RESEARCH REPORT

comparison of thermal permeability of the walls in the facility at Dolnej Wsi 58 for PSCoat system

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Research Report

1. **Subject of the study**
   The subject of the study is a research report of a multi-family building located at ul. Dolna Wies 58 in Gliwice, which aims to obtain a comparative heat transfer value for the front façade insulated with PSCoat technology, and the rear wall insulated with foamed polystyrene λ=0.031.

2. **Object description:**
   The object under study is a three-story building with commercial premises on the ground floor, residential above and an attic. The building has a basement. It is made in traditional brick technology.
   Front facade of the building is cover by PSCoat system. Rear facade and side facades are covered by styrofoam of 12cm thickness.

3. Object description:

The purpose of the study:

The study is aimed at obtaining the estimated thermal permeability coefficient and comparing it for both baffles, i.e. with insulation in PSCoat technology and styrofoam with a thickness of approx. 12cm, λ=0.031. Due to the unique nature of PSCoat insulation, we can not calculate the thermal permeability coefficient, therefore we refer to the comparison of temperature values with commonly known technology.

Comparative study of the estimated thermal permeability parameter.

The estimation of the thermal permeability parameter is determined on the basis of the temperature difference between the three zones: indoor temperature, outdoor temperature and internal temperature of the tested partition.

We determine the replacement heat flux based on the formula:

$$Q' = \frac{Twew - Tściany}{Rsi} \qquad (1)$$

where:
Q- heat flux
Twew – indoor temperature
Tściany – temperaturę of the tested partition
Rsi – heat transfer resistance according to PN-EN ISO 6946

Comparitive thermal permeability is calculate based on the formula:

$$U' = \frac{Q}{Twew - Tzew} \qquad (2)$$

where:
U- thermal permeability
Q- heat flux
Twew – indoor temperature
Tzew – outdoor temperature

The obtained result is compared with the known calculation value of thermal permeability of the partition insulated with 12 cm of polystyrene acc. to PN-EN ISO 6946.

Comparing the results according to the approximate and computational method, we obtain a comparative parameter:

$$\theta = \frac{U}{U'} \qquad (3)$$

The estimated value of thermal transmittance for the PS Coat insulated barrier is scalable acc.to parameter θ. New results we are able to compare to the real thermal permeability value

The course of the study:

- Thermovision was carried out using a thermal imaging camera on the inner front wall of the building in the living space of the building's owner. The air temperature inside and outside the room was measured using thermometers. In the second place,

similarly, thermovision was carried out using the thermal imaging camera of the inner rear wall of the building in the living space of the building's owner. The internal air temperature was measured using thermometers

4. Thermal imaging camera

- Research equipment:
FLIR TG165 thermal imaging camera
Temperature measurement using infrared:

Meter type	Point thermal imaging camera
Type of display	LCD TFT 2" (176x220), colour
Measuring range of temperature	-25...380°C
Optical resolution	24:1
Field of view	38.6° horizontal x 50° vertical
Accuracy of non-contact temperature	±1,5% lub ±1,5°C
External dimension	186 x 55 x 94mm
Power source	akumulator Li-Ion 3,7V 2600mAh
Measure	Non-contact temperature (IR)

-Object:
The walls of the building were made in the traditional technology of full brick with a thickness of 38 cm, cement-lime plaster. Inside the room, the walls are covered with acrylic paint.
- Material emissivity coefficients have been defined for two temperatures:
temperature 0 °C ; temperature 20 °C
- brick: 0,85 ; 0,93
- acrylic paint: 0,94; 0,95
- cement lime plaster: 0,88 ; 0,93

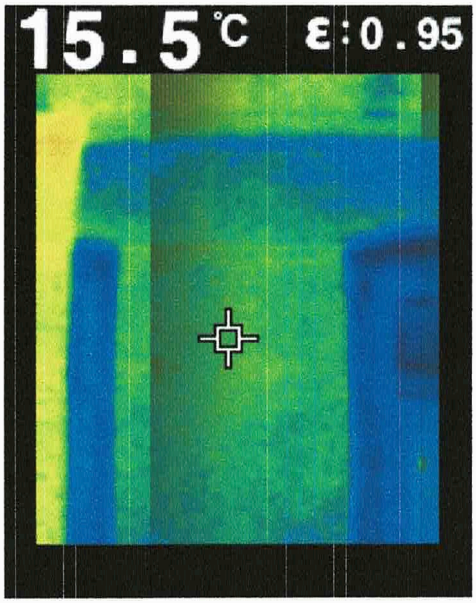
-Building orientation:

The front wall of the building has a south-eastern exposure. The rear wall of the building has a north-western exposure.

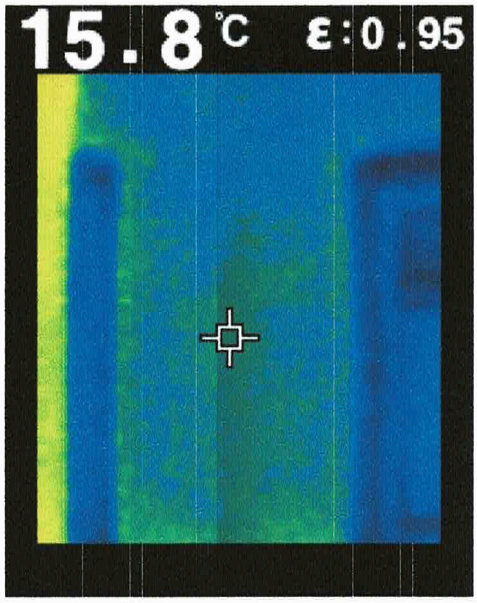
-Atmospheric conditions
The control of atmospheric conditions was carried out twice.
First measurement: 14.01.2019
Temperature: -1 °C, 984 hPa; Wind:35km/h, north west direction; Opad: 0mm; Cloudy
Second measurement: 15.01.2019
Temperature: 2 °C, 990 hPa; Wind:32km/h, north west direction; Fall: 1mm; Cloudy
During research report was equal to 2 °C
Indoor air temperature in room 1: front wall painted with the PScoat system: 18,6 °C
Indoor air temperature in room 2: rear wall insulated with 12 cm thick polystyrene foam: 18,4 °C

All measurements made with a thermal imaging camera were made at the same distance from the wall, away from all thermal bridges for the most accurate measurement.

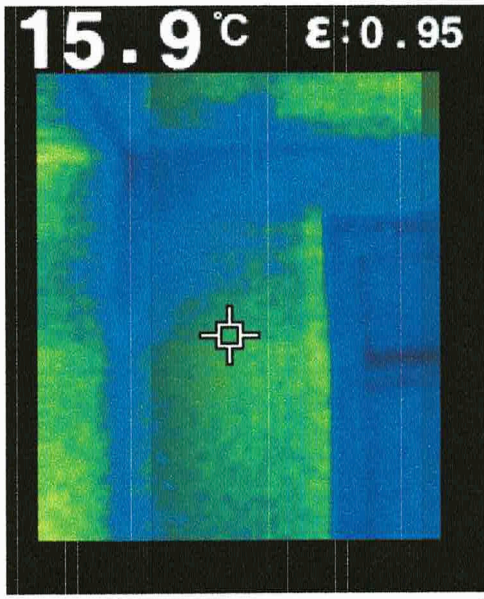
-Pictures from the thermalvision camera



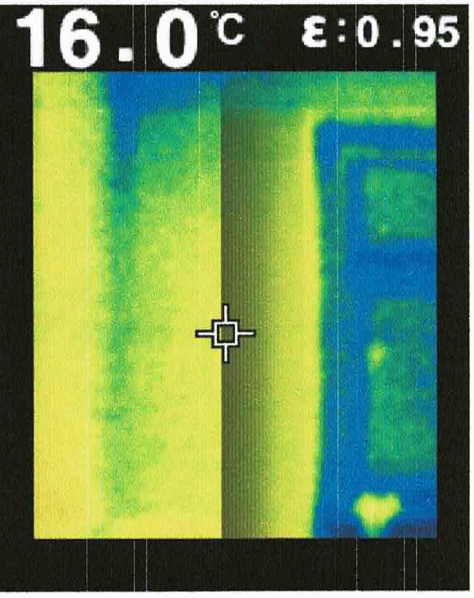
Front wall



Front wall



Rear wall



Rear wall

5. Research data

a) Front facade covered by PSCoat system

Front facade + PSCoat		
Temperature of the internal wall [st. C]		Outside air temperature
Point 1	Point 2	2,0
15,8	15,5	
Avarage temperature		
15,65		

b) Rear facade covered by styrofoam of 12cm thickness

Rear facade + styrofoam 12 cm		
Temperature of the internal wall - tylnej [st. C]		Outside air temperature
Point 1	Point 2	2,0
15,9	16,00	
Avarage temperature		
15,95		

6. Calculation of the comparitive thermal permeability parameter

a) Front facade covered by PSCoat system

Calculation of the heat flux value [Q] and thermal permeability [U]					
Rsi [(m2*st.C)/W]	Internal temperature [st. C]	Front wall internal [st. C]	Outside air temperature [st. C]	Q [W/m2]	U [w/(m2*st.C)]
0,13	18,6	15,65	2	22,6923	1,3670

b) Rear facade covered by styrofoam of 12cm thickness

Calculation of the heat flux value [Q] and thermal permeability [U]					
Rsi [(m2*st.C)/W]	Internal temperature [st. C]	Front wall internal. [st. C]	Outside air temperature [st. C]	Q [W/m2]	U [w/(m2*st.C)]
0,13	18,4	15,95	2	18,8462	1,1492

Calculation of the theoretical value of heat transfer "U" for a wall insulated with 12 cm polystyrene λ = 0,031

The design value of heat transfer U of the partition acc. to PN-EN ISO 6946:1999					
		Rbrick [m2*C/W]	Rstyrofoam	R	U
Insulation	Styrofoam 12 cm	0,4935	3,870967742	4,5345	0,220532734

7. Determination of the comparative parameter

	Partition		Ratio
Styrfoam	U tested	1,1492	0,1919
	U calc.	0,2205	

8. Calculation of the calculated values of the thermal permeability tested

Partition	Ratio	U tested	U comparative
Styrofoam	0,1919	1,1257	0,2205
PSCoat		1,3670	0,2678

The difference in thermal permeability between the two comparative partitions is 0,0473

9. Finding a calculated value „U" partition PSCoat for styrofoam λ = 0,031

The design value of heat transfer U of the partition according to the standard PN-EN ISO 6946:1999

		Rbrick [m2*C/W]	Rstyrofoam	R	U
Insulation	Styrofoam 12 cm	0,4935	3,8710	4,5345	0,2205
	Styrofoam 10cm	0,4935	3,2258	3,8893	0,2571
	Styrofoam 9cm	0,4935	2,9032	3,5667	0,2804

10. Conclusions

After the examination of walls insulated in two different technologies - Styrofoam of thickness 12 cm (λ = 0,031) and PSCoat system , conclude that using PSCoat system is in range between 9 a 10 cm

Insulation	U
Styrofoam 9cm	0,2804
PSCoat	0,2678

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