TermoTest
Opava

Evaluations performed by the firm:
Alena Chmelová, Prokopa Holého 258/4, Opava, Czech Republic
EU VAT no.: CZ7357281987
Tel.: (+420) 607 594 827, (+420) 602 769 785
Email: termotest@seznam.cz, http://www.termotest.cz

Completed by: Ing. Petr Nešuta

THERMOGRAPHIC MEASUREMENT REPORT

Assessed for: FIRST Heating s.r.o., Revoluční 3, Praha 1, Czech Republic

Observed at: PROBAEQ s.r.o., Vrahovická 41, Prostějov, Czech Republic

Prepared: 25 November 2011

Ing. Petr Nešuta 

Description of building thermography:

Irregularities in thermal properties of the constituent elements of the structure of a building result in temperature variations at its surface. Surface temperature distribution is the result of thermal anomalies caused by varying factors such as insulation, moisture content and air infiltration among the elements that compose the building structure.

Thermography is a method of recording and visually displaying distribution of surface temperatures. An infrared sensing device (thermographic camera) is used to capture IR radiation on the thermal image.

The thermal color scale ranges from dark blue for the lowest temperatures to the highest temperatures, which are yellow to white.

Objective and subjects of the measurement:

The objective was to determine the heating properties of infrared heating panels manufactured by FIRST Heating. Two measurements were performed:

Evaluation 1: Angle / expansion of infrared radiation from heating panels

Evaluation 2: Measurement of heat emitted by objects in relation to time and distance

Date and Time

The abbreviated form of testing according to ČSN EN 13187 was performed on:

4 November 2011, 07:30 - 11:30

14 November 2011, 10:15 - 13:30

Interior conditions of the testing area:

4 November 2011: air temperature T = 17.4°C, relative humidity 48.8%, air pressure 985.8 hPa

14 November 2011: air temperature T 14.5°C, relative humidity 36.7%, air pressure 995.8 hPa.

Equipment used: **FLIR b 50** infrared camera, **TESTO 905-T2** surface thermometer, **Greisinger GFTB 100** humidity meter, all calibrated.

Procedure and results:

Evaluation 1:
Angle / expansion of infrared radiation from heating panels

The heat emission angles of three heating panels with dimensions of 600mm x 600mm, 600mm x 900mm and 600mm x 1500mm were measured, and were positioned facing a wall. From the measured dimensions of the same area temperature was calculated by the angle α.
The equipment position is illustrated in Figure 1 and measurement results are in Table 1.

Figure 1 – Equipment position

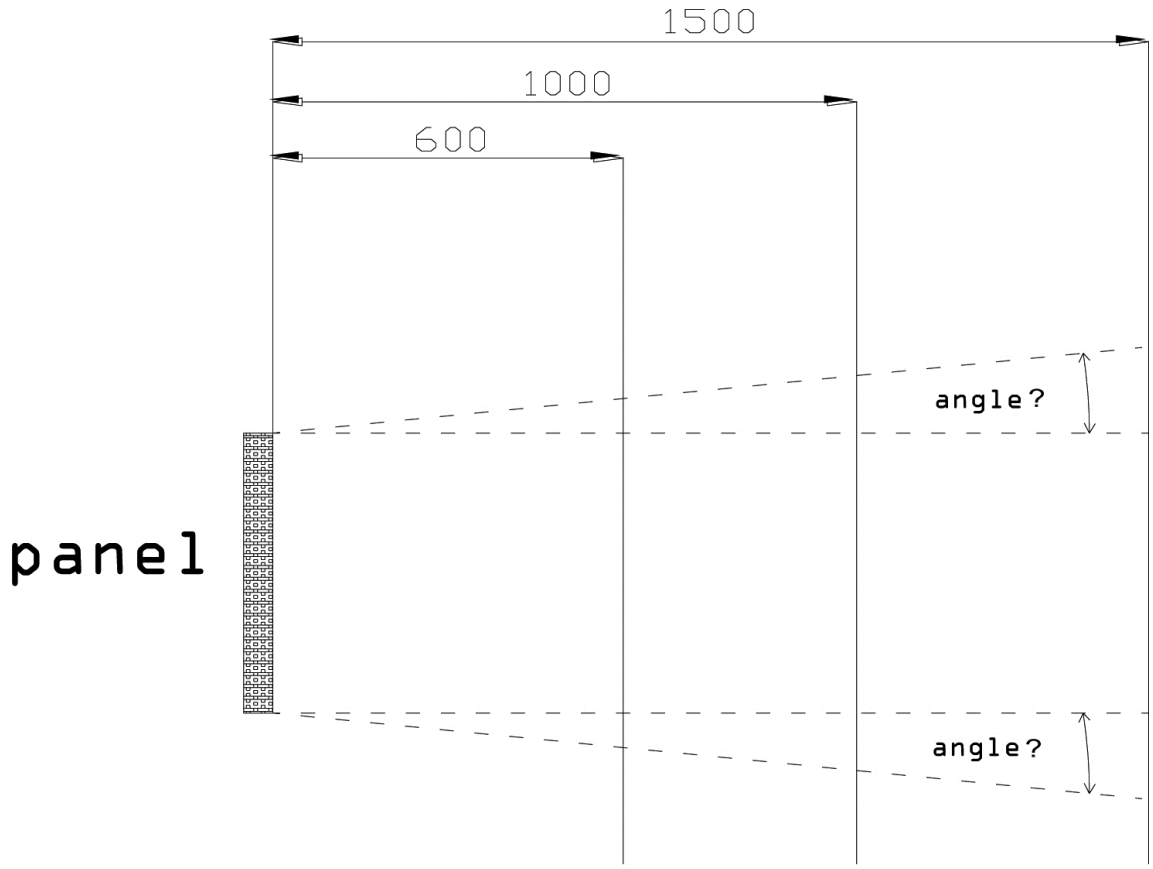
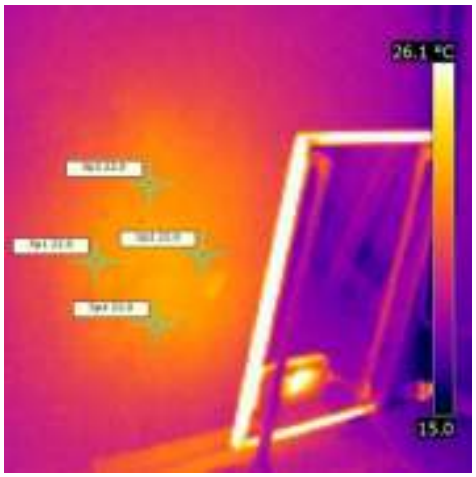
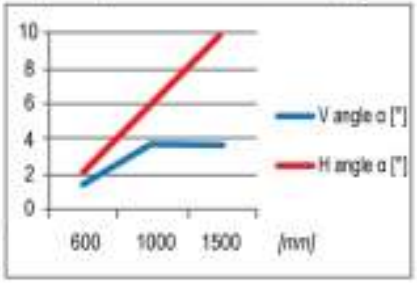


Figure 2 – Measurement

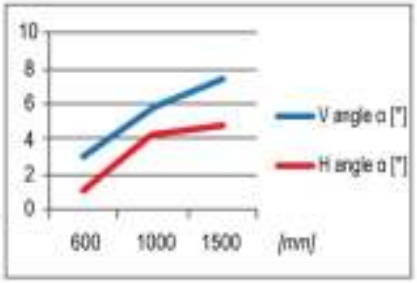


Graphic representation of radiant angle

panel dimensions 600mm x 600mm	panel height [mm]	panel width [mm]	distance from wall [mm]	height [mm]	width [mm]	expansion [mm]	expansion [mm]	Vertical, Horizontal angle α [°]	
								V	H
	600	600	600	630	650	15	25	1.43	2.20
			1000	730	760	65	80	3.72	6.01
			1500	790	920	95	160	3.62	9.87
							average	**2.92**	**6.03**



panel dimensions 600mm x 900mm	panel height [mm]	panel width [mm]	distance from wall [mm]	height [mm]	width [mm]	expansion [mm]	expansion [mm]	Vertical, Horizontal angle α [°]	
								V	H
	600	900	600	660	930	30	15	2.86	0.92
			1000	800	1050	100	75	5.71	4.09
			1500	990	1080	195	90	7.41	4.76
							average	**5.33**	**4.42**



panel dimensions 600mm x 1500mm	height [mm]	width [mm]	distance from wall [mm]	height [mm]	width [mm]	expansion [mm]	expansion [mm]	Vertical, Horizontal angle α [°]	
								V	H
	600	1500	600	750	1540	75	20	7.13	0.74
			1000	940	1560	170	30	9.65	1.10
			1500	1080	1600	240	50	9.09	9.87
							average	**8.62**	**6.03**

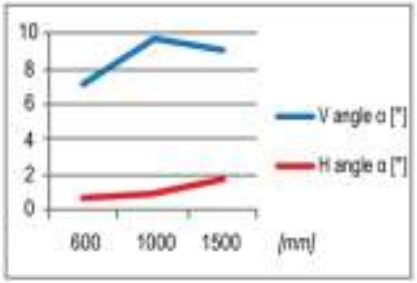


Table 1 – Measurement results of the angle / expansion of IR radiation

Evaluation 2:
Measurement of heat emitted by objects in relation to time and distance

Temperature measurements were made on wooden boards (see Figure 3 below).
Six individual boards were spaced at distances of 0.5m from each other in a row, beginning at 0.5m from the heating panel. The temperatures of the boards were recorded every 5 minutes for a period of 120 minutes. A 600mm x 900mm heating panel was used in this observation. Measurements were performed with a thermal camera and contact thermometer. The results are listed in Table 2, the graph of temperatures in Figure 4, and in the Annex of thermal images.

It is evident from the measurement results that the greatest temperature increase (about 5°C) occurred within the first 20 minutes. Further increase of temperature slowed for the remainder of the evaluation to about 2°C.

All of the boards up to a distance of 3m gained temperature. Some then had slight reductions of temperature near the end of the measurement. The final temperature difference between boards nearest and most distant from the heating panel was nearly 3°C.

The room air temperature rose 1.1°C during the evaluation.

Figure 3 – Arrangement of the objects for evaluation, thermographic samples.

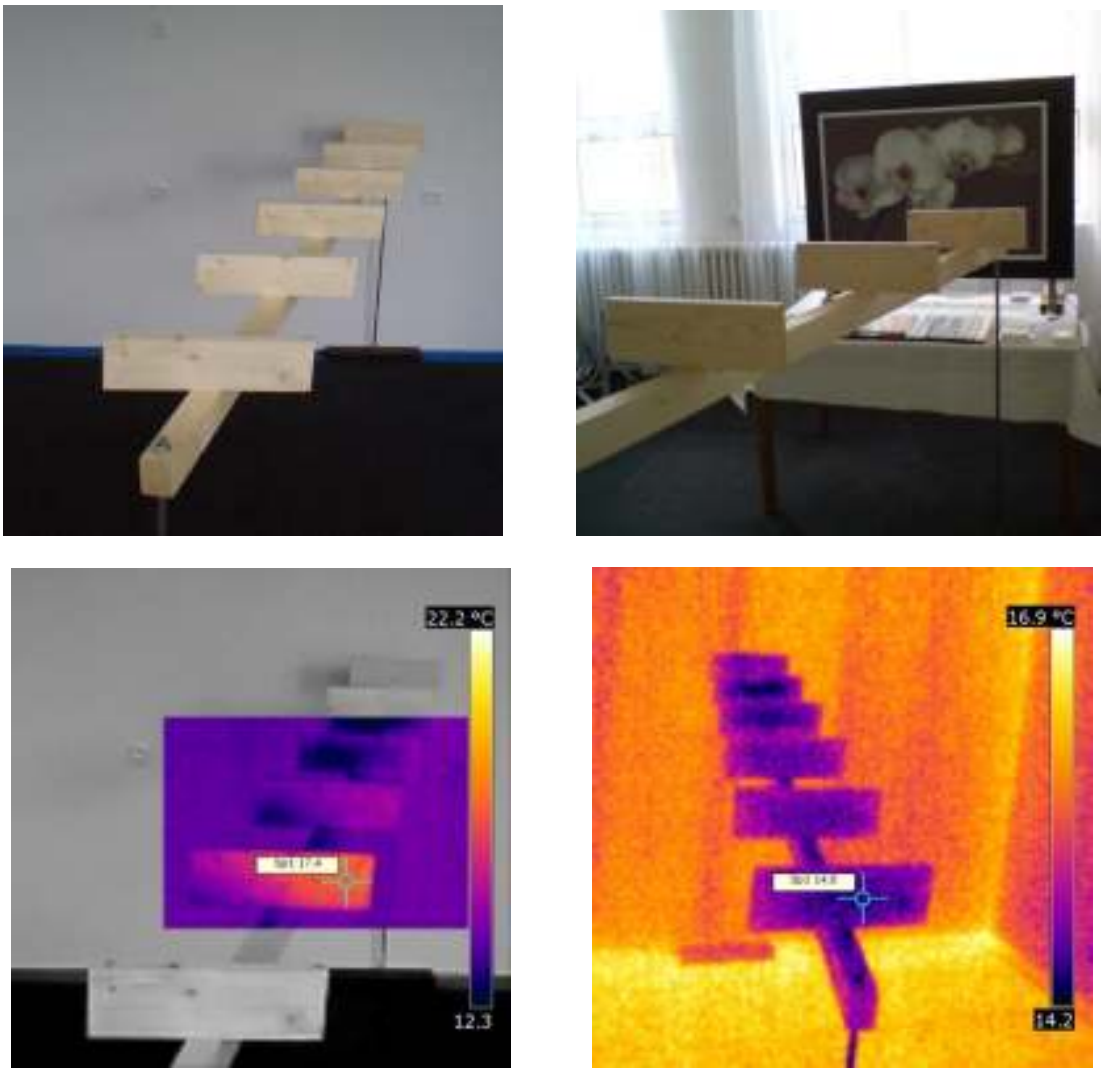
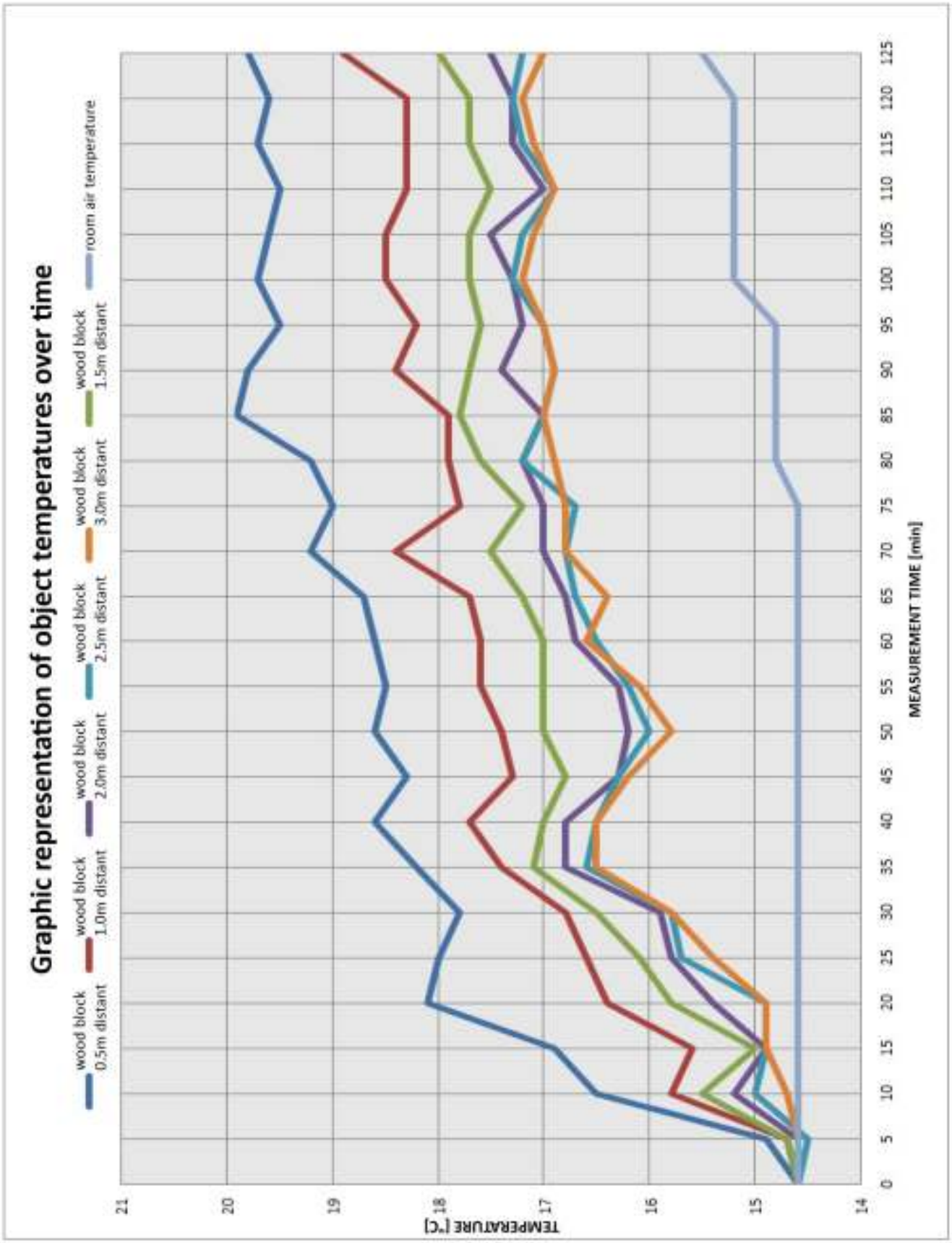


Table 2 – Temperature readings of heated objects over time

Table of recorded temperatures from 0-125 minutes (in °C)								
time		dist. 0.5m	dist. 1.0m	dist. 1.5m	dist. 2.0m	dist. 2.5m	dist. 3.0m	room temperature
hr:min	min							
11:03	0	14.6	14.6	14.6	14.6	14.6	14.6	14.6
11:08	5	14.9	14.7	14.7	14.6	14.5	14.6	14.6
11:13	10	16.5	15.8	15.5	15.2	15.0	14.7	14.6
11:18	15	16.9	15.6	15.0	14.9	14.9	14.9	14.6
11:23	20	18.1	16.4	15.8	15.4	14.9	14.9	14.6
11:28	25	18.0	16.6	16.1	15.8	15.7	15.4	14.6
11:33	30	17.8	16.8	16.5	15.9	15.8	15.8	14.6
11:38	35	18.2	17.4	17.1	16.8	16.6	16.5	14.6
11:43	40	18.6	17.7	17.0	16.8	16.5	16.5	14.6
11:48	45	18.3	17.3	16.8	16.3	16.3	16.2	14.6
11:53	50	18.6	17.4	17.0	16.2	16.0	15.8	14.6
11:58	55	18.5	17.6	17.0	16.3	16.2	16.1	14.6
12:03	60	18.6	17.6	17.0	16.7	16.5	16.6	14.6
12:08	65	18.7	17.7	17.2	16.8	16.7	16.4	14.6
12:13	70	19.2	18.4	17.5	17.0	16.8	16.8	14.6
12:18	75	19.0	17.8	17.2	17.0	16.7	16.8	14.6
12:23	80	19.2	17.9	17.6	17.2	17.2	16.9	14.8
12:28	85	19.9	17.9	17.8	17.0	17.0	17.0	14.8
12:33	90	19.8	18.4	17.7	17.4	16.9	16.9	14.8
12:38	95	19.5	18.2	17.6	17.2	17.0	17.0	14.8
12:43	100	19.7	18.5	17.7	17.3	17.3	17.2	15.2
12:48	105	19.6	18.5	17.7	17.5	17.2	17.1	15.2
12:53	110	19.5	18.3	17.5	17.0	16.9	16.9	15.2
12:58	115	19.7	18.3	17.7	17.3	17.2	17.1	15.2
13:03	120	19.6	18.3	17.7	17.3	17.3	17.2	15.2
13:08	125	19.8	18.9	18.0	17.5	17.2	17.0	15.5

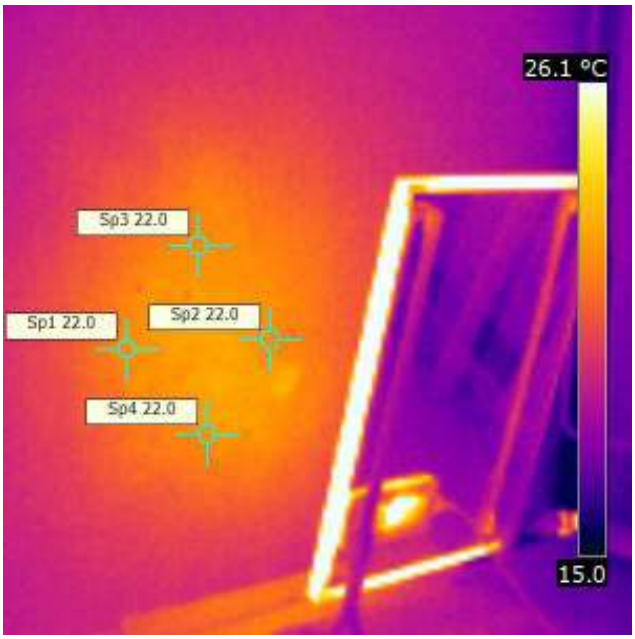
Figure 4 – Temperature chart of heated objects over time



Report

Date of report	25 November 2011

Company	TermoTest Opava	Client	FIRST Heating s.r.o.
Address	Opava, P. Holého 4	Address	Revoluční 3, Praha 1
Performed by	Ing. Petr Nešuta, tel.602769785		



Parameters of image and object	
Camera type	FLIR b 50
Image date	4.11.2011 8:36:26
File	IR_1166u.jpg
Emissivity	0.95
Reflected temperature	15.0°C
Distance	1.0m

Comments

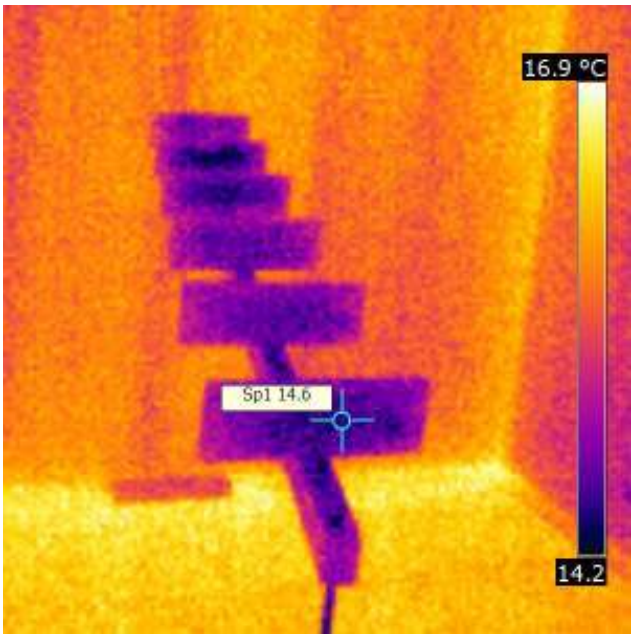
Description

Measuring the angle of IR radiation
600mm x 900mm heating panel

Report

Date of report	25 November 2011

Company	TermoTest Opava	Client	FIRST Heating s.r.o.
Address	Opava, P. Holého 4	Address	Revoluční 3, Praha 1
Performed by	Ing. Petr Nešuta, tel.602769785		



Parameters of image and object	
Camera type	FLIR b 50
Image date	14.11.2011 10:53:24
File	IR_1215u.jpg
Emissivity	0.93
Reflected temperature	1.0°C
Distance	1.0m

Comments

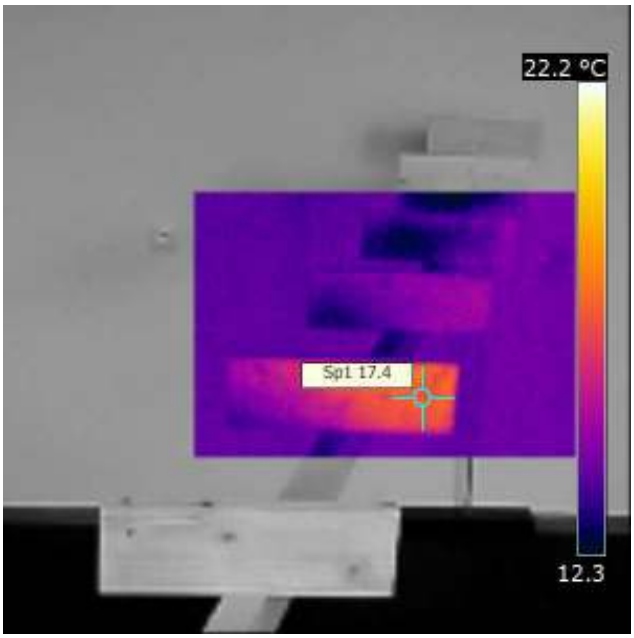
Description

Measurement time – minute 0

Report

Date of report	25 November 2011

Company	TermoTest Opava	Client	FIRST Heating s.r.o.
Address	Opava, P. Holého 4	Address	Revoluční 3, Praha 1
Performed by	Ing. Petr Nešuta, tel.602769785		



Parameters of image and object	
Camera type	FLIR b 50
Image date	14.11.2011 11:37:08
File	IR_1260u.jpg
Emissivity	0.93
Reflected temperature	36.0°C
Distance	1.0m

Comments

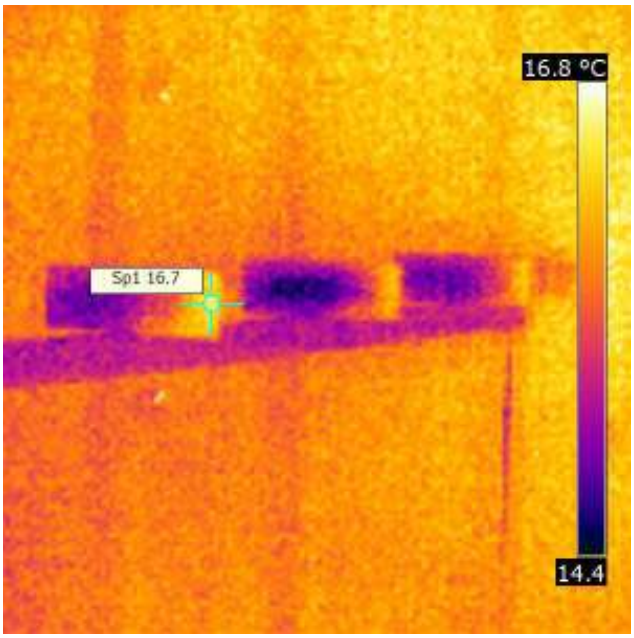
Description

Measurement time – minute 30

Report

Date of report	25 November 2011

Company	TermoTest Opava	Client	FIRST Heating s.r.o.
Address	Opava, P. Holého 4	Address	Revoluční 3, Praha 1
Performed by	Ing. Petr Nešuta, tel.602769785		



Parameters of image and object	
Camera type	FLIR b 50
Image date	14.11.2011 12:03:38
File	IR_1280.jpg
Emissivity	0.93
Reflected temperature	17.0°C
Distance	1.0m

Comments

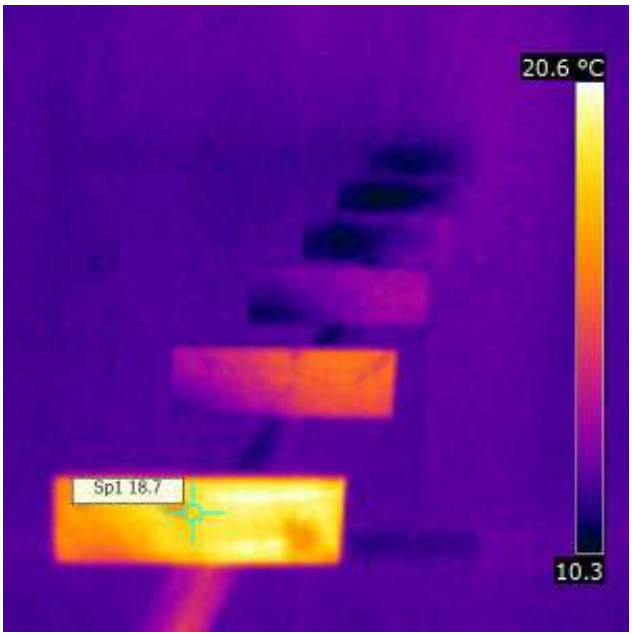
Description

Measurement time – minute 55
Board no. 4

Report

Date of report	25 November 2011

Company	TermoTest Opava	Client	FIRST Heating s.r.o.
Address	Opava, P. Holého 4	Address	Revoluční 3, Praha 1
Performed by	Ing. Petr Nešuta, tel.602769785		



Parameters of image and object	
Camera type	FLIR b 50
Image date	14.11.2011 12:08:13
File	IR_1284u.jpg
Emissivity	0.93
Reflected temperature	61.0°C
Distance	1.0m

Comments

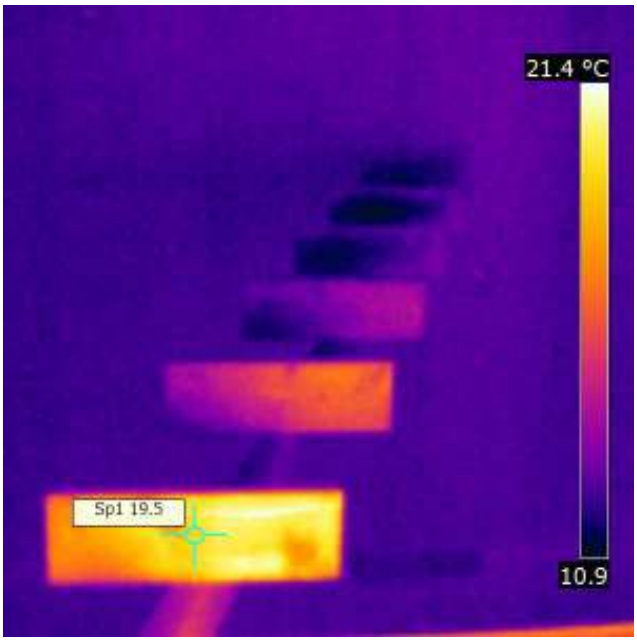
Description

Measurement time – minute 60

Report

Date of report	25 November 2011

Company	TermoTest Opava	Client	FIRST Heating s.r.o.
Address	Opava, P. Holého 4	Address	Revoluční 3, Praha 1
Performed by	Ing. Petr Nešuta, tel.602769785		



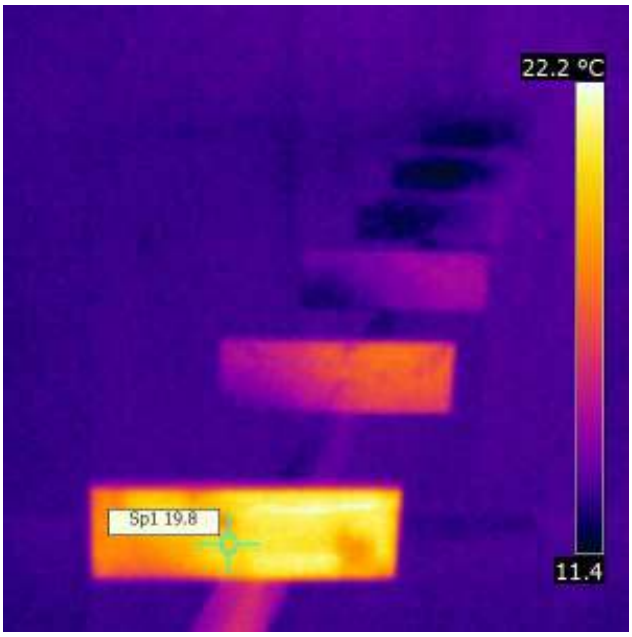
Parameters of image and object		Comments
Camera type	FLIR b 50	
Image date	14.11.2011 12:38:12	
File	IR_1302u.jpg	
Emissivity	0.93	
Reflected temperature	61.0°C	
Distance	1.0m	

Description
Measurement time – minute 90

Report

Date of report	25 November 2011

Company	TermoTest Opava	Client	FIRST Heating s.r.o.
Address	Opava, P. Holého 4	Address	Revoluční 3, Praha 1
Performed by	Ing. Petr Nešuta, tel.602769785		



Parameters of image and object	
Camera type	FLIR b 50
Image date	14.11.2011 13:08:35
File	IR_1322u.jpg
Emissivity	0.93
Reflected temperature	61.0°C
Distance	1.0m

Comments

Description

Measurement time – minute 120