

2010

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TWA**



## Radiant heating systems

An energy and cost saving method of heating , that provides comfort to a room, much the same way as the sun warms the earth. Radiant heating and cooling panels offer a number of advantages over conventional systems and can easily be modified to fit your needs and specifications.

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Radiant heating panels - 2009

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## 1. RADIANT HEATING PANEL TECHNOLOGY



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## **Radiant Panel Technology...What Is It?**

Radiant panel ceiling systems are similar to other air-water HVAC systems with respect to the arrangement of components. The important difference is that room thermal comfort is maintained primarily by radiant heat transfer instead of convective heat transfer (as is the case with tube and fin baseboard radiation). The significance of this is best illustrated by an analogy:

*You are walking outside on a brisk fall day in bright sunshine. Suddenly the sun goes behind a cloud. Although you feel an immediate chill, the outside air temperature did not change in the instant that the sun was hidden; it is just that you were, until that instant, bathed in a warming radiant field.*

Radiant ceiling panels create a radiant field, similar to the sun's but of lower intensity, inside the occupied space. This radiant field heats the solid objects within the space without appreciably heating the room air. In addition, since most interior finishes have high emissivity, all surfaces within the room absorb and reradiate the heat to give a generally even warming effect.

## **How Is It Different From Conventional "Radiation"?**

Heat may be transferred by conduction (warmth transferred by objects that are touching each other), or convection (heat that is carried from a warmer to a cooler body by an intermediate fluid such as air) or by radiation. Most conventional tube and fin "radiators" are in fact, convectors. They heat a space by warming the air that passes by the heated fins. This air, now warmer than the surrounding air, rises due to buoyancy. This is known as free convection. Where the air is moved past the fins by a blower or fan it is called forced convection. In either case the idea is the same, to compensate for perimeter heat losses by circulating warm air within the space.

By contrast, between 75 and 90 per cent of the energy from a radiant panel is propagated by thermal radiation. Thermal radiation is an electromagnetic radiation propagated due to a difference in temperature. Therefore, the heat is transferred to all bodies "seen" by the panel that are at a lower absolute temperature than the panel itself.



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### Why Are The Panels In the Ceiling?

It is often asked "Why put the panels in the ceiling? Heat rises, doesn't it?" The answer is no, heat does not rise. Warm air rises. The panels are most effective in the ceiling because from there, they are best able to "see" the objects in the room. Again, for clarification, consider the following analogy:

*For maximum effect, lighting is placed in the ceiling. This is because from above, it is not obstructed by room objects and its light can be most effectively cast on the surroundings.*

*Light is a type of electromagnetic radiation which has a shorter wave length than thermal radiation. Therefore, as with a light, the optimal location for a radiant panel is the ceiling.*

Another reason for placing the panels in the ceiling is so that higher surface temperatures can be used. The rate of radiant heat transfer from the panel is governed by the Stefan-Boltzmann Law<sup>1</sup>,  $q = \sigma T_s^4$ , which demonstrates that the radiative heat transfer from a body increases dramatically as its temperature is increased. Radiant ceiling panels are typically operated at 79-85°C (175-185°F). On the other hand, wall mounted radiators cannot be operated at these high temperatures. This makes radiant panels comparatively more effective radiators.

### Are Radiant Panels New?

Radiant panel technology is not new to the HVAC (Heating, Ventilating and Air Conditioning) industry. It is a mature, proven technology that has been in use in Europe for over 100 years. Over the last 35 years the Canadian and United States HVAC industry has employed radiant panels in many commercial and institutional settings. In fact, since the much publicized outbreak of Legionnaire's disease (spread by contaminated central air systems), radiant heating systems have been the choice for U.S. Veteran's Administration Hospitals and, in the last 10 years, over 80% of the new hospitals constructed in the provinces of Western Canada have employed radiant panel ceiling heating systems.

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<sup>1</sup> Holman, J.P.: Heat Transfer, McGraw-Hill Book Company, New York, 1981



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### What Are Some Of The Advantages Of This Technology?

The principal advantages of radiant panel heating systems are listed in Chapter 6 of the 1992 ASHRAE <sup>2</sup> (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.)

Handbook as:

1. Because not only indoor air temperature, but also mean radiant temperature, can be controlled, total human thermal comfort may be better satisfied. Additionally, because the operative temperature for required human thermal comfort may be maintained by primarily controlling the mean radiant temperature of the conditioned indoor space, dry-bulb air temperature may be lower in heating or higher in cooling, reducing sensible heating and cooling loads.
2. All pumps, fans, filters and so forth can be centrally located, simplifying maintenance.
3. Cooling and heating can be simultaneous, without central zoning or seasonal changeover when three and four pipe systems are used.
4. In terms of simple payback period, ceiling cooling panels and chilled beams have the highest energy savings potential. (DOE 2002)
5. Noise associated with fan-coil or induction units is eliminated.
6. Supply air quantities usually do not exceed those required for ventilation and dehumidification.
7. Draperies and curtains can be installed at the outside wall without interfering with the heating and cooling system.
8. The modular panel concept provides flexibility to meet changes in partitioning.
9. A 100% outside air systems may be installed with less severe penalties in terms of refrigeration load because of reduced air quantities.
10. Wet surface cooling coils are eliminated from the occupied space, reducing potential for septic contamination.
11. Comfort levels are better than those of other conditioning systems because radiant loads are treated directly and air motion in space is at normal ventilation levels.
12. Mechanical equipment is not needed at the outside walls, simplifying the wall, floor and structural systems.

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<sup>2</sup> 2004 ASHRAE Handbook HVAC Systems and Equipment. Chapter 6 pp 6.1 – 6.2



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### What About Cold Feet...Warm Head?

Research and testing of radiant panels was carried out in the mid 1950's by ASHRAE (actually called ASHVE at that time). Although this corpus of research is over 35 years old, wives tales about radiant panel technology still persist.

Cold feet? Hardly. Tests have shown that the floors in a room heated by a radiant panel ceiling exhibit temperatures 1 to 2°C (3 to 4°F) above the ambient air temperature and actually provide a source or reradiated heat themselves. In fact, where downdrafts from cold walls or glazing present design challenges with respect to occupant comfort, radiant panels provide a solution. The ceiling panels warm the wall or window surfaces by direct transfer of radiant energy, significantly increasing the temperature of each. It has been found that even under extreme cold wall conditions (27°F, -2.7°C), the air velocities are non-draft in nature (less than 50 fpm or 0.25 m/s)<sup>3</sup>.

And if your head is hot, don't blame it on your radiant panel ceiling. Typically, radiant panel surface temperatures are 170 to 185°F (about 82°C). This can cause the directional mean radiant temperature (DMRT) to be 16 to 20°C (30 to 40°F) above the ambient air temperature. By contrast, on a sunny day, the DMRT outside is 30 to 40°C (50 to 70°F) higher than the ambient air temperature<sup>4</sup>. So, if you enjoy being out in the sunshine, you will enjoy the indoor warmth of a radiant panel ceiling.

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<sup>3</sup> Schutrum and Min, "Cold Wall Effects in a Ceiling-panel Heated Room". ASHVE Transactions, vol. 63, 1957.

<sup>4</sup> Fanger, P.O.: Thermal Comfort - Analysis and Applications in Environmental Engineering. Danish Technical Press, Copenhagen, 1970.



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### Where Is This Technology Used?

Radiant panel technology is applicable in a wide variety of building environments, most notably it is well suited for hospital patient rooms and laboratories. Radiant panels provide a silent, draft-free, thermally stable environment for sedentary patients and require no mechanical equipment or bacteria/virus collectors in the heated space. This is of extreme importance in a hospital or laboratory setting where maintenance of an aseptic environment is crucial. It has been shown that the elimination of baseboard convectors alone can reduce bacterial growth in a space by over 40%<sup>5</sup>.

Radiant panel ceiling systems are not just for hospital and laboratories. The leasable space reclaimed by eliminating 6 to 8 inches of baseboard convectors around the entire perimeter of every floor of an office building can mean significantly increased earnings for the commercial owner. Also, with ceiling panels, leased areas can be easily re-partitioned since there is no wall fin to build around. Most importantly, with no mechanical equipment in the occupied space, radiant ceiling panels are almost maintenance free.

Radiant panels can also be the ideal retrofit. In areas where lay-in acoustic ceiling tiles are used, radiant panels can provide heat that is architecturally invisible. With the hot water supply piping already in the ceiling space, the panel installation is very straightforward:

1. Remove an existing acoustic ceiling tile.
2. Make two plumbing connections to the hot water supply and hot water return pipes.
3. Lay the radiant ceiling panel in the same T-Bar opening.

There are no risers to run and no cabinets to paint. In fact, once silk-screened to match the pattern of the existing ceiling tiles, the radiant heating panels are almost indistinguishable from the surrounding ceiling design.

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<sup>5</sup> Byar, Brown and Shaffer, "Radiant Ceilings tested for Bacterial Count", The Modern Hospital, June 1966.



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**Where Can I Find Out More About Radiant Ceiling Systems?**

Design guidelines for radiant panel ceiling systems are included in this catalogue and in the 2004 ASHRAE HANDBOOK (Chapter 6). Also, radiant panel product information and design assistance is available from the manufacturer and agents throughout the United Kingdom, Canada and the U.S.

For further information contact our nearest agent:

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## 2. TESTING



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## Testing

All Price Twa radiant panels are independently tested for heat output by B.S.R.I.A. in Bracknell, Berkshire, England (EN442 testing) and the University of Stuttgart in Germany (EN14037 testing). The latest tests have been conducted as of November 2006 with written documentation.

### Objective

The objective was to determine the thermal performance of every Price Twa radiant panel in the heating mode.

### Testing

Determination of the thermal output to EN14037. Differing from the requirements in EN14037 the following conditions applied:

- The inner surface of the test room ceiling was covered with a joint-sealed thermal insulation of 100mm thickness.
- The top parts of the inner test room surfaces (height 360mm) were covered with a joint-sealed thermal insulation of 100mm layer thickness.
- Lower test temperature range
- Measuring points for the reference temperature and for air temperatures.
- For the L-24-W radiant panel a standard t-bar ceiling grid was installed.

Inside dimensions of the room:

- Length = 4.1m
- Width = 4.0m
- Height = 2.875m

Distance between test object surface and floor:

- 2.575m

The initial test consisted of suspending the panel from the ceiling and testing with hot water at three different temperatures. The panel was insulated on the top surface by a 6mm thick layer of r-foil insulation.

The L-24-W test consisted of suspending the panel within a standard t-bar ceiling grid and testing with hot water at three different temperatures. The panel was insulated on the top surface by a 6mm thick layer of r-foil insulation.

**A full copy of the Price Twa EN442 and EN14037 test results can be provided upon request**



### **3. Designing with radiant panels**





## 4. Linear Heating Panels



## Description

Linear panels are an established approach to radiant heating. The linear panel is an extruded aluminium radiant heating strip that provides exceptionally high heat transfer. Linear panels are available in virtually any width and length up to a maximum of 4800mm. This product, while offering an up-to-date visual appearance, is suitable for both ceiling or wall mounting. Linear panels are also available with a range of mounting accessories providing flexible setup.

## Advantages

The system is easily designed into any heating scheme with few dimensional constraints. Installation is straightforward and, as found through independent tests, the heat output of linear panels is equal to or better than other radiant heating products.

## Applications

Linear panels can be used in hospitals, nursing homes, daycares, commercial office developments, schools, museums, security facilities, airports, churches, banks, condominiums, laboratories, swimming pools, factories and workshops.

## Material Specification

The aluminium planks incorporate a tube saddle channel as an integral part of the profile. The copper tube is seated into this channel and held in direct thermal contact with the extrusion. A non-hardening heat paste between copper and aluminium ensures even heat distribution to the active panel providing overall thermal efficiency.

Panel planks are tongue-and-groove to provide a clean joint longitudinally. They are held together using a special clamping system.

## Dimensions and Weight

Linear panels can be provided in single panel lengths of up to 4200mm and multiple panel lengths of up to 30000mm. Aluminium linear panels have a dry weight of 8.38 kg/m<sup>2</sup> and an operating weight of 10.73 kg/m<sup>2</sup> which should be used when calculating the requirements for clamping and suspension components.

## Materials of construction

Pipework:	16mm o.d. copper tube. 15mm o. d. Copper connections.
Panels:	Extruded aluminium planks with profile face design.
Panel Joint Strips:	Cadmium or zinc-plated steel springs.
Panel Suspension Clips:	Cadmium or zinc-plated steel springs.
Pipework Clips:	Cadmium or zinc-plated steel springs.
Cross Brace:	Extruded aluminium 38mm x 19mm x 1.6mm
Colour:	Standard colour is an off-white electrostatic polyester powder coating.
Suspension System:	Standard t-bar or drywall installation. The panels can be suspended with or without a frame for custom applications.
Insulation:	R-foil supplied and factory installed by Twa Panel Systems Inc.



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## LINEAR RADIANT PANEL SPECIFICATION

### 1.0 General

#### 1.1 Scope of Work

- .1 To provide a complete extruded linear panel system as per plans and specifications.

#### 1.2 Approved Equals

- .1 Manufacturer: Twa Panel Systems, Inc.
- .2 Alternate manufacturers will not differ from Twa Panel Systems, Inc. with regard to number of tube rows, water pressure drops, piping connections and such features as surface finish and cleanability.

#### 1.3 Quality Assurance

- .1 The mechanical contractor shall furnish all labour, materials, tools, equipment, appliances and services necessary to deliver and install all radiant panels as defined. The mechanical contractor will be solely responsible for providing radiant panels dimensions to the radiant panel manufacturer.
- .2 Supplier shall submit complete shop drawings showing layouts, fixing details and piping details of all areas where radiant panels are indicated. These drawings shall be coordinated with, and interference cleared with other trades.

### 2.0 Product

#### 2.1 Linear Radiant Panels

- .1 Constructed of extruded aluminium planks.
- .2 Width and number of tubes as per design specifications.
- .3 Tube saddle shall be an integral part of the aluminium plank.
- .4 Each panel shall be factory supplied in standard white polyester powder coat.
- .5 Circulation tubing shall be 16 mm (5/8") O.D. round tubing mechanically fastened to the plank. A non-hardening heat transfer paste is required between the tubing and the aluminium saddle.
- .6 Planks shall interlock using tongue and groove connection and be held together using aluminium or steel cross channels with spring clips.
- .7 All plank interlocking to be done at the factory with return copper coil factory installed prior to going on site. No site assembly permitted.
- .8 Copper coil is to be continuous. If the manufacturer cannot supply a continuous coil, then return bends must be factory installed and a pressure test report must be submitted to the Mechanical Consultant.
- .9 The length of the panels shall be based on lengths supplied by the Mechanical Contractor. The factory to allow for expansion before the final cut. No site cutting allowed.
- .10 Panel performance shall be that of Frenger linear ceiling panel manufactured by Twa Panel Systems, Inc. of Nisku, Alberta. Capacities of installed panels shall be as called in the specifications and shown on the drawing.



### 3.0 Mechanical Equipment Schedule

#### 3.1 Linear Radiant Panels

- .1 Manufacturer: Twa Panel Systems, Inc.
- .2 Model: Linear
- .3 Performance: BTUH per lineal foot - Watts per lineal metre
- .4 Width: Specify
- .5 Length: Wall to wall or specify
- .6 Output based on Mean Water Temperature of \_\_\_\_°F or \_\_\_\_°C and Room Temperature of 70°F or 21°C.
- .7 The maximum water pressure drops shall be in accordance with the following:  
Flow of:           0.5 gpm -pressure drop over 100 feet of tube = 1/2 ft  
                      1.0 gpm -pressure drop over 100 feet of tube = 2 ft  
                      2.0 gpm -pressure drop over 100 feet of tube = 7 ft  
                      2.5 gpm -pressure drop over 100 feet of tube = 10 ft  
                      3.0 gpm -pressure drop over 100 feet of tube = 14 ft

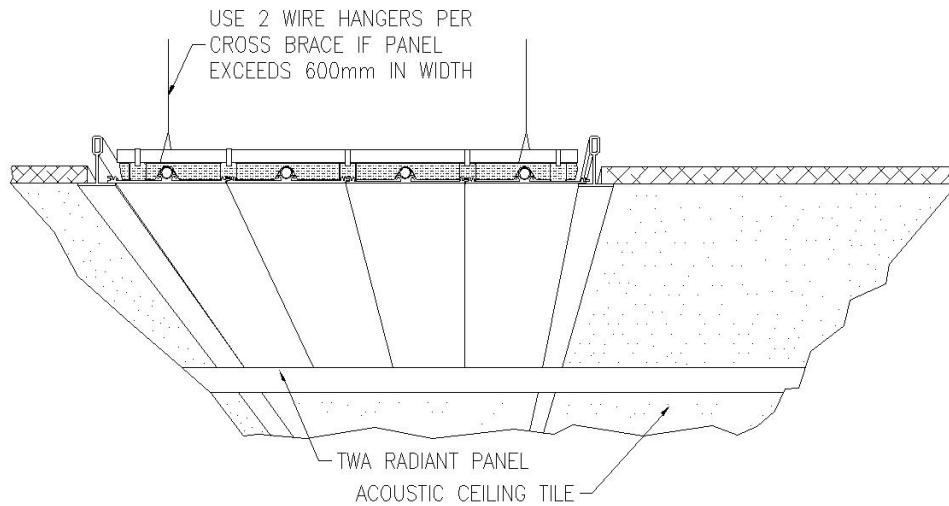
#### 4.0 Installation

- .1 The mechanical contractor shall cooperate with other trades working in the ceiling area to achieve a neat and well coordinated installation.
- .2 All support mouldings shall be the responsibility of Division 9 unless specialized application is required. All wall mouldings shall be mitred with cross tees installed flush. Perimeter moulding to be extruded aluminium - minimum 25 gauge. Ensure ceiling openings and wall mouldings are installed as per radiant panel shop drawings.
- .3 Twa Panel Systems, Inc. supplied inter-connectors must be used to connect panels installed in series. Soft copper or pigtail type connectors will not be acceptable.
- .4 Connection to supply, return piping with 16 mm (5/8") O.D. soft copper.
- .5 All panels to be covered by minimum 25 mm (1") foil backed insulation after connection and testing of panels is complete. Insulation by responsible trade.
- .6 All system piping shall be thoroughly cleaned and flushed before connecting to radiant panels.
- .7 All radiant panels to be pneumatically tested as per Engineer's specifications, before being filled.
- .8 Minimum of one hanger wire for safety and seismic restraint per crossbrace. Minimum of 2 per panel.
- .9 All radiant panels shall be installed by personnel wearing clean white gloves.



## T-Bar mounted linear heating panel

Reference: L-24-W



### Description

The L-24-W linear radiant panels have been designed to fit in a standard t-bar ceiling grid. Panels can be manufactured in one piece up to a length of 4200mm (4195mm) and are supplied with t-bar fixing clips to hold the panels into the grid, insulation, touch-up paint and white cotton gloves (for installation). It is recommended that all panels are fitted using wire hangers so that the ceiling grid doesn't have to support the full weight of the panels.

### Linear output table

Width (mm)	#Tubes (Passes)	Mean Water Temperature (°C)							
		45	50	55	60	65	70	75	80
600	4	150	187	201	258	294	336	367	406
600	6	156	195	209	269	308	350	386	427
600	8	163	204	217	281	323	364	406	448

### Notes

Outputs expressed in watts per linear metre and are based on 21°C room temperature. For every 1°C decrease in temperature below 21°C, the output increases by 2%.

600 x 600 (595 x 595) panels are only available with 4 tube passes.

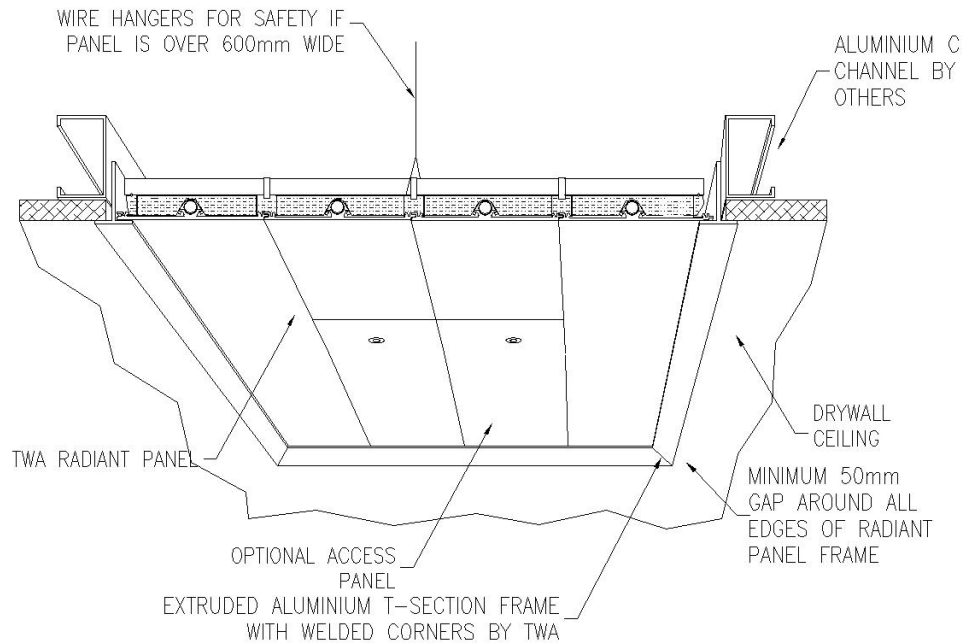
All outputs stated are radiant output only.

**All of the above panels have been tested to EN14037-1 at the University of Stuttgart.**



## Plasterboard mounted linear heating panel with integrated access panel

Reference: L-30-W



### Description

The L-30-W linear radiant panels have been designed to fit flush in a standard plasterboard ceiling and include an integrated access panel for access to the flow and return connections. Panels can be manufactured in one piece up to a length of 4200mm and are supplied with fixing frame, insulation, touch-up paint and white cotton gloves (for installation). Panel frames are to be fixed to independent supports (by others) on the back of the plasterboard ceiling. The panels then drop into the frames like they would in a t-bar ceiling grid.

### Installation Instructions

Framed panels by Price Twa require careful handling and installation. The opening must be parallel and square. Do not over-torque screws to compensate for improper opening preparation as this will distort the panel frame. The required frame & panel opening is indicated on the panel schedule. Allowances will be made for the frame & panel to fit this size of opening. The radiant panel must be held back a minimum of 50mm from all walls.



## L-30-W Continued

### Linear output table

Width (mm)	#Tubes (Passes)	Mean Water Temperature (°C)							
		45	50	55	60	65	70	75	80
300	2	74	91	98	146	158	182	217	231
300	4	81	99	108	160	174	200	238	254
450	4	101	124	135	200	218	250	297	318
450	6	114	140	151	222	242	285	329	352
600	4	150	187	201	258	294	336	367	406
600	6	156	195	209	269	308	350	386	427
600	8	163	204	217	281	323	364	406	448
750	6	179	224	238	309	355	400	446	501
750	8	188	235	249	324	373	420	468	530
750	10	197	247	261	340	392	441	491	560
900	8	221	277	292	381	439	494	549	636
900	10	228	285	301	392	452	508	565	653
900	12	235	293	310	403	466	523	581	671

### Notes

Outputs expressed in watts per linear metre and are based on 21°C room temperature. For every 1°C decrease in temperature below 21°C, the output increases by 2%.

600 x 600 panels are only available with 4 tube passes.

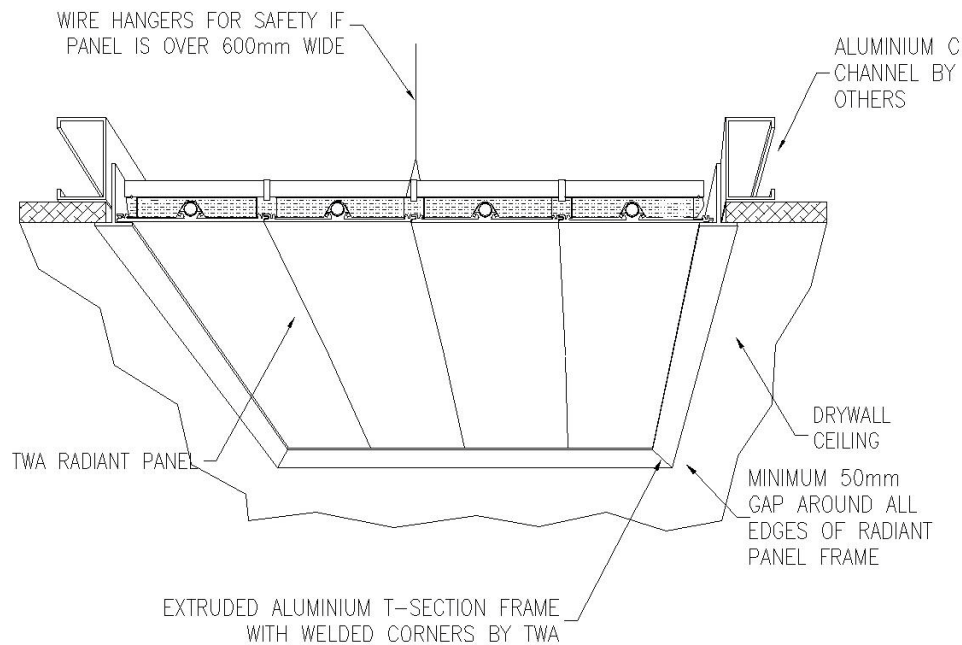
All outputs stated are radiant output only.

**All of the above panels have been tested to EN14037-1 at the University of Stuttgart.**



## Plasterboard mounted linear heating panel

Reference: L-30-2-W



### Description

The L-30-2-W linear radiant panels have been designed to fit flush in a standard plasterboard ceiling. Panels can be manufactured in one piece up to a length of 4200mm and are supplied with fixing frame, insulation, touch-up paint and white cotton gloves (for installation). Panel frames are to be fixed to independent supports (by others) on the back of the plasterboard ceiling. The panels then drop into the frames like they would in a t-bar ceiling grid.

### Installation Instructions

Framed panels by Price Twa require careful handling and installation. The opening must be parallel and square. Do not over-torque screws to compensate for improper opening preparation as this will distort the panel frame. The required frame & panel opening is indicated on the panel schedule. Allowances will be made for the frame & panel to fit this size of opening. The radiant panel must be held back a minimum of 50mm from all walls.



## L-30-2-W Continued

### Linear output table

Width (mm)	#Tubes (Passes)	Mean Water Temperature (°C)							
		45	50	55	60	65	70	75	80
300	2	74	91	98	146	158	182	217	231
300	4	81	99	108	160	174	200	238	254
450	4	101	124	135	200	218	250	297	318
450	6	114	140	151	222	242	285	329	352
600	4	150	187	201	258	294	336	367	406
600	6	156	195	209	269	308	350	386	427
600	8	163	204	217	281	323	364	406	448
750	6	179	224	238	309	355	400	446	501
750	8	188	235	249	324	373	420	468	530
750	10	197	247	261	340	392	441	491	560
900	8	221	277	292	381	439	494	549	636
900	10	228	285	301	392	452	508	565	653
900	12	235	293	310	403	466	523	581	671

### Notes

Outputs expressed in watts per linear metre and are based on 21°C room temperature. For every 1°C decrease in temperature below 21°C, the output increases by 2%.

600 x 600 panels are only available with 4 tube passes.

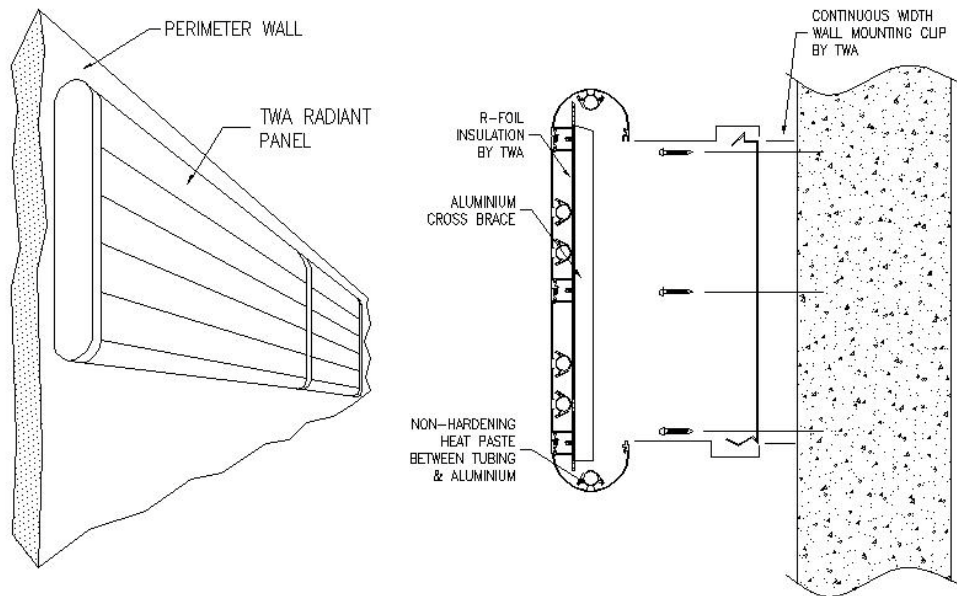
All outputs stated are radiant output only.

**All of the above panels have been tested to EN14037-1 at the University of Stuttgart.**



## Surface wall mounted linear heating panel

Reference: L-35-5-W

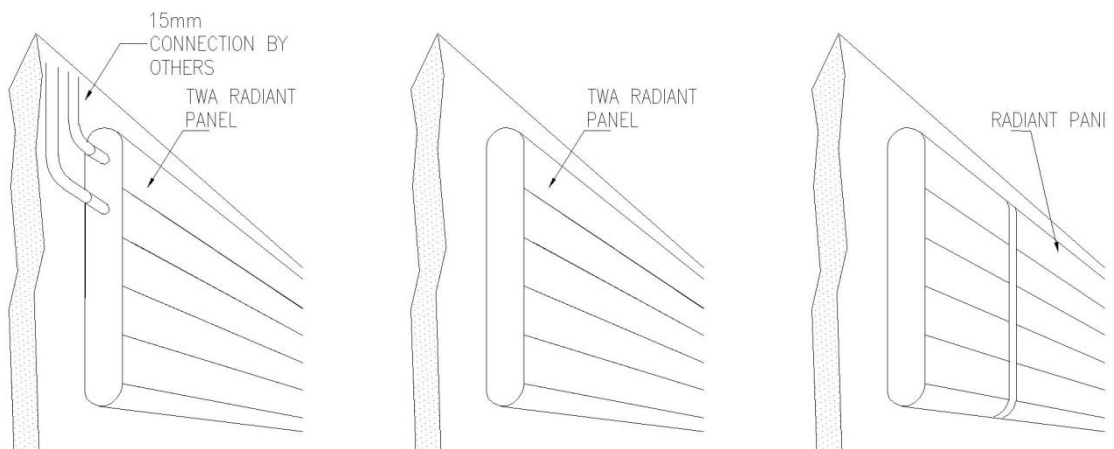


### Description

The L-35-5-W linear radiant panels have been designed to be surface wall mounted and can be supplied with or without an access panel. Panels can be manufactured in one piece up to a length of 4200mm and are supplied with fixing brackets, insulation, touch-up paint and white cotton gloves (for installation).

### Options

L-35-5-1-W = External Connections L-35-5-2-W = Internal Connections L-35-5-3-W = Access Panel



## L-35-5-W Continued

### Linear output table

Width (mm)	#Tubes (Passes)	Mean Water Temperature (°C)							
		45	50	55	60	65	70	75	80
450	4	101	124	135	200	218	250	297	318
600	4	150	187	201	258	294	336	367	406
600	6	156	195	209	269	308	350	386	427
750	6	179	224	238	309	355	400	446	501
750	8	188	235	249	324	373	420	468	530
900	8	221	277	292	381	439	494	549	636
900	10	228	285	301	392	452	508	565	653
1050	10	258	322	341	443	513	575	639	743
1050	12	266	332	351	456	528	592	658	763
1200	12	296	368	389	506	586	658	732	849
1200	14	305	379	400	521	603	677	754	872
1350	12	334	413	437	568	658	739	823	955
1350	14	344	425	450	585	677	761	848	982

### Notes

Outputs expressed in watts per linear metre and are based on 21°C room temperature. For every 1°C decrease in temperature below 21°C, the output increases by 2%.

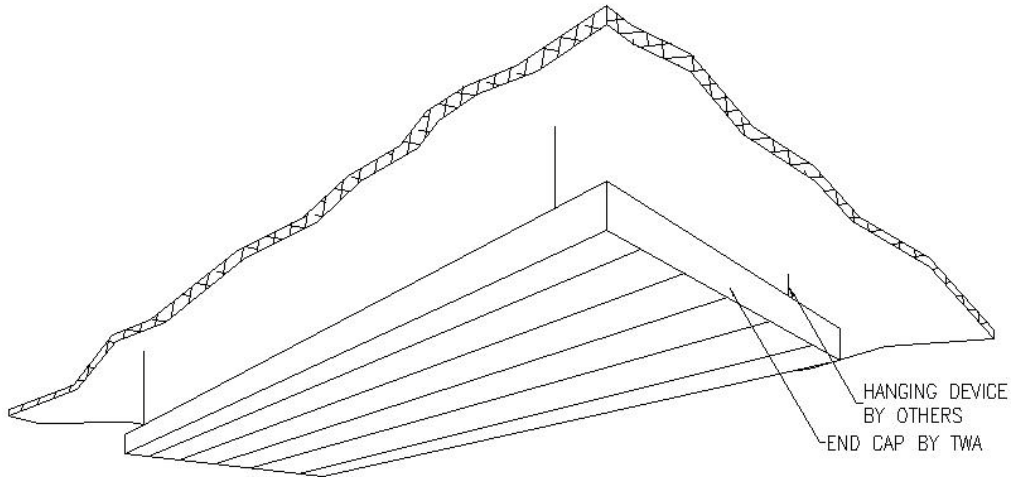
All outputs stated are radiant output only.

**All of the above panels have been tested to EN14037-1 at the University of Stuttgart.**



## Square edged free hanging linear heating panel

Reference: L-36-SQ-W



### Description

The L-36-SQ-W linear radiant panels have been designed to be free hung in spaces with no ceilings. A number of different suspensions can be used to mounted the panels including wire hanger, chains etc. Panels can be manufactured in one piece up to a length of 4200mm and are supplied with insulation, touch-up paint and white cotton gloves (for installation).

When panel lengths are required over 4200mm then panels are butted together and flexible copper interconnectors are supplied to connect the panels together. 50mm aluminium cover strips are included to cover the joints where the panels butt together.

### Options

- Standard aluminium top covers
- Sloping aluminium top covers
- Surface mount brackets to mount the panels directly to the underside of a plasterboard ceiling



## L-36-SQ-W Continued

### Linear output table

Width (mm)	#Tubes (Passes)	Mean Water Temperature (°C)							
		45	50	55	60	65	70	75	80
450	4	101	124	135	200	218	250	297	318
600	4	150	187	201	258	294	336	367	406
600	6	156	195	209	269	308	350	386	427
750	6	179	224	238	309	355	400	446	501
750	8	188	235	249	324	373	420	468	530
900	8	221	277	292	381	439	494	549	636
900	10	228	285	301	392	452	508	565	653
1050	10	258	322	341	443	513	575	639	743
1050	12	266	332	351	456	528	592	658	763
1200	12	296	368	389	506	586	658	732	849
1200	14	305	379	400	521	603	677	754	872
1350	12	334	413	437	568	658	739	823	955
1350	14	344	425	450	585	677	761	848	982

### Notes

Outputs expressed in watts per linear metre and are based on 21°C room temperature. For every 1°C decrease in temperature below 21°C, the output increases by 2%.

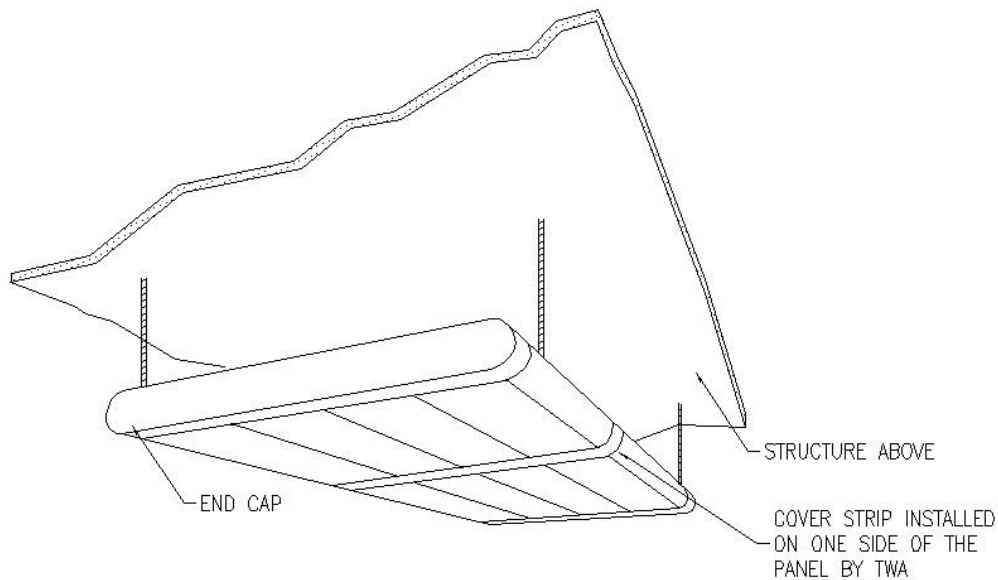
All outputs stated are radiant output only.

**All of the above panels have been tested to EN14037-1 at the University of Stuttgart.**



## Round edged free hanging linear heating panel

Reference: L-36-BN-W



### Description

The L-36-BN-W linear radiant panels have been designed to be free hung in spaces with no ceilings. A number of different suspensions can be used to mounted the panels including wire hanger, chains etc. Panels can be manufactured in one piece up to a length of 4200mm and are supplied with insulation, touch-up paint and white cotton gloves (for installation).

When panel lengths are required over 4200mm then panels are butted together and flexible copper interconnectors are supplied to connect the panels together. 50mm aluminium cover strips are included to cover the joints where the panels butt together.

### Options

- Standard aluminium top covers
- Sloping aluminium top covers
- Surface mount brackets to mount the panels directly to the underside of a plasterboard ceiling



## L-36-BN-W Continued

### Linear output table

Width (mm)	#Tubes (Passes)	Mean Water Temperature (°C)							
		45	50	55	60	65	70	75	80
450	4	101	124	135	200	218	250	297	318
600	4	150	187	201	258	294	336	367	406
600	6	156	195	209	269	308	350	386	427
750	6	179	224	238	309	355	400	446	501
750	8	188	235	249	324	373	420	468	530
900	8	221	277	292	381	439	494	549	636
900	10	228	285	301	392	452	508	565	653
1050	10	258	322	341	443	513	575	639	743
1050	12	266	332	351	456	528	592	658	763
1200	12	296	368	389	506	586	658	732	849
1200	14	305	379	400	521	603	677	754	872
1350	12	334	413	437	568	658	739	823	955
1350	14	344	425	450	585	677	761	848	982

### Notes

Outputs expressed in watts per linear metre and are based on 21°C room temperature. For every 1°C decrease in temperature below 21°C, the output increases by 2%.

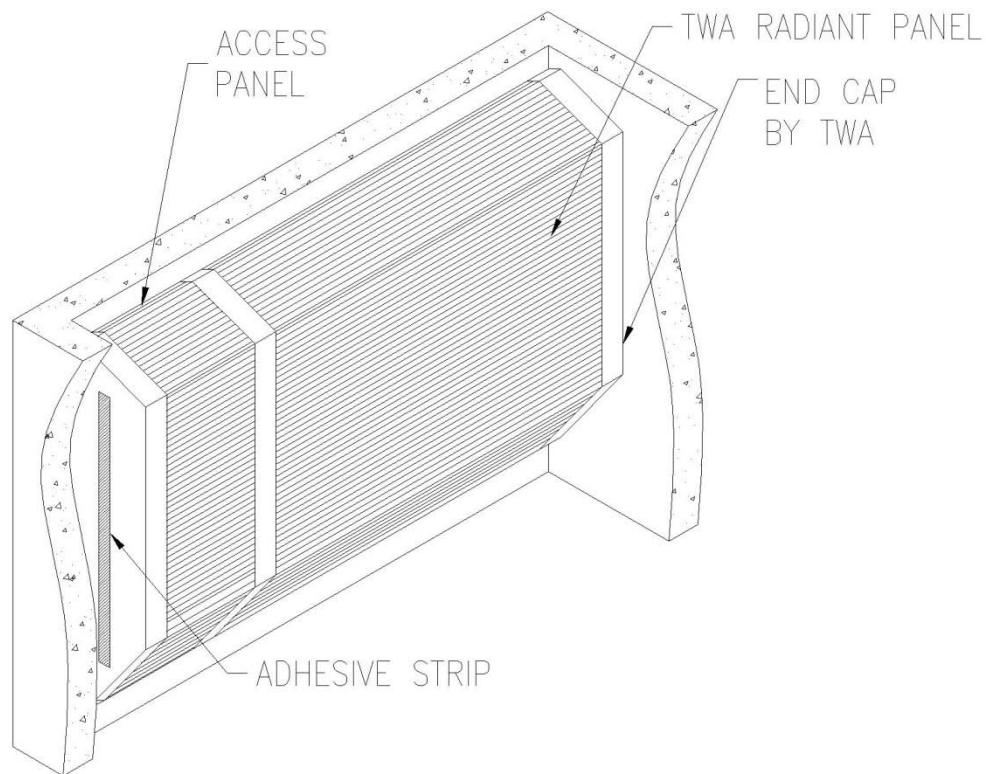
All outputs stated are radiant output only.

**All of the above panels have been tested to EN14037-1 at the University of Stuttgart.**



## Wall mounted gymnasium linear heating panel

Reference: L-39-W



### Description

The L-39-W linear radiant panels have been designed specifically for gymnasiums and sports halls. With sloping tops and bottoms they have been built so that balls and shuttlecocks are unable to get trapped on the panels. Panels can be manufactured in one piece up to a length of 4200mm and are supplied with insulation, touch-up paint and white cotton gloves (for installation).

When panel lengths are required over 4200mm then panels are butted together and flexible copper interconnectors are supplied to connect the panels together. 50mm aluminium cover strips are included to cover the joints where the panels butt together.

### Options

- 100mm deep
- 152mm deep – Designed so that mains pipes can be hidden behind the panels



## L-39-W Continued

### Linear output table

Width (mm)	#Tubes (Passes)	Mean Water Temperature (°C)							
		45	50	55	60	65	70	75	80
450	4	101	124	135	200	218	250	297	318
600	4	150	187	201	258	294	336	367	406
600	6	156	195	209	269	308	350	386	427
750	6	179	224	238	309	355	400	446	501
750	8	188	235	249	324	373	420	468	530
900	8	221	277	292	381	439	494	549	636
900	10	228	285	301	392	452	508	565	653
1050	10	258	322	341	443	513	575	639	743
1050	12	266	332	351	456	528	592	658	763
1200	12	296	368	389	506	586	658	732	849
1200	14	305	379	400	521	603	677	754	872
1350	12	334	413	437	568	658	739	823	955
1350	14	344	425	450	585	677	761	848	982

### Notes

Outputs expressed in watts per linear metre and are based on 21°C room temperature. For every 1°C decrease in temperature below 21°C, the output increases by 2%.

All outputs stated are radiant output only.

**All of the above panels have been tested to EN14037-1 at the University of Stuttgart.**



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## OPERATION AND MAINTENANCE

Linear panels are incorporated into a building's heating systems and will remain trouble free provided the following procedures are followed and inspections performed during start up and maintenance.

### Operation

Heating mains should be flushed prior to connection to the radiant panels. After connection, the hydronic system should be flushed again and then dry pressure tested to isolate any leaks. Any remaining air should be vented from the system and boiler temperature should be brought up gradually.

### Maintenance

Apart from cleaning any strainers, little maintenance should be required on the pipework system. Any descaling of pipework should be carried out in the same way as for other hydronic heating systems. The panels are robust and should resist damage. If for some reason a panel has been damaged, the pipework should be inspected to ensure that no clips have been displaced and that extruded planks are still securely fastened.

### Cleaning

The surface of linear panels is best cleaned using an industrial vacuum cleaner to remove dust. However, if the panels become soiled they should be cleaned using a damp cloth and mild detergent.

### Handling

Price Twa linear panels are finished with a polyester powder coating. The panel surface must not come in contact with bare skin as perspiration or grease from an ungloved hand can potentially leave a mark on the panel.

Installation personnel must wear clean white gloves when handling the radiant panels.

Use a heat pad between the radiant panel and the copper pipe when making solder connections. Excessive heat can damage the paint finish.

### Touch-up Paint

- Ensure surface is clean and dust free.
- Using a fine grit sand paper (200 or greater) feather the edges surrounding the damaged area.
- Shake the spray bomb to ensure paint is thoroughly mixed.
- Maintaining a distance of 150 to 200mm give the damaged area a light dusting.
- Apply 3 to 4 light coats while increasing the area in which paint is applied with each pass. Let dry between coats.



## 5. Security Heating Panels



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**Description**

Security panel is a new concept in radiant heating panels. It is a smooth faced radiant panel designed and constructed to form a building feature in accordance with architectural requirements. The product can be highlighted to form an architectural feature or more typically, blended into the structure to become a hidden source of efficient heating.

**Advantages**

Security ceiling panel system has proven to be the most economical method of heating high security areas. The security panel system is extremely flexible, yet is damage and vandal resistant while being virtually maintenance free.

**Applications**

Security panels are used for psychiatric assessment areas in hospitals, youth detention centres, prisons, holding cells, and military police stations.

**Material Specification**

The security panel system is a custom designed system that can be recessed or surface mounted in or on columns, walls or ceilings. Hot water supply temperature may be varied depending on the heating performance required. Insulation on the coil or inactive side increases radiant heat transfer.

Panels are fabricated from steel or aluminium plates. Temperature control is as for other hydronic systems; panels may be controlled individually or in zones with control and shut off valves set outside secured areas for easier maintenance. Thermostatic controls allow areas of a building to be heated as desired. Controls are by others.

**Dimensions and Weight**

The panels are individually designed for a specific installation and are offered in widths of up to 1200mm with a maximum panel length of 3000mm. Weight of the operating system is dependent on the design of the system and material used but does not exceed 37 kg/m<sup>2</sup>.

**Materials of Construction**

Pipework:	16mm o.d. copper tube.
Pipework Attachment System:	The coil is clipped to an extruded aluminium heat saddle using plated spring steel clips. The aluminium heat saddle is attached to the panel with steel studs. Heat transfer paste is used at the interface between the aluminium heat saddle and both the steel plate and the tubing.
Panels:	Steel or aluminium security panel system. The radiant panel can be supplied with edges formed to suit the individual installation. Non radiating "in fill" panels can be supplied to form a continuous covering for the wall, column or ceiling.
Paint Finish:	Standard colour is an off-white electrostatic polyester powder coating.
Insulation:	R-foil can be supplied and installed by the factory if specified.



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## Outputs

Steel Outputs	
Mean Water Temp (°C)	Panel Output W/m <sup>2</sup>
65.6	460
68.3	490
71.1	520
73.9	545
76.7	580
79.4	615
82.2	640
85.5	680
87.8	710
90.6	745
93.3	770
96.1	805
98.9	840

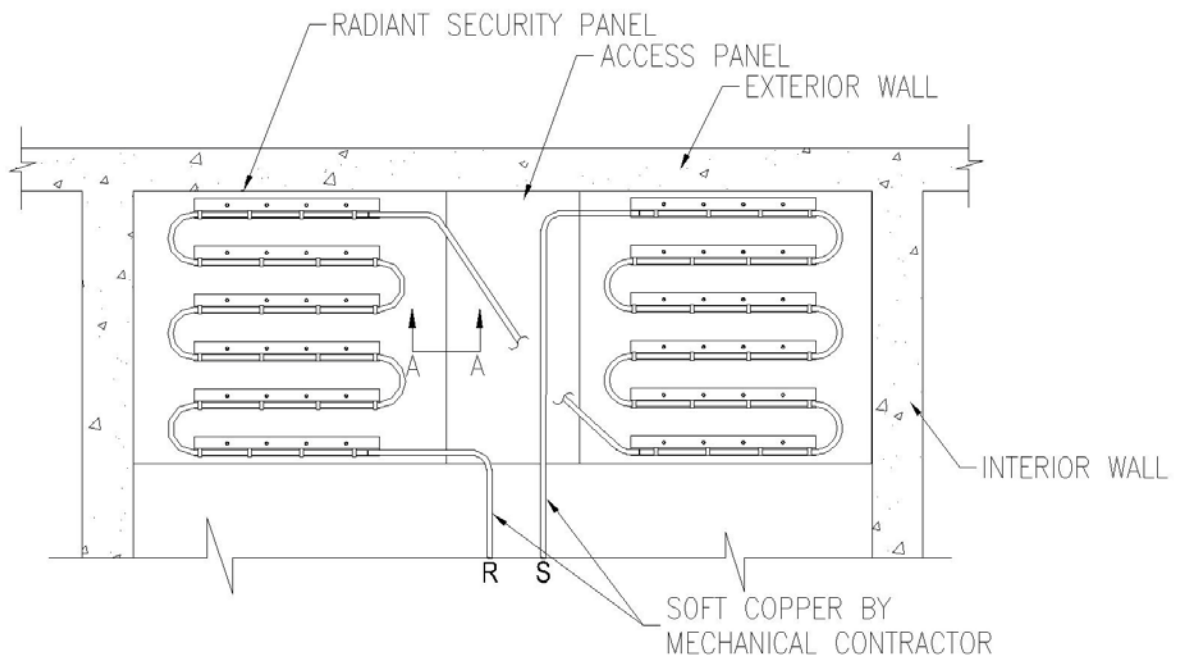
Aluminium Outputs	
Mean Water Temp (°C)	Panel Output W/m <sup>2</sup>
65.6	491
68.3	519
71.1	551
73.9	577
76.7	614
79.4	652
82.2	678
85.5	721
87.8	752
90.6	790
93.3	816
96.1	853
98.9	890

Outputs expressed in Watts/metre<sup>2</sup> of panel and are based on 21°C room temperature and 150mm coil centres. For every 1°C decrease in temperature below 21°C, the output increases by 2%.

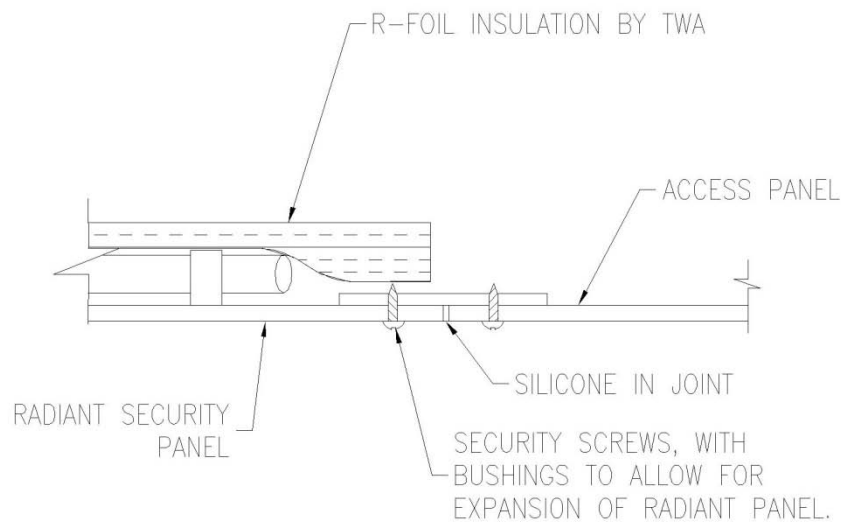
**All of the above outputs are based on tests carried out to EN14037-1 at the University of Stuttgart.**



## Access panel and piping details



Note: Due to weight of panels, two security panels supplied with access panel for ease of installation.

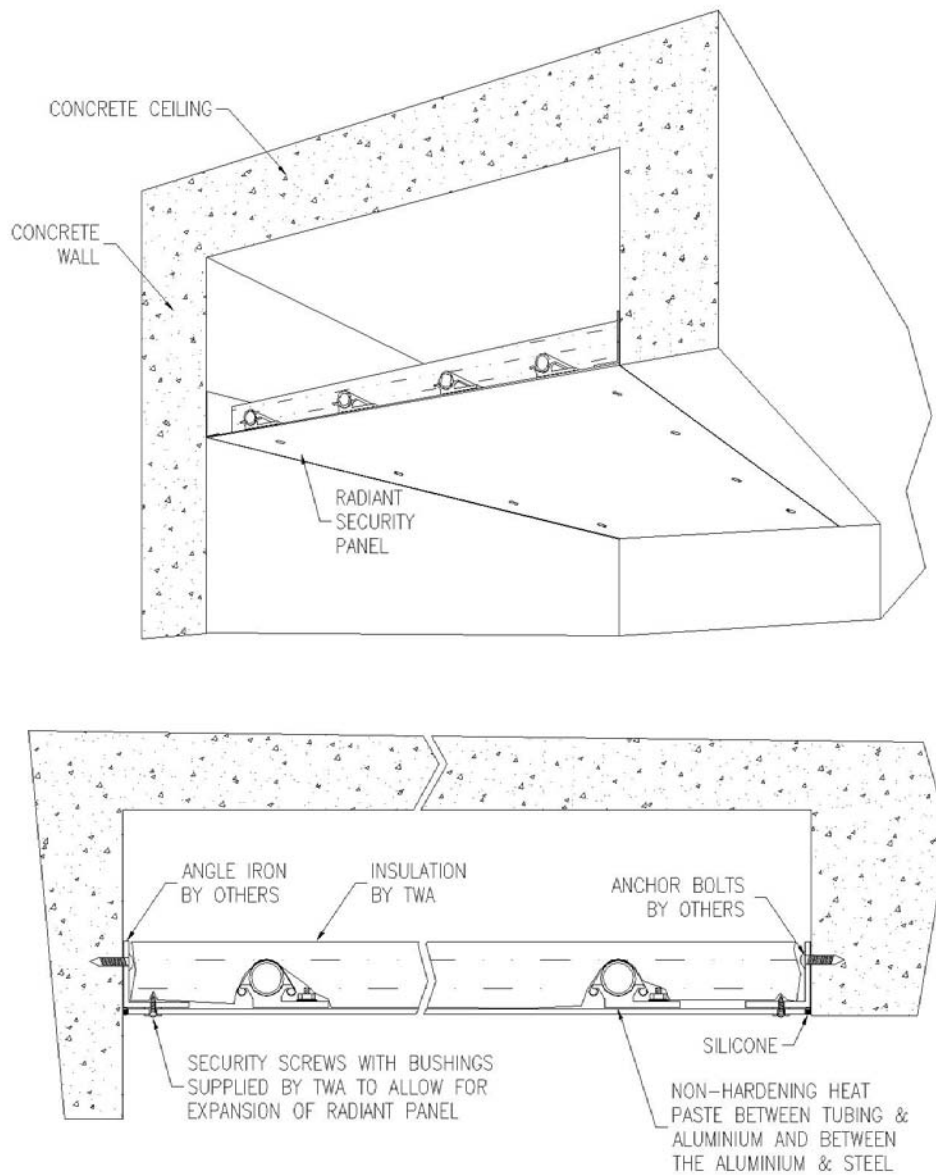


Section A-A: Typical interface between panel and access panel.



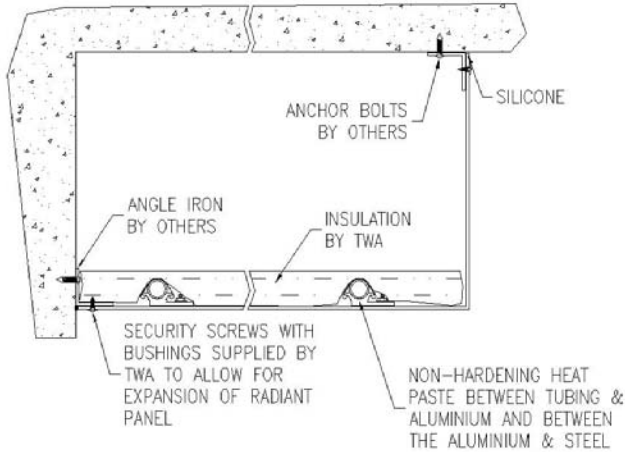
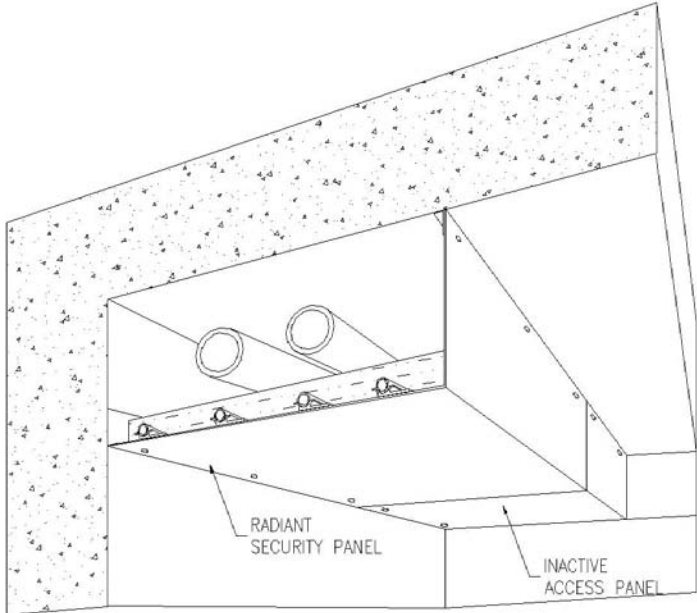
## Flush mounted security heating panel

Reference: S-6-W



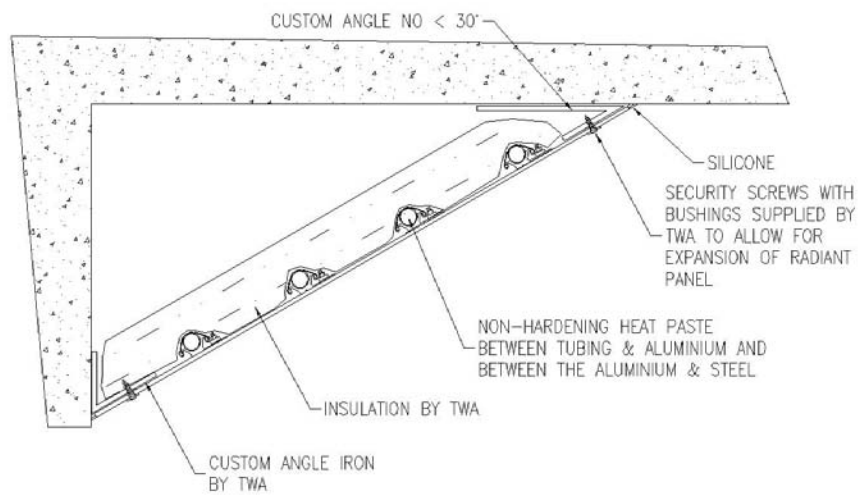
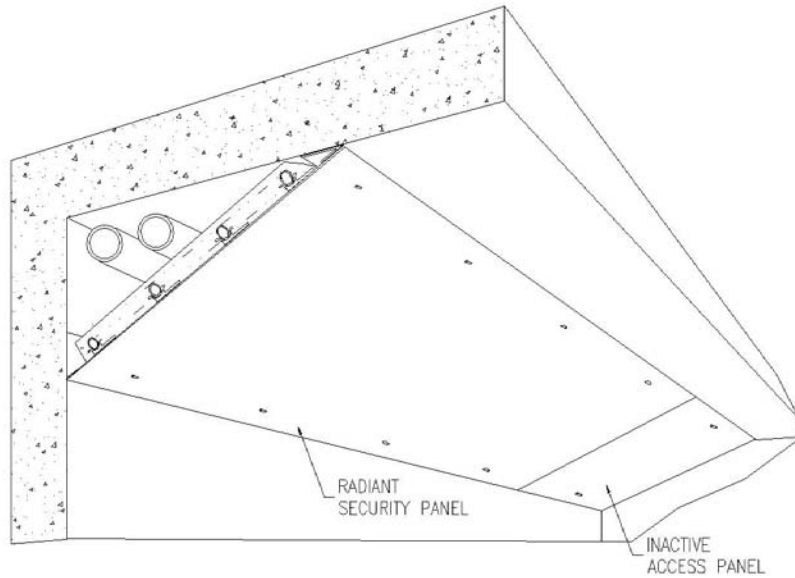
Surface mounted security heating panel

Reference: S-7-W

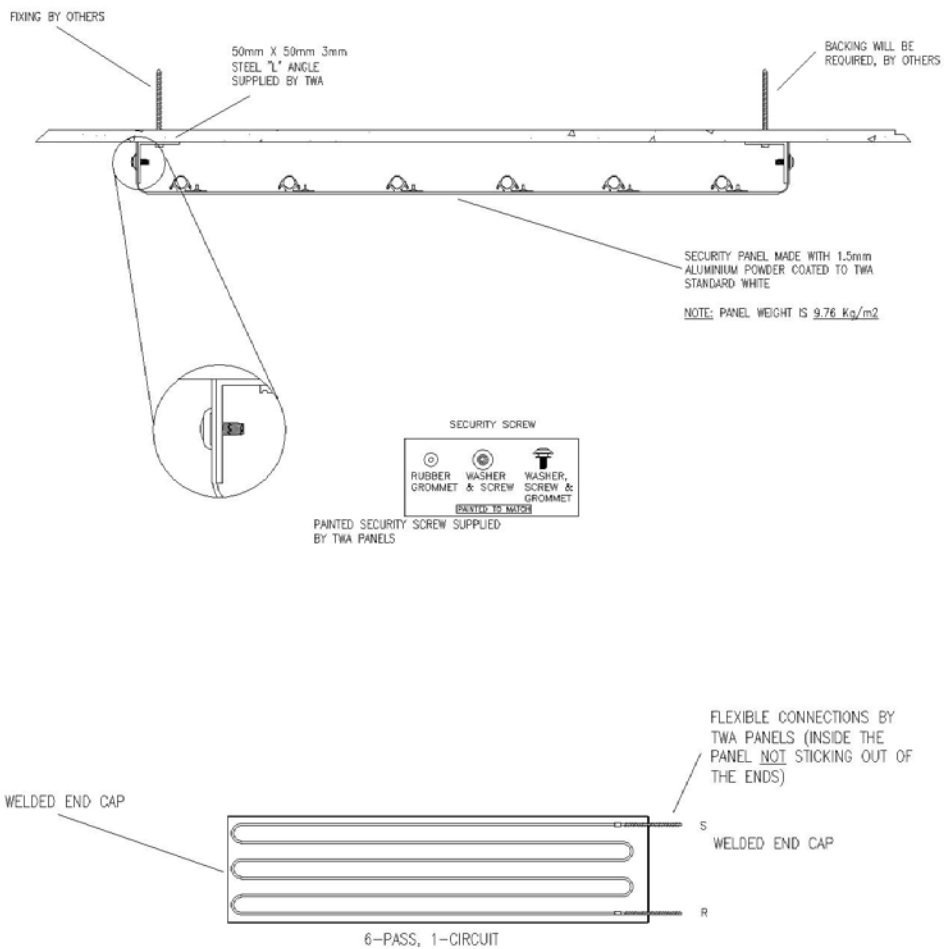


## Angle mounted security heating panel

Reference: S-8-W



**Surface mounted security heating panel for high risk areas**  
**Reference: S-10-W**



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## OPERATION AND MAINTENANCE

Security panels are incorporated into a building's heating systems and will remain trouble free provided the following procedures are followed and inspections performed during start up and maintenance.

### Operation

Heating mains should be flushed prior to connection to the radiant panels. After connection, the hydronic system should be flushed again and then dry pressure tested to isolate any leaks. Any remaining air should be vented from the system and boiler temperature should be brought up gradually.

### Maintenance

Apart from cleaning any strainers, little maintenance should be required on the pipework system. Any descaling of pipework should be carried out in the same way as for other hydronic heating systems. The panels are robust and should resist damage. If for some reason a panel has been damaged, the pipework should be inspected to ensure that no clips have been displaced and that extruded planks are still securely fastened.

### Cleaning

The surface of linear panels is best cleaned using an industrial vacuum cleaner to remove dust. However, if the panels become soiled they should be cleaned using a damp cloth and mild detergent.

### Handling

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Installation personnel must wear clean white gloves when handling the radiant panels.

Use a heat pad between the radiant panel and the copper pipe when making solder connections. Excessive heat can damage the paint finish.

### Touch-up Paint

- Ensure surface is clean and dust free.
- Using a fine grit sand paper (200 or greater) feather the edges surrounding the damaged area.
- Shake the spray bomb to ensure paint is thoroughly mixed.
- Maintaining a distance of 150 to 200mm give the damaged area a light dusting.
- Apply 3 to 4 light coats while increasing the area in which paint is applied with each pass. Let dry between coats.



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