mhs RADIATORS

Aqua Line

Hot water radiant panels

Installation Guide

5 FIVE YEAR WARRANTY

Read this document before installing the appliance

Warning

Incorrect installation, adjustment, alteration, repair or maintenance work may lead to material damage or injury. All work must be carried out by certified, qualified professionals. If the appliance is not positioned in accordance with the instructions, the warranty shall be rendered void. This appliance is not intended for use by children or persons with a physical, sensory or mental handicap, or who lack the required experience or expertise, unless they are supervised or have been instructed in the use of the appliance by somebody who is responsible for their safety. Children must be supervised to ensure that they do not play with the appliance.

If the manual refers to an image or table, a number will be shown between square brackets, for example **[3]**. The number refers to images and tables at the back of the manual with the stated number.

1.0 General

1.1 Application

The Aqua Line heats a room by means of radiant heat. Warm water is pumped through the pipes in the radiant panels. This makes the panel warm and heat is then radiated. The Aqua Line can also be used for cooling: cooled water is pumped through the pipes making the panel cold and cooling the environment. Condensation must be prevented from forming. The minimum water temperature therefore depends on the level of atmospheric humidity in the room.

Subject to change

The manufacturer is committed to constantly improving its products and reserves the right to make changes in the specifications without prior notice. The technical details are considered correct but do not form the basis for a contract or warranty. All orders are accepted according to the standard terms of our general sales and delivery conditions (available upon request).

Key table **[6]**

T = type of panel

K = medium upper temperature $K = \frac{T_{wi} + T_{wu}}{2} - T_{omg}$

P = number of pipes per distributor

Key table **[7]**

TR = water return temperature in °C
W = minimum mass flow of water per pipe in kg/h

Key table **[9]**

L_B = section length
U = section expansion in mm
T_{gem} = average water temperature.

1.2 Panel type + dimensions: [1]

T	Type	G	Thicknesses of material
A	Length	H	Weight per 4m (empty)
B	Width	I	Weight per 6m (empty)
C	Number of pipes	J	Water content per 4m
D	Pipe diameter	K	Water content per 6m
E	Thickness of pipe wall	L	Max. temperature
F	Height of radiation hood (radiation panel)	M	Max. operating pressure

1.3 General warnings

Incorrect installation, adjustment, alteration, maintenance activity or repair may lead to material or environmental damage and/or injuries. The appliance should therefore be installed, adapted or converted by a skilled and qualified installer, taking into account national and international regulations. A faulty installation, adjustment, alteration, maintenance activity or repair shall render the warranty void.

1.4 Description of the Aqua Line panel [3]

A radiation panel is made up of multiples of four pipes attached to a profiled steel plate. Because the pipes are actually located within the profile of the steel plate, there is a large contact area. This also benefits the delivery capacity. The top of the radiation panel should be insulated on the upper side using the loose insulating material supplied (to be fitted by you). This will restrict undesirable upward radiation. The insulation strips must be cut to length manually.

1.5 Construction of the panel [3]

1 Reflector
2 Water-carrying pipe
3 Distributor
4 1" connections, water side
5 Mounting set (profile and carbine hooks)
6 Push-on connectors (optional)
7 Insulating material
8 De-aeration connection ½" (de-aeration nipple is not included in MHS's scope of supply)

The panels are delivered in standard lengths of 4 or 6 metres. Longer lengths can also be created by joining the panels together using the push-on connectors **[3]**. Note the water flow in this case. In addition to the length, the width can also be adjusted. The distributors are also installed using the push-on connectors. If required, the push-on connectors can be concealed using a reflector concealing cover to create a neat finish **[4]**.

2.0 Selection and design advice [5]

In order to heat the room evenly, it is important to follow the steps below. These calculations determine the type of panel, the panel length, distributors and the pressure drop. In connection with the water side pressure drop and panel expansion, we advise you to keep the maximum section length below 46 metres.

2.1 Signs and symbols

B = Width of the room
H = Height of the room
H_m = Installation height
K = Upper temperature
L = Length of the room
L_B = Section length
L_{tot} = Total section length
n_{sp} = Number of radiation sections
n = Number of pipes per group
m_{pb} = Mass flow per pipe
m = Mass flow per panel length
q = Panel heat output per section length
Q = Heating requirement
T_{omg} = Ambient temperature
T_{wi} = Water temperature in (feed)
T_{wu} = Water temperature out (return)
ΔT = Temperature variation
Q_{pp} = Heat capacity per panel (table) **[6]**
n_{pp} = Number of panel lengths needed
R = Pressure drop per pipe per metre of panel
Z = Distributor pressure drop

2.2 Steps to be followed

1. Determine the width, height and type of panel for the space. **[5]**

   T_{wi} = 65°C
   T_{wu} = 50°C
   T_{omg} = 18°C (Temp. in the room)

2. Determine the section length: **[5]**

   $L_B = L - 3m$
   $L_B = 45 - 3 = 42m$

   NOTE!
   Only 4 or 6 metre panels may be used.
   42m is divisible by 6. This results in 7 panels, each 6 metres in length
   See table **[9]**

3. Determine the installation height:
   $H_m = H - 0.5m$
   $H_m = 5 - 0.5 = 4.5m$
   This is also the optimal distance from the centre point of each panel. **[5]**

4. Determine the upper temperature:

$$k = \frac{T_{wi} + T_{wu}}{2} - T_{omg}$$

$$k = \frac{65 + 50}{2} - 18 = 39 \text{ Kelvin}$$

This value can be used to look up the heat capacity of the panel in the table (heat delivery table) **[6]** (type 1,2,3 and 4). This is the value Q_{pp}.

(T=1) Q_{pp} = 132 W/m (heat output table) **[6]**

5. Determine the heat delivery for a single length:
$q = L_B \times Q_{pp}$
$q = 42 \times 132 = 5544$ W/section

6. Determine the temperature variation of the water:

$\Delta T = T_{wi} - T_{wu}$
$\Delta T = 65 - 50 = 15$ K

7. Determine the mass flow of the liquid in one panel length:

$m = (q/\Delta T) \times 0.86$

$$m = \frac{5544}{15} \times 0{,}86 = 318 \text{ kg/h}$$

8. Determine the mass flow per pipe:
$m_{pb} = m / n$

1 section consisting of a Type 1 panel. **[2]**
Flow may take place through 4 pipes or 2 pipes. The mass flow must be calculated for these two situations in order to connect the panel on the water side.

m_{pb} = 318 / 4 = 79,5 kg/h (B)
318 / 2 = 159 kg/h (A)

9. Check the minimum mass flow using the appropriate table **[7]** (68 kg/h). The calculated value must be higher in order to achieve turbulent flow through the pipes. This then gives the correct number of distributors **[2]**.

10. Determine the pressure drop on the water side **[2]**:

T1	Single side Sit.A	$\Delta P = (Lb \times R1) + (Lb \times R2) + Z$
T2	Single side Sit.A	$\Delta P = (Lb \times R1) + (Lb \times R2) + Z$
T3	Single side Sit.A	$\Delta P = (Lb \times R1) + (Lb \times R2) + Z$
T4	Single side Sit.A	$\Delta P = (Lb \times R1) + (Lb \times R2) + (Lb \times R3)\ (Lb \times R4) + Z$
T1	Alternating sides Sit.B	$\Delta P = (Lb \times R1) + Z$
T2	Alternating sides Sit.B	$\Delta P = (Lb \times R1) + Z$
T3	Alternating sides Sit.B	$\Delta P = (Lb \times R1) + (Lb \times R2) + (Lb \times R3) + Z$
T3	Alternating sides Sit.C	$\Delta P = (Lb \times R1) + Z$

R = Water resistance per panel length in Pa/m
Z = water resistance in Pa for both distributors

$$R = \left(\frac{\frac{m}{pipes}}{173} \right)^2 \times 196 \qquad Z = \left(\frac{m}{1000} \right)^2 x\ 2000$$

Calculation example: T=1 , 79,5 kg/h (B)

$\Delta P = LB \times R + Z$

R = 41 Pa Z = 202 Pa
Determine the pressure drop for both panel groups:
$\Delta P = 42 \times 41 + 202 = 1924$ Pa

3.0 Transport

Leave the panels on the pallet for as long as possible.
Ensure the pallet does not bend too much (do not move the pallet using a pallet truck).
To prevent bending, move the panel rotated/turned by 90° **[8]**.
Panels must be stored in a dry environment.

4.0 Mounting panels [9][10]

4.1 Mounting instructions [9]

- The panel must be placed at a minimum height of 2m above the floor.
- The measurement from the centre point of the panels must not be greater than the height above the floor. **[5]**
- Distance between the installation profiles max. 2 metres **[9]**.
- Suspend the panels in such a way that they can expand freely lengthways **[9][10]**.

Key table **[10]**
A = Number of tubes
B = Section length
D = Number of brackets
E = Number of press links
F = Cover between panels

l_2 = Expansion in mm
l_1 = Section length mm
α = Linear expansion coefficient of steel => $11.7x10^{-6}$
$T_{w\ gem}$ = Average water temperature.
T_{omg} = Temperature in the room.

Determine the expansion of 1 section length:
$l_2 = l_1 \times (1 + \alpha \times (T_{w\ gem} - T_{omg})$
$l_2 = 42000 \times (1 + 11.7x10^{-6} (57.5 - 0))$
$l_2 = 42028.3mm$

Expansion U = 28.3mm
Expansion table **[11]**.

4.2 Order of installation. [4]

– Fit the suspension points **[9][10]**
– The panels can be mounted directly to threaded rod or hung from chains **[12]**.
– Join the panels together using the push-on fittings.
– Install the distributors **[3]**.
– Add the insulation.
– Place covers, if required, on the panel connections and distributors **[4]**.

5.0 Start-up

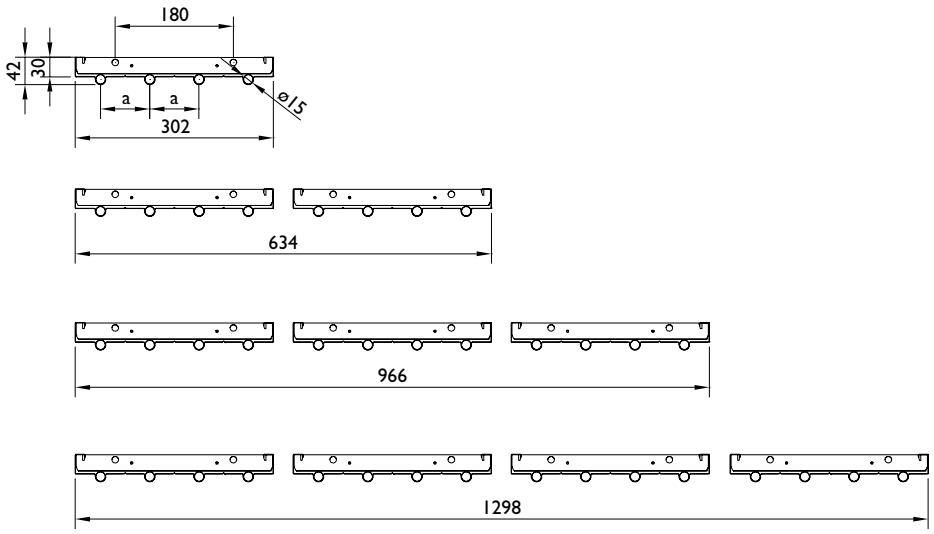
Fill the installation with water, bleed the pipes and rinse through to remove any contamination. Adjust any flow controls. Ensure that the water mass flow does not fall below that indicated in the table **[7]**. If the water mass flow is lower, output cannot be guaranteed.

Key table **[7]**
TR = water return temperature in °C
W = minimum mass flow of water per pipe in kg/h

6.0 Maintenance

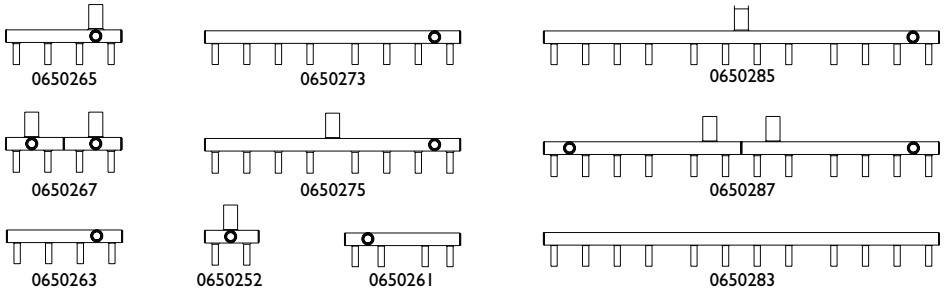
Clean the panels regularly, check them for leaks and check the suspension points. If applicable, ask a qualified installer for maintenance advice.

[1]



T		1	2	3	4
A	m	4/6	4/6	4/6	4/6
B	mm	305	636	968	1300
C	n	4	8	12	16
D	mm	15	15	15	15
E	mm	1,0	1,0	1,0	1,0
F	mm	42	42	42	42
G	mm	0,5	0,5	0,5	0,5
H	kg	12,2	24,4	36,6	49,2
I	kg	18,2	36,4	54,6	72,8
J	dm^3	2,12	4,24	6,36	8,48
K	dm^3	3,19	6,38	9,57	12,76
L	°C	120	120	120	120
M	bar	8	8	8	8

[1]



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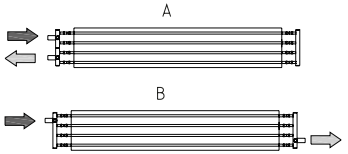

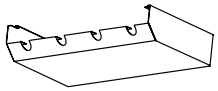
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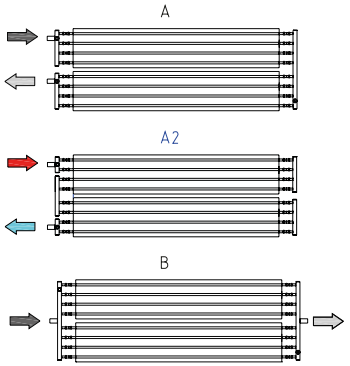

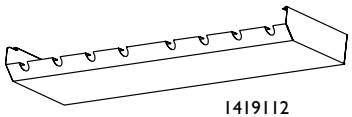
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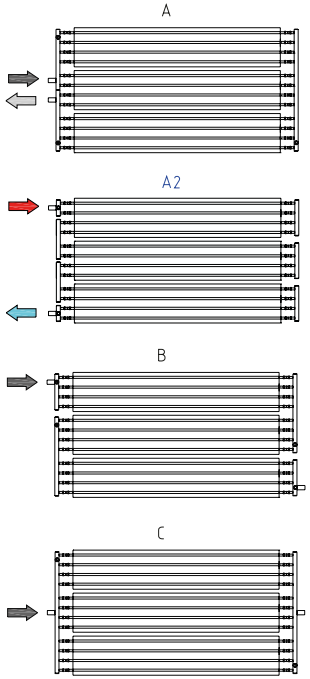

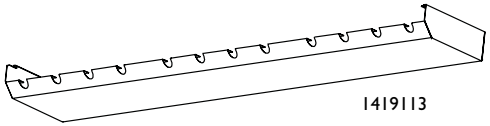
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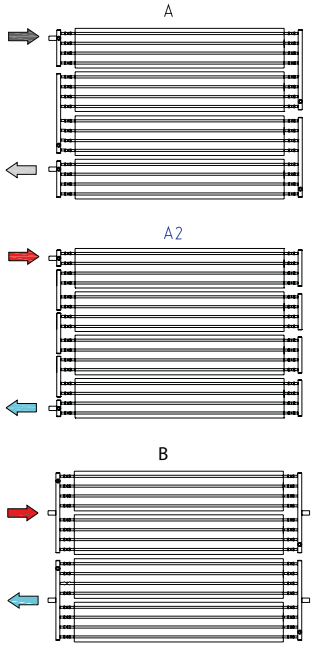

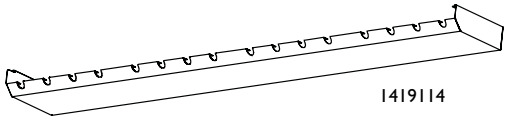
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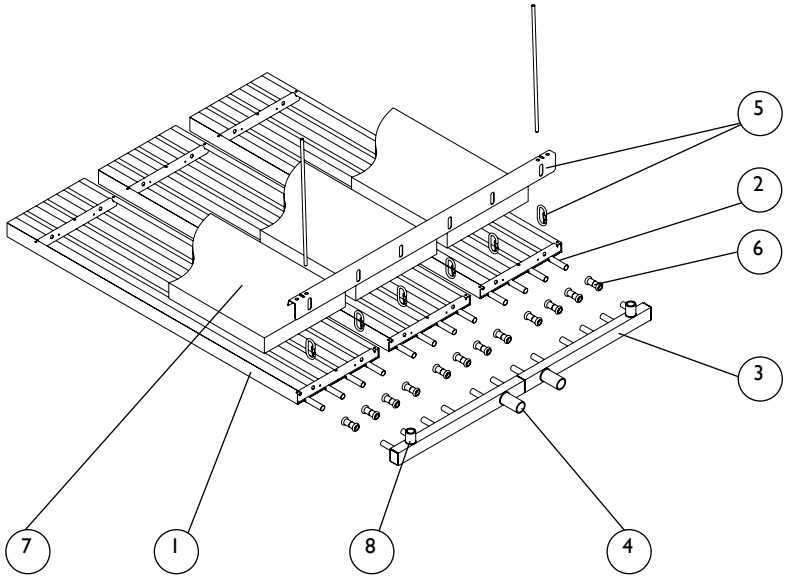

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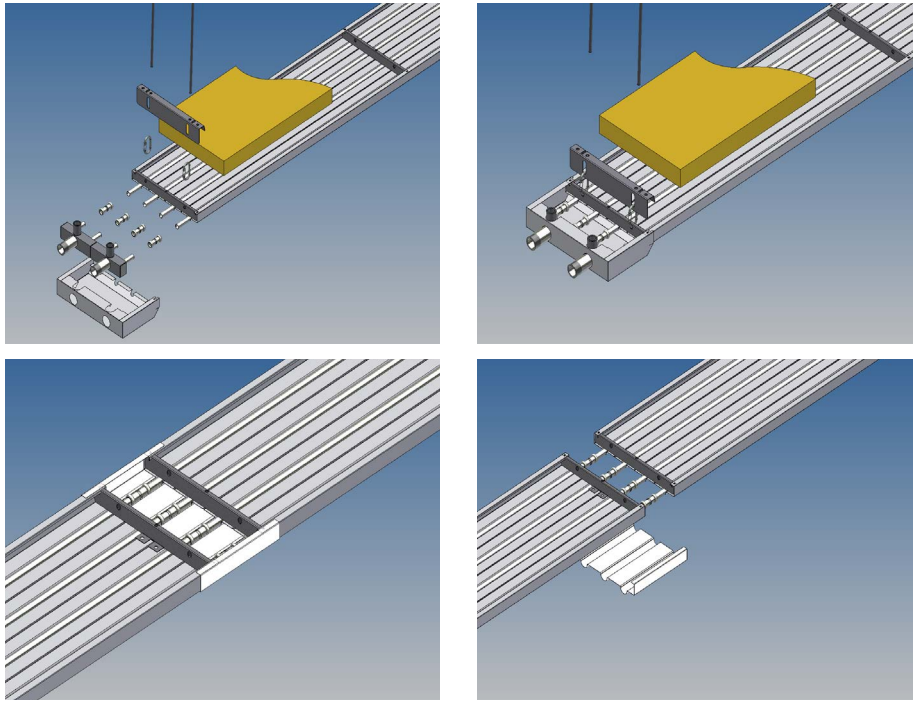

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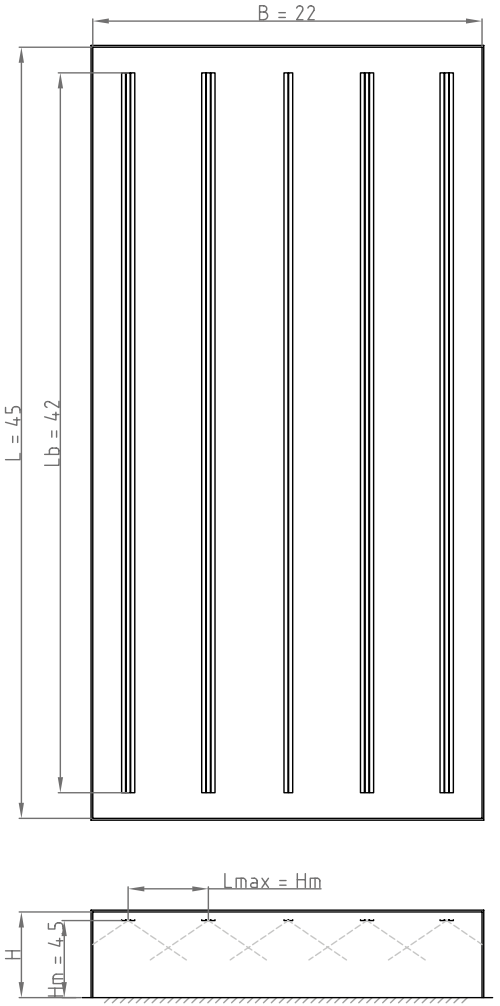


[6]

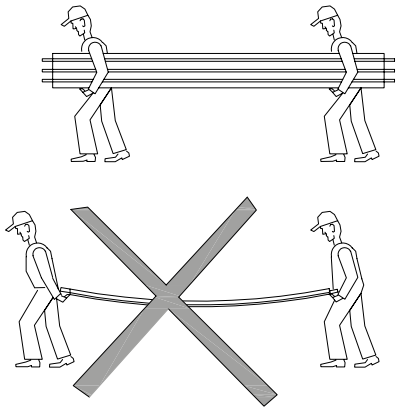
Watt/m to EN 14037 1-3

Medium overtemp K	T				Medium overtemp K	P			
	1	2	3	4		4	8	12	16
115	476	952	1428	1904	115	165	330	494	659
110	451	903	1354	1806	110	156	312	468	624
105	427	855	1282	1709	105	147	295	442	590
100	403	807	1210	1613	100	139	278	417	556
95	380	759	1139	1518	95	131	261	392	522
90	356	712	1068	1424	90	122	244	367	489
85	333	666	998	1331	85	114	228	342	456
80	310	619	929	1239	80	106	212	318	423
75	287	574	861	1148	75	98	196	293	391
70	264	529	793	1058	70	90	180	270	360
69	260	520	780	1040	69	88	177	265	353
68	256	511	767	1022	68	87	174	260	347
67	251	502	753	1004	67	85	170	256	341
66	247	493	740	987	66	84	167	251	335
65	242	485	727	969	65	82	164	246	329
64	238	476	714	951	64	81	161	242	322
63	233	467	700	934	63	79	158	237	316
62	229	458	687	916	62	78	155	233	310
61	225	449	674	899	61	76	152	228	304
60	220	441	661	881	60	74	149	223	298
59	216	432	648	864	59	73	146	219	292
58	212	423	635	847	58	71	143	214	286
57	207	415	622	830	57	70	140	210	280
56	203	406	609	812	56	68	137	205	274
55	199	398	596	795	55	67	134	201	268
54	195	389	584	778	54	66	131	197	262
53	190	381	571	761	53	64	128	192	256
52	186	372	558	744	52	63	125	188	250
51	182	364	545	727	51	61	122	183	244
50	178	355	533	710	50	60	119	179	239
49	173	347	520	694	49	58	116	175	233
48	169	338	508	677	48	57	113	170	227
47	165	330	495	660	47	55	111	166	221
46	161	322	483	644	46	54	108	162	215
45	157	314	470	627	45	52	105	157	210
44	153	305	458	611	44	51	102	153	204
43	149	297	446	594	43	50	99	149	198
42	144	289	433	578	42	48	96	145	193
41	140	281	421	562	41	47	94	140	187
40	136	273	409	546	40	45	91	136	182
39	132	265	397	529	39	44	88	132	176
38	128	257	385	513	38	43	85	128	171
37	124	249	373	497	37	41	83	124	165
36	120	241	361	482	36	40	80	120	160
35	116	233	349	466	35	39	77	116	154
30	97	194	291	388	30	32	64	96	128
25	78	156	235	313	25	26	51	77	102
20	60	120	180	240	20	19	39	58	78
15	43	85	128	171	15	14	27	41	55

[7]

TR °C	W kg/h
30	99
35	88
40	81
45	73
50	**68**
55	61
60	58
65	53
70	50
75	47
80	44
85	41
90	39
95	37
100	35

[8]

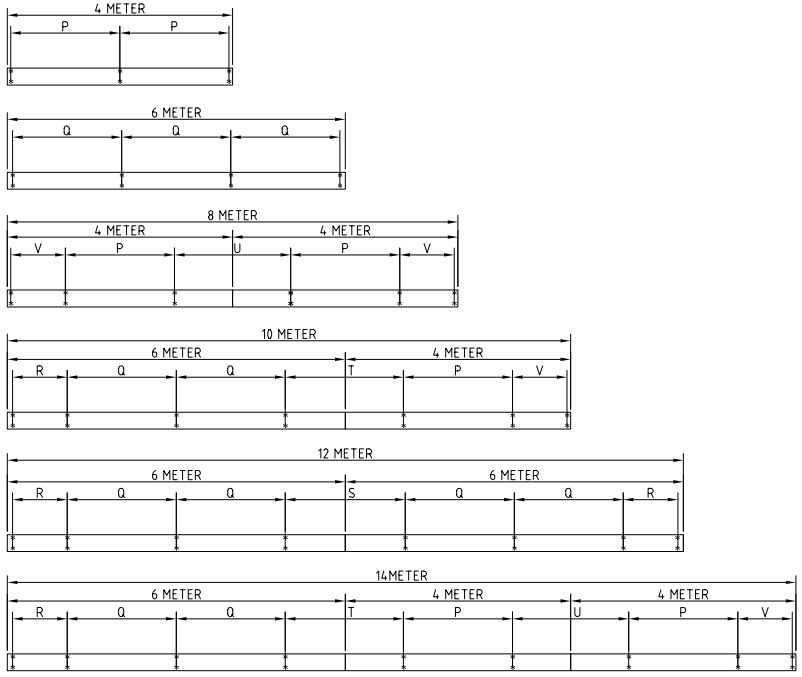


[9]

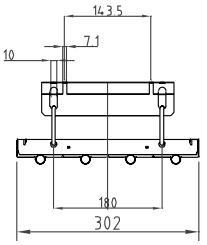
MTR									
4	P-P								
6	Q-Q-Q								
8	V-P-U-	P-V							
10	R-Q-Q-	T-P-V							
12	R-Q-Q-	S-Q-Q-R							
14	R-Q-Q-	T-P-U-	P-V						
16	R-Q-Q-	S-Q-Q-	T-P-V						
18	R-Q-Q-	S-Q-Q-	S-Q-Q-R						
20	R-Q-Q-	S-Q-Q-	T-P-U-	P-V					
22	R-Q-Q-	S-Q-Q-	S-Q-Q-	T-P-V					
24	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-R					
26	R-Q-Q-	S-Q-Q-	S-Q-Q-	T-P-U-	P-V				
28	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	T-P-V				
30	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-R				
32	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	T-P-U-	P-V			
34	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	T-P-V			
36	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-R			
38	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	T-P-U-	P-V		
40	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	T-P-V		
42	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-R		
44	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	T-P-U-	P-V	
46	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	T-P-V	
48	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-R	
50	R-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	S-Q-Q-	T-P-U-	P-V

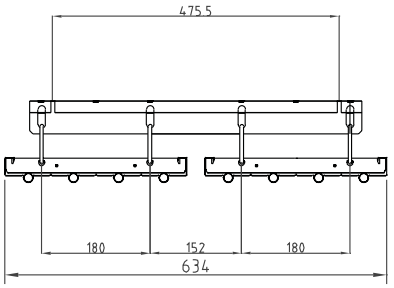
4 m

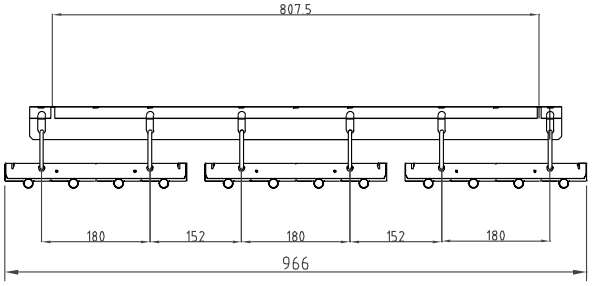
6 m

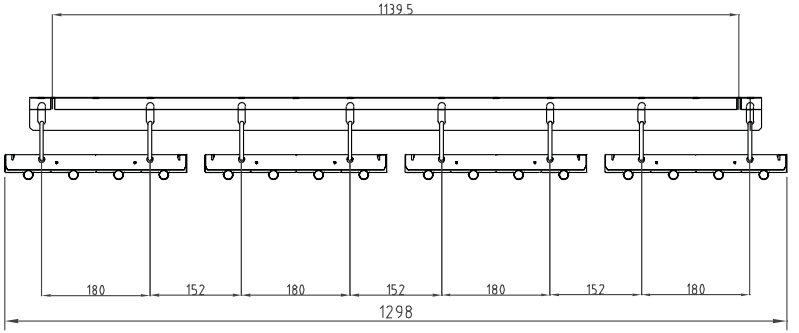


P	Q	R	S	T	U	V
1936	1958	979	2085	2075	2064	968





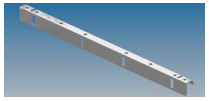




[10]

A	4			8			12			16		
B	D	E	F	D	E	F	D	E	F	D	E	F
length	3007111	0536603	1419110	3007112	0536603	1419110	3007113	0536603	1419110	3007114	0536603	1419110
4	3	8	0	3	16	0	3	24	0	3	32	0
6	4	8	0	4	16	0	4	24	0	4	32	0
8	6	12	1	6	24	2	6	36	3	6	48	4
10	7	12	1	7	24	2	7	36	3	7	48	4
12	8	12	1	8	24	2	8	36	3	8	48	4
14	9	16	2	9	32	4	9	48	6	9	64	8
16	10	16	2	10	32	4	10	48	6	10	64	8
18	11	16	2	11	32	4	11	48	6	11	64	8
20	12	20	3	12	40	6	12	60	9	12	80	12
22	13	20	3	13	40	6	13	60	9	13	80	12
24	14	20	3	14	40	6	14	60	9	14	80	12
26	15	24	4	15	48	8	15	72	12	15	96	16
28	16	24	4	16	48	8	16	72	12	16	96	16
30	17	24	4	17	48	8	17	72	12	17	96	16
32	18	28	5	18	56	10	18	84	15	18	112	20
34	19	28	5	19	56	10	19	84	15	19	112	20
36	20	28	5	20	56	10	20	84	15	20	112	20
38	21	32	6	21	64	12	21	96	18	21	128	24
40	22	32	6	22	64	12	22	96	18	22	128	24
42	23	32	6	23	64	12	23	96	18	23	128	24
44	24	36	7	24	72	14	24	108	21	24	144	28
46	25	36	7	25	72	14	25	108	21	25	144	28
48	26	36	7	26	72	14	26	108	21	26	144	28
50	27	40	8	27	80	16	27	120	24	27	160	32

D



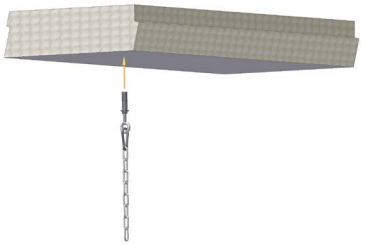
E

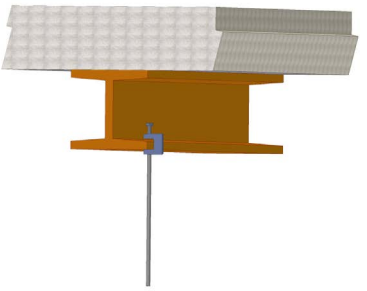
F

[11]

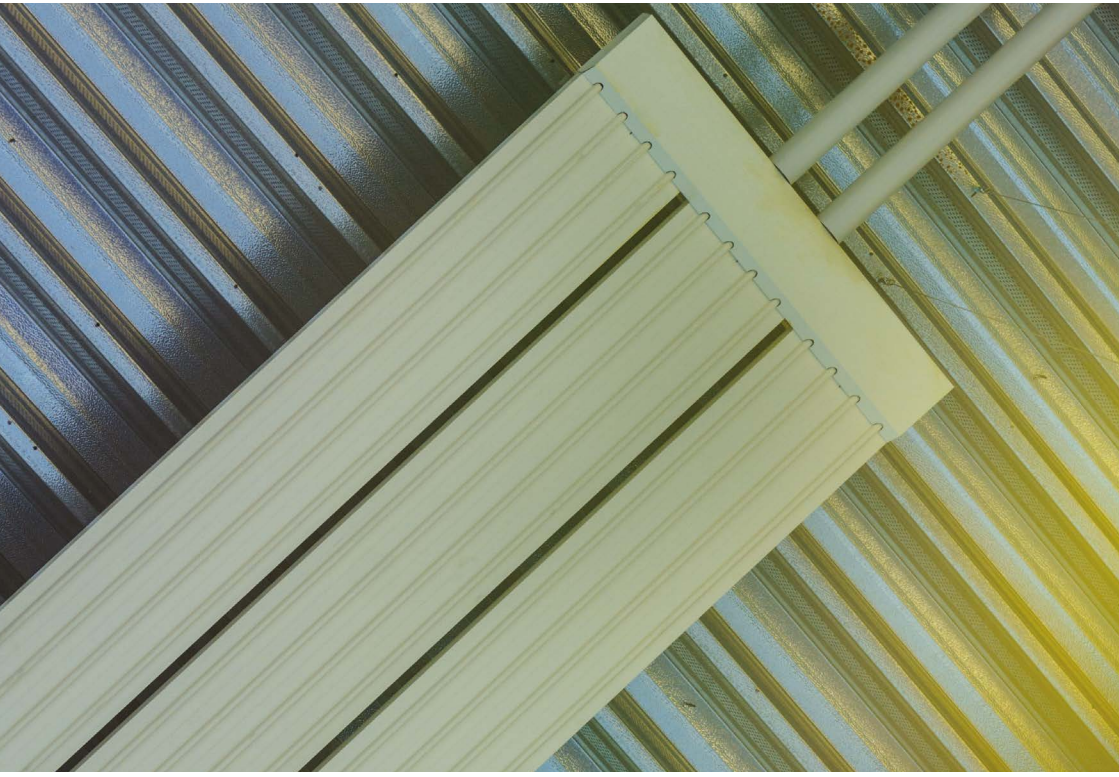
	U(mm)				
L_B (mm)	10.000	20.000	30.000	40.000	50.000
T_{gem} (°C)					
30	3,5	7,0	10,5	14,0	17,6
50	5,9	11,7	17,6	23,4	29,3
70	8,2	16,4	24,6	32,8	40,9
80	9,4	18,7	28,1	37,4	46,8
90	10,5	21,1	31,6	42,1	52,7

[12]





RC/0119/7371RC



ISO 9001 REGISTERED FIRM
URS CERTIFICATE NO.75710

ISO 14001 REGISTERED FIRM
URS CERTIFICATE NO.07571

OHSAS 18001 REGISTERED FIRM
URS CERTIFICATE NO.07571

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