WSP LAB

Heating and cooling system on the ceiling and on the walls

Test Report

21.58.CIO.001/A1

on the conformity of a chilled ceiling
according to EN 14240:2004

This report replaces report no. 21.58.CIO.001 and consists of 14 pages

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DAkkS Deutsche Akkreditierungsstelle D-PL-11156-01-00

0.	**Modification of report**	Name and address of customer and manufacturer
1.	**Test laboratory and location of test**	**WSP***Lab* Dr.-Ing. Frank Bitter Kapuzinerweg 7 70374 Stuttgart Germany Phone: +49 711 953922-0 Fax: +49 711 953922-66 Test laboratory recognized by DIN CERTCO and accredited to EN ISO/ IEC 17025
2.	**Customer**	PANELRADIANT S.R.L Jud. BH Mun. Oradea Str. Principatele Unite nr. 18, et 1, ap. 8 Romania
3.	**Manufacturer**	PANELRADIANT S.R.L Jud. BH Mun. Oradea Str. Principatele Unite nr. 18, et 1, ap. 8 Romania
4.	**Identification of test item**	
4.1	Receipt of test item	21.11.2021
4.2	Date of test	23.11.2021
4.3	Manufacturer's designation	Heating and cooling system on the ceiling and on the walls
4.4	Details of test item	Closed chilled ceiling consisting of 21 panels. Each panel consists of a plasterboard (1200 mm x 520 mm x 15 mm) with integrated plastic pipes laid in meandering pattern (8 mm x 1 mm; pipe spacing 50 mm) and an insulation layer (expanded polystyrene plate, thickness 27 mm) on the top side. All panels are hydraulically connected in parallel, details see drawings in chapter 9.

4.5	Nominal dimensions of test item	Active area: A_a = (1,13 m x 0,5 m) x 21 = 11,87 m² Installation area: A_i = (3 x 1,2 m + 1 x 0,25 m) x (7 x 0,52 m) = 14,01 m² Test room area: A_t = 14,71 m² Installation area ratio: $R_i = A_i / A_t$ = 0,95 Active area ratio: $R_a = A_a / A_i$ = 0,85
4.6	Hydraulic connection of test item	Number of elements connected in series: - Number of units connected in parallel: 21
4.7	Insulation	Top of elements: Yes (integral part of the system) Connecting pipelines: Yes Collectors and distributors: Yes Connections between elements: -

5. Test room information and test set-up

5.1	Type of test facility	tightly closed controlled and water-flowing enclosing surfaces
5.2	Test specification	EN 14240:2004
5.3	Inside dimensions of insulated test room	Length = 3886 mm Width = 3786 mm Height = 2775 mm
5.4	Distance between test item bottom edge and floor	2475 mm
5.5	Measuring point of reference temperature (Globe temperature)	At a height of 1,10 m above the floor in the centre of the test room
5.6	Number of heated dummies	12

6. Measurement method and instruments

The determination of the cooling capacity is based on the measurement of the cooling water flow rate and the temperature difference between cooling water inlet and outlet.

6.1	Cooling water flow rate	Electromagnetic flow meter, calibrated with weighing method
6.2	Cooling water temperatures (inlet and outlet)	PT 100 sensors
6.3	Globe temperature	PT 100 sensor with blackened light metal sphere (diameter 150 mm, emissivity 0,9)
6.4	Air temperatures	Radiation shielded thermo couples NiCr-Ni
6.5	Effective electric power	Wattmeter

7. Test results

The values presented in this test report are rounding values based on exact measured values. Hence, in case of any recalculation using these values, the results can differ from the data given in this test report.

All test results relate only to the items tested.

Graphic characteristics are located on pages 6 and 7, the measurement protocol is shown on page 8.

Characteristic equation of cooling capacity related to active area at nominal cooling water flow rate:

$P_a = k \cdot \Delta\theta^n$ [W/m²] Coefficient k = 5,381

Exponent n = 1,029

Nominal cooling capacity related to active area at $\Delta\theta_N$ = 8 K and nominal cooling water flow rate:

P_a = 45,7 W/m²

Stuttgart, 08.02.2022

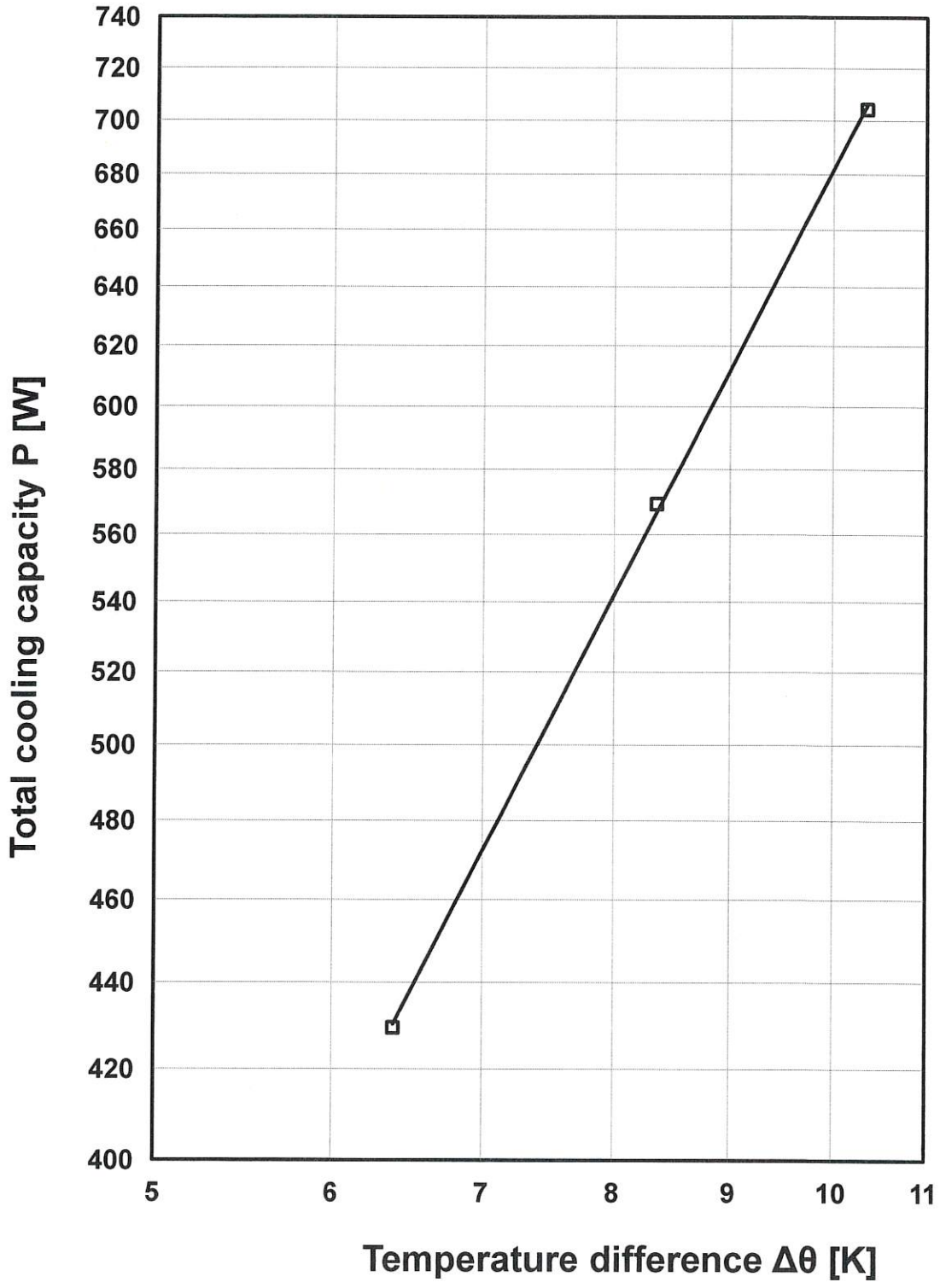
T. Haase

Dipl.-Ing. (BA) Thomas Haase
(Technical Manager of the Laboratory)

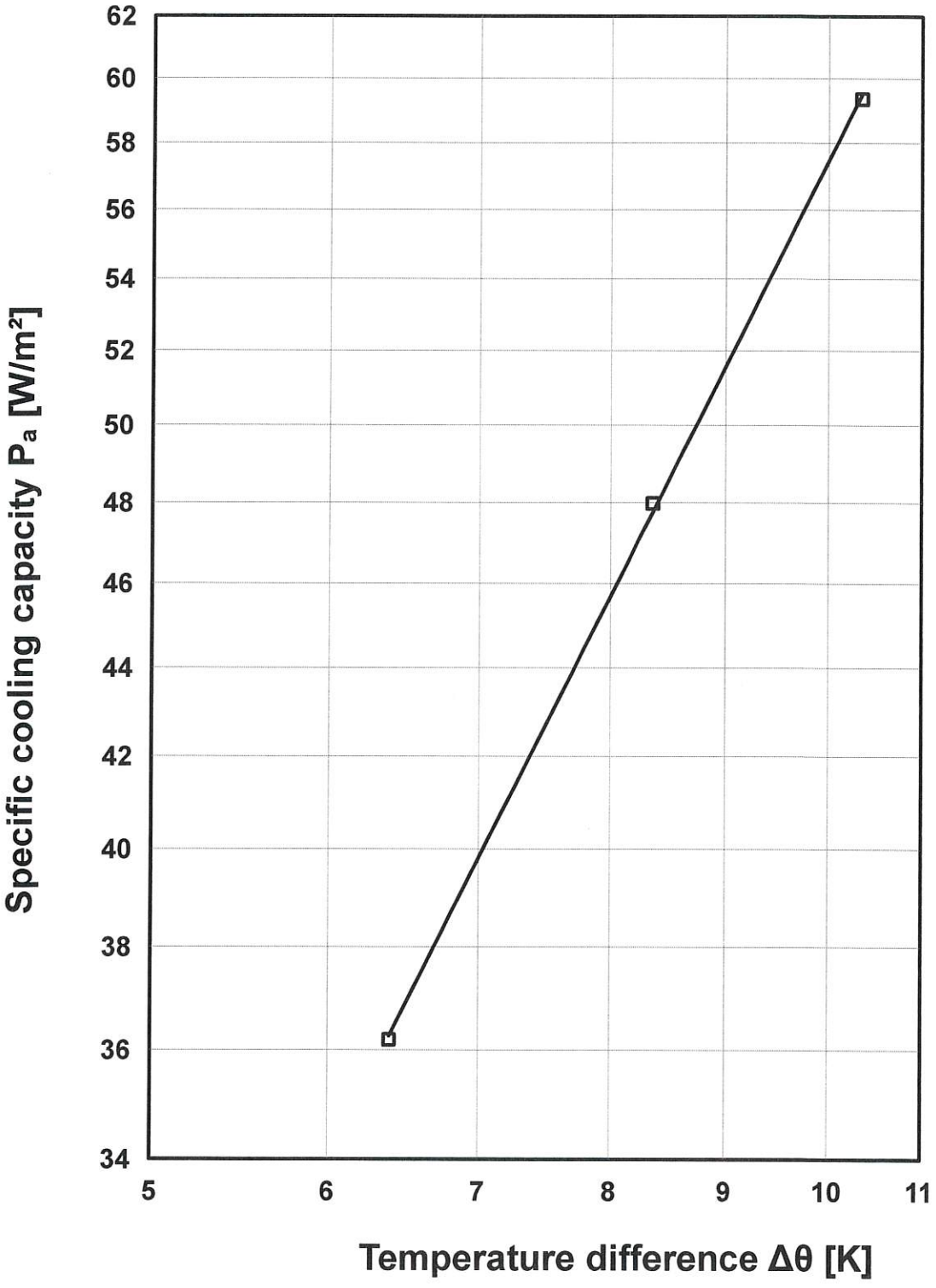
A. Heindl

M. Sc. Andrea Heindl
(Test Manager)

Characteristic equation of cooling capacity:



Characteristic equation of specific cooling capacity, related to active area:



8. Measurement protocol

Results of measurements					
Number of measuring point			1	2	3
Date of measurement			23.11.2021	23.11.2021	24.11.2021
Cooling water flow rate [kg/h]		q_w	233,6	233,5	233,4
Temperatures [°C]	Water inlet	θ_{w1}	16,66	18,92	14,45
	Water outlet	θ_{w2}	18,76	20,50	17,04
	Globe	θ_g	26,07	26,10	26,09
	Air - 1,7 m	$\theta_{a1,7}$	26,3	26,3	26,3
	Air - 1,1 m	$\theta_{a1,1}$	26,4	26,3	26,4
	Air - 0,1 m	$\theta_{a0,1}$	26,3	26,3	26,4
	Surface wall 1	θ_{sw1}	26,2	26,2	26,1
	Surface wall 2	θ_{sw2}	26,2	26,2	26,2
	Surface wall 3	θ_{sw3}	26,2	26,2	26,2
	Surface wall 4	θ_{sw4}	26,2	26,2	26,2
	Surface inside floor	θ_{floor}	26,1	26,1	26,1
	Surface inside ceiling	$\theta_{ceiling}$	26,1	26,1	26,1
	Air - void	$\theta_{a\text{-}void}$	21,7	22,6	20,8
Heating capacity - dummies [W]		P_s	554,0	411,0	687,0

Calculations from measurements					
Number of measuring point			1	2	3
Reference temperature [°C]		θ_{ref}	26,07	26,10	26,09
Δθ [K]	Water temperature rise	$\Delta\theta_w$	2,10	1,58	2,59
	Reference mean water	$\Delta\theta$	8,35	6,39	10,34
Cooling capacity	Specific - test room area [W/m²]	P_t	38,7	29,2	47,9
	Specific - installation area [W/m²]	P_i	40,6	30,6	50,3
	Specific - active area [W/m²]	P_a	48,0	36,2	59,4
	Total [W]	P	569,2	429,4	704,2
Heat transfer/ test room periphery [W]		P_B	22,2	17,3	25,2
Heat balance [W]		ΔQ	6,9	-1,2	7,9
Heat balance maximum value [W]		0,05 · P	+/- 28,5	+/- 21,5	+/- 35,2

9. Drawings of the test item

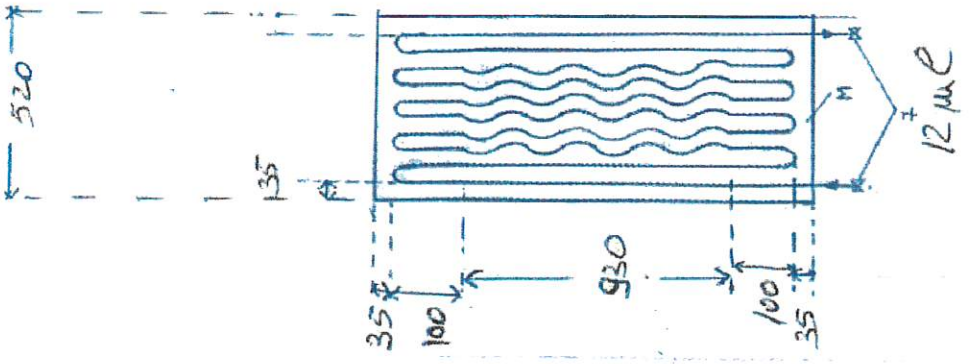
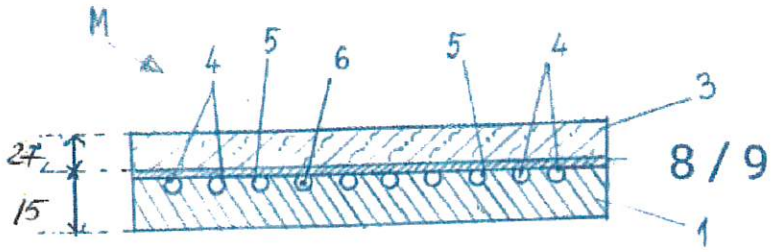
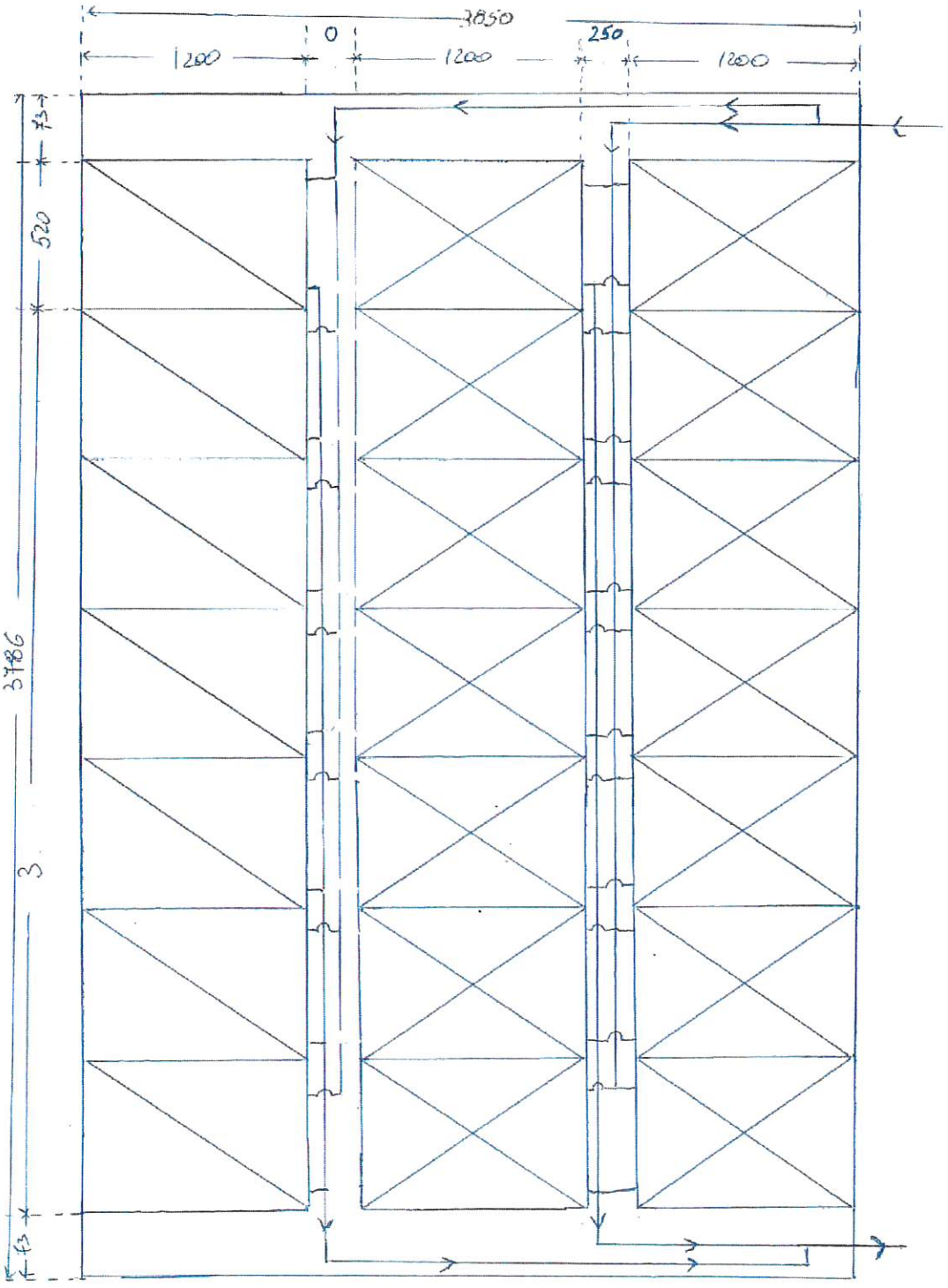


Figura 2



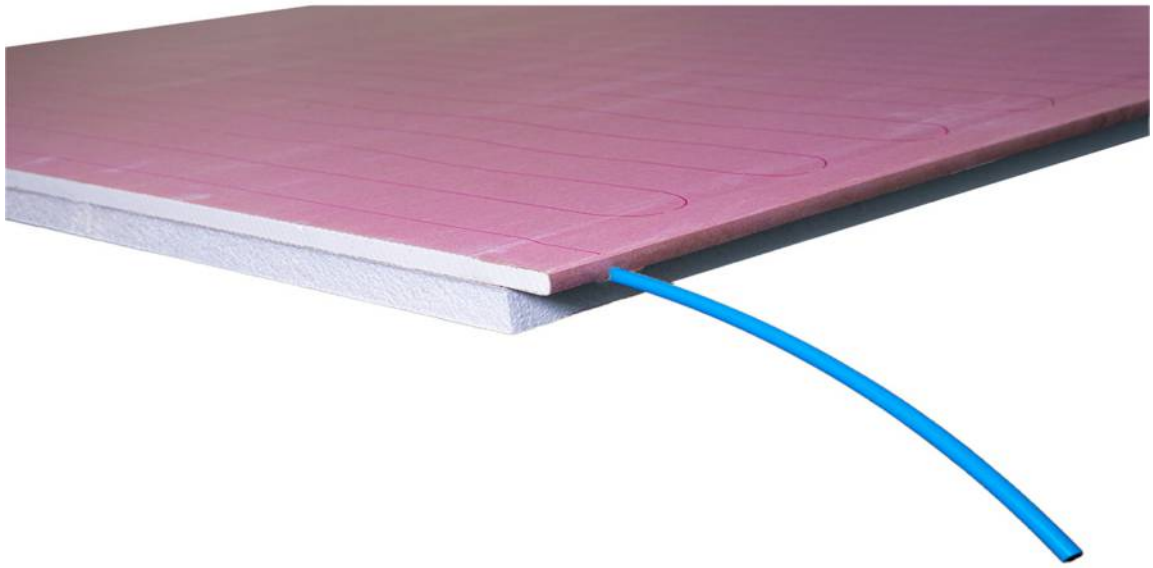

3850
0
250
1200
1200
1200
73
520
3786
3
73

10. Photographs of the test item

Lower side of an element:

Upper side of an element:

Setup of an element:



Complete test setup: