

Insulation and Coverings Department

Structural Hygrothermics Division

**Case No.: 13-047**

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“DETERMINING THE HEAT RESISTANCE (R) OF AN  
INSULATION PROCEDURE CONCERNING A  
SKYTECH REFLECTIVE PRODUCT COMBINED  
WITH TWO AIR GAPS ACCORDING TO STANDARD  
NF EN 16012”

Version 1

Study requested by:

Company: Winco  
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This study report comprises 7 pages, including 2 pages of attachments.

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## I. AIM OF STUDY

The aim of this study is to determine, on behalf of the company Winco Technology, the heat resistance in the level of an insulation procedure consisting of a Skytech reflective product in combination with two air gaps according to Standard NF EN 16012.

The performance level assessed does not take account of the possible presence of integrated thermal bridges produced by fixed elements within the procedure.

The technical elements used as a basis for carrying out this study were sent by Winco Technology for the description of the procedure, the EMI division of CSTB Grenoble for the emissivity value (report no. EMI 13/26045328-1) and the HTO Division Laboratory of CSTB for the heat resistance value of the reflective product (report no. HO 13-E13 027). These elements are reproduced as an annex to this report.

This report deals only with the thermal aspect of the procedure and does not in any way prejudge its fitness for use.

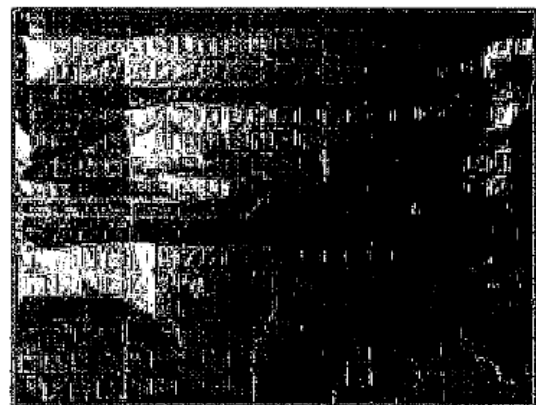
## II. BRIEF DESCRIPTION

Insulation procedure comprising a type-2 reflective insulation product, applied between two unventilated air gaps and marketed by Winco Technology under the name Skytech.

The following Figure 1 provides an overview of the two faces of the Skytech product.



Face 1 (fine frame)



Face 2 (squared frame)

Figure 1 – Faces 1 & 2 of the Skytech product

## III. METHODOLOGY

### III.1. Principle

The calculation involves adding the intrinsic heat resistance of the reflective product, measured in accordance with Standard NF EN 16012, and the heat resistance of the adjacent air gaps, taking account of the emissivity levels measured on both faces of the reflective product.

### III.2. Rules for calculation

The heat resistance of the procedure has been determined in accordance with Standard NF EN 16012.

### III.3. Hypotheses

#### III.3.1. Geometry

- The thicknesses of the air gaps adjacent to the product are fixed at 20 mm for calculation purposes. For lesser thicknesses, the heat resistance of the air gaps must be recalculated according to Standard NF EN ISO 6946.
- The thickness of the air gaps is assumed to be homogeneous.
- The temperature difference in the air gaps is assumed to be 5K or less.
- The average temperature in the air gaps has been fixed at 15°C.

#### III.3.2. Heat resistance of layers

Layers	Heat resistance m <sup>2</sup> .K/W	Sources
Unventilated air gap face 1 (20 mm)	0,658	NF EN ISO 6946
Skytech	0,47	Test report no. HO 13-E13 027
Unventilated air gap face 2 (20 mm)	0,615	NF EN ISO 6946

Table 1 – Heat resistance of layers

#### III.3.3. Declared emissivity levels for faces of product

Face	$\epsilon_D^1$	Sources
Reflective product face 1	0,05	Test report no. EMI 13/26045328-1
Reflective product face 2	0,07	
Materials facing each other	0,9	NF EN ISO 6946

Table 2 – Conditions at limits

<sup>1</sup> The declared emissivity level is determined in accordance with Standard NF EN 16012 on the basis of measurements performed on three samples at five points, applying the statistical processing indicated in Standard EN ISO 10456 to take account of variation in production and uncertainty of measurement.

### III.4. Formulae

The total heat resistance coefficient for the procedure  $R_{\text{procedure}}$  is calculated using the following relation:

$$R_{\text{procedure}} = R_{\text{gap1}} + R_{\text{product}} + R_{\text{gap2}} \quad \text{W}/(\text{m}^2.\text{K})$$

Where:

$R_{\text{gap1}}$  is the heat resistance of air gap 1, expressed in  $\text{m}^2.\text{k/W}$

$R_{\text{gap2}}$  is the heat resistance of air gap 2, expressed in  $\text{m}^2.\text{k/W}$

$R_{\text{product}}$  is the intrinsic heat resistance of the reflective product, expressed in  $\text{m}^2.\text{k/W}$

## IV. RESULTS

The results shown below are valid only for the hypotheses in Section III.3. They are valid only for the product subjected to the tests and do not prejudice the characteristics of similar products.

	<b>Thickness of single reflective product<sup>2</sup>, mm</b>	<b><math>R_{\text{product}}</math>, intrinsic, in <math>\text{m}^2.\text{K/W}^3</math></b>	<b>Total thickness of procedure, mm</b>	<b><math>R_{\text{procedure}}</math> in <math>\text{m}^2.\text{K/W}</math></b>
<b>Skytech procedure combined with 2 unventilated air gaps</b>	13	0.47	53	1.70

Table 3 – Results

<sup>2</sup> Measured according to Standard NF EN 823

<sup>3</sup> Measured using flowmeter according to fake samples method, as per Standard NF EN 16012

## V. ANNEXES

**Calculation of 90/90 fractile**

Measurement	Face 1	Face 2
1	5	6
2	4	6
3	5	7
4	4	5
5	5	5
6	3	5
7	3	5
8	4	4
9	3	5
10	3	4
11	4	4
12	3	4
13	4	4
14	4	5
15	4	5
Average	3,86667	4,93333
Estimated standard deviation	0,74322	0,88372
k2;p=90%	1,87	1,87
Upper limit value, confidence range	5	7

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**INSULATION AND COVERINGS**

Hygrothermics of Structures

## **TEST REPORT HO 13-E13 027**

### **Concerning**

## **Determination of the heat resistance of the Skytech product from Winco**

This test report certifies only the characteristics of the item submitted for tests and does not prejudge the characteristics of similar products. It is not a product certificate within the meaning of Articles L.115-27 to L.115-33 and R.115-1 to R.115-3 of the Consumer Code.

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Marne-La-Vallee – Paris – Grenoble – Nantes – Sophia-Antipolis



## **AIM**

To determine the heat resistance of the Skytech product from Winco.

## **REFERENCE TEXTS**

- NF EN 923:1994      Determining the thickness of samples
- NF EN 12 085:1997    Determining the linear dimensions of samples
- NF EN 1602:1997      Determining the apparent mass by volume
- NF EN 16012:2012    Reflective insulation products – determining the declared performance level
- NF EN 12 667:2001    Determining heat resistance using the guarded hotplate method and the flowmeter method – products with high and medium thermal resistance

## **ITEM SUBMITTED FOR TEST**

Description:            Reflective insulation product in roll, not compressed within packaging  
Reception date:        24 May 2013  
Origin:                  Winco Technologies  
Identification:          E13-027  
Date of tests:           19 June – 13 August 2013  
Test operative:         Marion Delahaie

Compiled in Marne-La-Vallée, 2 September 2013

Laboratory Manage



Eric Pilch

## PRODUCT CHARACTERISTICS

The principal characteristics supplied by the applicant appear below:

Samples reference	E13-027
Client reference	Skytech
Nominal thickness of product, mm	Not advised by applicant
Type of product according to Standard NF EN 16012	Type-2 product

## 1. RESULTS OF TESTS

### 1.1. Dimensional and weight-related characteristics of samples

The thickness of the samples is determined in accordance with Standard NF EN 823, with a load plate of 50 Pa on three samples measuring about 1m x 1m.

The results of the measurements to determine the thickness according to Standard NF EN 823 appear in Table 1 below.

**Table 1: Determining the thickness**

Reference of samples	Thickness in mm
E13-027-1	12.4
E13-027-2	12.4
E13-027-3	13.5
Average	13

The area density is measured according to Standards NF EN 12085 and NF EN 1602 (area density is  $m/S$  with the mass ( $m$ ) measured according to Standard NF EN 1602 and  $S$  defined by  $S = l \times b$ ) on the heat test sample.

The results of the area density measurement on the sample appear in Table 2 below.

**Table 2: Determining the area density of the test sample**

Sample reference	Length, mm	Width, mm	Mass, g	Area density, $g/m^2$
E13-027-1	490	488	327.2	1,368

## 1.2. Heat characteristics

The heat resistance is determined using the methods of Standard NF EN 16012.

The heat characteristics have been determined using the fake samples method.

The results of the measurements obtained appear in Table 3 below.

**Table 3: Results of heat measurements**

Product reference	Test thickness, mm	Average temperature, °C	Flow density, in W/m <sup>2</sup>	Heat resistance at 10°C, in m <sup>2</sup> .K/W
E13-027-1	13	10	9.91	0.47

**END OF REPORT**

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## **TEST REPORT EMI 13/26045328-1**

### **Determining the hemispheric emissivity of samples of reflective product**

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## 1. AIM

To determine hemispheric emissivity on samples of reflective product.

## 2. REFERENCE TEXTS

NF EN ISO 16012 dated June 2012: "Heat insulation of buildings – Reflective insulation products – Determining the declared thermal performance level." Annex D

## 3. TEST DATE

Conditioning was carried out during the period 1-29 July. The tests were performed on 30 July 2013.

## 4. ITEM SUBMITTED FOR TEST

The item was supplied by Winco via CSTB Marne-La-Vallée and received at CSTB Grenoble by transport vehicle on 26 June 2013. It bears the following reference:

<b>CSTB reference</b>	<b>Product reference</b>	<b>Remarks</b>
EMI260-45328-SK	Skytech	Face 1: fine frame Face 2: squared motif (5 mm)

Technical Associate responsible for tests: François-Dominique Meneteau

Grenoble, 31 July 2013

Engineer Responsible for Tests



François Olive

## 5. PREPARATION OF SAMPLES

3 specimens measuring approximately 25 x 25 cm were cut within the sample, which was not subjected to any cleaning.

## 6. CONDITIONING

The specimens were conditioned in an oven at 70°C and 90% RH without UV, over a period of 28 days in the oven.

## 7. MEASUREMENT METHOD

A hemispheric surface maintained at 100°C issues diffuse infrared radiation towards the sample. A detector measures the infrared reflection from the surface of the sample.

The emissivity of the sample is measured following calibration of the detector with calibrated samples (high and low emissivity values).

## 8. APPARATUS

The hemispheric emissivity levels are measured using an Inglas emissions meter, type TIR 100-2.

## 9. RESULTS

The hemispheric emissivity values are shown (as %s) in the following table. Estimated uncertainty is 3%.

Sample reference	Face	Emissivity measurement %					Average emissivity	Average emissivity
		1	2	3	4	5	Specimen	Sample
EMI260-45328-SK1	1	5	4	5	4	5	4	4
EMI260-45328-SK2	1	3	3	4	3	3	3	
EMI260-45328-SK3	1	4	3	4	4	4	4	
EMI260-45328-SK1	2	6	6	7	5	5	6	5
EMI260-45328-SK2	2	5	5	4	5	4	4	
EMI260-45328-SK3	2	4	4	4	5	5	4	

Table 1: Hemispheric emissivity, %

**END OF REPORT**