the heat loss for the space needs to be calculated.

The total heat loss for a space is the sum of the fabric loss, the ventilation loss and the air change loss. See page 30 for an example for calculating these individual aspects.

Water temperatures (LTHW)

The supply water temperature can affect the product that is selected. The higher the water temperature the higher the output. If you need a high output but only have low water temperatures, then a dynamic (fan assisted) product may be necessary to meet the requirements, and this might affect the type of product that you select.

Size limitation

The physical constraint will have a bearing on the product being selected as every product will take up useable space. The physical size must be considered early in the design stage to ensure there are no clashes with other aspects of the construction. You must also consider any accessories (such as TRV heads) that will take up space beyond the actual heating solution.

The physical constraints are very important when considering trench heating, or units to be in a recess or under a windowsill.

Aesthetics

Although the colour of a radiator has no bearing on the function, it does have an effect on the style of the solution that can be offered. And if you are looking at a natural convection trench heater product, then the grille finish does have a bearing on the output achievable. The higher the grille spacing (free airflow) the better the output, so again this is something to consider quite early when selecting the solution. This same theory also applied to units that are likely to be built into architectural boxing.

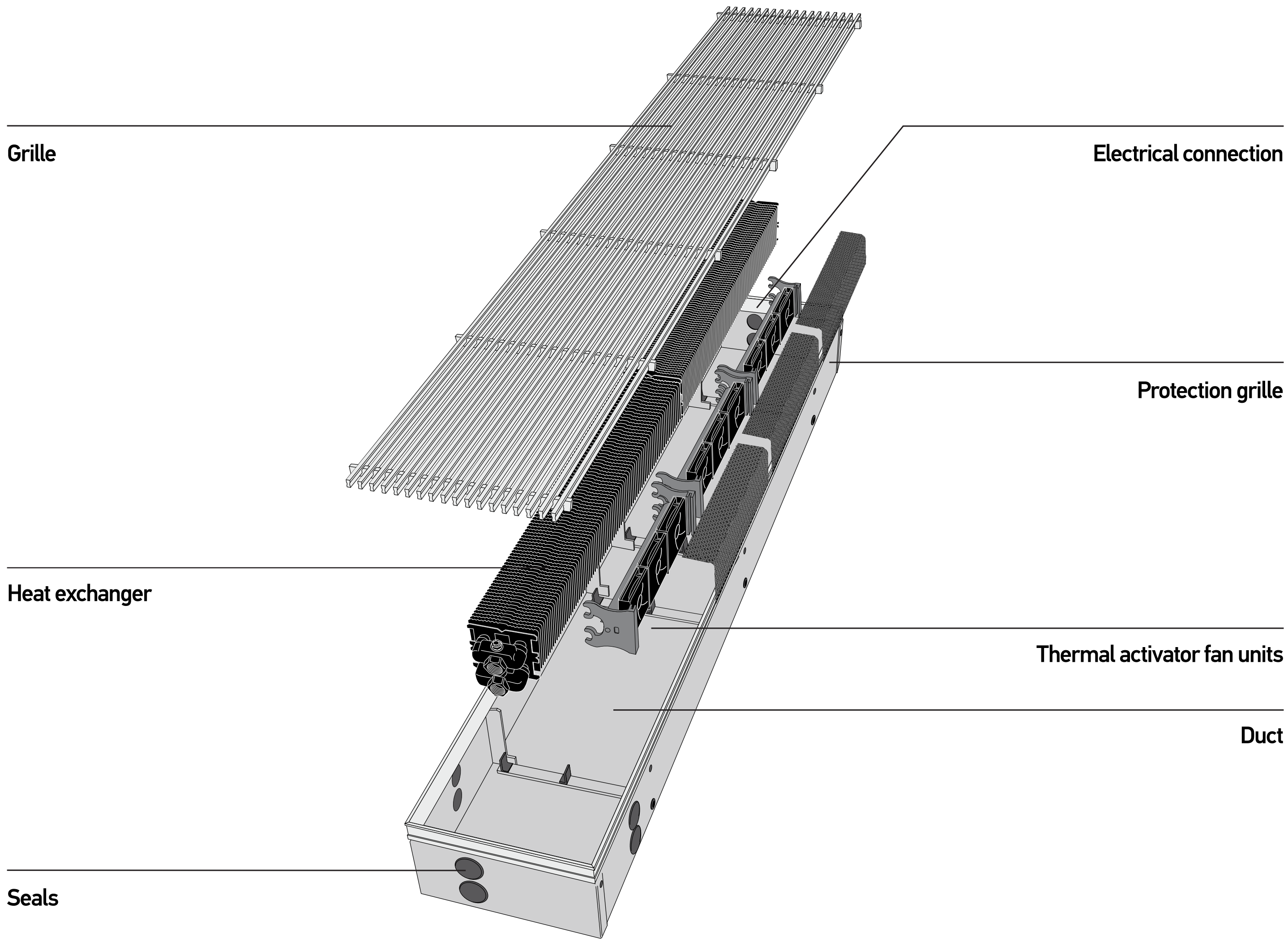
Design considerations: Selecting the right product

It is generally considered that trench heating is the ideal solution to overcome the challenges associated with façade heating. There is a certain amount of truth to this as it is a “hidden” solution that is the most versatile.

Whether it is the range of heights, widths and lengths, the option of grilles, or even cooling and ventilation, you will almost certainly be able to find a trench heater to give you the right solution. And of course one of the biggest advantages of trench heating is that it doesn’t take up wall space and can therefore be easily installed in front of full height (floor-to-ceiling) glazing, with no impact on visibility.

The components to consider

These are the basic components that make up a standard trench radiator



The components

The duct

This could be manufactured from sheet metal or a composite material and is designed to hold all the internal components. This might also provide a water proof barrier (for high water tables) or air tight seal (for pressurised floors) depending on the application. It is also possible to cast a trench into the sub-floor and only install the internal components and the grille. Whatever your selection the fundamentals are the same – the bigger the duct, the higher the output.

The element (heat exchanger)

The element (or heat exchanger) is the critical part of the trench heater. Without the element the trench is just that – a trench. There are various elements available for trench heating, and each one has its own advantages. Whatever the element, it is important that the connections are considered, the size of the element within the trench, and how much of the element is actually active. The element will have a series of fins (generally aluminium) mechanically attached to the element tubes (generally copper). The fins will warm up, heating the air around them, then that will rise out of the trench, heating the space and creating a convection current of air.

The grille & frame

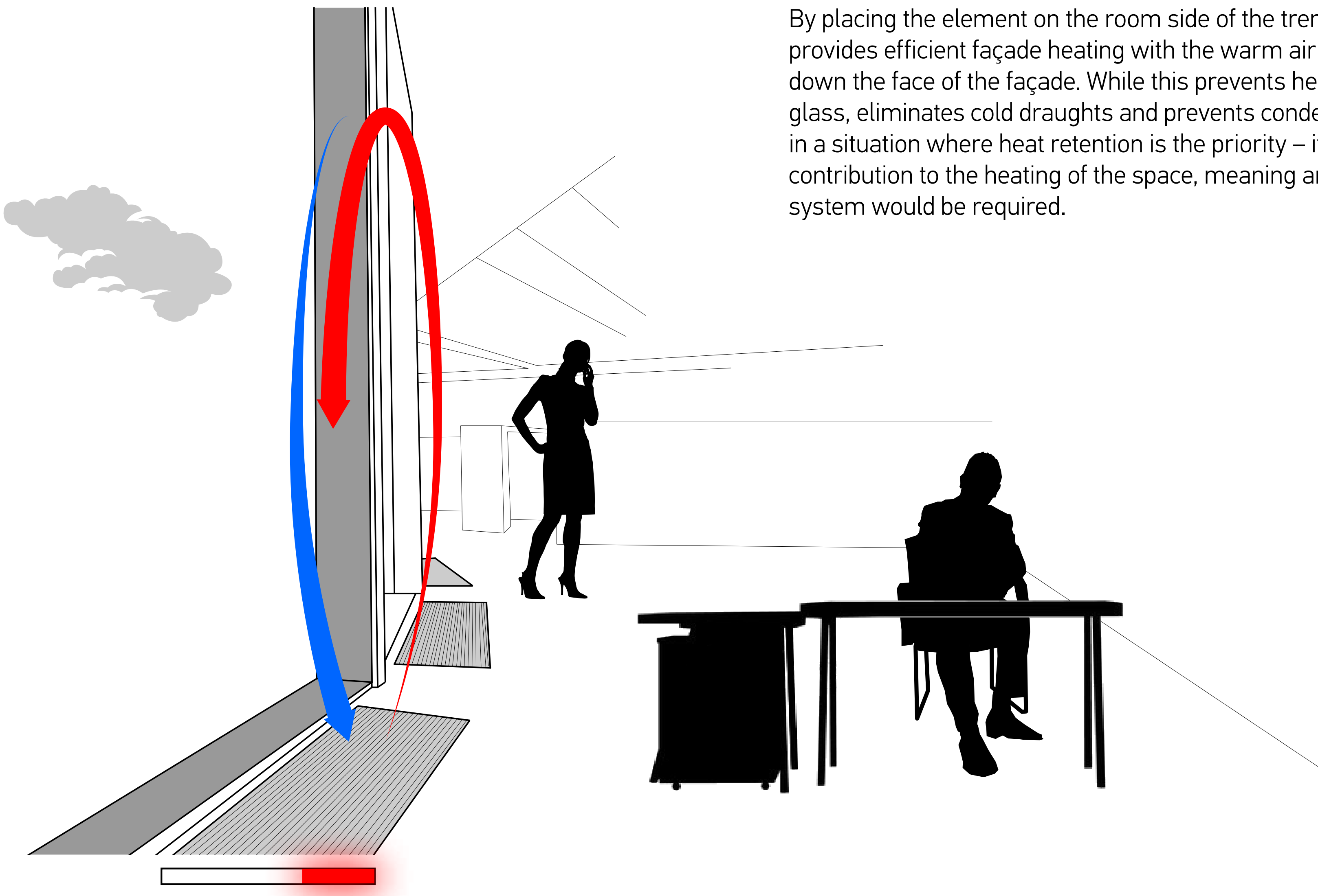
These items come in a range of finishes, each with its own unique properties. As a result of the variety of finishes available, you can nearly always get the right finish for the application – whether it be a wooden grille to match a wooden floor, or an aluminium grille to contrast with carpet. The possibilities are nearly endless.

Element positioning

The position of the heating element within the trench not only affects the output of the radiator, but also has a significant effect on how the warm air is distributed. Care should also be taken that the chosen positioning of the trench does not adversely affect, or is affected by, other aspects of the interior's design. For example, in a domestic situation, curtains drawn should be nearer the glazing than the trench so as not to affect the space heating functions of the trenches.

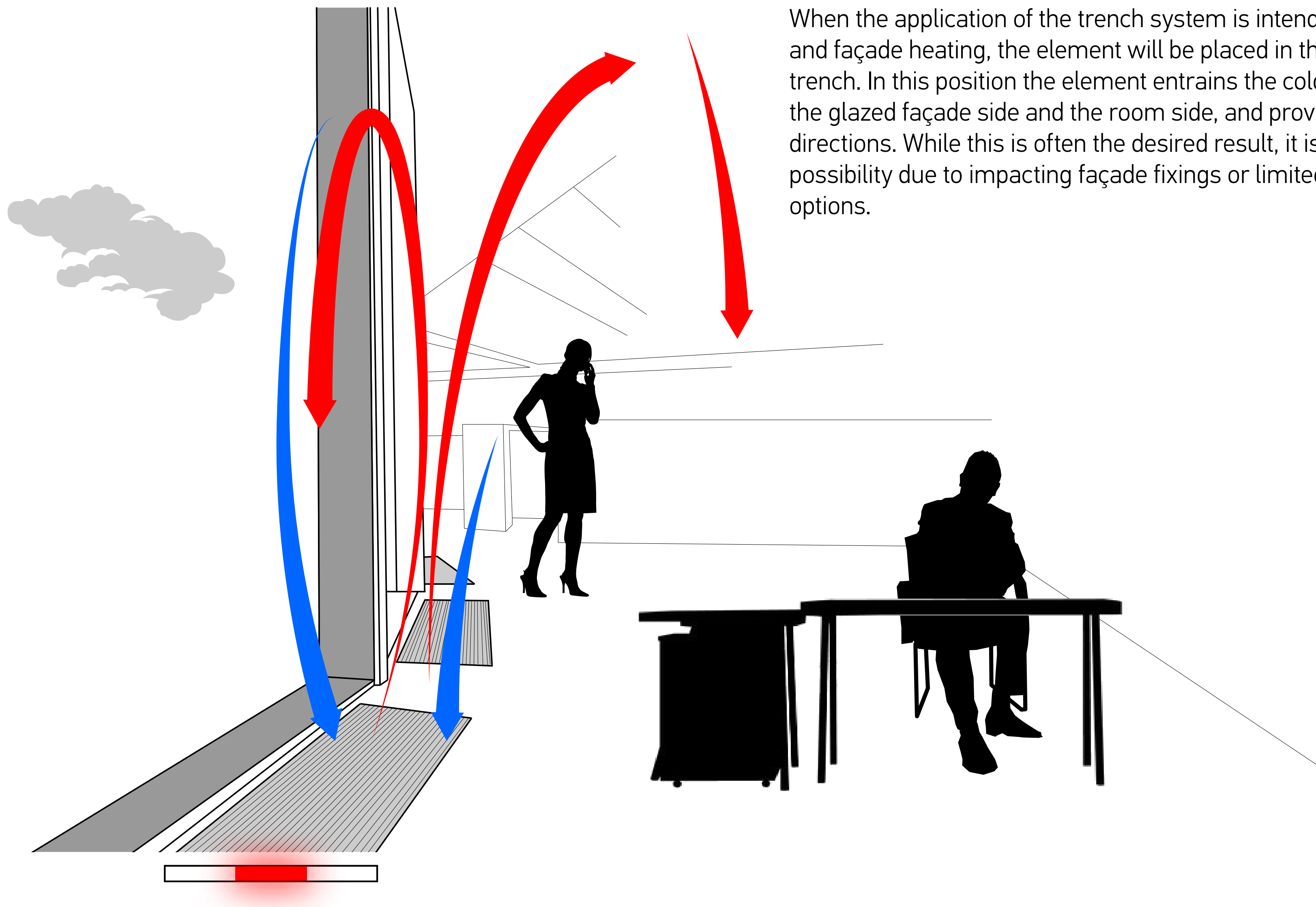
Element & trench positioning

Heating element on the room side



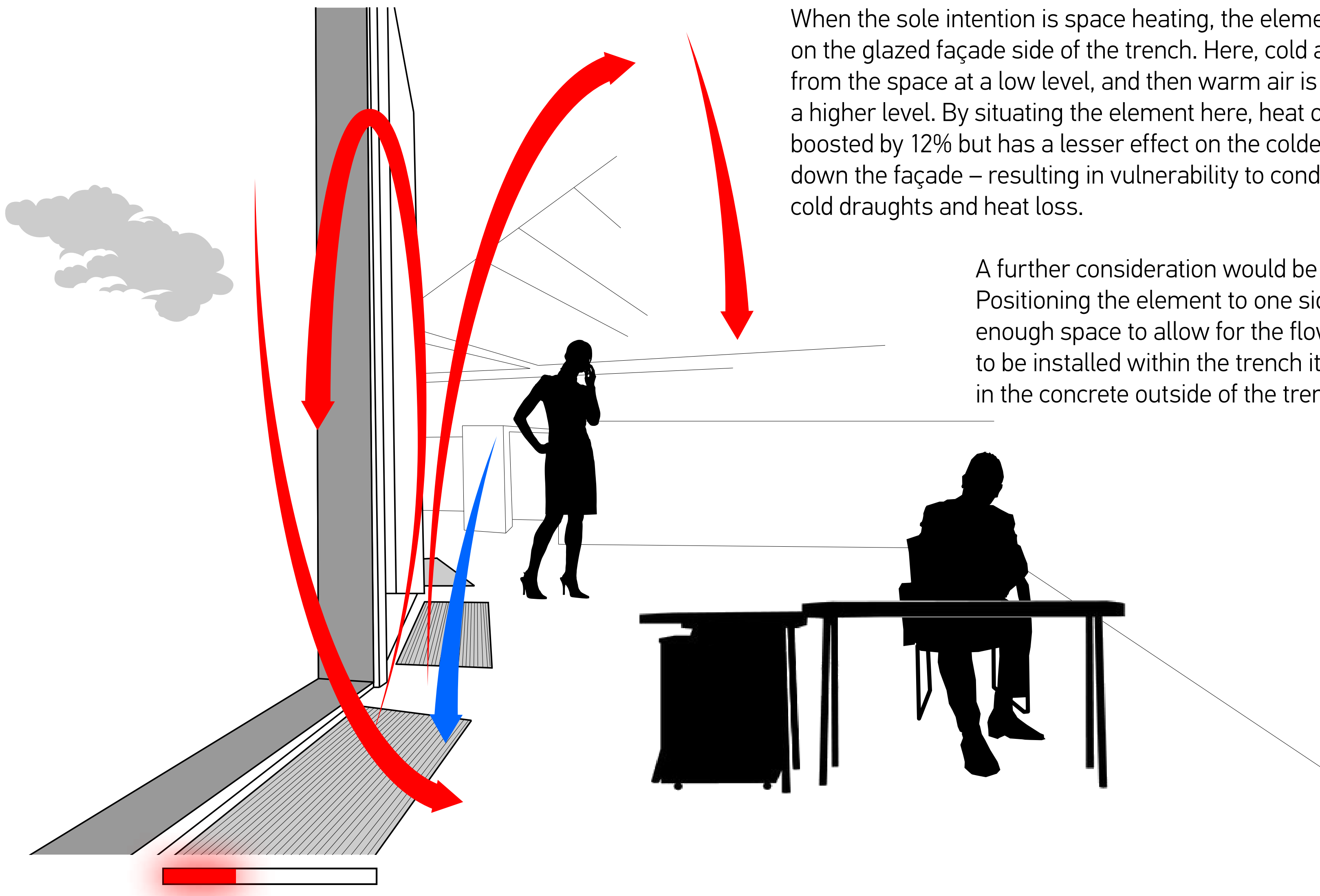
By placing the element on the room side of the trench, the radiator provides efficient façade heating with the warm air rising, then circling down the face of the façade. While this prevents heat loss through the glass, eliminates cold draughts and prevents condensation – ideal in a situation where heat retention is the priority – it offers very little contribution to the heating of the space, meaning an additional heating system would be required.

Heating element in centre of trench



When the application of the trench system is intended for both space and façade heating, the element will be placed in the centre of the trench. In this position the element entrains the cold air from both the glazed façade side and the room side, and provides heat in both directions. While this is often the desired result, it is not always a possibility due to impacting façade fixings or limited connection options.

Heating element on window side



When the sole intention is space heating, the element will be placed on the glazed façade side of the trench. Here, cold air is entrained from the space at a low level, and then warm air is returned to a higher level. By situating the element here, heat output can be boosted by 12% but has a lesser effect on the colder air dropping down the façade – resulting in vulnerability to condensation build up, cold draughts and heat loss.

A further consideration would be the pipework. Positioning the element to one side may give enough space to allow for the flow/return piping to be installed within the trench itself, rather than in the concrete outside of the trench.

Trench positioning

While the positioning of the element has a drastic impact on the results provided by the trench system, the position of the trench itself, and its relation to the façade glazing, also needs to be considered.

When the distance between the façade and the trench is decreased, the output of heat also reduces. Best practice spacing is 500mm between trench and façade. This provides effective heat output, while remaining unobtrusive to the occupants of the space.

Curved glazed façades, which currently are a design technique enjoying growing popularity, present special challenges in positioning the trench. Some manufacturers do offer curved trench heating - a huge advancement within the industry, as installing a straight trench in front of a curved façade is usually aesthetically unappealing. With curved trenches, the element and trench itself will still be straight, but the grille and frame will be curved to create an installation that visually follows the line of the curved façade. Be aware that curved trenches will likely come in at 2-4 times the cost of a straight trench of similar length.

Also, with the growing popularity of open-plan spaces, everything – from electrical cabling to insulation – needs to be hidden within the floor. This means often there is little space within the floor voids for trench heating, so positioning options are limited, and fan-assistance is often required for desired output.

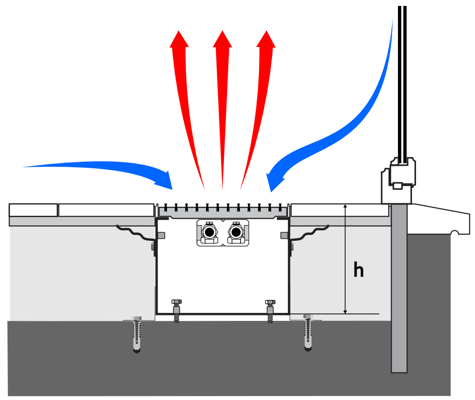
Design considerations: Influence of dimensions

The dimensions of a trench can greatly influence the heat output provided by a system. The theory, in its most basic form, is the smaller the space around an element, the less output it supplies due to airflow resistance. Similarly, the bigger the dimensions, the higher the output.

Further increases in output can be achieved by using dynamic fan-assisted products.

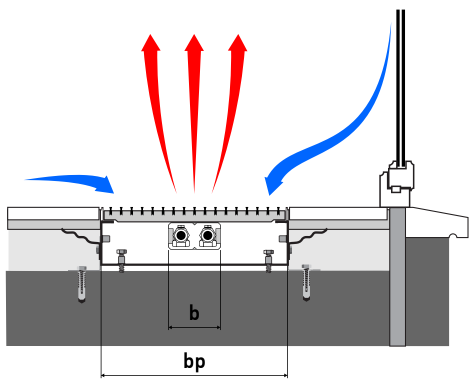
Please note that the trench should always be 100mm-200mm longer than the trench to leave sufficient room for the valve.

Deeper the trench = more output



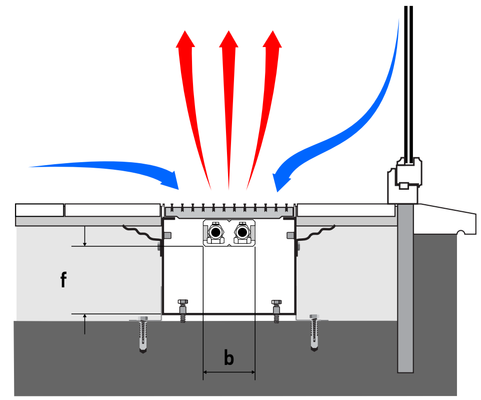
Illustrated here is the effect of increasing resistance to the airflow across the element, as the depth of the trench decreases.

Wider the trench = more output



Here the influence of airflow resistance increases in relation to the decrease in trench width.

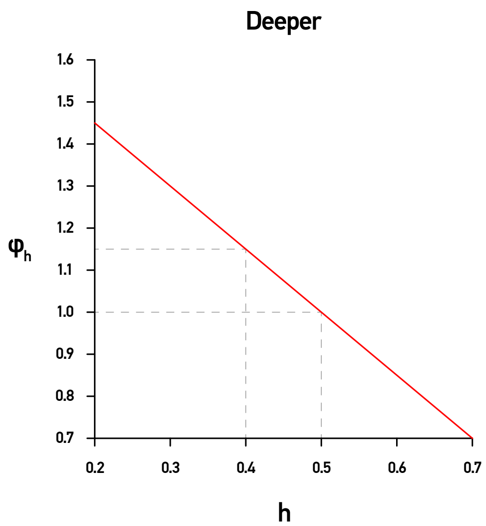
Space under element = supports output

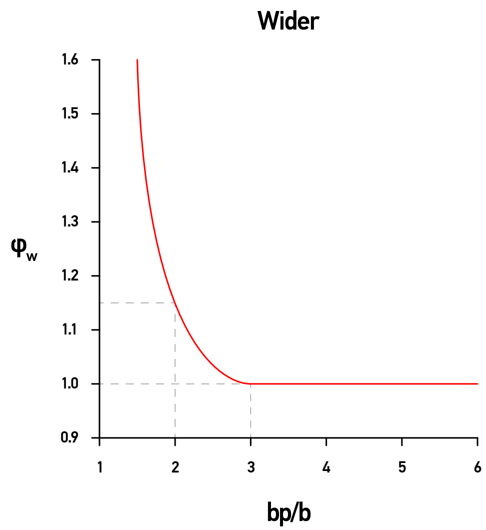


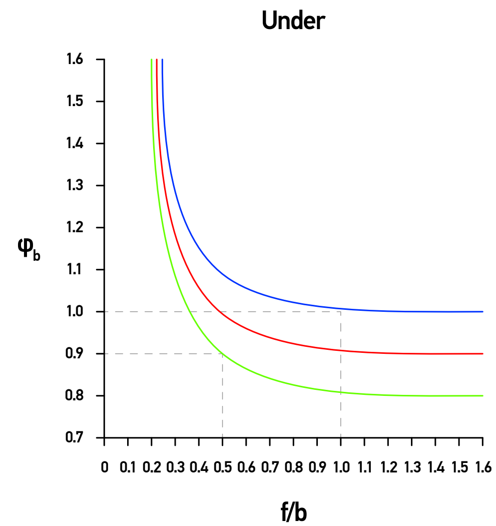
This illustrates the effect of varying the space between the bottom of the element and the floor of the trench. Again, the airflow resistance declines by increasing the space beneath the element.

However it is important to note that too much space around an element can result in a heat loss due to there being too much airflow for the element to warm.

The following diagrams illustrate best practice dimensions of a trench in respect to the size of the element, and the increase or decrease in percentage output caused by moving the element within the trench.



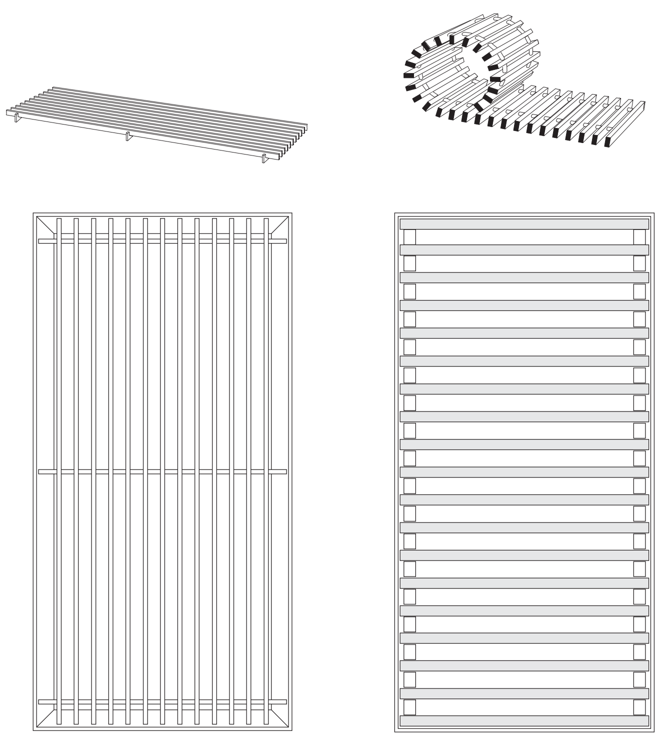




Design considerations: Grille selection

The choice of grille can have a significant impact on warm air distribution and consequent outputs of a trench heating system.

Logically, the wider the grille, the more air circulates in and around the element, resulting in more warm air being distributed back into the room. However, often wider spaced grilles can be impractical as they offer visibility through the grille to the element, and small items can be dropped through the spaces. Tightly spaced grilles mean little or no visibility into the trench, and when used in conjunction with a fan-assisted system, can provide the same amount of airflow as a wider grille.



As the amount of free space between grille slats can range from 52% for a roll-up wooden grille to 75% for a rigid aluminium grille, it is crucial the grille of choice is determined prior to finalising the heat specification. Because of this wide variety of output options, care should be taken to specify the grille type as early as possible in the project so that due account can be taken of this in the output calculations.

Additionally, there is the option to choose either a rigid or roll-up grille. Roll-up grilles are easy for handling, installation and maintenance purposes. Designed with a rubber perimeter, they are ideal in applications where occupants might constantly be walking over the grille, as the rubber edge dampens down sound. However, roll-up grilles are as easy to tamper with as they are to install. Rigid grilles are not as simple to remove, and do also have the option to be locked.

Design considerations: Natural vs Dynamic

Natural trench heating systems are effective in evenly dispersing air within a room and can provide targeted screening of air when installed beneath glazing to eliminate condensation. However in some circumstances fan-assisted airflow will provide a better balance of performance against energy consumption.

Trench height (mm)	Trench width (mm)	Average output W/m natural	Average output W/m active
140	260	357	1193
140	340	501	1548
140	420	656	1966

Based on 75/65 flow/return temperatures

This chart shows the relative outputs for passive and fan-assisted trench heating on a typical like-for-like size basis. A fan-assisted unit can achieve a higher output than similarly sized natural trench units, thus achieving the energy efficiency benefits of a low temperature system without aesthetic or structural compromises.

There are several common situations where fan-assisted systems are preferable to natural trench radiators.

When floor voids are shallow - or there are limitations on space available for trench length or width due to clients wanting to maximise floor space - trenches are required to be designed with smaller dimensions. As discussed previously, the smaller the space around the element, the more airflow resistance there is, resulting in a lower heat output. A fan-assisted system draws in as much air as needed, so smaller dimensions will not have an effect on the system's output.

Natural trench heating has the ability to distribute heat up to four metres in height, before the heated air is affected by the glazing of the façade. When façades are taller than four metres, some clients choose to secure a wall-mounted radiator to a cross-beam at that four metre point, to heat the remaining space. However this is often impractical and aesthetically unappealing. Alternatively, fan-assisted trench heating can reach heights of seven metres, before being affected by glazing.

The growing use of low and zero carbon heat sources such as heat pumps, PV solar panels or biomass boilers, have the ability to be used with lower flow and return water temperatures. Consequently, heat emitters now need to be sized for optimum performance with these lower temperatures in mind. In such applications, fan-assisted trench heaters are ideal and deliver the desired heating levels rapidly and precisely.

Finally, when a trench heating system faces a high heat requirement - especially when the trench is supplementing space heating systems or is providing all of the space heating – fan-assisted trench heating is more suitable due to its ability to provide up to three times as much output as a passive trench system.

Fan-assistance does not result in disruptive noise

A common predetermination of fan-assisted trench heating is that it will create too much disruptive noise. However, the internal sound of fan-assisted heating system reaches less than 35 dB(A) per unit, (figure taken from Jaga's DBE unit, when on boost).

To understand just how quiet fan-assisted trench heaters are, below is a decibel level comparison chart, illustrating the decibel levels of commercial, industrial and residential everyday occurrences. As the table indicates, the hum of a refrigerator has a higher decibel level than that of a fan-assisted trench.

Commercial	Industrial	Residential	dB level
		Breathing	10
		Whisper	20
Library		Living room	30
Refrigerator hum			40
Quiet office	Power lawn mower		50
Classroom			75
	Manual machines		80
Telephone dial	Handsaw		85
Music practice room	Electric drill		94
French horn	Average factory noise	Blender	100
Rock concert	Aircraft carrier deck	Jet takeoff	140

Design considerations: Trench for ventilation and cooling

Indoor Air Quality (IAQ) has a major influence on occupant health, comfort and well-being of a building. Poor IAQ has been linked to Sick Building Syndrome resulting in reduced productivity and an increase in absenteeism, due to indoor exposure to air pollutants.

Providing the correct level of ventilation in any building application is of upmost importance for occupant health, comfort and productivity.

Recently, the heating and ventilating industry has seen an increase in hybrid technology available on the market. It is now possible to purchase single radiators that not only heat, but have the additional function of ventilating – and sometimes even cooling.

This breakthrough ability applies to the trench systems as well. Now, trench radiators can be used to introduce fresh air, by direct connection to the outside, rather than using a separate ventilation system. This access can be found via ducts and grilles, or by pressurising a sub-floor void and forming apertures in the trench unit's walls.

However, as with most aspects of trench system, each application needs to be considered thoroughly to ensure optimum results.

While the effect of a heating and ventilating trench system can be determined for each application, the results are dependent on the size of a duct connection (where applicable) and also the size of the apertures in the trench unit's construction. Furthermore, relative air pressures between the outside and inside, and the temperature of the cold air entering the trench need to be considered.

It is important to note that while a colder on coil temperature increases the performance of the element and ensures effective ventilation, the system will require a higher output to raise the fresh air temperature to comfortable room conditions. Also, efficient care must be taken to ensure the fresh airflow, and consequent heat load, doesn't exceed the output of the heating element, otherwise cold upward draughts could occur.

Furthermore, with the growing trend in hybrid technology, trench systems can be equipped with the ability to cool an interior as well. This is due to heat pumps now being equipped with a reverse cycle, generating both hot and cold water. However, as cool air evidently doesn't rise, the trench system will certainly need to be fan-assisted, to force the cold air up.

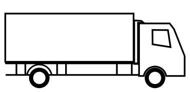
Design considerations: Trench installation and maintenance

Installation

Often people mistrust the effectiveness of a trench radiator and prefer to opt for something more traditional, like a wall-mounted unit. But it is clear to see that a trench heating system remains true to the original concept of a conventional radiator.

This also applies to its installation. With the exception of constructing spaces within floor voids for the placement of trench units, the radiator itself is installed and connected to a hot water supply and control system, like any other radiator.

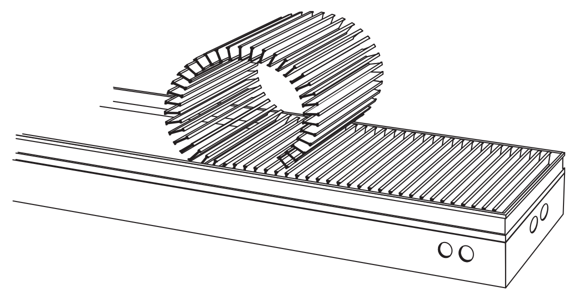
There is also the misconception that the purchaser of the trench system will have to build and test it themselves. In the majority of cases, this is not true. Trench heating systems are usually pressure tested at the point of manufacture, and will be delivered pre-assembled, ready for installation.



Additionally, as reputable heating product providers understand the importance of logistics, deliveries of trench heating systems can usually be phased – ensuring no system parts are left lying around site until ready for installation and eliminating the need for sourcing additional storage.

Maintenance

In terms of maintaining a trench heating system, the vast majority of installations are reliable, robust and need little in the aspect of maintenance. Due to the simple removal of roll up and rigid grilles, a quick vacuum of the element and around the trench, is generally all that is required periodically.



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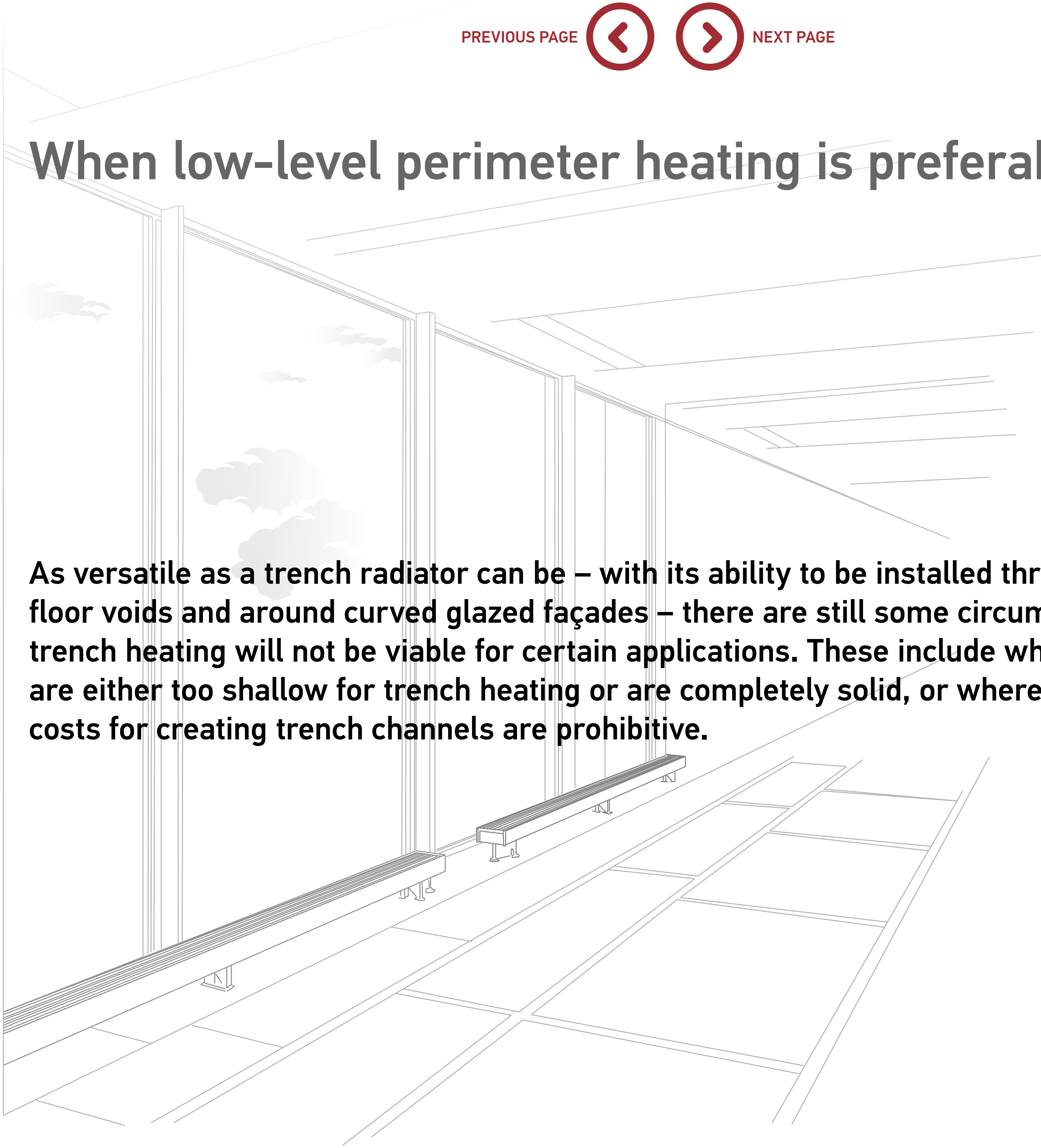
When low-level perimeter heating is preferable



As versatile as a trench radiator can be – with its ability to be installed throughout differing floor voids and around curved glazed façades – there are still some circumstances where trench heating will not be viable for certain applications. These include when floor voids are either too shallow for trench heating or are completely solid, or where construction costs for creating trench channels are prohibitive.

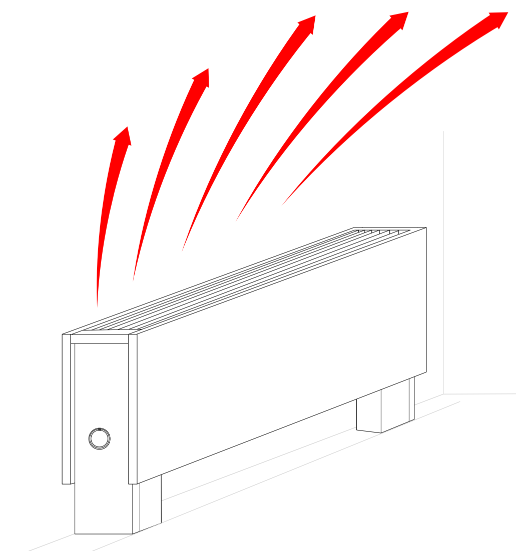
When low-level perimeter heating is preferable

In these instances, low-level freestanding perimeter heating is the ideal solution to provide effective, glazed façade and space heating, and can even meet LST requirements.

While low-level perimeter heating can be an effective alternative when trench systems are not suitable, there are additional benefits you can realise from this form of heating.

Although similar considerations of size and distance from façades need to be made, freestanding convectors provide a 'chimney' effect, where the height of the casing above the heating element influences the airflow across the element, and its output. This is affected by the height of the element above the finished floor level. Alternatively, freestanding radiators need less clearance above and below, as the convective airflow is less, and therefore the radiator can fit into more areas where there is still a height restriction - but due to the nature of the solution the length will be greatly increased to achieve the output.

Additionally, the advantages of low-level perimeter radiators in offering lower kW per £ costs than trench heating, their ease of installation – position it, fix it, connect it – and ability to be installed at the very end of a project often are compelling arguments in their favour. Also with low-level radiators, you are less likely to face unexpected issues on site like incorrectly measured floor void depths or façade fixing bolts interrupting the desired trench position.



Available in a range of colours, finishes and styles, low-level perimeter heating can be aesthetically pleasing and meet a wide range of architectural requirements.

However, while discreet, low-level perimeter radiators can still be somewhat obtrusive in front of glazed façades, take up floor space, are susceptible to damage and can only be installed after the flooring is completely finished.

Useful calculations

Façade heating calculation

To determine the façade heating output required for a project –focusing on façade heating rather than space heating - the measurements needed are the Surface Area of the façade in m^2, the façade U Value (a measurement given to the thermal insulation qualities of the façade), and the difference in temperature between inside the building and outside.

With requirements above, you can then use the following algorithm to find the output requirement to ensure effective façade heating:

Surface Area x U Value (approximately between 1.3 – 2.5) x Temperature difference between inside and outside = Output requirements (Watts)

Façade and space heating calculation

To determine the output required from a trench heating system, to not only effectively heat the façade, but the space too, the same calculation is used, however the U Value of the entire space needs to be determined – including the walls, the roof, the floor, any party walls and the façade.

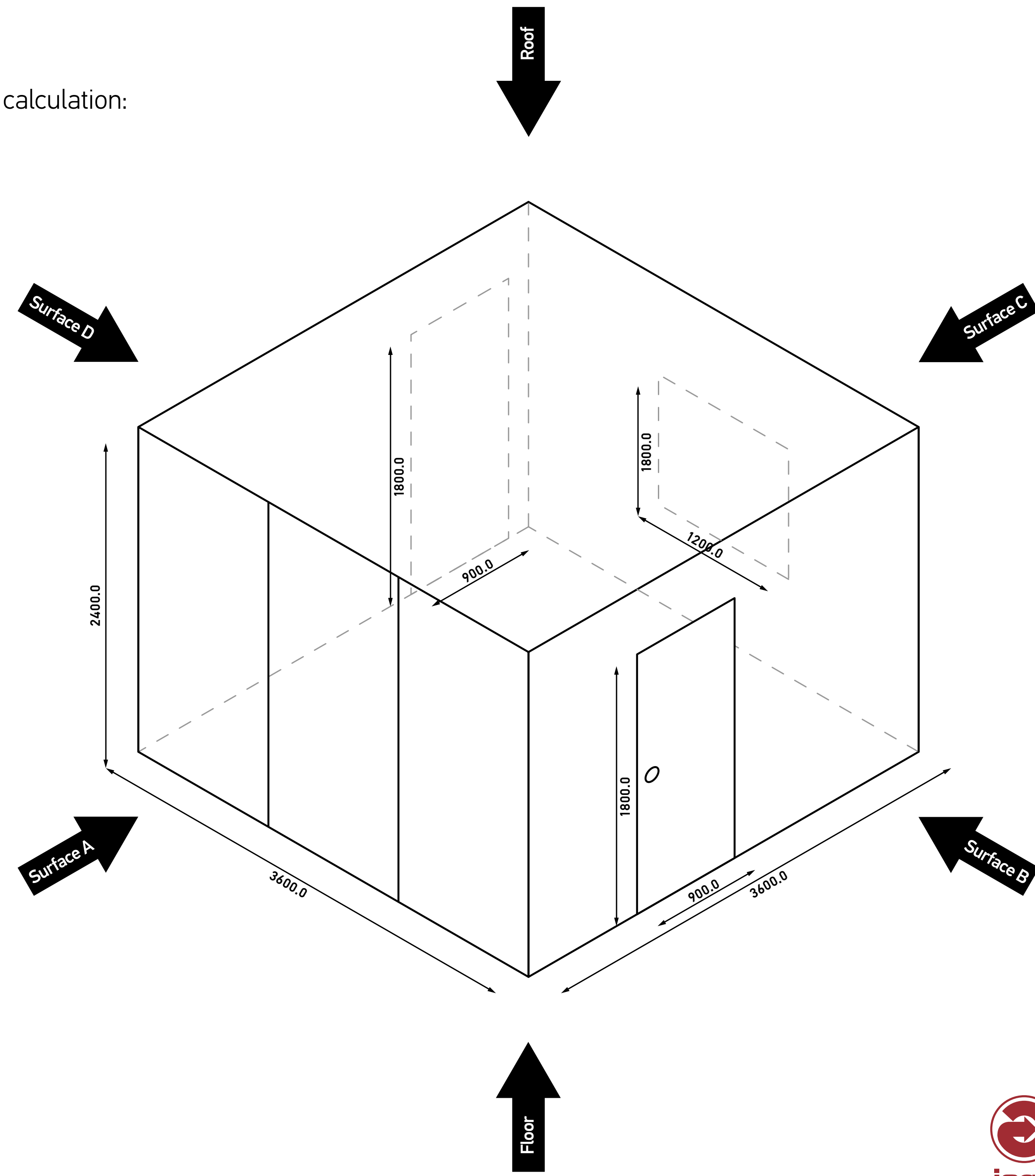
Once these are determined, the calculation to find the output required to effectively heat the space as well as the façade is the sum of all of the heat losses for the individual aspect of the space calculated in the same way as above.

You will also need to include for ventilation and infiltration losses as well as the fabric losses.

Limiting fabric parameters	
Roof	0.20 $W/m^2 . K$
Wall	0.30 $W/m^2 . K$
Floor	0.25 $W/m^2 . K$
Party wall	0.20 $W/m^2 . K$
Windows, roof windows, glazed rooflights, curtain walling and pedestrian doors	2.00 $W/m^2 . K$

Useful calculations

Here is an example of a façade and space heating calculation:



Living Room @ 21°C
Adjacent Room @ 18°C
External Temperature @ -5°C
Air changes @ 1 per hour

Total Heat loss =
Fabric Loss Surface A + Fabric Loss Surface B
+ Fabric Loss Surface C + Fabric Loss Surface D
+ Fabric Loss Roof + Fabric Loss Floor
+ Infiltration loss + Ventilation Loss

Useful calculations

Heat Loss Surface A – Glazed Façade

H = A × U × (ti – to)
= (2.4 × 3.6) × 2 × (20-(-5))
= 8.64 × 2 × 25
= 432 Watts

Heat Loss Surface B1 – External Wall

H = A × U × (ti – to)
= ((2.4 × 3.6) - (1.8 × 0.9)) × 0.3 × (20-(-5))
= (8.64-1.62) × 0.3 × 25
= 52.65 Watts

Heat Loss Surface B2 – External Door

H = A × U × (ti – to)
= (1.8 × 0.9) × 2 × (20-(-5))
= 1.62 × 2 × 25
= 81 Watts

Heat Loss Surface C1 – External Wall

H = A × U × (ti – to)
= ((2.4 × 3.6) - (1.0 × 1.2)) × 0.3 × (20-(-5))
= (8.64-1.2) × 0.3 × 25
= 55.8 Watts

Heat Loss Surface C2 – External Window

H = A × U × (ti – to)
= (1 × 1.2) × 2 × (20-(-5))
= 1.2 × 2 × 25
= 60 Watts

Heat Loss Surface D1 – Internal Wall

H = A × U × (ti – to)
= ((2.4 × 3.6) - (1.8 × 0.9)) × 0.2 × (20-18)
= (8.64-1.62) × 0.2 × 2
= 2.8 Watts

Heat Loss Surface D2 – Internal Door

H = A × U × (ti – to)
= (1.8 × 0.9) × 2 × (20-18)
= 1.62 × 2 × 2
= 6.48 Watts
= 60 Watts

Heat Loss Roof – External

H = A × U × (ti – to)
= (2.4 × 3.6) × 0.2 × (20-(-5))
= 8.64 × 0.2 × 25
= 43.2 Watts

Heat Loss Floor - External

H = A × U × (ti – to)
= (2.4 × 3.6) × 0.25 × (20-(-5))
= 8.64 × 0.25 × 25
= 54 Watts

Useful calculations

Infiltration Loss

$$Hi = cp \times \rho \times n \times V \times (ti - to)$$
$$= 1005 \times 1.2 \times (1 \div 3600) \times (3.6 \times 3.6 \times 2.4) \times (20-(-5))$$
$$= 1005 \times 1.2 \times 0.00028 \times 31.104 \times 25$$
$$= 259.89 \text{ Watts}$$

Ventilation Loss (assuming a ventilation rate of 0.006m^3/sec)

$$H = cp \times \rho \times qv \times (ti - to)$$

$$= 1005 \times 1.2 \times 2 \times (3.6 \times 3.6 \times 2.4) \times (20-(-5))$$
$$= 1005 \times 1.2 \times 0.006 \times 31.104 \times 25$$
$$= 562.67 \text{ Watts}$$

So, the total heat loss for this space is:

432 + 52.65 + 81 + 55.8 + 60 + 2.8 + 60 + 43.2 + 54 + 259.89 + 562.67
= 1664.01 Watts

When selecting a radiator it is advisable to oversize from this heat loss by a minimum of 10% to allow for warm up.

For this particular example, the radiator specified would need to be capable of achieving 1830 Watts.

Download the useful calculations sheet to use when installing a trench heating system

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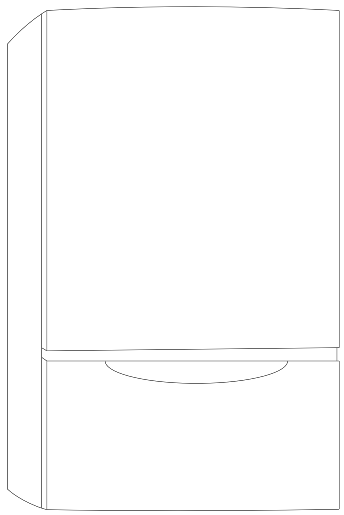
Controlling the system

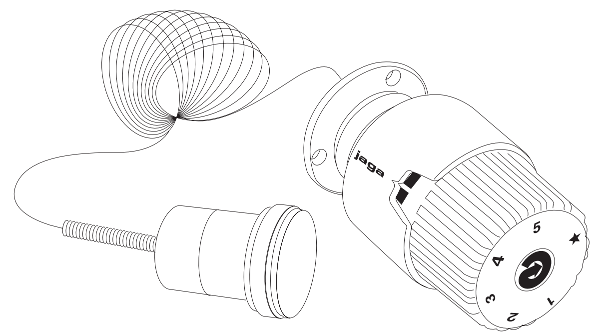
When opting for a trench radiator, the choices of controlling the system are no different to that of a wall-mounted or free-standing radiator.

Boiler control



If the system is heated from a boiler, you have a 'wet' central heating system, whether it is gas, LPG or oil-fired. The full set of controls should ideally include a boiler thermostat. This will control the heat of the water running through the trench elements. So, consequently, if you turn the boiler down or off, this will affect the trench system. While this is effective for small trench units, it would not suffice for larger installations.

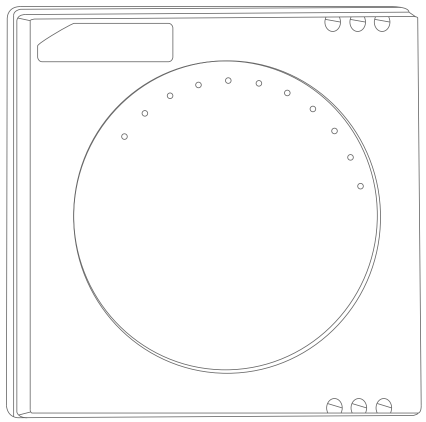
Room thermostats



For more control over the system, a room thermostat will prevent the space from becoming warmer than comfortable, and conversely, will automatically turn on until the space reaches the desired temperature.

A programmable room thermostat combines time and temperature controls, allowing the ability to set different temperatures for different times of the day – ideal in a situation when solar heat gains through the glazed façades are expected at a certain time.

Individual room control

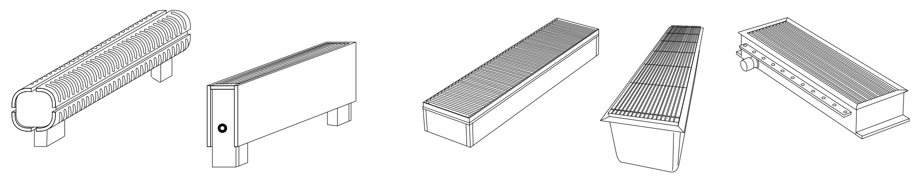


In an application where occupancy might differ from room to room, temperature requirements will also vary. Individual room control is ideal for controlling the entire system, but has the ability to differ temperature requirements in different spaces.

This can be achieved through the installation of Thermostatic Radiator Valves (TRVs). Instead of controlling the boiler and its temperatures, TRVs reduce the flow of water through the trench radiator they are fitted to. So depending what level each individual trench is set at, by sensing the air temperature around it, if the temperature goes above or below the applied setting, the TRV will adjust the water flow accordingly.

Jaga as a solution

At Jaga UK, we sell and distribute Europes widest range of natural and dynamic trench and low-level perimeter heating solutions. These solutions are suitable for both perimeter heating in front of glazed façades and for primary heating throughout commercial projects.



Numerous times we have been able to offer much appreciated advice on how to design in mitred corners or curved trenches for best possible aesthetic effect and heat output. Or offer recommendations where trench heating is preferable to low-level perimeter heating and vice versa, or how to make a trench system part of a building's cooling as well as heating strategy.

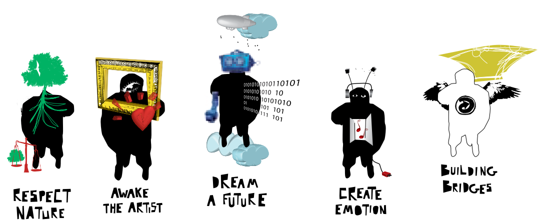
Then, even before you place the order with Jaga, we will visit your site and measure where the trench is to be installed, double check the floor void, note the intended positioning of the façade fixing bolts and so on. From this inspection, we will then produce CAD drawings that can easily be integrated into your own plans to save time and help ensure trouble-free installation on site later on in the development.

We will also guide you through the process of how the trench should interface with the BMS and provide electrical wiring diagrams for fan-assisted, dynamic trench heating systems if that is the system of choice.

Additionally, our trench units are factory-assembled and pressure tested for better quality, no waste and reduced installation time and costs for you.

At every stage in the design and development, we aim to go above and beyond what you might typically expect from a heating solutions company. At every stage we want you to feel extremely confident that the solution is going to perform exactly as planned and that everything is completely on track.

Finally, once the solution is in place, we provide full on-site commissioning support for our dynamic products plus on-going, dedicated UK-based after sales support. Post completion we will also give you a project guarantee pack which includes an unmatched 30 year guarantee on all Jaga heat exchangers.



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Quatro Canal

Ultra-compact and powerful heating, cooling and ventilation system

jaga

Canal Compact & Canal Plus

Powerful, controlled output

jaga

Mini Canal

Responsive, versatile and efficient

Mini Canal DBE

Highly responsive, versatile and efficient

Micro Canal

The shallowest Jaga trench heater available

Clima Canal

Complete climate control

Low-level perimeter heating products

jaga

Knockonwood Freestanding

As stylish as it is efficient

jaga

Mini Freestanding

Unobtrusive model with powerful output

jaga

Linea Plus Freestanding

Designed on contemporary lines

jaga

Tempo Freestanding LST

The new standard in LST radiators

jaga

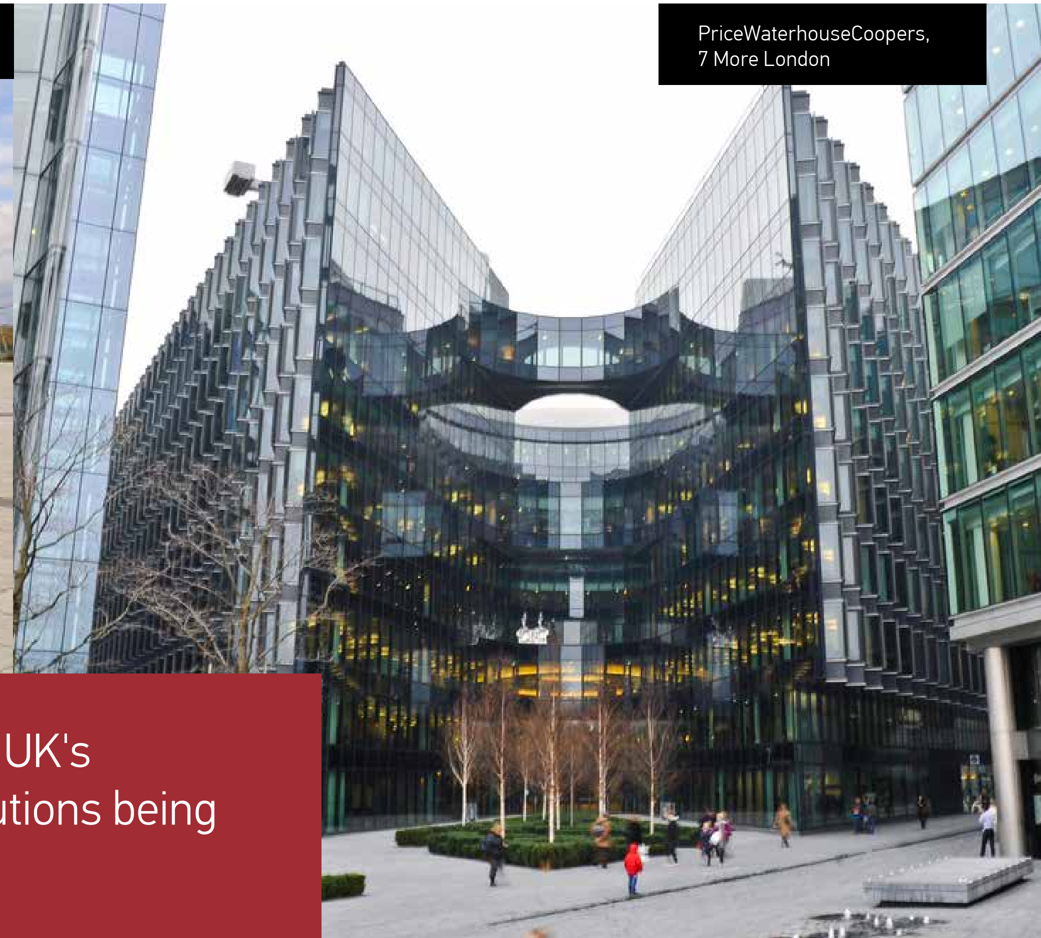
Brise Freestanding

Heating and cooling from a single freestanding radiator

Why choose Jaga?

TRENCH HEATING	JAGA PROVIDES
Systems to efficiently eliminate condensation, provide space heating, mitigate heat loss	✓
A variety in trench dimensions	✓
A variety in element dimensions	✓
Equipped with Low-H20 technology	✓
A variety of grille materials and colours	✓
Roll-up and rigid grilles	✓
Natural and Dynamic Boost Effect (DBE) trench options	✓
Ability to heat, ventilate and cool from one unit	✓
Can be built for curved glazed façades	✓
Adapted to differing floor voids, starting at a shallow depth of 6 cm	✓
Can be positioned for façade heating only,or both space and façade heating	✓
Pressure tested	✓
Pre-assembled	✓
Phased deliveries	✓
Alternative low-level perimeter heating	✓
Standard range	✓
Bespoke specials to meet the needs of the customer	✓

Strathclyde Fire and Rescue, Scotland



PriceWaterhouseCoopers, 7 More London

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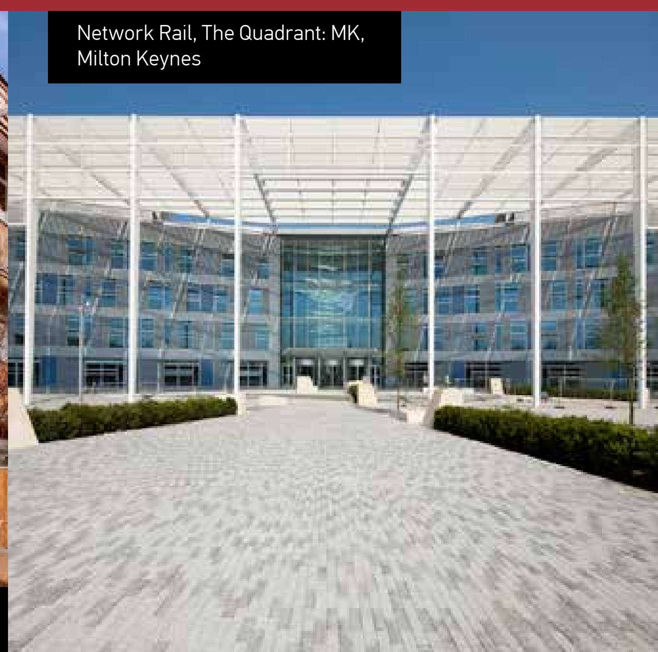
Our project experience

Here are some examples of Jaga UK's trench and perimeter heating solutions being used in commercial applications

Aardman Animations HQ, Bristol



Network Rail, The Quadrant: MK, Milton Keynes

QVC Television, West London

Coin Street Neighbourhood Centre, London

Links to further resources

Jaga quality assurance

Jaga is committed to ensuring all our heating and ventilation solutions meet the highest levels of quality, allowing our customers to have complete confidence in our products. Jaga has been assessed and approved by the global assessment and certification organisation QMS International plc. Click here for more information, including the quality management systems, standards and guidelines.

Trench & Perimeter Heating

Trench and perimeter heating options allow you to maximise available floor-space without losing valuable heat output. Ideal for countering draughts from the glazed windows commonly found installed at modern office developments, Jaga's sub-floor trench heating options start from a depth of just 6cm, with stylish above-floor perimeter heating options available where required. For more help choosing the ideal trench or perimeter heating solution, please download our product selection matrix

Contact

Jaga Heating Products (UK) Ltd
Orchard Business Park
Bromyard Road
Ledbury
Herefordshire
HR8 1LG

For sales and all other enquiries
please phone 01531 631 533
or email jaga@jaga.co.uk

Technical support

Jaga is committed to supplying full after-sales support.

Technical enquiries 0845 250 7251

For technical enquiries regarding the selection
or installation of Jaga products
Monday–Thursday 8.30am-5.00pm
Fridays 8.30am-4.00pm

Please note that this number is for UK customers only.