SUstainable solutions for affordable REtroFIT of domestic buildings

Call: H2020-LC-SC3-2018-2019-2020

Topic: LC-SC3-EE-1-2018-2019-2020

Type of action: IA

Grant Agreement number	**894511**
Project acronym **Project full title**	**SUREFIT** **SU**stainable solutions for affordable **RE**tro**FIT** of domestic buildings
Due date of deliverable	**30/11/2021**
Lead beneficiary	**Cândido José Rodrigues (CJR)**
Other authors	**Contribution of ISQ, UNOTT, FSM, AMS**

WP4 - Deliverable D 4.8

Prefabricated Panels

Dissemination Level

PU	**Public**	**X**
CO	Confidential, only for members of the consortium (including the Commission Services)	
Cl	Classified, as referred to in Commission Decision 2001/844/EC	

Document History

Version	Date	Authors	Description
1	27/06/2022	Cândido José Rodrigues	First draft
2	22/05/2023	Cândido José Rodrigues	Second draft
3	29/08/2023	Cândido José Rodrigues	Final document
4	31/08/2023	Sérgio Tadeu (ISQ)	Review
5	08/03/2024	Cândido José Rodrigues	Technical characteristics and laboratory tests results added
6	11/03/2024	Sérgio Tadeu (ISQ)	Review

Disclaimer

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No **894511**.

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Abbreviations

CPR	Construction Product Regulation
hEN	harmonized European Norm
EAD	European Assessment Document

1 Publishable summary

The work programme involves optimal sizing and prefabrication of technologies tailored to building design/requirements; retrofitting/monitoring buildings in different climates with support of advanced building energy management systems; analysing indoor environment quality, energy use, user behaviour/acceptance of the solutions; developing methodology, guidelines/effective operational tools for rapid retrofitting and decision-making; and developing business model involving all relevant actors including, public authorities/investors/users and holistic integration of disciplines across the value chain. These outcomes will be delivered by a consortium comprising leading companies, research/public institutions from European countries.

This deliverable consists of the specification of the prefabricated panels.

2 Introduction

Leading Beneficiary: Cândido José Rodrigues (CJR)

Participants: ISQ, WINCO, UNOTT, FSM, AMS

Task description: Task 4.4

Prefabrication of renovation technologies appropriate for each building and climate (by all Participants from Month 15 to Month 24). The technologies produced and tested above were prefabricated for integration into the five demonstration buildings. The choice of different technologies and combination of different methods as a whole building solution were optimised using the life cycle analysis taking into account additional criteria such as being simple to use, highly efficient and easy to replicate as well as local culture. Overall, holistic renovation of the buildings includes energy efficient technologies for different aspects of building structure and services. The plan for integration of the above technologies into the five buildings for renovation was as follows:

• Building in Portugal: Multi-functional heat pumps for heating, cooling and heat recovery, PV vacuum glazing windows and window thermal recovery, solar collectors and PV panels on roof and low energy fully integrated control system.

• Building in Greece: Breathable membrane, multi-functional heat pumps for heating, cooling and heat recovery, bio aerogel panels for wall and floor insulation, PV vacuum glazing windows and window thermal recovery, evaporative cooler, solar collectors and PV panels on roof and low energy fully integrated control system.

• Building in Spain: Breathable membrane, multi-functional heat pumps, bio-aerogel panels for wall and floor insulation, PV vacuum glazing windows and window thermal recovery, PV roof, PCM storage, evaporative cooler, integrated heat recovery system; surface coating of the exterior, solar thermal and/or PV panels and low energy fully integrated control system.

• Building in Finland: Daylight Louvers.

• Building in the UK: Breathable membrane, bio-aerogel panels for wall and floor insulation, PV vacuum glazing windows and window heat recovery, multi-functional heat pumps for heating, cooling and heat recovery system, low energy fully integrated control system, surface coating of the exterior, solar thermal and/or PV panels.

This work package was carried out mainly by UNOTT, SOLIMPEKS, WINCO, AMS, ONCONTROL, KOST, PCM, AALTO and CJR. Other participants assisted production and testing of the technologies and optimise their integration into buildings.

Figure 1 - Cândido José Rodrigues

Figure 2 - SUREFIT PROJECT

3 Summary

Buildings represent about 40% of the EU energy consumption, and 36% of the total CO_2 emissions. A major part of these is due to heating and cooling, to maintain comfortable indoor conditions. In 2012, energy consumption for residential space heating in the EU was 200 Mtoe. The EU has committed to meet 20% of all energy demand through the use of renewable energy sources by 2020, and a further target of 100% by 2050 is already underway. Rational use of energy and integration of renewable energy technologies can substantially reduce the conventional energy demand in new and existing buildings and assist the EU in meeting the climate change objectives under the 2015 Paris Agreement.

The European Directive on Energy Performance of Buildings aimed to improve the overall energy efficiency of new buildings and large existing buildings (>1,000 m^2). The most recent update of the directive calls for cost optimal solutions for both new buildings and for the renovation of existing buildings. In the building sector, a recast of the European Performance of Buildings Directive (EPBD) requires all new buildings to become nZEB by the end of 2020. The nZEB concept requires a high level of energy efficiency, in combination with on-site renewable energy use/production. Currently the inflexible, low skilled construction industry is finding it very hard to meet those standards in a cost-effective manner.

Although the construction of new buildings to the energy efficiency standards in Europe is essential for reducing energy consumption and hence global warming, the benefits will accrue slowly because it will take several decades before such buildings form a significant proportion of the building stock. At present, about 35% of the EU's buildings are over 50 years old and almost 75% of the building stock is energy inefficient but only 0.4-1.2% of the building stock is renovated each year due to slow and costly renovation processes. Buildings must be created that people want to work in and use, while significantly reducing greenhouse gas emissions.

The key to achieving this goal is to understand how best to manufacture, select and integrate various technologies from the many available, to optimise performance for different building types, climates and socio-economic conditions with minimum disruption to occupants. Systemic approaches for building renovation could address the key challenges facing the construction industry by minimising energy use and material waste, maximising the energy efficiency and the use of renewable energy sources for heating, cooling, power generation and lighting, and fast and affordable retrofitting through the use of prefabrication.

4 Proposed Solution

Until now, renovation of a building made use of mostly conventional technologies and commercial renewable products and enabled significant reduction of building energy consumption from existing levels, maximising the perceived comfort of the individual users.

The proposed project will go beyond current practices to bring about a step change in renovation. The technologies currently available for renovation are expensive and renovation processes are time consuming while disturbing the occupants, making it unattractive for deep retrofit to building owners. This project will make use of innovative modular/prefabricated technologies to rapidly renovate a selection of domestic buildings to reduce energy consumption not only from the existing levels but also to meet the aspiration for near zero energy buildings and meet personal comfort level.

The innovative technology proposed by Grant Agreement, was bio-aerogel. However, it turned to be “*expensive and difficult to produce or handle*” by UNOTT. Taking this into account, UNOTT proposed the utilization of silica aerogel.

Firstly, were presented different solutions, with different materials, but always with silica aerogel. Those solutions were changed by this last one (Figure 3), because of conditioning on buildings.

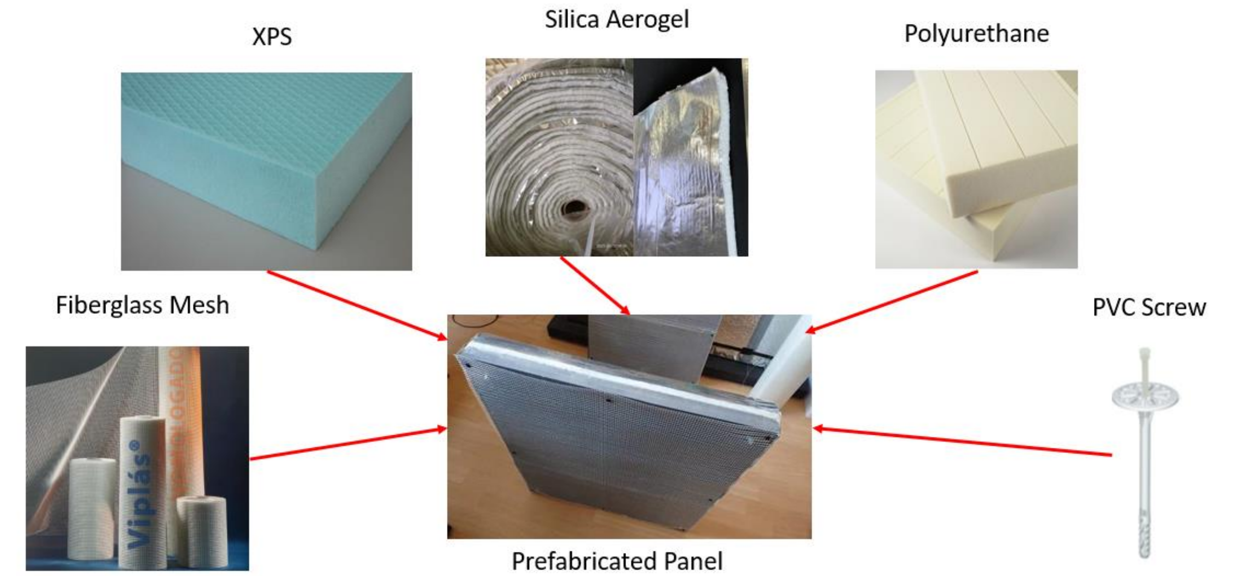

Figure 3 - Prefabricated Panel

4.1 Layers and materials

	Material	Thermal conductivity (w/m.K)	Thickness (mm)	Weight (kg/m2)
Spain	Fiberglass Mesh	0,000	0,6	0,16
	XPS	0,033	20	0,63
	Silica Aerogel	0,022	20	3,74
	XPS	0,033	20	0,63
	Fiberglass Mesh	0,000	0,6	0,16
			61,20 mm	5,32 kg/m2

Table 1 - Layers and Materials of Prefabricated Panel to Spain

	Material	Thermal conductivity (w/m.K)	Thickness (mm)	Weight (kg/m2)
Greece	Fiberglass Mesh	0,000	0,6	0,16
	XPS	0,033	20	0,63
	Silica Aerogel	0,022	20	3,74
	Polyurethane	0,023	30	1,05
	Fiberglass Mesh	0,000	0,6	0,16
			71,20 mm	5,74 kg/m2

Table 2 - Layers and Materials of Prefabricated Panel to Greece

This solution has contributions from partners of UNOTT, AMS, FSM.

CJR, with help from ISQ, has asked for a determination of the thermal resistance of those two prefabricated panels (attached to this document). Here's some conclusions:

Based on the information provided by the customer, the prefabricated panels considered are building components consisting of homogeneous layers which have the following composition:

• **SPAIN**: extruded polystyrene foam (XPS) [20 mm] + silica aerogel [20 mm] + extruded polystyrene foam (XPS) [20 mm];

• **GREECE**: rigid polyurethane foam (PU) [30 mm] + silica aerogel (20 mm) + extruded polystyrene foam (XPS) [20 mm].

The rigid polyurethane foam (PU) layer is in contact with the façade.

Figure 4 shows the two-dimensional temperature distribution in the prefabricated panels considering a heat flow with direction perpendicular to the face, obtained by numerical calculation, solved by the finite element method.

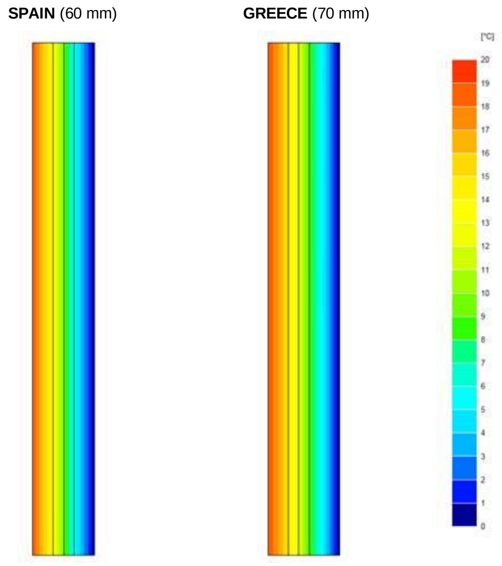

Figure 4 - Thermal resistance

The thermal conductivities of both solutions were:

- Thermal conductivity (Spain) = 0.029 W/m x K;
- Thermal conductivity (Greece) = 0.025 W/m x K.

U-values were also determined:

- U-value (Spain) = 0.481 W/m²K;
- U-value (Greece) = 0.360 W/m²K.

4.2 Installation

As presented on 30th month Consortium Meeting, this technology is like an ETICS (External Thermal Insulation Composite System), but instead of EPS, silica aerogel blanket is used, which allow us to have smaller thickness on the wall with better insulation characteristics. As it works like ETICS, the installation is very simple:

Figure 5 - European Association for ETICS

5 Conclusions

The main purpose of this project is to obtain sustainable solutions for affordable retrofit of domestic buildings, to demonstrate fast-track renovation of existing domestic buildings by integrating innovative, cost-effective, and environmentally conscious prefabricated technologies. This is to reach target of near zero energy through reducing heat losses through building envelope, and energy consumption by heating, cooling, ventilation, and lighting, while increasing the share of renewable energy in buildings.

This prefabricated panels solution, will promote a fast-track renovation, once the initial plate fixed to the wall, is shaped to include the insulation panel and membrane, as well as the cladding panels.

This is also a cheap, light, and sustainable solution, thus fulfilling all the requirements of the purpose of this project.

6 References

(ISO 10211:2017(en) - Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations)

(ISO 6946:2017(en) - Building components and building elements — Thermal resistance and thermal transmittance — Calculation methods)

Appendix A: Technical characteristics and laboratory tests results

itecons

Determination of the thermal resistance of a building component (ISO 6946:2017, ISO 10211:2017)

Prefabricated panels

Customer:

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REPORT

(OMH034/23)

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Report

Determination of the thermal resistance of a building component (ISO 6946:2017, ISO 10211:2017). Prefabricated panels

1 - Scope of the report

This report follows a request by the company "Cândido José Rodrigues, S.A." with the objective of determining the design value of the thermal resistance of two typologies of prefabricated panels.

The design values of the thermal resistance were determined based on the ISO 6946:2017 and ISO 10211:2017 standards.

2 - Geometric characteristics of the prefabricated panels

Based on the information provided by the customer, the prefabricated panels considered are building components consisting of homogeneous layers which have the following composition:

- **SPAIN**: extruded polystyrene foam (XPS) [20 mm] + silica aerogel [20 mm] + extruded polystyrene foam (XPS) [20 mm]
- **GREECE**: rigid polyurethane foam (PU) [30 mm] + silica aerogel (20 mm) + extruded polystyrene foam (XPS) [20 mm]

The rigid polyurethane foam (PU) layer is in contact with the façade.

3 - Thermal parameters considered in the calculation

The thermal conductivity of the materials used in the production of the prefabricated panels are presented in Table 1, and were obtained by consulting technical sheets, presented in Annex.

Table 1: Thermal conductivity values of the materials used in the production of the prefabricated panels

Material	Thermal conductivity, λ [W/(m·ºC)]
extruded polystyrene foam (XPS)	0,033
silica aerogel	0,023
rigid polyurethane foam (PU)	0,023

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4 - Determination of the thermal resistance of the prefabricated panels

The determination of the thermal resistance of the prefabricated panels were carried out based on the ISO 6946:2017 standard, by applying a two-dimensional numerical calculation model based on the ISO 10211:2017 standard. For this purpose, the Bisco software, from *Physibel*, was used.

The design value determined for the thermal resistance of the prefabricated panel was R_{SPAIN} = 2,08 m²·K/W and R_{GREECE} = 2,78 m²·K/W.

Figure 1 shows the two-dimensional temperature distribution in the prefabricated panels considering a heat flow with direction perpendicular to the face, obtained by numerical calculation, solved by the finite element method.

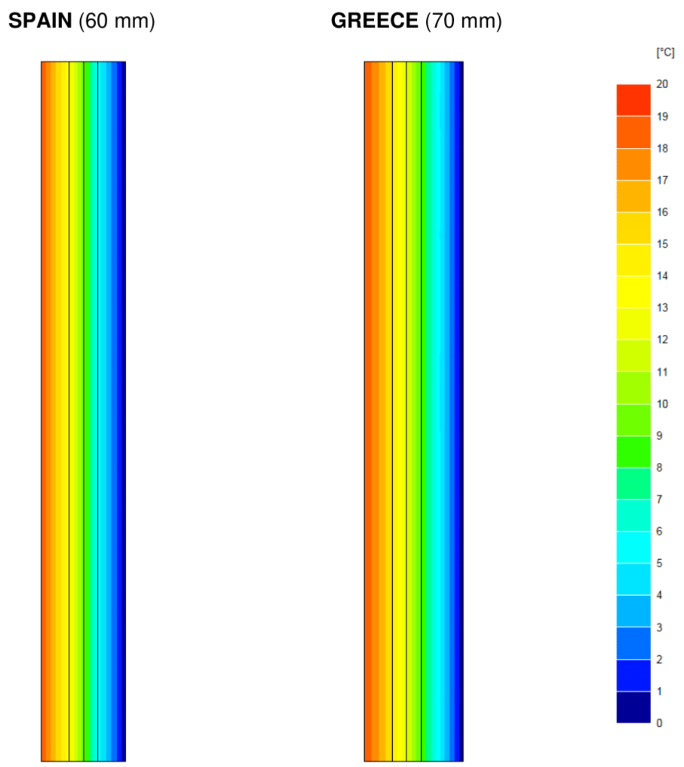

Figure 1: Two-dimensional temperature distribution in the prefabricated panels considering a heat flow with direction perpendicular to the face

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5 - Final considerations

The purpose of this report was to determine the design value of the thermal resistance of two typologies of prefabricated panels, based on the ISO 6946:2017 and ISO 10211:2017 standards.

The design value determined for the thermal resistance of the prefabricated panel was R_{SPAIN} = 2,08 $m^2 \cdot K/W$ and R_{GREECE} = 2,78 $m^2 \cdot K/W$.

Coimbra, 28th of march of 2023

Report author	Technical responsibility	Administration
António Nascimento António Nascimento Senior Official	Nuno Simões Nuno Simões Technical and Scientific Supervisor	Validated document

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ANNEX

Technical sheets

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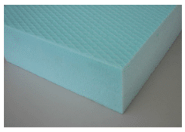
fibran xps®

ENERGYSHIELD
ETICS GF

FICHA TÉCNICA

DESCRIÇÃO



FIBRAN*xps* **ETICS GF,** é uma placa de isolante térmico em espuma rígida de poliestireno expandido extrudido (XPS). Tem uma estrutura de células fechadas e é fabricada em conformidade com processos certificados segundo a Norma Europeia EN 13164 - *"Produtos de isolamento térmico para aplicação em edifícios - Produtos manufacturados de espuma de poliestireno extrudido (XPS) - Especificação"*. As placas de FIBRAN*xps* **ETICS GF** apresentam-se sem pele de extrusão em ambas as faces, com textura gofrada e com encaixes de bordo tipo recto, i.e., com perfil em 'I'.

PROPRIEDADES

Térmicas
Excelentes características de isolamento térmico (baixo λd);
Elevada resistência à absorção de água;
A adequada difusão do vapor de água;
Capilaridade nula;
Mecânicas
Elevada resistência mecânica, nomeadamente à compressão;
Elevada estabilidade dimensional;
Densidade homogénea (30 a 33kg/m^3);
Resistência ao fogo
Euroclass E;
Ambientais
Produzido com gases expansores amigos do ambiente (sem CFC'S nem HCFC'S);
Tempo de vida útil idêntico ao do edifício (estima-se 50 anos);
100% reciclável
Resistência química
Insensibilidade ao ataque de ácidos e bases, mas sensível a materiais com componentes voláteis (solventes);
Compatível com os materiais de construção convencionais (argamassas de cimento, cal, gesso, etc.);
Possível incompatibilidade com membranas de impermeabilização de PVC;
Não se desenvolvem quaisquer bolores ou outras eflorescências;
Sem valor nutritivo para roedores, insetos, etc.
Aplicabilidade
Leve, fácil de transportar, cortar e aplicar;
Estas propriedades são estáveis ao longo do tempo.

APLICAÇÕES CONSTRUTIVAS

- Sistemas de Isolamento Térmico pelo Exterior do tipo ETICS (External Thermal Insulating Composite Systems)
- Correcção de pontes térmicas; colagem com colas de cimento com polímeros;

CERTIFICAÇÃO

Produto certificado segundo a norma europeia EN 13164
Empresa certificada segundo a ISO 9001 e ISO14001
Entidades certificadoras:
LNEC, Laboratório Nacional de Engenharia Civil, Portugal;
AENOR, Asociación Española de Normalización y Certificación, Espanha.

CE | AENOR Producto Certificado | AENOR Gestão Ambiental ISO 14001 | AENOR Empresa Certificada ISO 9001

CUIDADOS NA UTILIZAÇÃO

As placas de FIBRAN*xps* devem ser aplicadas sobre superfícies planas, regularizadas e limpas. Resistem bem ao betume, cal, cimento, gesso, água do mar, lixívias, desodorizantes, ácidos, gases inorgânicos, álcool e silício. Contudo, em contacto com materiais que contenham ingredientes voláteis entrarão em processo de dissolução. Possível incompatibilidade com membranas de PVC, contactar o fornecedor das mesmas. Em caso de dúvida, recomenda-se um teste preliminar ou entrar em contacto com o produtor. A temperatura máxima de trabalho durante a aplicação é de 75ºC e o valor mínimo de -50ºC. O filme retrátil só deve ser removido imediatamente antes da aplicação do FIBRAN*xps*. Estas placas são transportáveis com facilidade e segurança, e fáceis de cortar com folha de serra, faca ou lâmina, ou com um dispositivo de fio quente. Durante as operações de corte das placas, e em espaços fechados, recomenda-se o uso de máscaras de proteção respiratória e óculos de proteção ocular.

GEP-10–FT–04 | Revisão : 09.02.2018

fibran xps

ENERGYSHIELD ETICS GF

FICHA TÉCNICA

DADOS TÉCNICOS EN13164: **XPS-EN13164–T3-CS(10\Y) 300–DS(70,90)-SS150-TR400- WL(T)1,5-MU50**

Propriedades		Unidades	*EN standard*	FIBRANxps **ETICS GF**
Tipo de encaixe (perfil)				Recto (perfil em "I")
Superfície				sem pele e gofrada
Dimensões		mm	EN 822	1250 x 600
Tolerância da espessura			EN 823	T3 (±1mm)
Resistência à compressão (com 10% de deformação) - CS(10\Y) 300		kPa	EN 826	300
Condutibilidade Térmica Declarada – λ_d (após 25 anos)	*20mm | 30mm | 40mm |	W/(m$_x$K)	EN 12667	0,033
	50mm | 60mm | 80mm			0,035
	100mm			0,037
Resistência Térmica Declarada – R_d (após 25 anos)	*20mm | 30mm | 40mm |	m²K/W	EN 12667	0,60 |0,90 | 1,20
	50mm | 60mm | 80mm			1,40 | 1,70| 2,25
	100mm			2,70
Resistência à difusão de vapor de água - MU50		-	EN 12086	≥50
Absorção de água por imersão total de longa duração WL(T)1,5		(%v/v)	EN 12087	≤1,5
Resistência à Tracção perpendicular às faces - TR400		kPa	EN 1607	≥400
Resistência ao Corte - SS150		kPa	EN 12090	≥150
Estabilidade Dimensional DS(TH)	à temperatura de 70ºC e humidade de 90%	%	EN 1604	≤ 5
Reação ao fogo (Euroclasse)		-	EN 13501-1	E

Abreviaturas usadas no Código de Designação segundo a norma EN 13164: XPS - poliestireno extrudido; Ti – Nível de tolerância da espessura declarada; CS(10\Y)x – Resistência a Compressão Declarada (com 10% de deformação); DS(TH) – Estabilidade dimensional declarada sob temperatura específica e condições de humidade.

CONSTITUIÇÃO DAS EMBALAGENS

Embalagem em filme retráctil em pacotes com altura máxima de 45 cm e com identificação do conteúdo.

Espessura (mm)	Nº de Placas por Embalagem (unidades)	Quantidade por Embalagem (m²)
20*	20	15,00
30	14	10,50
40	10	7,50
50	8	6,00
60	7	5,25
80	5	3,75
100	4	3,00

*Produto apenas com marcação CE ; (Outras espessuras sob consulta)

CUIDADOS NA APLICAÇÃO EM SISTEMAS "ETICS"

O sistema de isolamento pelo exterior ETICS deve ser aplicado de acordo com as regras de aplicação indicadas pelos fornecedores do sistema ou da argamassa de colagem. Não é da responsabilidade da Iberfibran qualquer anomalia causada pelo não cumprimento das regras indicadas pelo fornecedor do sistema.
Regras fundamentais: Placa deve ser aplicada à sombra, protegida com rede e nunca com temperaturas exteriores inferiores a 5ºC ou superiores a 30ºC. Devem ser aplicadas de baixo para cima, na horizontal e devidamente coladas (totalmente ou perimetralmente) e fixadas mecanicamente com buchas adequadas ao suporte (mínimo de 4 buchas por placa). O suporte deve ser regular, seco e limpo. As placas devem ser aplicadas por forma a não haver juntas com mais de 2mm entre as mesmas. Devem ser respeitados todos os pormenores de remates, juntas e zonas de ligação definidos pelo fornecedor do sistema ou da argamassa de colagem. Mais informações em **www.fibran.com.pt.**

ARMAZENAMENTO

As placas de FIBRAN*xps* podem ser armazenadas ao ar livre, sobre uma superfície limpa e lisa, ou em espaços fechados e ventilados. São insensíveis à água da chuva e neve, mas não às radiações ultravioletas. O filme retrátil é resistente aos raios UV por um período máximo de 6 meses.
Devem ser armazenadas longe de materiais inflamáveis, do fogo, ou de outras fontes de ignição. Não devem entrar em contacto com solventes como a gasolina, alcatrão e ácido fórmico, ou com gases como o metano, etano, propano e butano. O seu aspeto ou estrutura pode ser danificado(a) quando em contacto com minerais e óleos alimentares, parafina, fenol e gorduras.

GEP-10–FT–04 | Revisão: 09.02.2018

PARA INFORMAÇÕES ADICIONAIS, POR FAVOR CONTACTE : **www.fibran.com.pt | www.fibran.com**
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Tel.: +351 256 579 670 | Fax: +351 256 579 674 | e-mail : iberfibran@iberfibran.pt
Apoio Técnico: satecnico@iberfibran.pt

Silica aerogel insulation blanket

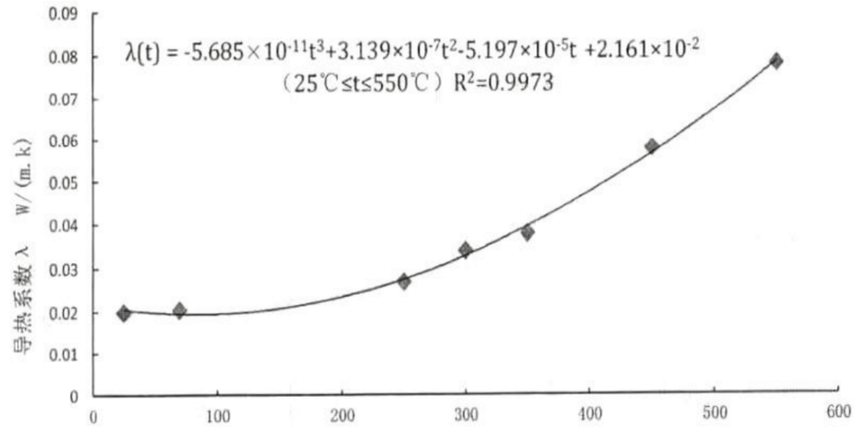
Product	Aerogel blanket
Item No.	HL650

Physical property：

Thickness	3 mm, 6 mm,10 mm, 20 mm	Width:1500 mm
Density	180 ~-220kg/m	
Applicable temperature	-200℃—+1000℃	
Hydrophobicity	absolute hydrophobicity (below 350 ℃)	
Thermal conductivity:	0.020-0.023w/m- K (at 25 ℃)	
Packaging form	Roll	

Parameter	**Standar**	**Value**
Density kg/m3	GB/T 5480-2008	187
Hydrophobicity %	GB/T 10299-2011	99.7
Reshrinking temp	GB/T 11835-2016 appendix E	790
Vibration mass loss rate %		0.7
Heating permanent line thermalization	GB/T 17911-2006	0.5 (Both length and width shrink)
Tensile strength kPa		1879
Compression strength (25% compression deformation) kPa	GB/T 13480-2014	79
Compression rebound rate (compress 20% and hold for 5 min)	(compress 20% and hold for 5 min)Unload all the load and let it recover, measure the thickness before and after compression, and calculate the thickness retention rate	94

Parameter		Standard	Value
Conductivity W/(M`K)	mean temperature 25 °C	GB/T 10295-2008	0.02
	mean temperature 70 °C	GB/T 10294-2008	0.02
	mean temperature 250 °C		0.027
	mean temperature 300 °C		0.034
	mean temperature 350 °C		0.038
	mean temperature 450 °C		0.058
	mean temperature 550 °C		0.078



Mean temperature

Parameter		Standard	Value
Combustion performance grade A(A1)	heat of combination MJ/kg	≤2.0	1.7
	Mass loss rate %	≤50	5.2
	Temperature °C	≤30	30
	Burning duration s	0	0

Aerogel felt's construction thickness

直径DN 外径ON	32, 38	40, 45	50, 57	65, 73	80, 89	100, 108	150, 159	200, 219	250, 273	300, 325	350, 377	400, 42, 377	500, 530	600, 630	700, 720	800, 820
-200&deg	37	38	40	42	43	45	48	50	51	52	53	54	55	55	56	56
-100&deg	28	29	30	30	32	33	34	36	37	38	39	39	40	40	41	41
200&deg	9	9	9	10	10	10	10	10	11	11	11	11	11	11	11	11
300&deg	16	16	17	17	18	18	19	19	19	20	20	20	20	20	20	20
400&deg	25	25	27	28	29	31	32	33	33	33	34	34	34	35	35	35
500&deg	35	36	38	40	41	42	45	47	48	49	50	50	51	52	52	53
600&deg	49	51	54	57	59	61	65	69	71	73	74	75	77	78	79	80
650&deg	57	59	62	66	69	71	77	81	84	86	88	89	91	93	94	95

Working conditions:

Insulation:

Ambient temperature = 258deg, Wind speed =OM / s,

Surface temperature of insulation layer 50 & DEGO

Cold insulation:

humidity = 70%

Ambient temperature = 20 & deg , Wind speed= OM / s

Dew point temperature = 14.2 & deg, and the insulation layer does not condense.

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ISO 9001 BUREAU VERITAS Certification

Planchas de Poliuretano D/35

DESCRIPCIÓN

- Planchas de espuma rígida de poliuretano cortadas y mecanizadas a partir de un bloque del material.

APLICACIONES

- Aislamiento térmico para la construcción de camiones frigoríficos.
- Aislamiento térmico de suelos de cámaras frigoríficas y de túneles de congelación.
- Aislamiento térmico en paneles sándwich con chapa metálica, poliéster, madera, fibrocemento, etc.
- Intervalo de temperatura de trabajo: 70ºC hasta temperaturas negativas.

VENTAJAS

- Menor espesor de aislamiento gracias al bajo coeficiente de conductividad térmica de la espuma de poliuretano.
- Prácticamente nula absorción de agua gracias a la estructura de celda cerrada del polímero
- Paneles de gran rigidez y poco peso.
- Facilidad de mecanizado y corte.

PRESENTACIÓN

- Planchas de 2500 x 1000 mm y 2000 x 1000 mm, en cualquier espesor.
- Otras dimensiones consultar.

CARACTERÍSTICAS

	NORMA ENSAYO	UNIDADES	VALORES ESPECIFICADOS
Densidad	UNE-EN 1602	kg/m^3	35 ± 2
Coeficiente conductividad térmica, $\lambda_{45d\ 10°C}$	UNE-EN 12667	W/m·K	0,023
Resistencia a la compresión	UNE-EN 826	kPa	‖ → 180 ± 50 ⊥ → 100 ± 30
Reacción al fuego	ASTM D-1692	-	AE

Rev.5