

**STATE ENTERPRISE CONSTRUCTION PRODUCTS  
CERTIFICATION CENTRE**



Linkmenų g. 28, LT-08217 Vilnius  
Tel.: +370 5 2728077, +370 5 2728078  
Fax: +370 5 2728075  
e-mail [centras@spsc.lt](mailto:centras@spsc.lt)  
Website: [www.spsc.lt](http://www.spsc.lt)

**National technical assessment**

**NTI-01-061:2019**

(original Lithuanian language version)

<b>Trade name:</b>	<b>Wooden frame external panels with insulation straw core</b>
<b>National technical evaluation owner:</b>	<b>Odminių str. 10-10, LT-01122 Vilnius, Lithuania</b>
<b>Generic type and use of the construction product:</b>	<b>Timber frame external panel with a thermal-insulation layer of straw for construction of external walls of residential and non-residential buildings</b>
<b>Manufacturing plant:</b>	<b>Gedimino str. 30, LT-70421 Kybartai, Vilkaviškis district</b>
<b>Valid from:</b>	<b>14-01-2019</b>
<b>Valid till:</b>	<b>14-01-2024</b>
<b>This national technical assessment contains:</b>	<b>30 pages, including 3 Annexes</b>

## I LEGAL BASIS AND GENERAL CONDITIONS

1. This national technical assessment was issued by the State Enterprise Construction Products Certification Centre (*VĮ Statybos produkcijos sertifikavimo centras*) in accordance with:
  - 1.1. The Law on Construction of the Republic of Lithuania of 19 March 1996 with amendments made before 15 November 2018 inclusive;
  - 1.2. Regulation of the European Parliament and of the Council 305/2011/EC;
    - 1.2.1. STR 1.01.02:2016 Construction normative technical documents;
    - 1.2.2. STR 1.01.04:2015 Assessment, verification and declaration of the constancy of performance of construction products without harmonised technical specifications. Designation of testing laboratories and certification bodies. National technical assessments; designation and publication of technical assessment bodies;
  - 1.3. other documents:
    - 1.3.1. Order No. D1-631 of 28 August 2013 of the Minister of Environment of the Republic of Lithuania on designation of State Enterprise Construction Product Certification Centre for preparation of respective fields of construction products and issuance of national technical assessments and European technical assessments;
    - 1.3.2. Order No. D1-894 of 3 November 2017 of the Minister of Environment of the Republic of Lithuania on amendment of Order No. D1-631 of 28 August 2013 of the Minister of Environment of the Republic of Lithuania on designation of State Enterprise Construction Product Certification Centre for preparation of respective fields of construction products and issuance of national technical approvals and European technical approvals;
    - 1.3.3. Order No. 093-T of 14 January 2019 of the Director of State Enterprise Construction Product Certification Centre on approval of national technical approval.
2. In drawing up this national technical approval, the requirements and provisions of the following documents were taken into account:
  - 2.1. Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market.
  - 2.2. Construction Technical Regulation STR 2.01.02:2016 Design and Certification of Energy Performance of Buildings;
  - 2.3. Construction Technical Regulation STR 2.01.03:2009 Thermal technical design values of construction materials and products (valid at the time of the first edition of NTA and until 31 December 2016).
  - 2.4. ETAG 004 External Thermal Insulation Composite Systems with Rendering. Edition of 2000 with annexes of 2011 and 2013.
  - 2.5. Guideline for European Technical Assessment ETAG 007 Timber building kits. Edition of November 2010.
  - 2.6. Common Understanding of Assessment Procedure CUAP 12.01/02c11 (edition June 2003, revision 1 June 2005, revision 2 October 2009) Factory-made thermal insulation material and/or acoustic insulation material made of vegetable or animal fibres.
  - 2.7. European Assessment Document EAD 040005-00-1201 Factory-made thermal and/or acoustic insulation products made of vegetable or animal fibres. Edition of June 2015.
3. The production plant is responsible for performance characteristics of timber frame panels with a thermal insulation layer of straw presented in this national technical assessment and stability of characteristics.
4. In accordance with the specified procedure, the State Enterprise Construction Product Certification Centre may repeal this national technical assessment.

5. Only the full text of this national technical assessment may be copied and distributed (including electronic dissemination). Reproduction and distribution of parts is allowed only with the consent of the State Enterprise Construction Product Certification Centre. In this case, the reproduced and distributed part must be clearly marked with the national technical assessment number and the trade name of the product. Text and drawings presented in promotional publications must not contravene the guidelines for this national technical assessment.

6. Only the full text of this national technical assessment may be reproduced or otherwise copied, including electronic reproduction. Partial reproduction of this national technical assessment is allowed only with prior written consent of State Enterprise Construction Product Certification Centre. The reproduced and distributed part must be clearly marked with the national technical assessment number and the trade name of the product. Text and technical drawings presented in promotional publications must not contravene the provisions of this national technical assessment.

7. This national technical assessment is issued in the Lithuanian language.

## **II SPECIFIC CONDITIONS CONCERNING THE NATIONAL TECHNICAL ASSESSMENT**

### **1. Definition of product and intended use**

#### **1.1. Product definition**

The technical assessment is intended for timber frame external panels with a thermal insulation layer of straw manufactured by Ecocono LTD.

The panel is made up of a supporting wooden frame filled with a pressed straw bale layer. The panels are manufactured in a factory without the inner and outer layers of finish. These layers are installed after installation on site. At the customer's request, the mixture of dry clay plaster for the interior wall surface decoration produced by the manufacturer may be supplied along with the panels.

Specification of materials and components used for the panel manufacturer is provided in Annex 1. The general view of the wooden frame of the panel is provided in Annex 2.

Panels are made separately for each individual building. In general, the wooden panel frame is designed so that only small incisions or shaping have to be made on-site, which does not affect the structural and mechanical durability of the entire enclosure design.

#### **1.2. Intended uses**

Panels are designed for the construction of exterior walls of residential and non-residential buildings.

A separate type of panel is a lintel which is used for the openings for doors and windows.

Panels are recommended for the construction of buildings in 0, I, II, III and IV category areas as defined by LST EN 1991-1-4. The use of panels must always be considered in each case individually depending on the marginal climatic conditions.

Application of panels depends on the construction technical regulations and other legal acts, and in individual cases on specific customer requirements, specific climatic conditions, and should be described in the design documentation in each case.

The base and load-bearing element of the walls is the timber frame, which, according to the required building mechanical strength and durability, in each particular case, may be enhanced by additional bearing elements (e.g., columns, beams, girders, etc.).

Provisions of this technical assessment are determined from the condition that the economically reasonable useful life of these panels is 50 years for load-bearing structures, inaccessible components and materials, and 25 years for replaceable and interchangeable components and materials provided that the building will be operated and maintained properly, and will be heated during the winter season.

The panels are designed for the use in environments corresponding to service class 1 and 2 in accordance with LST EN 1995-1-1.

### **2. References**

Dated and undated reference provisions from other publications are included in this technical assessment. These normative references are written in the appropriate places in the text and the list of publications is given in this section.

In case of dated references, all subsequent amendments or corrections of these publications apply to this technical assessment only when they are included in it as amendments or corrections. In case of undated references, the latest edition applies (including any amendments).

- 2.1. LST 1413.9 “Building mortar. Test methods. Determination of mortar contraction – expansion deformation”;
- 2.2. LST EN 310:1999 Wood-based panels. Determination of modules of elasticity in bending and of bending strength;
- 2.3. LST EN 314-1 Plywood. Bonding quality. Part 1: Test methods;
- 2.4. LST EN 314-2 Plywood. Bonding quality. Part 2: Requirements;
- 2.5. LST EN 326-1:1999 Wood-based panels. Sampling, cutting and inspection. Part 1: Sampling and cutting of test pieces and expression of test results;
- 2.6. LST EN 336 “Structural timber. Sizes, permissible deviations”;
- 2.7. LST EN 338:2016 Structural timber. Strength classes;
- 2.8. LST EN 350:2016 Durability of wood and wood-based products. Testing and classification of the durability to biological agents of wood and wood-based materials;
- 2.9. LST EN 351-1 “Durability of wood and wood-based products. Preservative-treated solid wood. Part 1. Classification of preservative penetration and retention”;
- 2.10. LST EN 380 “Timber structures. Test methods. General principles for static load testing”;
- 2.11. LST EN 460 “Durability of wood and wood-based products. Natural durability of solid wood. Guide to the durability requirements for wood to be used in hazard classes”;
- 2.12. LST EN 594 “Timber structures. Test methods. Racking strength and stiffness of timber frame wall panels”;
- 2.13. LST EN 595 “Timber structures. Test methods. Test of trusses for the determination of strength and deformation behaviour”;
- 2.14. LST EN 596 “Timber structures. Test methods. Soft body impact test of timber framed walls”;
- 2.15. LST EN 636:2012+A1:2015 Plywood. Specifications.
- 2.16. LST EN 717-1 “Wood-based panels. Determination of formaldehyde release. Part 1. Formaldehyde emission by the chamber method”;
- 2.17. LST EN 823:2013 Thermal insulating products for building applications. Determination of thickness;
- 2.18. LST EN 998-1:2017 Specification for mortar for masonry. Part 1: Rendering and plastering mortar;
- 2.19. LST EN 1015-10 Methods of test for mortar for masonry. Part 10: Determination of dry bulk density of hardened mortar;
- 2.20. LST EN 1015-11 Methods of test for mortar for masonry. Part 11: Determination of flexural and compressive strength of hardened mortar;
- 2.21. LST EN 1027:2016 Windows and doors. Water tightness. Test method;
- 2.22. LST EN 1309-1 “Round and sawn timber. Method of measurement of dimensions. Part 1. Sawn timber”;
- 2.23. LST EN 1309-3:2018 Round and sawn timber. Methods of measurements. Part 3: Features and biological degradations;
- 2.24. LST EN 1310 “Round and sawn timber. Method of measurement of features”;
- 2.25. LST EN 1602:2013 Thermal insulating products for building applications. Determination of the apparent density;
- 2.26. LST EN 1607:2013 Thermal insulating products for building applications. Determination of tensile strength perpendicular to faces;
- 2.27. LST EN 1609:2013 Thermal insulating products for building applications. Determination of short term water absorption by partial immersion;
- 2.28. LST EN 1934 “Thermal performance of buildings. Determination of thermal resistance by hot box method using heat flow meter. Masonry”;
- 2.29. LST EN 1990 “Eurocode. Bases for design of structures”;
- 2.30. LST EN 1990:2004/NA:2010 Eurocode. Basis of Structural Design;
- 2.31. LST EN 1990:2004/A1:2006/NA:2012 “Eurocode. Bases for design of structures”;

- 2.32. LST EN 1991-1-1 "Eurocode 1. Actions on structures. Part 1-1. General actions. Densities, self-weight, imposed loads for buildings";
- 2.33. LST EN 1991-1-1:2004/NA:2011 Eurocode 1: Actions on structures. Part 1-1: General actions. Densities, self-weight, imposed loads for buildings;
- 2.34. LST EN 1991-1-1:2004/NA:2011/P:2011 Eurocode 1: Actions on structures. Part 1-1: General actions. Densities, self-weight, imposed loads for buildings;
- 2.35. LST EN 1991-1-4:2005 "Eurocode 1. Actions on structures. Part 1-4. General actions. Wind actions";
- 2.36. LST EN 1991-1-4:2005/AC:2010 Eurocode 1: Actions on structures. Part 1-4: General actions. Wind actions;
- 2.37. LST EN 1991-1-4:2005/A1:2010 Eurocode 1: Actions on structures. Part 1-4: General actions. Wind actions;
- 2.38. LST EN 04-01-1991:2005/NA:2012 "Eurocode 1. Actions on structures. Part 1-4. General actions. Wind actions";
- 2.39. LST EN 1995-1-1:2005/NA:2012 "Eurocode 5. Design of wooden structures. Part 1-1. General provisions. General and building rules";
- 2.40. LST EN 1995-1-1:2005/AC:2006 Eurocode 5: Design of timber structures. Part 1-1: General common rules and rules for buildings;
- 2.41. LST EN 1995-1-1:2005/A1:2008 Eurocode 5: Design of timber structures. Part 1-1: General common rules and rules for buildings;
- 2.42. LST EN 1995-1-1:2005/A1:2008 Eurocode 5: Design of timber structures. Part 1-1: General common rules and rules for buildings;
- 2.43. LST EN 1995-1-1:2005/A2:2014 Eurocode 5: Design of timber structures. Part 1-1: General common rules and rules for buildings;
- 2.44. LST EN 12086:2013 Thermal insulating products for building applications. Determination of water vapour transmission properties;
- 2.45. LST EN 12152 "Curtain walling. Air permeability. Performance requirements and classification";
- 2.46. LST EN 12153 "Curtain walling. Air permeability. Test method";
- 2.47. LST EN 12154 "Curtain walling. Imperviousness to water. Performance requirements and classification";
- 2.48. LST EN 12155 "Curtain walling. Leakproofness. Laboratory test under static pressure";
- 2.49. LST EN 12667 "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";
- 2.50. LST EN 12865 "Hygrothermal performance of building components and building elements. Determination of the resistance of external wall systems to driving rain under pulsating air pressure";
- 2.51. LST EN 12939 Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Thick products of high and medium thermal resistance;
- 2.52. LST EN 13171 "Building thermal-insulating products. Factory made products of wood fibre (WF). Specification";
- 2.53. LST EN 13183-2 "Moisture content of a piece of sawn timber. Part 1. Determination by oven dry method";
- 2.54. LST EN 13497:2018 Thermal insulation products for building applications. Determination of the resistance to impact of external thermal insulation composite systems;
- 2.55. LST EN 13501-1 "Fire classification of construction products and building elements. Part 1. Classification using data from external fire exposure to roofs tests";
- 2.56. LST EN 13501-2 "Fire classification of construction products and building elements. Part 2. Classification using data from fire resistance tests, excluding ventilation services";

- 2.57. LST EN 13823 “Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item”;
- 2.58. LST EN 13986:2004+A1:2015 Wood-based panels for use in construction. Characteristics, evaluation of conformity and marking;
- 2.59. LST EN 14592 Timber structures. Dowel-type fasteners. Requirements;
- 2.60. LST EN 15048-1:2016 Non-preloaded structural bolting assemblies - Part 1: General requirements;
- 2.61. LST EN ISO 717-1:2013 Acoustics. Rating of sound insulation in buildings and of building elements. Part 1: Airborne sound insulation;
- 2.62. LST EN ISO 846 “Plastics. Evaluation of the action of microorganisms”;
- 2.63. LST EN ISO 898-1:2013 Mechanical properties of fasteners made of carbon steel and alloy steel. Part 1: Bolts, screws and studs with specified property classes. Coarse thread and fine pitch thread (ISO 898-1:2013);
- 2.64. LST EN ISO 6946:2017 Building components and building elements. Thermal resistance and thermal transmittance. Calculation methods (ISO 6946:2017);
- 2.65. LST EN ISO 8990 “Thermal insulation. Determination of steady-state thermal transmission properties. Calibrated and guarded hot box”;
- 2.66. LST EN ISO 10140-1:2016 Acoustics. Laboratory measurement of sound insulation of building elements. Part 1: Application rules for specific products;
- 2.67. LST EN ISO 10140-2 “Acoustics. Laboratory measurement of sound insulation of building elements. Part 2. Measurement of airborne sound insulation”;
- 2.68. LST EN ISO 10456 “Building materials and products. Hygrothermal properties. Tabulated design values and procedures for determining declared and design thermal values”;
- 2.69. LST EN ISO 11925-2 Reaction to fire tests. Ignitability of products subjected to direct impingement of flame. Part 2: Single-flame source test;
- 2.70. LST EN ISO 12460-3:2016 Wood-based panels. Determination of formaldehyde release. Part 3: Gas analysis method;
- 2.71. LST EN ISO 12572 Hygrothermal performance of building materials and products. Determination of water vapour transmission properties. Cup method;
- 2.72. LST EN ISO 12567-1 “Thermal performance of windows and doors. Determination of thermal transmittance by the hot-box method. Part 1. Complete windows and doors”;
- 2.73. LST EN ISO 13788:2013 Hygrothermal performance of building components and building elements. Internal surface temperature to avoid critical surface humidity and interstitial condensation. Calculation methods (ISO 13788:2012);
- 2.74. ETA-11/0024, edition of 2 March 2017, “E.u.r.o. Tec screws type KonstruX”, “Paneltwistec”, “Topduo“, “Terrassotec“, “SP FK”, “Speedo”, “Hobotec”, “Hapatec”, “SP ZK”, “Ecotec”, “WBS”, “FBAS”, “VSS” and “Brutus”;
- 2.75. ISO 7892:1988 “Vertical building elements. Impact resistance tests. Impact bodies and general test procedures”;
- 2.76. ONORM B 6010 “Materials for thermal and/or acoustic insulation in building construction. Test methods”.

### 3. Terms and definitions

Terms and definitions used in this technical evaluation:

3.1. wooden external frame panel with thermal insulation straw layer – a panel with the timber frame as the main load-bearing element, filled with a compressed straw layer.

### 4. Symbols and Abbreviations

Markings used in this technical assessment:

- $d_N$  – nominal product thickness. mm;

- $\lambda_D$  – declared value of thermal transmittance coefficient, W/(m·K);
- $\lambda_{90/90}$  – 90% quintile of the limit level of the thermal conductivity coefficient at the confidence level 90%, W/(m·K);
- $\lambda_{ds}$  – design value of thermal transmittance coefficient, W/(m·K);
- $R_D$  – the cleared thermal resistance of the thermal insulation layer, (m<sup>2</sup>·K)/W;
- $R_{90/90}$  – 90% quintile of the thermal resistance threshold at the confidence level 90%, (m<sup>2</sup>·K)/W;
- $R_{pl}$  – panel thermal resistance, (m<sup>2</sup>·K)/W;
- $U_{pl}$  – heat transfer coefficient value of the panel, W/(m<sup>2</sup>·K);
- $\rho$  – density, kg/m<sup>3</sup>.

The following abbreviations used in this technical approval:

- **NTI** – national technical assessment;
- **TAB** – technical assessment body.

Other symbols and abbreviations used in this national technical assessment were taken from technical specifications listed in the references.

## 5. Essential performance characteristics of the product and methods of their verification

This national technical assessment sets out the requirements for external panels, essential performance characteristics and their minimum values, and test and calculation methods to support these characteristics.

### 5.1. Requirements for materials

#### 5.1.1. Timber

C24 and higher strength class timber is used for the manufacture of panels in accordance with LST EN 338.

Wood moisture content  $\leq 20\%$ .

The timber must be suitable for use for the performance class 2 under LST EN 01-01-1995.

Requirements for geometric dimensions and shape of the wood beam are given in Table 1.

**Table 1.** Requirements for geometric dimensions and shape of the wood beam

Characteristic	Permitted tolerances	Method of measurement
Cross-sectional dimensions	Class 2 according to LST EN 336	LST EN 1309-1
Shape accuracy: - spring* - bow** - twist*** - cup****	$\leq 4$ mm in 2 m length $\leq 6$ mm in 2 m length $\leq 6$ mm in 25 mm width and in 2 m length; $\leq 2$ mm 100 mm of the side	LST EN 1310

\* – spring – longitudinal shift of the lumber workpiece, perpendicular to the edge;

\*\* – bow – lengthwise shift of the lumber workpiece perpendicular to the sides;

\*\*\* – twist – helical lengthwise twisting of the lumber workpiece sides;

\*\*\*\* – cup – curvature of the lumber workpiece perpendicular to the width of the side.

#### 5.1.2. Straw

Straw requirements are given in Table 2.

**Table 2.** Straw requirements

Characteristic	Requirement	Method of
----------------	-------------	-----------



		<b>measurement</b>
Humidity	$\leq 20\%$	Manufacturer's method
Biocide (pesticide) quantity	Must meet the requirements of Directive 98/8/EC for biocidal products	straw supplier's declaration
Straw structure	Technical specification of the manufacturer	visual inspection

### 5.1.3. Fibreboard

Essential fibreboard performance characteristics are specified in Table 3. Fibreboard used for external panels are compliant with the standard LST EN 13171, type H WF-EN 13171-T5-DS(70.90)2-CS(10\Y)150-TR20(30)-WS1.0-MU5.

**Table 3.** Essential wood fibre board characteristics

<b>Characteristic</b>	<b>Value</b>	<b>Method of measurement/assessment</b>
Nominal density	270 kg/m <sup>3</sup>	LST EN 1602
Nominal thickness $d_N$	60 mm	LST EN 823
Thickness accuracy class	T4	LST EN 13171
Declared value of thermal transmittance coefficient $\lambda_D$	0.048 W/(m·K)	LST EN 12667 LST EN 13171
Design value of thermal transmittance coefficient $\lambda_{ds}$	0.049 W/(m·K)	STR 2.05.01:2005
Class of reaction-to-fire performance	E	LST EN ISO 11925-2 LST EN 13501-1
Water vapour diffusion resistance factor $\mu$	5	LST EN 13171
Tensile strength perpendicular to the surface	$\geq 20$ kPa	LST EN 1607
Short-term water absorption by partial submission in water	$\leq 1.0$ kg/m <sup>2</sup>	LST EN 1609

### 5.9.4. Plywood

Requirements for 12 mm plywood are specified in Table 4.

**Table 4.** Characteristics of plywood according to LST EN 636 and LST EN 13986.

<b>Main characteristic</b>	<b>Value</b>	<b>Method of measurement/assessment</b>
Modulus of elasticity in bending, class	E 80/50	LST EN 310
Bending strength, class	F 40/35	LST EN 326-1
Bonding quality, class	3	LST EN 314-1 LST EN 314-2
Formaldehyde emission class	E1	LST EN ISO 12460-3
Flammability class	D-s2, d0	LST EN 13501-1
Water vapour transmission	90/220	LST EN 12572 or LST EN 13986, 9 l.
Mechanical durability, performance class	2	LST EN 1995-1-1
Biological durability, class	5	LST EN 350

### 5.1.5. Fasteners

Fasteners used for timber frame elements of external panels are dowel-type fasteners according to LST EN 14592 specified in the manufacturer's technical documentation.

Fasteners used for timber frame elements of external panels are dowel-type fasteners according to LST EN 14592 specified in the manufacturer's technical documentation.

Fasteners must be resistant to corrosion or be protected from it. The minimum corrosion protection requirements under LST EN 1995-1-1:2005+AC:2006 are given in Table 4.1.

If the controlled strength (selected from the condition of strength) bolts to be used for the panel connection, their class according to LST EN ISO 898-1 must not be less than 4.6. In this case, screw sets must be chosen according to the requirements of LST EN 15048-1.

### 5.1.6. Clay plaster

Essential characteristics of clay plaster used and included in the delivery are specified in Table 5.

**Table 5.** Clay plaster performance characteristics according to LST EN 998-1.

Characteristic	Value	Method of measurement/assessment
Compressions strength	1.7 MPa.	LST 1413.6
Water absorbtion	NPD	LST EN 1015-18
Specific thermal conductivity, $\lambda_{10 DM}$	0.61-0.82 W/m K	LST EN 1745, Table A.12
Density	1600÷1800 kg/m <sup>3</sup>	LST EN 1015-10
Water vapour diffusion coefficient $\mu$	15/35	LST EN 1745, Table A.12
Flammability	A1	LST EN 13501-1
Plaster adhesion to the straw insulation layer: - bond strength - method of disintegration	40 kPa in the straw layer	ETAG 004 5.1.4.1.1

In order to ensure that essential characteristics of panels match the performance characteristics set out in Annex 1 to this NTI, characteristics of fibreboard, plywood and clay plaster used for finishing applications must be at least equal to the values specified in tables 3, 4 and 5.

## 5.2. Performance characteristics of timber frame external panel with a layer of straw

This national technical assessment sets out the requirements and test methods for the essential performance characteristics of products that are necessary to confirm their suitability for intended use.

### 5.2.1. Geometric shape and dimensional accuracy

Requirements for the accuracy of geometric dimensions and shape of the products are presented in Table 6.

**Table 6.** Requirements for geometric dimensions and shape accuracy of panels

Indicator	Permitted tolerance	Test method
Height:	± 2 mm	Measurement accuracy – 1 mm. Measured in three places on both sides of the panel – at the panel edges and in the middle.

		Assessment – by the arithmetic mean of all measurements.
Width	$\pm 2$ mm	Measurement accuracy – 1 mm. Measured in three places on both sides of the panel – on top, bottom and middle of the panel. Assessment – by the arithmetic mean of all measurements.
Thickness	$\pm 2$ mm	Measurement accuracy – 1 mm. Measured in three places on both sides of the panel – on top, bottom and middle of the panel. Assessment – by the arithmetic mean of all measurements.
Perpendicularity	$\pm 5$ mm	Measurement accuracy – 1 mm. Measured diagonals. Evaluation – difference in diagonals.
Edge straightness	$\pm 2$ mm/2 mm	Measurement accuracy – 1 mm. Measured on all edges. Measurement length – 2 m.

### 5.2.2. Mechanical resistance and stability

Calculations of mechanical strength of the wall panel were performed according to the requirements of LST EN 1990, LST EN 1991-1-1, LST EN 1995-1-1 and the ETAG 007 guidelines.

The estimated mechanical strength characteristics are given in Annex 1.

Partitioning of the described wall panels can be installed on all types of foundations: for example, concrete slab on the soil, strip concrete or masonry foundation, concrete basement walls. This technical assessment does not include the foundation design, which must be designed based on individual requirements.

### 5.2.3. Safety in case of fire

#### 5.2.3.1. Flammability

Flammability classification of the wall panel and its individual components LST EN 13501-1 are presented in Annex 1.

#### 5.2.3.2. Fire resistance

The property not determined.

If necessary, the panel fire resistance can be determined in accordance with the requirements of LST EN 13501-2.

### 5.2.4. Hygiene, health, and environment protection

#### 5.2.4.1. Water vapour permeability, and resistance to moisture effects

Having performed calculations in accordance with LST EN ISO 13788, STR 2.05.01:2005 under normal climatic conditions, the panels were rated as ensuring sufficient support of moisture depending on the scope of application specified in section 1.2, provided that the building is heated during the winter season.

#### 5.2.4.2. Water impermeability

The panel structure and its interconnection units and connection units with other structures ensure their tightness to rain and snow.

In order to protect the panel structure from moisture penetration through the foundation, the waterproof layer must be equipped between the panel and the foundation.

The use of these panels in higher humidity areas such as bathrooms, are possible by equipping the additional layer impervious to water and water vapour on the inner surface of the panel, to ensure

the moisture resistance of the structure. This technical assessment does not include the panels of his design.

#### 5.2.4.3. Dangerous substances

According to the manufacturer's declaration, the wall panels do not contain any harmful and hazardous materials, other than:

- potential presence of formaldehyde in wood fibre panels and plywood;
- potential presence of pesticides and fungicides in the thermal insulating straw layer.

Formaldehyde emission class E1 according to LST EN 13986.

Straw used in the manufacture of panels may be processed during growth. In this case, the manufacturer must declare:

- the name of the pesticide (s), name and concentration of the active ingredient;
- processing stage and the amount applied.

The manufacturer must ensure that the products used in the processing of straw during growth meet the requirements of Directive 98/8/EC for biocidal products.

#### 5.2.5. Safety in use

##### Impact resistance

The impact resistance of the outer surface of the panel is ensured by the materials used, and is determined and declared in accordance with the corresponding technical specification.

The surface impact resistance of the internal plastered clay panel is validated by performing the impact resistance test to a solid body according to LST EN 13497 or ISO 7892 under the following test conditions:

- 2 J, 500 g, 408 mm;
- 10 J, 1000 g, 1020 mm.

Resistance to impact is considered to be satisfactory if no mechanical damage (cracks, detached layers) is visible after the test.

#### 5.2.6. Protection against noise

Airborne sound insulation indicator of external wall panel was determined according to the provisions of the standards LST EN ISO 10140-1:2010, LST EN ISO 10140-2:2010 and LST EN ISO 717-1:1999, which were applicable at the time of initial type testing. Airborne sound insulation value determined by testing is presented in Annex 1.

#### 5.2.7. Energy economy and heat retention

##### 5.2.7.1. Thermal resistance

Wall panel thermal resistance  $R_{pl}$  and its corresponding heat transfer coefficient  $U_{pl}$  are set to meet LST EN ISO 6946 and STR 2.01.03:2009.

The thermal properties of the corresponding materials are taken from LST EN ISO 10456, from the manufacturers' declarations of conformity or from direct test results.

Values of thermal properties, thermal conductivity and heat transfer coefficients are given in Annex 1.

##### 5.2.7.2. Air permeability

The analysis of the panel design and its interconnection units and connection points with other structures showed that the panels are sufficiently impermeable to air according to the intended use, provided they are properly interconnected to each other and to the adjacent structures.

#### 5.2.8. Durability

##### 5.2.8.1. Durability

The rules for the design of timber frame building ensure that the wear of materials and components within the economically reasonable service life will be negligible and will not affect the essential performance characteristics if the building is used for the intended purpose indicated in section 1.2.

#### 5.2.8.2. Wood product resistance to biological effects

Depending on the durability class and the use of wood components, wood components can be treated for wood beetles, insects, fungi, and the blue mould.

This technical assessment does not include exterior decoration of the panels. These products must meet the durability requirements of corresponding technical specifications.

#### 5.2.8.3. Corrosion resistance of metal fasteners

Metal fasteners and structural connections (bolts, screws, etc.) must be corrosion resistant or protected against corrosion in accordance with the requirements of LST EN 01-01-1995.

#### 5.2.8.4. Thermal insulating straw layer resistance to biological effects

Straw layer durability was rated according to its resistance to mould fungi under increased humidity conditions. The test was conducted in accordance with the requirements of ONORM B 6010. evaluating the fungi mould overgrowth of samples according to the methods of LST EN ISO 846.

Description of the test procedure and result of assessment are presented in Annex 1.

## 6. Evaluation of the constancy of performance, testing and marking

### 6.1. System of the evaluation of the constancy of performance, testing and marking

The evaluation and approval system of the constancy of performance of panels is presented in Table 7. The manufacturer must demonstrate the compliance of its product with the following national technical assessment requirements:

- by initial type testing;
- production control.

**Table 7.** System of evaluation and approval of the constancy of performance, testing and marking

Product(s)	Intended use	Evaluation and approval scheme
Timber frame external panels with thermal insulation layer of straw	For exterior petitioning of residential and non-residential buildings, as provided in section 1.2	2+ <sup>a</sup>
<sup>a</sup> (see European Parliament and Council Regulation (EC) 305/2011V, Annex (1.3))		

Scope of the constancy evaluation process of performance and distribution of tasks is specified in Table 6.1.2.

**Table 6.1.2.** Scope of the constancy evaluation of performance and distribution of tasks

	Tasks	Scope of the task
Tasks of the manufacturer	- initial type testing	see 6.2.1.1
	- production control (PC)	see 6.2.1.2
	- testing of samples taken from the manufacturer according to the Control plan (Annex No 4)	see Control plan (Annex No 4)
System 2+: See paragraph 12 of Construction Technical Regulation STR 1.01.04:2015.		

The manufacturer draws up the declaration of performance and, if necessary, determines the product type on the basis of assessment and verification of performance characteristics carried out in accordance with system 2+.

For declaration of performance of external panels, the manufacturer shall use the 2<sup>nd</sup> declaration/labelling method, i.e. declaration of product characteristics.

Distribution of performance assessment and verification tasks is specified in Table 8.

**Table 8.** Distribution of external panel performance evaluation and verification tasks

Tasks		Scope of the task	
Tasks for producer		Type tests	6.2.1.1.
		Internal production control	6.2.1.2.
		Tests in production company according to control plan, Annex 4	According to requirements in control plan, Annex 4
Tasks to certification body	Grounds for IPC compliance certification:	initial production plant and IPC verification	6.2.3.1.
		continuous IPC monitoring and assessment	6.2.3.2.

## 6.2. Responsibilities

### 6.2.1. Tasks of the manufacturer

#### 6.2.1.1. Initial type testing

The results of tests and assessments carried out for the first edition of this national technical assessment in 2013 are used as type testing. In case of changes to the manufacturing process, components and manufacturing control system which may affect the declared performance characteristics or their stability, type testing must be carried out again.

The scope of type testing performed by the manufacturer is specified in Table 9. Type testing of characteristics other than those listed in the Table are the responsibility of the technical assessment body, State Enterprise Construction Product Certification Centre.

**Table 9.** Scope of the initial type testing performed by the manufacturer

Characteristic	Test/assessment method
Water vapour permeability, and resistance to moisture effects (p. 5.3.1)	Calculation according to LST EN ISO 13788, STR 2.05.01
Water impermeability	Evaluation according to the provided element and component drawings in accordance with known engineering practice. Test acc. to the methods of LST EN 12155, LST EN 12154, LST EN 1027, LST EN 12865.
Dangerous substances (p. 5.3.3)	The declaration according to the supplier compliance documents
Impact resistance (p. 5.4.1)	LST EN 13497 or ISO 7892 under the conditions: - 2 J, 500 g, 408 mm; - 10 J, 1000 g, 1020 mm.
Airborne sound insulation indicator (p. 5.5.1)	LST EN ISO 10140-1, LST EN ISO 10140-2, LST EN ISO 717-1
Air permeability (p. 5.6.2)	Evaluation according to the provided element and component drawings in accordance with known engineering practice.

	Testing in accordance with the methods of LST EN 12153, LST EN 12152.
--	---

Initial type testing results must be recorded, submitted for inspection and stored for at least 10 years after the date of the last manufactured batch for which it was intended.

Tests must be carried out using testing methods described in this technical assessment.

### 6.2.1.2. Internal production control (PC)

The internal production control system must be established, validated and documented. The internal production control system must cover the manufacturing process and production control activities to ensure that products placed on the market complies with the requirements of this technical assessment and declarative values. These internal controls must include:

- incoming materials and components control in accordance with the Control plan (see Annex 4), with the determination of their admission criteria for quick evaluation whether the materials and components are appropriate. This control must also ensure that the external panel components not manufactured by the manufacturer are compliant with the requirements of this technical assessment;
- control of manufacturing processes in accordance with the Control Plan, establishing the frequency of testing and parameters or required criteria. Suitability of processing and measuring equipment must be ensured. Actions to be taken in case the tested parameters or criteria do not meet those specified must be determined;
- finished product storage management and control to ensure that nonconforming products are clearly identified. The recall procedure of nonconforming products must be documented.

Internal production control results are recorded and evaluated. The records must include at least the following information:

- registration and validation of materials and components;
- technological process control results;
- finished product control results and, if applicable, comparison with the requirements;
- product labelling and manufacturing date.

External panels may be accepted after an evaluation of component, technological process, finished product control and initial type testing results.

The records must be presented to the inspection body during the continuous surveillance. They must be delivered to the Construction Product Certification and Testing Centre upon request.

### 6.2.2. Tasks for technical assessment body

#### 6.2.2.1. Initial type testing

The results of tests and verifications carried out for the first edition of this national technical assessment in 2013 are used as type testing. In case of changes to the manufacturing process, materials, components and manufacturing control system which may affect the declared performance characteristics or their stability, type testing must be carried out again.

The scope of type testing performed by the technical assessment body is specified in Table 10. Type testing other than listed in the Table shall be the responsibility of and performed by the manufacturer.

**Table 10.** Type testing within the responsibility of TAB

Characteristic	Test/assessment method
Mechanical durability and stability (p. 5.1)	Calculation according to requirements LST EN 1990. LST EN 1991-1-1, LST EN 1995-1-1 and ETAG 007. Tests according to LST EN 380. LST EN 594, LST EN 595, LST EN 596.
Class of reaction-to-fire performance (p. 5.2.1)	LST EN 13501-1

Fire resistance (p. 5.2.2)	LST EN 13501-2
Thermal characteristics (p. 5.6.1): - of the straw layer $\lambda_D$ ; - thermal resistance of panel $R_{pl}$	Tests according to LST EN 12667, according to LST EN 12939. Calculations according to LST EN ISO 6946 and STR 2.01.03.
Durability (straw layer resistance to biological effects)	Tests according to ONORM B 6010. Evaluation according to the methods LST EN ISO 846.

### 6.2.3. Tasks to certification body

#### 6.2.3.1. Initial production plant and production control verification

Based on this technical assessment and the Control plan, the certification body must make sure that the factory (personnel and equipment) internal production control ensure the declared performance characteristics and their stability and IPC is compliant with the requirements of this NTI.

The initial approval must evaluate the scope and the result of the original type testing.

#### 6.2.3.2. Continuous IPC monitoring and assessment

The frequency of IPC monitoring and assessment performed by the certification body should be at least once a year.

By carrying out continuous IPC monitoring and assessment, the certification body must make sure that the production plant (personnel and equipment) and internal production control ensure the declared performance characteristics and their stability and IPC is compliant with the requirements of this NTI.

IPC monitoring and assessment must be carried out in accordance with the Control Plan.

During each IPC monitoring and assessment, the certification body must check the records listed in paragraph 6.2.1.2:

In cases where the provisions of the technical assessment and the Control plan are no longer complied with, the production control certificate must be suspended.

#### 6.2.4. Production control certificate and declaration of performance characteristics

Once the conditions specified in this technical assessment are met, the certification body must issue a certificate of conformity of production control. The certificate must contain the following information:

- name and address of the certification body;
- manufacturer's name, address, place of manufacture;
- general product description (type, corresponding identification details, use);
- provisions met by the product (marking of this technical assessment);
- certificate number;
- validity of the certificate and conditions, if any;
- full name and position title of the person authorised to sign the certificate.

The manufacturer must draw up a declaration of performance, which must include the information required under SRT 1.01.04:2015. The declaration must contain the performance characteristics declared and provided in Annex 1.

## 7. Marking and labelling

Each external panel supplied to the market must be identified in order to ensure traceability back to the manufacturing site and manufacturing date prior to installation. To this end, the manufacturer must label the products or provide identifying information in the accompanying documents so that, if necessary, internal production control records required under this NTI could be referred to. The labelling of the products must be durable.

Each panel must be identified by specifying:



- external panel name (wall panel, lintel panel or sill panel);
- external panel type (T1 without struts; T2 with struts);
- dimensions (height, width, thickness), cm.

The product and/or accompanying documents must contain the following information:

- manufacturer's name or trademark and name;
- external panel identification information;
- number of the declaration of performance;
- external panel manufacturing date;
- external panel weight;
- mark of this technical assessment.

Beside the above information, the accompanying documents must provide the instructions for shipping, storage and installation of external panels or give reference where such information is publicly available.

Information about all performance characteristics listed in this technical assessment must be provided in the declaration of performance.

## **8. Assumptions for the assessment of external panel performance characteristics**

### **8.1. Manufacturing**

This national technical assessment for external panels was issued on the basis of:

- calculation according to indicated technical specifications and type testing results confirming the mechanical resistance and stability of external panels during shipping, installation and use;
- manufacturer's IPC ensuring the declared performance characteristics and their stability.

The results of calculations and tests obtained during technical assessment are stored by the manufacturer.

Any changes that may affect the performance characteristics and production process of external panels must be reported to the CPCC before implementing them. CPCC shall decide whether such changes shall affect the validity of the national technical assessment and whether an additional assessment and/or amendment of NTİ are necessary.

The production process is carried out in dry, heated industrial premises. All necessary materials and components are stored indoors ensuring favourable conditions for the quality of these materials and components.

### **8.2. Design**

The products are manufactured according to the design of the individual building, where they will be used. The design must take into account the following:

- requirements for load bearing capacity;
- fire protection garments;
- special requirements for health and the environment;
- safety of use;
- protection from noise,
- energy savings.

## **9. Montage and installation**

The manufacturer is responsible for providing adequate information about the installation of external panels. The panels must be installed in accordance with the installation instructions provided by the manufacturer. During installation of panels, the construction site must be protected against precipitation in order to prevent damage to panels by ambient humidity.

Products must be installed in accordance to the installation manual provided by the manufacturer.

Installation instructions must contain the following:

- method of installation and necessary means;
- temporary fastening of products during installation;
- final product attachment to the base;
- description of all materials and components;
- standard and special connector and an assembly drawings.

Prior to installation, make sure that external panels have not been damaged during shipping or storage. Damaged external panels cannot be installed and must be replaced.

## **9.2. Requirements for the base**

This national technical assessment is not intended for building foundations.

The foundations of residential and non-residential buildings must be individually designed according to the national technical specifications and construction normative documents in force at the place of construction.

Before beginning the installation of products, the installer must check the products and assess the existing base according to the tolerances indicated below (this is necessary for the correct mounting of the panels):

- allowed vertical deviation of the foundation:  $\pm 10$  mm;
- allowed horizontal deviation of the foundation:  $\pm 10$  mm.

The height of the foundation above the ground must be adequate to avoid impact on the durability of the external panels and, at the same time, the whole building, taking into account the climatic conditions.

Waterproof membrane must be installed between the base and the product according to the working drawings.

## **10. Packaging, transport, storage, maintenance, repair instructions**

### **10.1. Packaging, transport, storage**

The manufacturer must draw up the instructions for shipping and storage of external panels. During shipping and storage, the panels must be protected against precipitation to prevent moisture penetrating the wooden structure and thermal insulation layer of straw.

The products must be protected from harmful effects of atmosphere during transport, storage and installation.

Products and their components must not be subject to and stored in a manner that might damage them, for example, due to local stress or own weight, or due to excessive bending deformation.

### **10.2. Use, maintenance, repair**

The manufacturer is responsible for ensuring the proper information about the use of the products with each shipment, including general information and specific installation drawings and structural details.

Prior to the installation it must be ascertained that the products and components are not damaged during transportation and storage. Damaged items and components need to be replaced.

Where it is necessary to replace or repair the structure, it can be done only in accordance with the installation instructions. In other cases, changes may be made only with a written consent of the manufacturer.

In order to preserve the properties of products and ensure the stability of these properties through the reasonable time of use, they may require regular maintenance. In such case, the maintenance actions and frequency must be specified in the manufacturer's maintenance instructions.

## Overall appearance of panels, their configuration, basic geometry, and main performance characteristics

This annex contains information on the product configuration, components, basic dimensions and essential performance.

The panels are manufactured in the factory without the inner and outer layers of finish.

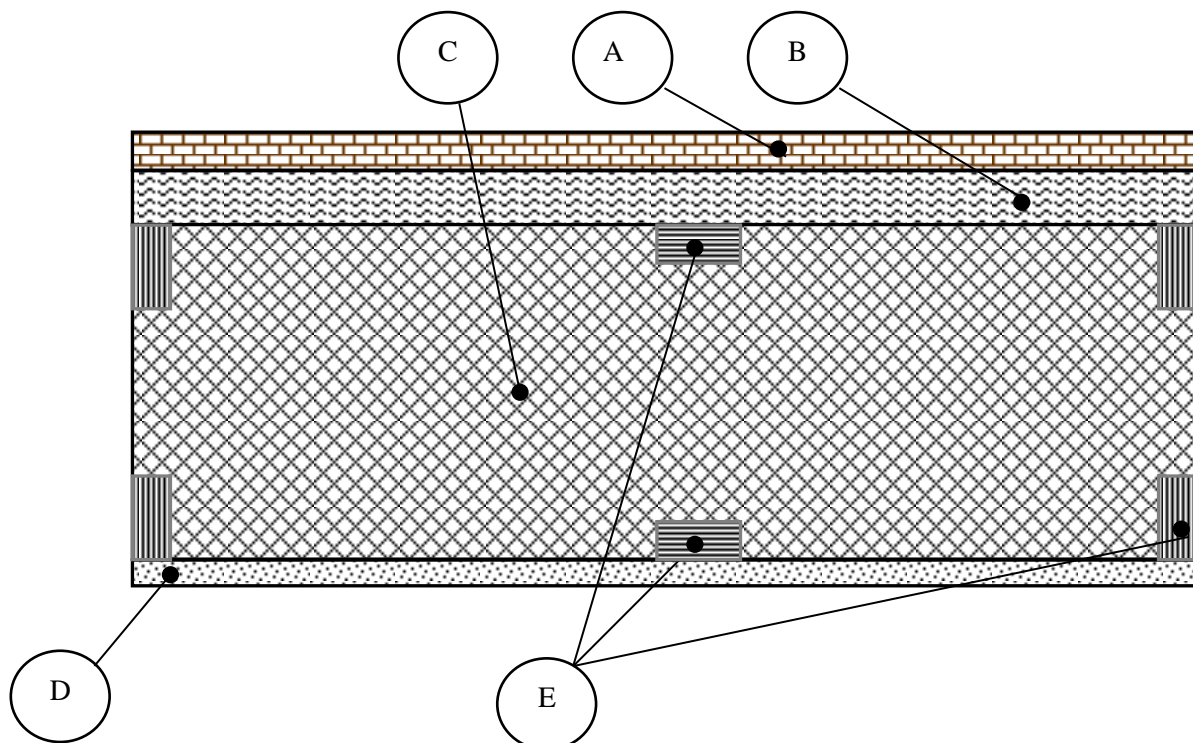
A mixture of clay plaster may be supplied for the inner layer together with the product. The inner layer of clay plaster is installed after the installation of the panels and protecting the internal structures of the building against precipitation.

Standard panel dimensions: height – 3000 mm, width – 1200 mm. If necessary, smaller dimension panels can be manufactured.

Depending on the panel timber frame structure, UAB Ecocon company produces two types of panels:

- Type T1 – no struts (see Fig. P.2.1);
- Type T2 – with struts (see Fig. P.2.2).

### P.1.1. Panel description



Marking	Description of the constituent
A	External finishing layer. Used according to customer's request. This technical approval does not include this layer and does not provide its requirements.
B	Fibreboard, density 270 kg/m <sup>3</sup> , thickness 60 mm, flammability class E, $\lambda_D = 0.048$ W/(m·K). For other properties, see. in Table 5.9.3.1
C	Thermal insulating layer of compressed straw, density 98 ÷ 127 kg/m <sup>3</sup> , humidity 12%, thickness 400 mm, $\lambda_D$ 0.060 W/(m·K)
D	internal clay plaster layer: clay plaster "brown clay", thickness 30 mm, density 1600÷1800 kg/m <sup>3</sup> , quantity 48 kg/m <sup>2</sup> , reinforced with hay fibre
E	Timber frame: - vertical C24 strength class timber beams, 95×45 mm; - struts from the C24 strength class of timber beams, 95×45 mm

Fasteners:

Connecting elements	Fastener type	Essential requirements
Timber frame load-bearing elements	Paneltwistec screws according to ETA-11/0024	Diameter: Ø4 mm, Ø6 mm; Ø8 mm. Steel limit strength: $\geq 600$ N/mm <sup>2</sup>

### P.1.2. Mechanical resistance and stability

Wall bearing capacity calculations were performed according to the requirements of LST EN 1990, LST EN 1991-1-1, LST EN 1995-1-1 and ETAG 007 guidelines. The calculations were carried out according to the ultimate safety state by applying the partial factor method.

Assumed in calculations:

- timber strength class C24 (characteristic timber density  $\rho_k = 350$  kg/m<sup>3</sup>);
- timber frame elements are connected with the screws Paneltwistec (Ø4 mm; Ø6 mm, Ø8 mm, ETA-11/0024, steel strength limit  $R_m = 600$  N/mm<sup>2</sup>);
- effects of timber fibreboard used for wall panelling is not evaluated.

Calculations were made using the operating conditions class 2 according to LST EN 01-01-1995.

In case of different classes of the timber strength and operating conditions, and other types of joints, the load-bearing values indicated in the table is should be adjusted accordingly.

In calculating the load bearing capacity of frame external panels, it was assumed that the external panels have clamps at the top preventing the frame panels from moving out of the wall plane and the frame wall is well secured to the foundation.

#### P.1.2.1. Characteristic vertical load bearing capacity

The load of roofing and floor elements asked be transferred to the walls through additional elements (beams, joists). The bearing capacity of those elements must be verified in separate calculations. In calculating the load bearing capacity of the wall, load-bearing wooden elements of only one side were taken into account. If additional construction elements are installed, which evenly distribute vertical load on both sides of the wall, the value of load-bearing capacity should be doubled.

The design vertical load-bearing capacity of external timber frame walls under the medium and short-term loads is presented in Table P.1.3.

#### P.1.2.1. Characteristic vertical load-bearing capacity

Design scheme of the panel	Characteristic vertical load bearing capacity
----------------------------	---

	(kN/m)
Without struts (Annex 2, Fig. P.2.1)	60.0
With struts (Annex 2, Fig. P.2.2)	38.5

### P.1.2.2. Characteristic vertical load bearing capacity together with horizontal load (perpendicular to wall plane)

Horizontal loads are approximately taken according to the possible maximum wind load pressures in Lithuania areas.

In calculating the load bearing capacity of the wall, load-bearing wooden elements of only one plane of the panel were taken into account. If additional construction elements are installed, which evenly distribute vertical load on both planes of the panel, the value of load-bearing capacity should be doubled.

The design vertical load-bearing capacity of external timber frame walls acting along with the horizontal load (perpendicular to the plane of the wall) is presented in Table P.1.2.2.

P.1.4. Design vertical load-bearing capacity (kN/m) at a short-term load along the horizontal (perpendicular to the plane of the wall) load

Design scheme of the panel	The design vertical load-bearing capacity (kN/m), the horizontal load q (kN/m <sup>2</sup> )		
	1.8	2.1	2.4
Without struts (Annex 2, Fig. P.2.1)	29.5	25.8	22.2
With struts (Annex 2, Fig. P.2.2)	18.8	11.1	3.5

### P.1.2.3. Characteristic shear load bearing capacity (in wall plane)

External timber frame walls The design horizontal characteristic (perpendicular to the plane of the wall) carrying power in the instantaneous load time is presented in Table P.1.5.

P.1.1.5. Design horizontal load-bearing capacity (perpendicular to the plane of the wall) under instant-term load

Design scheme of the panel	Characteristic shear load bearing capacity (kN/m)
Without struts (Annex 2, Fig. P.2.1)	0
With struts (Annex 2, Fig. P.2.2)	3.50

### P.1.2.4. Characteristic vertical load bearing capacity of the truss lintel

The load of roofing and floor elements must be transferred to the lintel through additional elements (beams, joists). The load bearing capacity of those elements must be verified by separate calculations. The required length of support must be calculated in the lintel support area.

Characteristic vertical load bearing capacity of the truss lintel is 6.30 kN/m.

In calculating the vertical load bearing capacity of the truss lintel, load-bearing wooden elements of only one side were taken into account. If additional construction elements are installed, which evenly distribute vertical load on both sides of the wall, the value of load-bearing capacity should be doubled.

## P.1.3. Thermal characteristics

### P.3.1. Thermal insulation layer of straw

The main thermal insulation material these panels – pressed layer of straw. Thermal resistance of this layer and the thermal conductivity are determined by measuring samples according to LST EN 12667 and thick samples – according to LST EN 12939.

The declared values of the thermal conductivity and thermal diffusivity coefficients are determined under the following conditions:

- average temperature – 100 °C;
- samples are conditioned by keeping them at least for 6 h in the temperature of  $(23\pm 2)$  °C, and in  $(50\pm 5)\%$  relative humidity of air;
- the measured values are expressed in three significant digits;
- thermal resistance  $R_D$  and the declared thermal conductivity coefficient  $\lambda_D$  is the limit values which represent at least 90% of production at 90% confidence level;
- value of the thermal conductivity coefficient  $\lambda_{90/90}$  is rounded with the accuracy of 0.001 W/(m·K) to the higher side and is shown as  $\lambda_D$  every 0.001 W/(m·K);
- the declared value of thermal resistance  $R_D$  is calculated by the nominal thickness  $d_N$  and the corresponding heat transfer coefficient value  $\lambda_{90/90}$ ;
- thermal resistance value of  $R_{90/90}$ , where it is calculated from the nominal thickness  $d_N$  and the corresponding heat transfer coefficient value  $\lambda_{90/90}$ , is rounded with the accuracy of 0.05 (m<sup>2</sup>·K)/W to the smaller side, and presented as  $R_D$  every 0.05 (m<sup>2</sup>·K)/W.

The declared values are calculated from at least ten test results of the thermal resistance or thermal conductivity.

Thermal properties of the straw insulating layer are presented in Table P.1.6.

P.1.6. Thermal properties of the straw insulating layer

Technical parameters of the thermal insulation layer of straw	$\lambda_D$ [W/(m·K)]	$d_N$ [mm]	$R_D$ [(m <sup>2</sup> ·K)/W]
Density: 98 ÷ 127 kg/m <sup>3</sup> Humidity: 12% Water vapour diffusion resistance factor $\mu$ : 1,4	0.060	400	6.65

P.1.3.2. Thermal characteristics of the panel

thermal properties of the panel are determined in the test in accordance with LST EN ISO 12567-1:2010. LST EN ISO 8990. LST EN 1934:2000 and calculations in accordance with LST EN ISO 6946:2017.

Tests and calculations were performed under the following conditions:

- fibre boards  $\lambda_{ds}=0.049$  W/(m·K);
- clay plaster  $\lambda_{ds}=0.0521$  W/(m·K);

Thermal characteristics of the panel is presented in Table P.1.2.3.

P.1.7. Thermal characteristics of the panel

Technical parameters of the panel	$U_{pl}$ [W/(m <sup>2</sup> ·K)]	$R_{pl}$ [(m <sup>2</sup> ·K)/W]
Layers: - 30 mm clay plaster layer, $\rho=1600$ kg/m <sup>3</sup> , $\lambda_{ds}=0.521$ W/m <sup>2</sup> ·K; - 400 mm layer of straw, $\rho=98 \div 127$ kg/m <sup>3</sup> , $\lambda_D=0.060$ W/m <sup>2</sup> ·K; - 60 mm wood fibreboard, $\rho=270$ kg/m <sup>3</sup> , $\lambda_D=0.049$ W/m <sup>2</sup> ·K	0.123	8.1

#### P.1.4. Flammability class

Flammability class was found by testing the panel test pieces in accordance with LST EN ISO 11925-2, LST EN 13823 and the classification in accordance with LST EN 13501-1. Tests were carried out on the external finishing layer.

Panel flammability classification results are shown in Table P.1.6.1.

#### P.1.8. Panel flammability classification results

Panel configuration	Class of reaction -to-fire performance	Extended application range
<p>Configuration 1:</p> <ul style="list-style-type: none"> <li>- wood frame (timber without protective coating, moisture content 8%);</li> <li>- thermal insulation compressed straw layer (density <math>\approx 100 \text{ kg/m}^3</math>, thickness 160 mm, humidity 12%);               <ul style="list-style-type: none"> <li>- fibreboard (density <math>270 \text{ kg/m}^3</math>, thickness 60 mm);</li> <li>- external layer (exposed to flame):</li> <li>- reinforcement lattice (<math>165 \text{ g/m}^2</math>)</li> <li>- Baunit open KlebeSpachtel White reinforcement – adhesive mixture (thickness <math>4.5 \div 5.0 \text{ mm}</math>, area mass <math>5.8 \div 6.5 \text{ kg/m}^2</math>)</li> <li>- Baunit UniPrimer primer (area weight <math>0.3 \text{ kg/m}^2</math>)</li> <li>- Baunit NanoporTop decorative plaster (thickness 2 mm, area weight <math>3.2 \text{ kg/m}^2</math>)</li> </ul> </li> </ul>	B-s1,d0	<p>This classification is applied for the specified configuration and can be extended to these product parameters:</p> <ul style="list-style-type: none"> <li>- compressed straw thickness <math>\geq 160 \text{ mm}</math>;</li> <li>- any unpainted mineral decorative plasters, with the thickness of <math>\geq 2 \text{ mm}</math></li> </ul>
<p>Configuration 2:</p> <ul style="list-style-type: none"> <li>- wood frame (timber without protective coating, moisture content 8%);</li> <li>- hardpanel strips every 20 cm (density <math>250 \text{ kg/m}^3</math>, thickness 5 mm);</li> <li>- thermal insulation compressed straw layer (density <math>\approx 100 \text{ kg/m}^3</math>, thickness 170 mm, humidity 12%);               <ul style="list-style-type: none"> <li>- external (layer 0 exposed to flame):</li> <li>- clay plaster “Brown clay”, 3 layers (thickness 30 mm, density <math>1600 \text{ kg/m}^3</math>, area mass <math>48 \text{ kg/m}^2</math>, reed fluff 0.05 %reinforcing mesh of <math>165 \text{ g/m}^2</math> is placed between the second and third layer)</li> <li>- decorative clay plaster “White clay” (thickness 2 mm, density <math>1600 \text{ kg/m}^3</math>, area mass <math>3.2 \text{ kg/m}^2</math>, cellulose 0.025%)</li> </ul> </li> </ul>	B-s1,d0	<p>This classification is applied for the specified configuration and can be extended to these product parameters:</p> <ul style="list-style-type: none"> <li>- compressed straw thickness <math>\geq 170 \text{ mm}</math></li> </ul>

**P.1.5. Airborne sound insulation indicator**

Airborne sound insulation indicator was determined using test methods specified in standards LST EN ISO 10140-1, LST EN ISO 10140-2 and LST EN ISO 717-1.

Airborne sound insulation value of the panel is presented in Table P.1.9.

**P.1.9. Airborne sound insulation value of the panel**

Panel configuration	Airborne sound insulation indicator
<u>Configuration:</u> - fibreboard (density 270 kg/m <sup>3</sup> , thickness 60 mm); - timber frame; - thermal insulation layer of compressed straw (density 98 ÷ 127 kg/m <sup>3</sup> , thickness 400 mm); - inner layer – clay plaster, thickness 30 mm, density 1600 kg/m <sup>3</sup>	$R_w (C;C_{tr};C_{100-5000}) = 54 (-1;-3;0)$

**P.1.6. Resistance of the thermal insulating straw layer to biological effects**

Test of mould fungi resistance of the straw insulating layer was conducted in accordance with ONORM B 6010 methodology applied to the straw samples. The test determines the mould fungi resistance of the samples by storing them for 28 days at a temperature of (23±2) °C, under 95% relative humidity. At the end of the test the samples were evaluated according to the intensity of the fungi growth on them, using a 5 point scale according to LST EN ISO 846.

Assessment results of the resistance of thermal insulating straw layer to biological effects are shown in Table P.10

**P.10. Resistance of the thermal insulating straw layer to biological effects**

Sample storage conditions	Resistance to biological impacts (points according to LST EN ISO 846)
28 days at ambient temperature of (23±2) °C and relative air humidity of 50 %	0 (no visible fungal growth through a microscope)
28 days at ambient temperature of (23±2) °C and relative air humidity of 95 %	2 (fungal growth visible with the naked eye covers the up to 25% of the sample surface)



**General view of the wooden frames of the product**

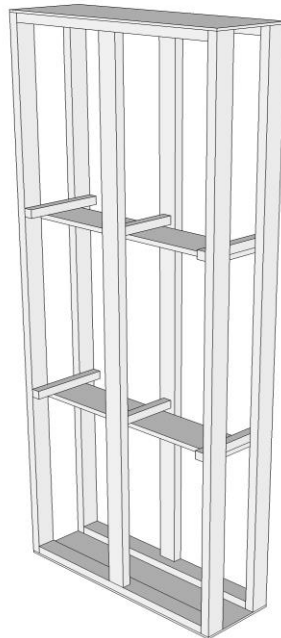


Fig. P.2.1 Wooden frame of panel T1 (no struts)

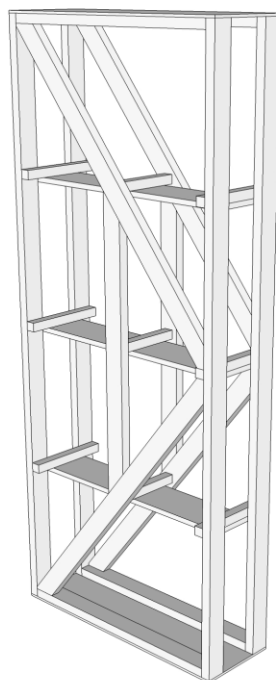


Fig. P.2.2 Wooden frame of panel T2 (with struts)



Fig. P.2.3 Wooden frame of truss lintel

**Control plan**

Products must be accepted after the evaluation of the results of materials, production process, finished goods testing, periodic testing, and the requirements of this technical approval.

**P3.1. Control of incoming materials**

The incoming materials control plan is presented in Table P3.1.

**P3.1. Incoming materials control plan**

No	Name of the raw material, characteristic	Test/control method	Requirement	Control/testing frequency
<b>1</b>	<b>Timber</b>			
1.1	Wood strength class	According to the conformity documents and visual inspection	C24	Each batch before unloading
1.2	Wood moisture content	According to the conformity documents and visual inspection. In case of doubt, measurement according to LST EN 13183-2.	Not exceeding 20%	Each batch upon unloading and opening the package
1.3	Wood sectional dimensional accuracy	Visual inspection. In case of doubt, measurement	Dimensions (95×45) mm. Accuracy – class 2 according to LST EN 336	1) each batch prior to unloading. 2) before using in the production
1.4	Wood shape accuracy	Measurements according to LST EN 1310	- spring ≤ 4 mm in 2 m length; - bow ≤ 6 mm in 2 m length; - twist ≤ 6 mm in 25 mm width and in 2 m length; - cup ≤ 2 mm in 100 m of the side;	1) each batch prior to unloading. 2) before using in the production
1.6	Resistance of wood to the biological effects of environment	According to the conformity documents of the supplier	LST EN 350-2, LST EN 351-1, LST EN 460	Each batch before unloading.
<b>2</b>	<b>Straw</b>			
2.1	Humidity	Measuring according to the manufacturer's method	Not exceeding 20%	1) each roll before unloading 2) before using in the production

2.2	Biocide (pesticide) quantity	According to the supplier's declaration	Requirements of Directive 98/8/EC for biocidal products	Each batch according to the supplier and place before unloading.
2.3	Straw structure	Visual inspection, manufacturer's method for testing the compressive strength of straw.	technical specification of the manufacturer	Each batch according to the supplier and place before unloading.
<b>3</b>	<b>Metal fasteners</b>			
3.1	Type	According to the conformity documents of the supplier	Type according to working drawings	Each batch before unloading
3.2	Durability (corrosion resistance)	According to the conformity documents of the supplier	According to the working drawings	Each batch before unloading
<b>4</b>	<b>Fibreboard</b>			
4.1	Type	According to the conformity documents of the supplier	According to the working drawings	Each batch before unloading
4.2	Appearance	Visual inspection	According to the reference sample	Each batch before unloading
4.3	Accuracy of measurements	Measurement	According to the working drawings	Each batch before unloading
<b>5</b>	<b>Plywood</b>			
5.1	Type	According to the conformity documents of the supplier	According to the working drawings	Each batch before unloading
5.2	Appearance	Visual inspection	According to the reference sample	Each batch before unloading
5.3	Accuracy of measurements	Measurement	According to the working drawings	Each batch before unloading

Notes:

- spring – longitudinal shift of the lumber workpiece, perpendicular to the edge;
- bow – lengthwise shift of the lumber workpiece perpendicular to the sides;
- twist – helical lengthwise twisting of the lumber workpiece sides;
- cup – curvature of the lumber workpiece perpendicular to the width of the side;

### P3.2. Manufacturing process control

The manufacturing process control plan is presented in Table P3.2.

#### P3.2. Manufacturing process control plan

No	Name of the raw material, characteristic	Test/control method	Requirement	Control/testing frequency
<b>1</b>	<b>Wood blanks preparation</b>			

1.1	Cross-sectional dimensions of timber (if the timber is cut)	Measurement	Class 2 according to LST EN 336	Prior to the use of production
1.2	Wood shape accuracy	Measurements according to LST EN 1310	<ul style="list-style-type: none"> <li>- spring* ≤ 4 mm in 2 m length;</li> <li>- bow** ≤ 6 mm in 2 m length;</li> <li>- twist*** ≤ 6 mm in 25 mm width and in 2 m length;</li> <li>- cup**** ≤ 2 mm in 100 m of the side</li> </ul>	Prior to the use of production
1.3	Wane	Visual	Impermissible	Prior to the use of production
1.4	Wood impregnation (if necessary)	Measurement	According to the technological documentation: <ul style="list-style-type: none"> <li>- material quantity;</li> <li>- coverage thickness;</li> <li>- impregnation depth</li> </ul>	Each batch
<b>2</b>	<b>Wood frame assembly</b>			
2.1	Selection of fasteners	Visually, measurement	According to the working drawings requirements	Each fastener type
2.2	Accuracy of assembly	Measurement	According to the working drawings requirements	Each frame
<b>3</b>	<b>Pressing of the thermal insulation layer of straw</b>			
3.1	Density	Weighing	100 ÷ 130 kg/m <sup>3</sup>	In case of doubt
3.2	Planes	Measurement	± 2 mm in 2 m length	In case of doubt
<b>4</b>	<b>Clay plaster (prescription) manufacturing</b>			
4.1	Dispensing accuracy	Weighing	± 2%	Each mixture

### P3.3. Finished product control

The finished production control records are presented in Table P3.3.

#### P3.3. Finished production control records

No	Control name	Test/control method	Control frequency
1	Control of shape and dimensions	Measurement	Each panel
2	Panel weight	Weighing	Each panel
3	Moisture content of the thermal insulation layer of straw	Measurement	Each panel
4	Marking	Visual control	Each product