

# 25 Year Guarantee

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Independently tested  
to EN 14037:2015 at  
HLK Stuttgart

*the future of space conditioning*

## Modula Standard Performance

## radiant heating panel



### Application

Commercial, hospitals, hotels, schools, shops, sports halls,  
offices, laboratories, food industry etc.

### Installation

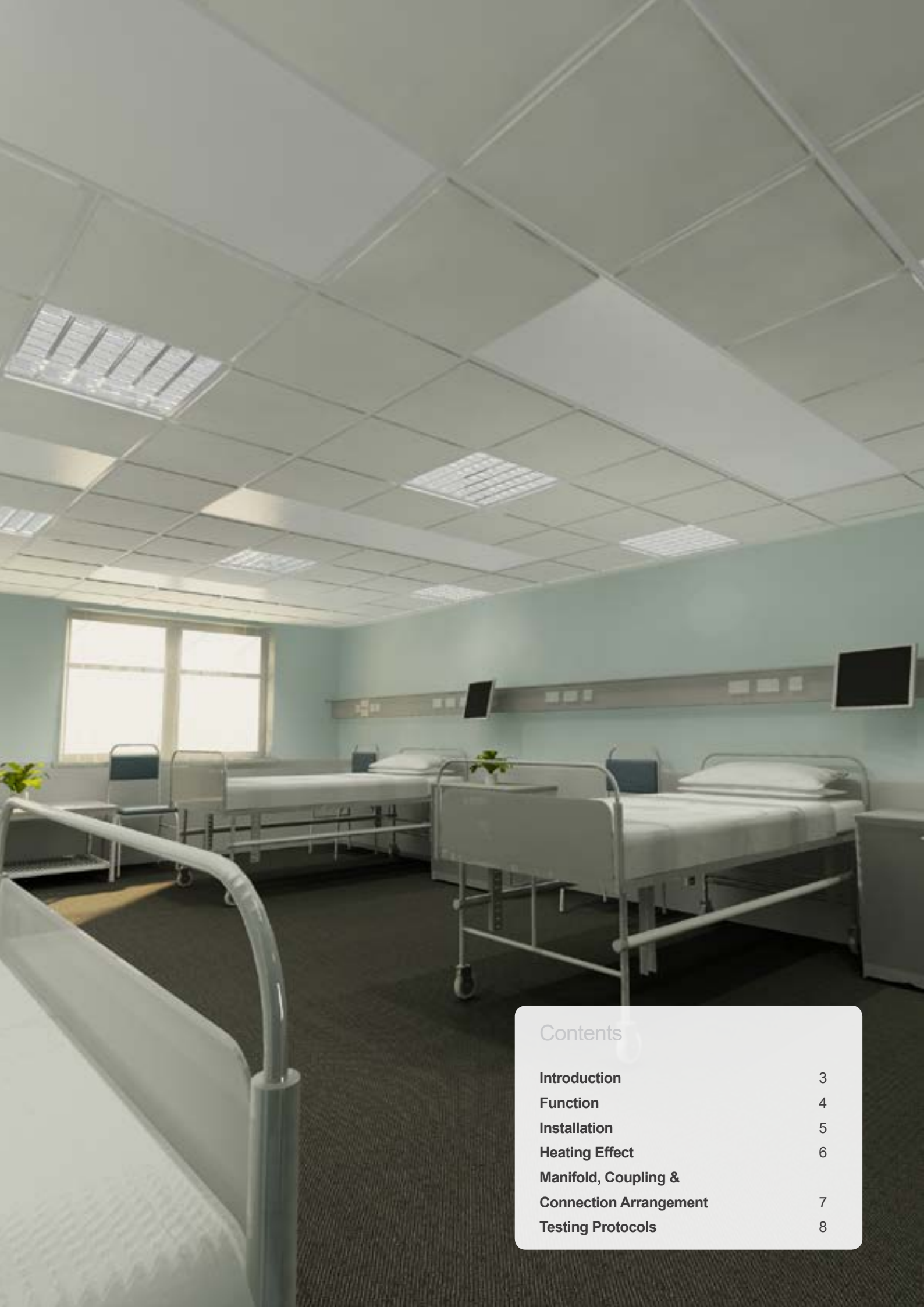
Ceiling integrated  
Free hanging  
Surface mounted  
Flanged recessed

### Capacity

527 W/m<sup>2</sup> @ 55 dTK

### Features

Smooth finish  
Technology proven over 50 years  
Low construction depth  
High capacity  
Cost effective  
Simple to install



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# Introduction

## How does ceiling heating work?

If hot air rises, why and how can a 'Radiator' on the ceiling be effective? - This is most people's reaction to the idea of utilizing a radiant ceiling heating panel system.

The basic way to explain on how such a system works is to compare the principle of our own 'Sun' - when you stand in direct sunlight you feel an almost immediate increase in temperature, this is due to the radiant energy that is transferred direct from the 'Suns' rays warming your skin.

A radiant ceiling heating panel system works on the same principle - it transfers a large proportion of its heating energy via radiation (typically up to 60% of panels overall heat output) direct to all and any of an areas surface it 'sees', traveling in much the same way as light is distributed and reflected in an area.

It is due to this 'reflection' and the constant radiation exchange between all room surfaces continuously striving to level out that ensures a very even temperature spread throughout an area.

Additionally this same radiant effect ensures that all room surfaces are heated to a higher temperature when compared to a conventional heating system. This means that a comfortable indoor climate temperature can be achieved with lower air temperatures than realized with a convective heating system - potentially up to 3 degrees lower. The net result of this is a reduction in the heat loads and energy consumption in any area that utilizes a radiant ceiling heating panel system.

## Modula SP Heating Panel



### Description

Modula is an unobtrusive modular radiant heating panel. The panels are manufactured from 1.0mm thick smooth-faced steel and are designed to be integrated within a standard 24mm exposed grid ceiling system. Copper pipes are expanded under pressure into extruded aluminium pipe seats to give high metal-to-metal contact and the pipe seats are securely fixed to the rear of the steel panels. Consequently, the arrangement delivers excellent heat transfer characteristics. Panels are insulated with 25mm thick class 'O' foil encapsulated mineral wool insulation 45 kg/m<sup>3</sup> density. The technology employed in the construction of the panel results in very high heating capacity at low water mass flow rates.

Modula has been specifically developed for use in schools and healthcare environments where a smooth faced simple-to-install panel width with high heating capacity is the preferred solution.

### Standard Features

- Modular system to fit into 600mm exposed grid ceiling.
- Modular lengths; 0.6m, 1.2m, 1.8m, 2.4m, 3.0m.
- Panel depth 45mm.
- Smooth faced, unobtrusive design.
- 527 W/m<sup>2</sup> @ 55 dtK room (mwt - room temp).
- Standard polyester finish RAL 9010 (25% gloss).

*water connections:* 15mm OD Copper, to EN12449 / EN127352

*weight:* less than 21 kg / m<sup>2</sup>

### Connection Possibilities

water; vertical, same end for flow and return.  
Alternative options available upon request.

### Maintenance

The unit has no moving parts, and therefore maintenance requirement is limited to periodic cleaning of the surface of the panel with a soapy sponge and drying with a cotton towel.

### Installation

Standard fixing arrangement from the structural soffit using rigid or flexible wire hangers (supplied by others), suspended via pre punched keyhole slots.

For simplicity and flexibility we recommend that flexible stainless steel braided EPDM hoses are used to connect the Modula panel.

# Function

With an output of 527 W/m<sup>2</sup> at 55 dtK. Modula is one of the most efficient smooth - faced radiant heating panels currently available.

The secret to Modula's outstanding performance lies in its unique method of expanding the water-carrying copper pipes within the heat radiating aluminium extrusions. The extrusions are then mechanically bonded to the zintec steel panel face using a heat transfer adhesive. Due to the high metal-to-metal contact between the copper waterways and extrusions and the fact that the aluminium pipe seats are fully bonded to the panel face, the energy transport between the pipe and panel face is extremely efficient.

The manufacture of Modula is semi-automated in our purpose-built facility; consequently panels can be produced to very high tolerances. Furthermore, the processes employed and the standardised design means that the cost of Modula remains highly competitive.

Modula is so simple to install that it is most often fitted by the ceiling installer. Frenger can offer an installation service using our own engineers or on-site training to ensure that the installation is carried out to the very highest standard.

## Design

**Dimensions:** Modula SP is available in three widths, as standard - 0.3m, 0.6m and 0.9m. The dimensions are reduced (minus 8mm on length and width) so that panels can be integrated within a traditional suspended ceiling using exposed T-bars (24mm wide) on a 600 x 600mm grid module. The depth of the Modula panel is just 45mm.

**Lengths:** Modula is produced in module lengths of 0.6m, 1.2m, 1.8m, 2.4m and 3.0m as standard; non-standard lengths are available upon request.

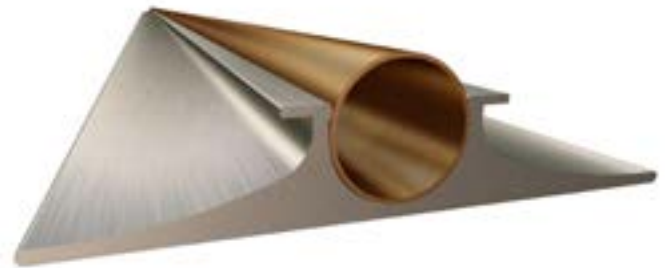
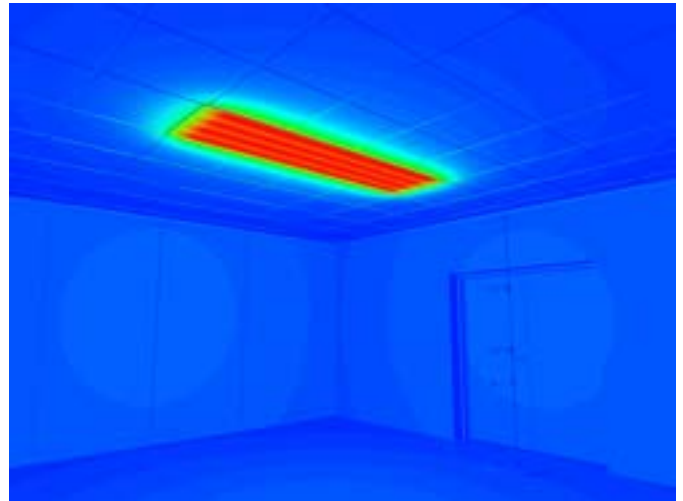
**Water connection:** Modula is available with two different connection configurations (C and D) please see page 7 for further details.

**Surface finish:** Modula is polyester coated as standard in RAL 9010, gloss value 25%, emissivity 0.94.

**Insulation:** Modula is supplied with integrated 25mm thick 45 kg/m<sup>3</sup> class 'O' foil encapsulated mineral wool insulation within the panels returned flanges.

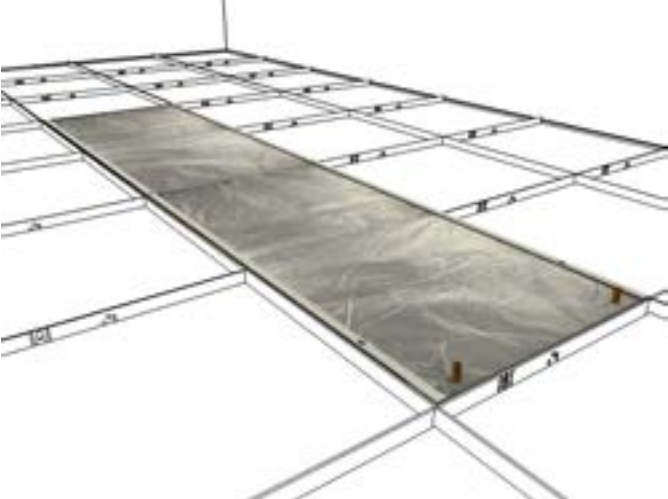
## Application

Modula is particularly suited for use in hospitals, schools, shops and offices; in fact wherever there is a need for a high-output radiant heating panel which is simple to install, easy to keep clean and comes at a very competitive price. Modula is the perfect solution for integration with an exposed grid ceiling system, but is equally suited to free hanging applications. The panel can also be adapted to suit surface mounted applications or recessed into a plasterboard ceiling.



# Installation

The Modula panels are designed to be fixed directly back to the structural soffit. Panels are supplied with pre-punched keyhole slots which are suitable for suspension using rigid or flexible wire hanging systems (by others). Four holes are required for each heating panel up to 1.8m long, each positioned no more than 200mm in from each end. Panels 2.4m long or over require 6 No. fixings.



It should be remembered that the ceiling system “main runners” must be designed to run either side of the Modula panel and parallel to its long sides. Ceiling system “cross noggin” bayonets must be capable of being bent back so as not to clash with the Modula panel.

For simplicity and flexibility we recommend that flexible stainless steel braided EPDM hoses are used to connect the Modula panel.



## Installation Examples



Surface mounted

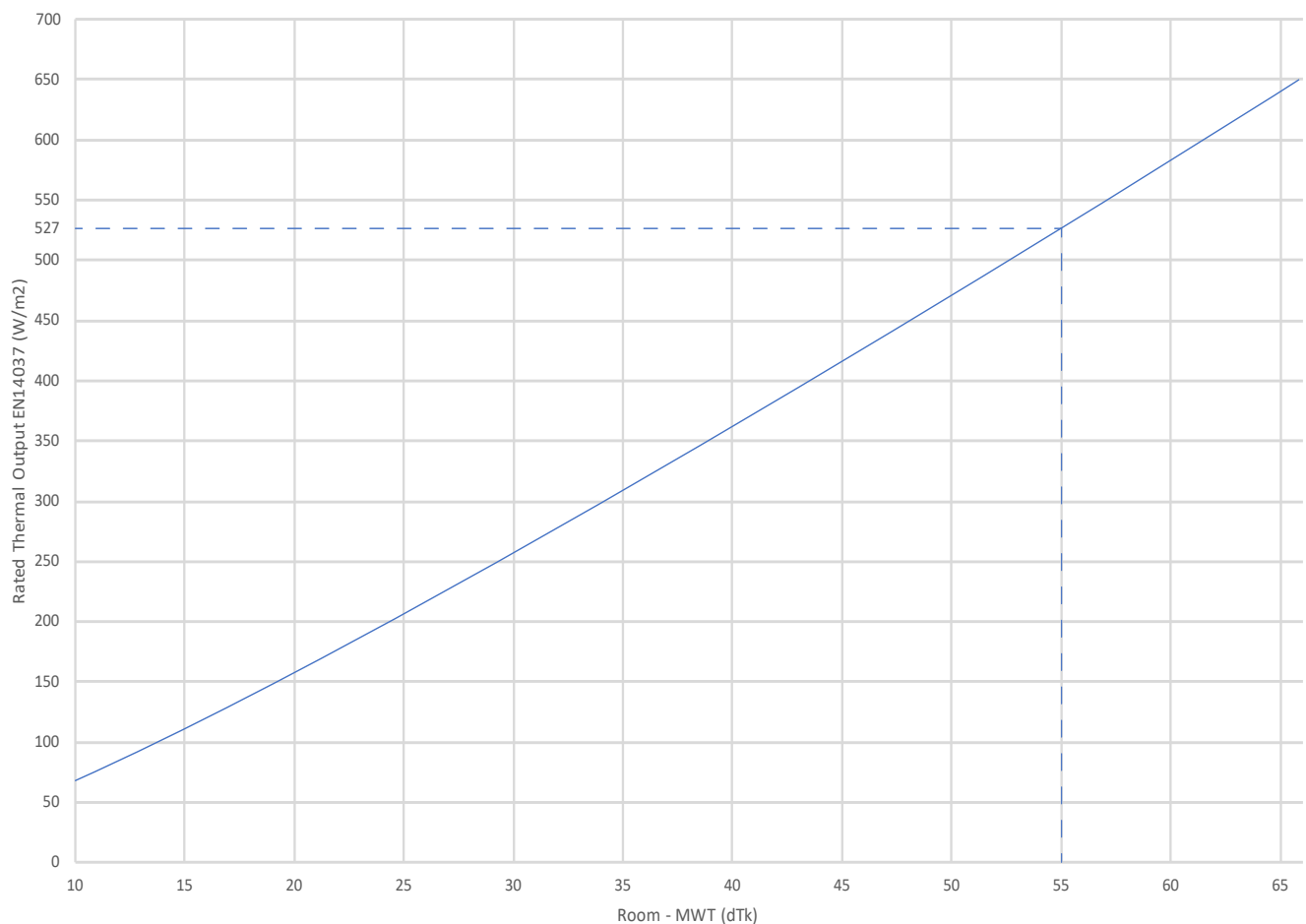


Integrated into plasterboard

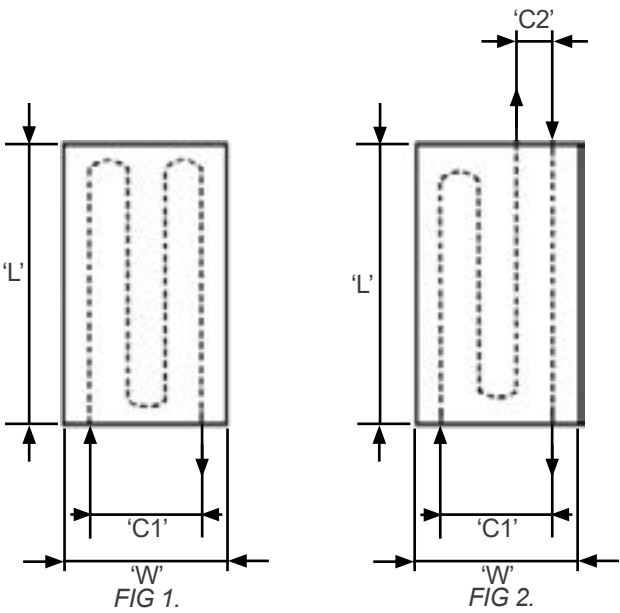
# Heating Effect

Panel Dimensions		ΔTK (Mean water Temperature less room temperature (°C))																	
		48		50		52		54		55		56		58		60		62	
Width (m)	Length (m)	Q̇(w)	ṁ (l/s)	Q̇(w)	ṁ (l/s)	Q̇(w)	ṁ (l/s)	Q̇(w)	ṁ (l/s)	Q̇(w)	ṁ (l/s)	Q̇(w)	ṁ (l/s)	Q̇(w)	ṁ (l/s)	Q̇(w)	ṁ (l/s)	Q̇(w)	ṁ (l/s)
0.3	0.6	81	0.012	85	0.012	89	0.012	93	0.012	95	0.012	97	0.012	101	0.012	105	0.012	109	0.012
	1.2	161	0.012	169	0.012	177	0.012	186	0.012	190	0.012	194	0.012	202	0.012	210	0.012	218	0.012
	1.8	242	0.012	254	0.012	266	0.012	278	0.012	284	0.012	291	0.012	303	0.012	315	0.012	328	0.012
	2.4	323	0.012	339	0.012	355	0.012	371	0.012	379	0.012	387	0.012	404	0.012	420	0.012	437	0.012
	3.0	404	0.012	424	0.012	444	0.012	464	0.012	474	0.012	484	0.012	505	0.012	525	0.012	546	0.012
0.6	0.6	161	0.012	169	0.012	177	0.012	186	0.012	190	0.012	194	0.012	202	0.012	210	0.012	218	0.012
	1.2	323	0.012	339	0.012	355	0.012	371	0.012	379	0.012	387	0.012	404	0.012	420	0.012	437	0.012
	1.8	484	0.012	508	0.012	532	0.012	557	0.012	569	0.013	581	0.013	606	0.013	630	0.014	655	0.014
	2.4	646	0.014	678	0.015	710	0.015	742	0.016	758	0.017	775	0.017	808	0.018	840	0.018	874	0.019
	3.0	807	0.018	847	0.018	887	0.019	928	0.020	948	0.021	968	0.021	1009	0.022	1051	0.023	1092	0.024
0.9	0.6	242	0.012	254	0.012	266	0.012	278	0.012	284	0.012	291	0.012	303	0.012	315	0.012	328	0.012
	1.2	484	0.012	508	0.012	532	0.012	557	0.012	569	0.013	581	0.013	606	0.013	630	0.014	655	0.014
	1.8	727	0.016	763	0.017	799	0.017	835	0.018	853	0.019	872	0.019	908	0.020	946	0.021	983	0.021
	2.4	969	0.021	1017	0.022	1065	0.023	1113	0.024	1138	0.025	1162	0.025	1211	0.026	1261	0.027	1310	0.029
	3.0	1211	0.026	1271	0.028	1331	0.029	1392	0.030	1422	0.031	1453	0.032	1514	0.033	1576	0.034	1638	0.036

Above stated radiant flow rates based on 82°C Flow and 72°C return with a room temperature of 21.5°C.  
 For red values the flow rate has been adjusted to the recommended minimum flow of 0.012 kg/s.



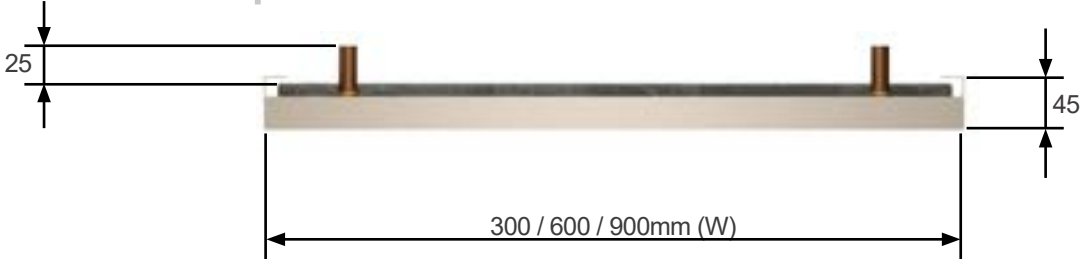
# Manifold, Coupling & Connection Arrangement



Coupling Type	C4	D4
Pipe Configuration	FIG 1.	FIG 2.
Length 'L'	M -8mm	M -8mm
Width 'W'	592mm	592mm
Con. Centre 1 'C1'	450mm	450mm
Con. Centre 2 'C2'	N/A	150mm
Water Content (per tube)	0.1 l/m	0.1 l/m
Panel Weight (Dry)	10.0 kg/m	10.0 kg/m
Minimum Flow Rate*	0.012kg/s	0.012 kg/s
Maximum Flow Rate**	0.105 kg/s	0.105 kg/s
Thermal Expansion***	1.6 mm/m	

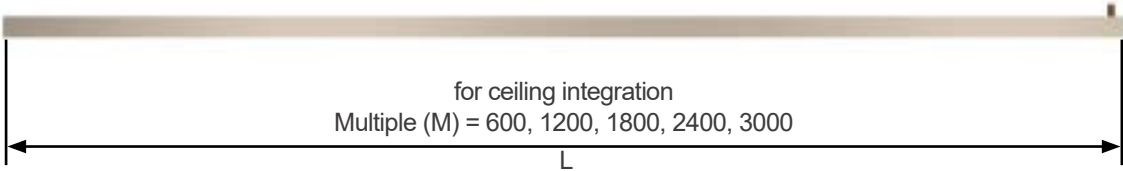
**Note:** All flow and return connections manifolds are 15mm OD vertical.  
 \* @ 76°C MWT  
 \*\* (1.0 m/s) with  $\Delta P = 9.7$  kPa (3.0m long panel)  
 \*\*\* @ 55°C Above Ambient

## Width & Depth mm



Modula is manufactured in standard module lengths (L) from 0.6m, up to 3.0m. Actual dimensions are less 8mm to fit into standard T-bars. All panels are manufactured to a dimensional tolerance of  $\pm 1$ mm.

## Length mm



Modula is manufactured in standard module lengths (L) from 0.6m, up to 3.0m. Actual dimensions are less 8mm to fit into standard T-bars. All panels are manufactured to a dimensional tolerance of  $\pm 1$ mm.

# Testing Protocols

Maximum working pressure	8.7 Bar (g)
Maximum test pressure	13.0 Bar (g)
Classification category	SEP
Pressure equipment directive 97 / 23 / EC	

## Extrusion Specification

Section tolerances	BS 1474
Chemical properties	BS 1472
Heat treatment	BS 1490

## Thermal Insulation

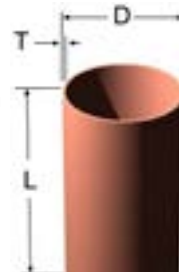
Modula panels are supplied with integrated 25mm thick 45 kg/m<sup>3</sup> class 'O' foil encapsulated mineral wool insulation within the panels returned flanges.



## Copper Pipe Specification

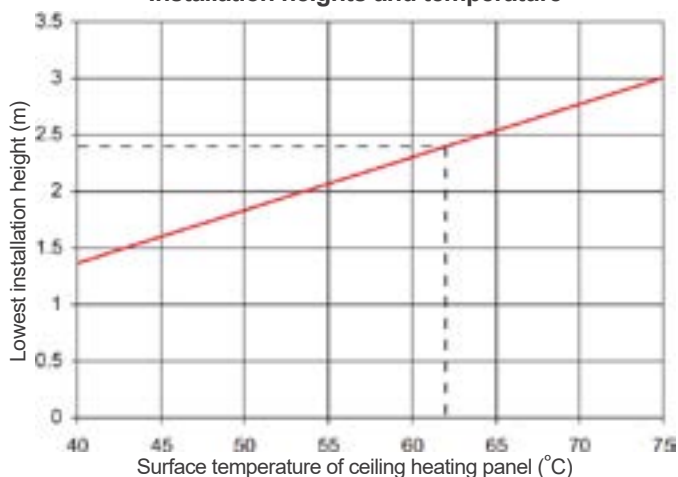
The copper pipe used in the manufacture of the Modula heating panel is compatible with the European Standard for Copper Tubes EN12449 / EN12735-2. The dimensional specification are as follows;

Outside Diameter (D): 15mm  
 Wall Thickness (T): 0.38mm  
 Minimum Straight Length (L): 35mm



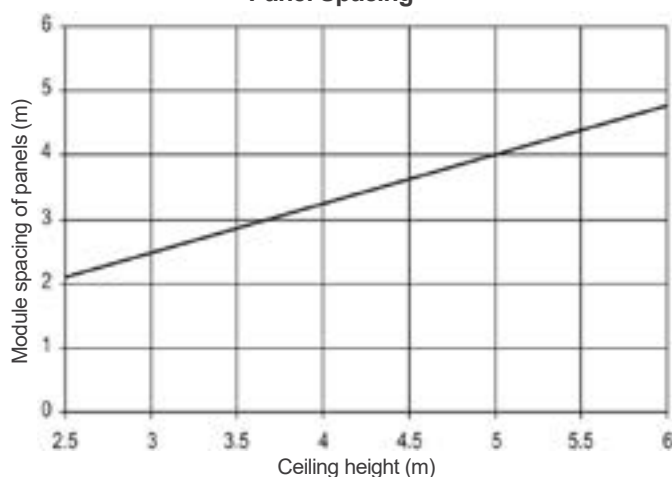
## Modula Dimension Guidelines

Installation heights and temperature



Guide to lowest installation height for the ceiling heater with radiant temperature asymmetry of 5°C. Assumes panel installation adjacent to cold wall / window.

Panel Spacing



Recommended spacings between heating panels (centre-to-centre).







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