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Designated according to Article 29 of Regulation (EU) No 305/2011

Member of EOTA
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European Technical Assessment

ETA 19/0219
of 03/03/2020

English version prepared by Itecons

General Part

Technical Assessment Body issuing the ETA: Itecons - Instituto de Investigação e Desenvolvimento Tecnológico para a Construção, Energia, Ambiente e Sustentabilidade	
Trade name of the construction product	DuraBale – Rice straw building systems
Product family to which the construction product belongs	Thermal Insulation Product Product area code: 4
Manufacturer	ILOS - Peace and Research Center, Lda. Monte Serro, Relíquias 7630-392 Relíquias PORTUGAL
Manufacturing plant(s)	Monte Serro, Relíquias 7630-392 Relíquias PORTUGAL
This European Technical Assessment contains	9 pages including 1 annex which form an integral part of this assessment
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	European Assessment Document (EAD) 040146-00-1201

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Specific parts

1. Technical description of the product

This European Technical Assessment (ETA) applies to a thermal insulation product "DuraBale" made from compressed rice straw bales without any additives. The raw material is collected from the rice fields while harvesting the rice grains, using a specific baling mechanism. In this process, rice straw is fixed by a cord to bales.

The ETA has been issued for the product on the basis of agreed data/information, deposited with Itecons, which identifies the product that has been assessed. This ETA applies only to products corresponding to this agreed data/information.

The product is not covered by a harmonised European standard (hEN).

2. Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)

Thermal insulation product used for buildings as insulation of walls, roofs and floors, between rafters and timber work.

The assessment of the thermal insulation product, according to section 3 of this ETA, only applies if the insulation product is installed according to the manufacturer's installation instructions and according to Annex A and if it will not be exposed to compression loads, precipitation, wetting or weathering in build state and during transport, storage and installation.

The assessment methods on which this ETA is based, lead to the assumption of a working life of the insulation product of 50 years when installed in the works (provided that the straw bales is subject to appropriate installation. These provisions are based upon the current state of the art and the available knowledge and experience. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3. Performance of the product and references to the methods used for its assessment

The identification tests and the assessment for the intended use of this thermal insulation product made of straw bales were carried out in compliance with the EAD 040146-00-1201.

3.1 Mechanical resistance and stability (BWR 1)

Not relevant.

3.2 Safety in case of fire (BWR 2)

3.2.1 Reaction to Fire

The reaction to fire was tested according to EN ISO 11925-2:2010 and to EN ISO 11925-2:2010/Cor1:2011 and classified according to EN 13501-1:2007+A1:2009.

The DuraBale meets the requirements of class E.

3.3 Hygiene, health and environment (BWR 3)

3.3.1 Biological resistance

The biological resistance was assessed by the determination of the growth of mould fungus was carried out according to Annex A of the EAD 040146-00-1201. The test results for biological resistance of the insulating product were evaluated according to Table 4 of EN ISO 846:1997 and are expressed in table 1 of this ETA.

Table 1: Biological resistance

Product	Intensity of growth
DuraBale	3

3.4 Safety and accessibility in use (BWR 4)

Not relevant.

3.5 Protection against noise (BWR 5)

Not relevant.

3.6 Energy economy and heat retention (BWR 6)

3.6.1 Specific airflow resistivity

The determination of the specific airflow resistivity was carried out according to ISO 9053:1991, method A. Table 2 presents the results obtained for airflow resistance.

Table 2: Specific airflow resistance

Product	Airflow resistance, r [kPa.s/m^2]
DuraBale	1

3.6.2 Thermal conductivity

Lambda fractile at 10 °C, at dry conditions ($\lambda_{10,dry,90/90}$)

The determination of lambda fractile at 10 °C, at dry conditions ($\lambda_{10,dry,90/90}$), representing at least 90 % of the production with a confidence limit of 90 % was carried out in accordance with Annex B, clause 1 of the EAD 040146-00-1201.

The thermal conductivity of the test specimens was measured according to EN 12667:2001 and lambda fractile at 10 °C, at dry conditions ($\lambda_{10,dry,90/90}$) was calculated using the principles as detailed in Annex A of the EN 13162:2012+A1:2015.

The lambda fractile at 10 °C, at dry conditions ($\lambda_{10,dry,90/90}$) is 0,0411 W/(m.K).

Mass-related moisture conversion coefficient ($f_{u,1}$)

The mass-related moisture conversion coefficient ($f_{u,1}$), for the conversion of $\lambda_{10,dry}$ to $\lambda_{23,50}$, was determined in accordance with Annex B, clause 2 of the EAD 040146-00-1201.

The thermal conductivity was measured according to EN 12667:2001 for the determination of lambda at 10 °C, at dry conditions ($\lambda_{10,dry}$) and lambda at 10 °C, at (23 ± 2) °C and (50 ± 5) % relative humidity conditions ($\lambda_{10,(23,50)}$).

The moisture content mass by mass at a moisture balance of 23 °C and 50 % relative humidity ($u_{23,50}$) and mass-related moisture conversion coefficient ($f_{u,1}$) were calculated according to Annex B, clause 2 of the EAD 040146-00-1201.

The moisture content mass by mass at a moisture balance of 23 °C and 50 % relative humidity ($u_{23,50}$) is 0,059 kg/kg and the mass-related moisture conversion coefficient ($f_{u,1}$) is 0,81.

Lambda declared at 23 °C and 50 % relative humidity $\lambda_{D(23,50)}$

The calculation of the lambda declared at 23 °C and 50 % relative humidity ($\lambda_{D(23,50)}$) was carried out in accordance with Annex B, clause 3 of the EAD 040146-00-1201.

The lambda declared at 23 °C and 50 % relative humidity ($\lambda_{D(23,50)}$) is 0,044 W/(m.K).

Mass-related moisture conversion coefficient to high moisture content ($f_{u,2}$)

The mass-related moisture conversion coefficient to high moisture content ($f_{u,2}$), for the conversion of $\lambda_{10,dry}$ to $\lambda_{23,50}$, was determined in accordance with Annex B, clause 4 of the EAD 040146-00-1201.

The thermal conductivity was measured according to EN 12667:2001 for the determination of lambda at 10 °C, at (23 ± 2) °C and (50 ± 5) % relative humidity conditions ($\lambda_{10,(23,50)}$) and lambda at 10 °C, at (23 ± 2) °C and (80 ± 5) % relative humidity conditions ($\lambda_{10,(23,80)}$).

The moisture content mass by mass at a moisture balance of 23 °C and 80 % relative humidity ($u_{23,80}$) and mass-related moisture conversion coefficient to high moisture content ($f_{u,2}$) were calculated according to Annex B, clause 4 of the EAD 040146-00-1201.

The moisture content mass by mass at a moisture balance of 23 °C and 80 % relative humidity ($u_{23,80}$) is 0,171 kg/kg and the mass-related moisture conversion coefficient to high moisture content ($f_{u,2}$) is 1,33.

Moisture conversion factor (dry-23/50 and 23/50-23/80)

The moisture conversion factor for the conversion of $\lambda_{10,dry}$ to $\lambda_{10,(23,50)}$ (F_{m1}) and for the conversion of $\lambda_{23/50}$ to $\lambda_{10,(23,80)}$ (F_{m2}) were determined in accordance with equation (4) of the EN ISO 10456:2007 and EN ISO 10456:2007/AC:2009.

The moisture conversion factor F_{m1} is 1,05 and the F_{m2} is 1,16.

Table 3 resumes the assessed thermal conductivity parameters.

Table 3 – Thermal conductivity

Product	$\lambda_{10,dry,90/90}$ [W/m.K]	Mass-related moisture conversion coefficient (f_{u1})	$\lambda_{D,23/50}$ [W/m.K]	Mass-related moisture conversion coefficient to high moisture content (f_{u2})	Moisture factor conversion (F_{m1})	Moisture factor conversion (F_{m2})
DuraBale	0,0411	0,81	0,044	1,33	1,05	1,16

3.6.3 Water vapour diffusion resistance

The water vapour diffusion resistance was carried out according to EN 12086:2013 for climate condition A. The results are shown in table 4.

Table 4 – Water vapour diffusion resistance

Product	Water vapour diffusion resistance μ [-]
DuraBale	5,47

3.6.4 Hygroscopic sorption properties

The determination of the hygroscopic sorption properties was carried out on the basis of EN ISO 12571:2013. The test method used was the climatic chamber method.

The average results for the moisture content mass by mass of three specimens of rice straw are presented in Table 5. The tests were performed at a temperature (T) of 23ºC. The Figure 1 shows the hygroscopic sorption and desorption curves.

Table 5: Average moisture content mass by mass (kg/kg) of the rice straw samples (T=23ºC)

Relative humidity ϕ (%)	Moisture content mass by mass u (kg/kg)
10,0	0,013
38,0	0,052
66,0	0,108
95,0	0,455
66,0	0,122
38,0	0,061
10,0	0,021

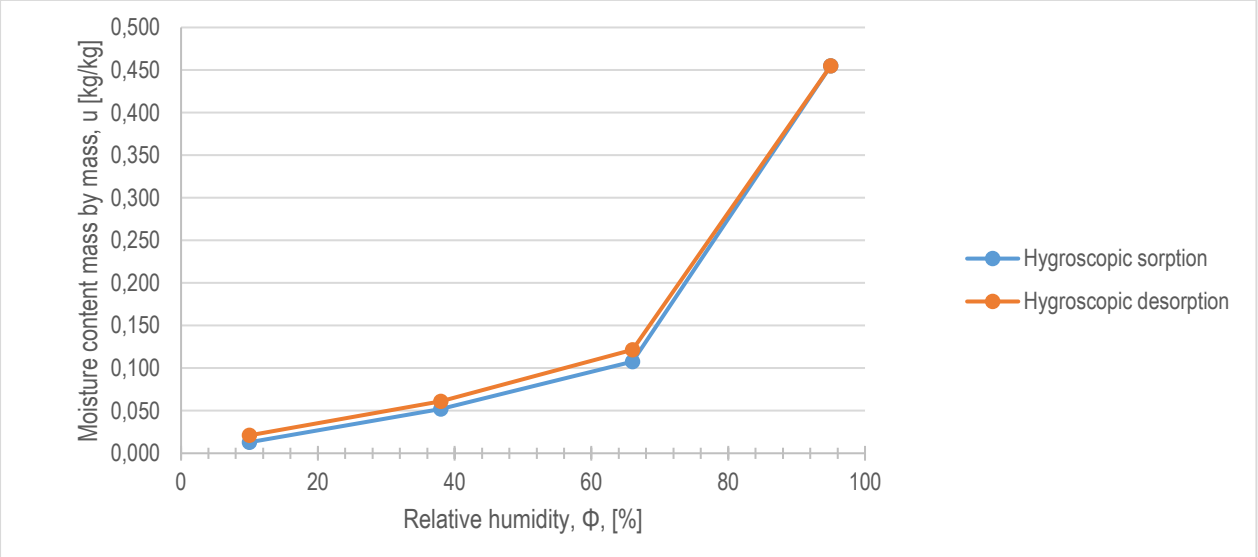

Figure 1: Hygroscopic sorption and desorption curves.

3.6.5 Water absorption

The determination of short term water absorption by partial immersion was carried out according to EN 1609:2013 (method A). The results are shown in table 6.

Table 6 – Water absorption

Product	Water absorption W_p [kg/m^2]
DuraBale	5

3.6.6 Geometry

Not relevant.

3.6.7 Density

The determination of density was carried out on the basis of EN 1602:2013. The results are presented in table 7.

Table 7 – Density

Product	Density [kg/m^3]
DuraBale	101 ± 6

3.6.8 Dimensional stability under specified temperature and humidity

Not relevant.

3.6.9 Tensile strength of the cording

The determination of the tensile strength of the cording was carried out taking into account EN 1608:2013. For testing cording as a loop including knot was installed in the tensile-testing machine (2 steal pins with a diameter of 8 mm) move freely. The feed-rate was 10 mm/min (±10%). The results are presented in table 8.

Table 8 – Tensile strength of the cording

Product	Tensile strength of the cording [kN]
Cording of DuraBale	2.743

3.7 Sustainable use of natural resources (BWR7)

Not relevant.

4. Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

According to the Commission Decision 1999/91/EC, as amended, of the European Commission the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No. 305/2011) given in the following table applies.

Product	Intended use(s)	Level(s) or classe(es)	System(s)
Thermal insulating products	any	---	3

In addition, the European legal basis for reaction to fire for products covered by EAD 040146-00-1201 is: Commission Decision 2001/596/EC. In this case, system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No. 305/2011) given in the following table applies.

Product	Intended use(s)	Level(s) or classe(es)	System(s)
Thermal insulating products	for uses subject to regulations on reaction to fire	A1 ([1]), A2 ([1]), B ([1]), C ([1])	1
		A1 ([2]), A2 ([2]), B ([2]), C ([2]), D, E	3
		(A1 to E) ([3]), F	4

([1]) 'Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material).

([2]) Products/materials not covered by footnote 1.

([3]) Products/materials that do not require to be tested for reaction to fire (e.g. Products/materials of Classes A1 according to Commission Decision 96/603/EC).

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

The technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Itecons.

Issued in Coimbra, Portugal on 03.03.2020

By

Technical Assessment Unit of

Itecons – Instituto de Investigação e Desenvolvimento Tecnológico para a Construção, Energia, Ambiente e Sustentabilidade

(Andreia Gil, Technical Assessment Unit Coordinator)

Annex A

The given performances for the insulation product in clause 3 apply only if:

1. The insulation product is installed as part of a building system that is protected from precipitation, weathering and moisture.
2. The insulation product is never exposed to precipitation, weathering and moisture during transport, storage or installation.
3. The insulation product can only be applied dry (moisture content u≤ 18% by mass) and other building components in contact with it shall also be dry (example: wood not exciding u≤ 20% by mass).
4. The insulation product can only be applied in structures with airtight inner finishes to avoid airflow from the inside outwards into the structure.
5. The insulation product is applied into building systems were the water vapor diffusion resistance factor of the outer face of the building system is lower than the water vapor diffusion resistance factor of the insulation product.
6. All elements are planned and executed such that no condensation and mould growth occur in the insulation product. it can be verified trough simulation based on standard EN 15026 for each building solution and local climatic conditions.