

## TEST REPORT No. 327360

**Place and date of issue:** Bellaria-Igea Marina - Italia, 31/08/2015

**Customer:** ASAWA INSULATION PRIVATE LIMITED - Plot No: 52 & 53, Arkose Industrial Estate,  
Adhoshi Road Dekhu, Sajgaon, Tal - Khalapur, Khopoli, Maharashtra - 410203 - India

**Date test requested:** 08/07/2015

**Order number and date:** 67129, 08/07/2015

**Date sample received:** 03/08/2015

**Test date:** from 03/08/2015 to 05/08/2015

**Purpose of test:** initial thermal resistance and initial thermal conductivity using the guarded hot plate method in accordance with standard UNI EN 12667:2002 of ductwork made from insulation ductboards with reference to UNI EN 13403:2004 standard

**Place of test:** Istituto Giordano S.p.A. - Blocco 1 - Via Rossini, 2 - 47814 Bellaria-Igea Marina (RN) - Italia

**Sample origin:** sampled and supplied by the Customer

**Identification of sample received:** No. 2015/1649

### Sample name\*

The test sample is called "SMART PIR PANELS".



(\*) according to information supplied by the Customer.

LAB N° 0021

Comp. AV  
Revis. PR

This test report consists of 7 sheets.

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### Description of sample\*

The test sample consists of No. 2 PIR (Poly-Isocyanurate) foam sheet boards, size 500 mm × 500 mm, with a nominal thickness of 20 mm, faced on both faces with aluminium foil (thickness of 80 µm).

Blowing agent: 141.



Photo of test sample

### Normative references

The test was carried out in accordance with the requirements of standard "UNI EN 12667:2002 dated 01/02/2002 "Prestazione termica dei materiali e dei prodotti per edilizia. Determinazione della resistenza termica con il metodo della piastra calda con anello di guardia e con il metodo del termoflussimetro. Prodotti con alta e media resistenza termica" (*"Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance"*), as foreseen by clause 4.7.8 "Thermal properties" of standard UNI EN 13403:2004 dated 01/03/2004 "Ventilazione degli edifici. Condotti non metallici. Rete delle condotte realizzata con condotti di materiale isolante" (*"Ventilation for buildings. Non-metallic ducts. Ductwork made from insulation ductboards"*).

(\*) according to information supplied by the Customer.

### **Specimen description**

No. 2 specimens of size 499 mm × 499 mm have been made by removal of aluminum foils.



**Photo of the specimens**

### **Test apparatus**

The test was carried out using a guarded hot plate with a two-specimen symmetrical configuration, square front sections of size 517 mm × 517 mm and vertical orientation in accordance with standard UNI EN 12667:2002.

The temperature on the faces of the test pieces was determined by using Pt 100  $\Omega$  resistance-thermometer sensors embedded on the test apparatus surfaces (3 sensors on each surface).

### **Specimen conditioning**

The specimens were conditioned at a temperature of 23 °C and 50 % of relative humidity.

Conditioning time: 24 h.

### **Test methods**

The test was performed using detailed internal procedure PP002 revision 21 dated 24/02/2014 “Determinazione della conduttività termica con il metodo della piastra calda con anello di guardia” (*“Determination of thermal conductivity by the Guarded hot plate apparatus method”*).

The test was carried out at a mean temperature of 10 °C, as foreseen by clause 5.2 “Conditioning” of standard UNI EN 131**Errore. L'origine riferimento non è stata trovata.** dated 21/03/2013 “Isolanti termici per edilizia. Prodotti di poliuretano espanso rigido (PU) ottenuti in fabbrica. Specificazione” (*“Thermal insulation product for building. Factory made rigid polyurethane foam (PU) products. Specification”*).

The temperature of the room containing the apparatus was set to the value of the mean test temperature and the edges of the specimens were insulated with insulation blanket, in order to reduce heat loss.

**Data obtained from sample**

Mass of sample upon receipt	0,69177 kg
Size of sample upon receipt	500 mm × 500 mm
Thickness upon receipt	0,02060 m

**Data obtained from specimens**

Average thickness of specimen A " $d_A$ "	0,02036 m
Average thickness of specimen B " $d_B$ "	0,02027 m
Average specimen thickness immediately after the test " $d$ "	0,02033 m
Specimen volume " $V$ "	0,01013 m <sup>3</sup>
Mass of specimens before conditioning " $m_1$ "	0,48603 kg
Mass of conditioned specimens " $m_3$ "	0,48576 kg
Relative mass change of specimens due to conditioning " $\Delta m_c$ "	0,06 %
Density of conditioned specimens " $\rho_c$ "	48,0 kg/m <sup>3</sup>
Specimen mass immediately after the test " $m_4$ "	0,48534 kg
Relative mass regain of specimens during the test " $\Delta m_w$ "	-0,09 %
Pressure applied to specimens	1400 Pa
Thickness measurement method	Test conditions
Method of mass measurement immediately after the test	Test conditions

**Data obtained during testing**

Thermal conductivity and thermal resistance test starting date	04/08/2015
Test duration	24 h
Time required to reach steady-state duration	14 h
Duration of measurement period for the determination of thermal characteristics	4 h
Metering area "A"	0,06656 m <sup>2</sup>
Heat flow rate in the metering section "Φ"	1,27 W
Density of heat flow rate across specimens "q"	9,51 W/m <sup>2</sup>
Average specimen(s) hot side temperature "T <sub>1</sub> "	14,97 °C
Average specimen(s) cold side temperature "T <sub>2</sub> "	5,00 °C
Mean steady-state temperature in test room "T <sub>a</sub> "	10,12 °C
Average temperature difference "ΔT" = T <sub>1</sub> -T <sub>2</sub>	9,97 K
Temperature gradient across the specimens $\frac{T_1 - T_2}{d}$	490 K/m
Mean test temperature "T <sub>m</sub> " = $\frac{T_1 + T_2}{2}$	9,99 °C



**Test results**

Thermal conductance " $\Lambda$ " = $1/R$ and relative expanded uncertainty	0,955 +0,019 -0,012	W/(m <sup>2</sup> · K)
Thermal resistance " $R$ " = $\frac{2A(T_1 - T_2)}{\Phi}$ and relative expanded uncertainty	1,05 +0,0 -0,02	m <sup>2</sup> · K/W
Thermal conductivity " $\lambda$ " = $\frac{\Phi \cdot d}{2A(T_1 - T_2)}$ and relative expanded uncertainty*	0,0194 +0,0003 -0,0003	W/(m · K)
Expanded uncertainty confidence level " $p$ "	95 %	
Expanded uncertainty coverage factor " $k_p$ "	2	

(\*) PIR foam is subject to aging, therefore the conductivity value is that measured when testing and represent the PIR foam aged value of thermal conductivity (according to standard UNI EN 13165).

Test results were obtained under the following conditions:

Specimen hygrothermal conditions	reference temperature of 10 °C and moisture content when in equilibrium with air at 23 °C and relative humidity of 50 %.
Specimens material conditions	Subjected to accelerated ageing in accordance with standard UNI EN 13165
Density of conditioned specimens " $\rho_c$ "	48,0 kg/m <sup>3</sup>

Test Technician  
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(Dott. Floriano Tamanti)

Chief Executive Officer  
(Dott. Arch. Sara Lorenza Giordano)

