(Translation)

REPORT No. 13_01694-2-a

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PURPOSE	DETERMINATION OF THERMAL INSULATION AS PER UNE-EN ISO 6946:2012
TESTED SAMPLE	POLYURETANE PANEL WITH FINE COATING OF FIREPROOF MATERIAL: REF.: "PANESPOL"
DATE OF RECEIPT	29.04.2013
TEST DATES	28.05.2013 – 29.05.2013
TRANSLATION DATE	17.09.2014

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BACKGROUND INFORMATION

On 29 April 2013, the necessary data to carry out the thermal performance study of the “decorative panel” building solution was received at TECNALIA, from the company PANESPOL SYSTEMS DE ALCOYM S.L. The solution sent by the client is: decorative panel with a fireproof acrylic coating and polyurethane core with the reference "PANESPOL".

The test requested is the *Thermal resistance and thermal transmittance calculation method for building components and building elements* in accordance with Standard UNE-EN ISO 6946:2012.

On 29 May 2013, TECNALIA issues this report with the results obtained, which are detailed below.

GOALS

The purpose of this report is to analyse the **thermal resistance** and **thermal transmittance** of the decorative panel building solution.

The calculation of the **thermal resistance**, in accordance with UNE-EN ISO 6946:2012, is based on calculating the thermal transmittance of the set. And it is based on the appropriate design thermal conductivity or thermal resistances of the materials and products used. This method is applied to components and elements made up of thermally homogeneous layers.

CHARACTERISTICS OF THE SAMPLE

The building solution is described below:

Polyurethane core Ref.: PANESPOL: sample characterised in accordance with Report 13_01694-1 in which the thermal conductivity of the polyurethane used in this solution is determined. The thickness of this core varies depending on the total thickness of the decorative panel.

Fireproof acrylic polymer coating: solution consisting of acrylic polymer of different thicknesses depending on the total thickness of the decorative panel.

According to the client, the decorative panel has an average thickness of **20.7mm.**

The thermal conductivity values of the materials that have been used in the calculation and which have previously been confirmed with the client are shown in the table:

MATERIAL	Thermal conductivity λ (W/mK)
Polyurethane core Ref.: PANESPOL	0.03234[1]
Acrylic polymer fireproof coating	0.20[2]

Table 1: Thermal conductivity values of each element that makes up the building solution.

[1] Data obtained from the thermal conductivity test in accordance with UNE-EN 12667:2002. See Report 13_01694-1

[2] Data obtained from tabulated values in accordance with UNE-EN 12524:2000.

CALCULATION METHOD

CALCULATION PRINCIPLES - THERMAL RESISTANCE

This standard provides the calculation method for the thermal resistance and transmittance of the building components and elements, except for doors, windows and other glazed components, components that involve heat transfer towards the land, and components through which air may penetrate.

The calculation method is based on the appropriate design thermal conductivity or thermal resistances of the materials and products used.

The method is applied to components and elements made up of thermally homogeneous layers (which may include air chambers). This standard also provides an approximate method that may be used with non-homogeneous layers, except in cases in which an insulation layer is metallic.

The principle of the calculation method consists of:

a) obtaining the thermal resistance of each thermally homogeneous part of the component;

b) combining these individual resistances to obtain the total thermal resistance of the component, including the effect of the surface resistances.

The thermal design values may be given as design thermal conductivity or design thermal resistance. If the thermal conductivity is given, the thermal resistance of the layer will be obtained with:

$$R = \frac{d}{\lambda}$$

where *d* is the thickness of the layer of material in the component; λ is the design thermal conductivity of the material, whether calculated or obtained from tabulated values.

As for the surface resistances, in the absence of specific information, the surface resistances specified in Standard En ISO 6946 will be used, in which the values of the “horizontal” column will be applied to heat flow directions of ±30º from the horizontal plane.

Resistencias superficiales (en $m^2 \cdot K/W$)

	Dirección del flujo de calor		
	Hacia arriba	**Horizontal**	**Hacia abajo**
R_{si}	0,10	0,13	0,17
R_{se}	0,04	0,04	0,04

NOTA – Los valores de la tabla 1 son valores de diseño. Para declarar la transmitancia térmica de los componentes y otros casos donde se requieren valores independientes de la dirección del flujo de calor, se recomienda utilizar los valores de flujo de calor horizontal.

Total thermal resistance, RT, of a building element comprised of thermally homogeneous layers, perpendicular to the heat flow shall be calculated in accordance with the following expression:

$$R_T = R_{si} + R_1 + R_2 + \ldots\ldots R_n + R_{se}$$

where, Rsi and Rse are the inner and outer surface resistances, respectively. And R1, R2, …Rn are the design thermal resistances of each layer.

In terms of thermal transmittance, it is defined as:

$$U = \frac{1}{R_T}$$

RESULTS

THERMAL RESISTANCE AND THERMAL TRANSMITTANCE OF THE "PANESPOL" DECORATIVE PANEL

The results calculated in accordance with Standard UNE-EN ISO 6946:2012 on Thermal transmittance, U, are detailed in the table below:

Espesor (m) recubrimiento	Espesor (m) nucleo PU	espesor total (m)	Resistencia Panel decorativo (m^2K/W)	Transmitancia térmica, Panel decorativo W/m^2K
0,0007	0,02	0,0207	**0,62**	**1,26**
0,0017	0,019	0,0207	**0,60**	**1,31**
0,0027	0,018	0,0207	**0,57**	**1,35**
0,0037	0,017	0,0207	**0,54**	**1,40**
0,0047	0,016	0,0207	**0,52**	**1,45**
0,0057	0,015	0,0207	**0,49**	**1,51**
0,0067	0,014	0,0207	**0,47**	**1,57**
0,0077	0,013	0,0207	**0,44**	**1,64**
0,0087	0,012	0,0207	**0,41**	**1,71**
0,0097	0,011	0,0207	**0,39**	**1,79**
0,0107	0,01	0,0207	**0,36**	**1,88**

The calculations have been made assuming that the decorative panel is always going to be positioned vertically (with a horizontal heat flow; perpendicular to the decorative panel), and never horizontally.