CONSTRUCTION HEAT PHYSICS LABORATORY
INSTITUTE OF ARCHITECTURE AND CONSTRUCTION
OF KAUNAS UNIVERSITY

LIETUVOS NACIONALINIS AKREDITACIJOS BIURAS

LITHUANIAN NATIONAL ACCREDITATION BUREAU

TESTING
ISO/IEC 17025 **No. LA. 01.031**

TEST PROTOCOL No. 064 SŠF/12 U
12 December 2012

Determining of Thermal Conductivity Coefficient of Pressed Straw

(*Name of test*)

Test and calculation carried out according to:

LST EN ISO 12567-1:2010: Thermal performance of windows and doors. Determination of thermal transmittance by hot box method. Part 1. Combination of windows and doors (ISO 12567-1:2000) and LST EN ISO 8990:Thermal insulation. Determination of steady-state thermal transmission properties. Calibrated and guarded hot box methods.
LST EN 1934:2000: Thermal performance of buildings. Determination of thermal resistance by hot box method using heat flow meter. Masonry.
LST EN ISO 6946:2008: Building components and building elements. Thermal resistance and thermal transmittance. Calculation method (ISO 6946:2007)

(Reference number of normative document or description of test method and test procedures, test error)

Product: Pressed straw block. Dimensions: width 1,200 mm; height 2,005 mm; thickness 265 mm. System: pressed straw in a wooden frame plastered with 30-mm clay on one side and covered with 40-mm STEICO protect (inthermo) wood-fibre wool on the other side.

(Name, marking or description of the normative document, means of identification)

Customer: *UAB ECOCOCON*, Dievogalos Village, Dievogalos Str. 69, Kaunas District
(Name and address)

Producer: *UAB ECOCOCON*, Dievogalos Village, Dievogalos Str. 69, Kaunas District
(Name and address)

Test results:

Name and dimension of indicator	Test method reference	Test results
Total sample thermal conductivity coefficient, U, $W/(m^2 \cdot K)$	LST EN ISO 12567-1:2010	0.29
Thermal conductivity coefficient through the central part of the sample (excluding frame) U, $W/(m^2 \cdot K)$	LST EN 1934:2000	0.23[1]
Pressed straw thermal conductivity coefficient λ, $W/(m \cdot K)$	LST EN ISO 6946:2008	0.056[1]
Note: 1) non-accredited area		

Place of testing: KTU ASI Construction Heat Physics Laboratory
(Name of the testing laboratory)

Samples delivery date: 11/12/2012 Date of test: 12/12/2012

Samples selected by: Customer. Sampling report 064/12, 11/12/2012

Other information: Application 11/12/2012, drawings
(*Any deviations, further testing, exceptions. and any other information related to a specific test*)

Annexes:
Annex 1. Test Data
Annex 2. Calculation Data
Annex 3. Sample Data
Annex 4. Test Equipment Data
(*Reference number and name of annex*)

Technical Manager: _____ J.Ramanauskas
(*Technically responsible for the test*) (Signature) (*Name, surname*)

Test carried out by: _____ A.Burlingis
(*Technically responsible for the test*) (Signature) (*Name, surname*)

Seal:

Annex 1. Test Data

Physical quantities		Value
Air flow on the warm side, down, v_I	m/s	0.39
Air flow on the cold side, up, v_e	m/s	3.95
Air supply power in the hot box, Φ_{in}	W	28.64
Sample heat flux density, q_{sp}	W/m^2	6.08
The average air temperature in the warm side, θ_{ci}	^oC	20.75
The average air temperature in the cold side, θ_{ce}	^oC	-0.03
Estimated ambient temperature in the warm side, θ_{ni}	^oC	20.78
Estimated ambient temperature in the cold side, θ_{ne}	^oC	0.13
Total thermal resistance of the surface, $R_{s,t}$	$m^2 \cdot K/W$	0.07
Sample measured thermal conductivity coefficient, U_m	$W/(m^2 \cdot K)$	0.29
Standard total thermal resistance of the surface, $R_{(s,t),st}$	$m^2 \cdot K/W$	0.17
Sample standardized thermal conductivity coefficient, U_{st}	$W/(m^2 \cdot K)$	0.29
Test uncertainty, ΔU_m	$W/(m^2 \cdot K)$	± 0.01498

Test carried out by: A.Burlingis Date: 12/12/2012

Annex 2. Calculation Data

Thermal properties of the sample straw

Sample details include:

- STEIKO protect plate layer (40mm thickness) with the adopted designed thermal conductivity coefficient λ_{ds} = 0.049 W/(m·K) (DEKLARACJA ZGODNOSCI NR 02/08/2007). Thermal resistance of the layer: R = 0.816 m²·K/W;
- Pressed straw (195mm thickness);
- Clay finishing plaster layer (30mm thickness) with the adopted design thermal conductivity coefficient λ_{ds} = 0,521 W/(m·K) (value measured according to LST EN 12667; measurement sheet No. 5-07, date 05/07/2012; sample code 065/12). Layer thermal resistance: R = 0.058 m^2·K/W;
- Total thermal resistance of the surface determined during the measurement: ΔR_m = 0.07 m²·K/W.
- Thermal conductivity coefficient measured using the heat flow meter in the middle of the sample: U = 0.226 W/(m^2·K).

  Data deducted from the result:

  Overall thermal resistance in the middle of the sample: R_t = 4.425 m²·K/W.

  Total thermal resistance in the middle of the sample: R_s = 4.355 m²·K/W.

  Thermal resistance of straw layer: R = 3.481 m²·K/W.

  Average thermal conductivity coefficient of straw layer: λ_{ds} = 0,056 W/(m·K).

  Thermal resistance of 40 cm thick straw layer would be: R_s = 7.14 m²·K/W.

  Thermal conductivity coefficient of 40 cm thick straw layer covered with 3 cm of clay plaster on the inside, and with 4 cm STEIKO protect plates on the outside will be: U = 0.122 W/(m²·K).

  Overall thermal resistance R_t = 8.20 m²·K/W.

Annex 3. Sample Data

Basic sample data:

a) Pressed straw block. Dimensions: width 1,200 mm; height 2,005 mm; thickness 265 mm. System: pressed straw in a wooden frame plastered with 30-mm clay on one side and covered with 40-mm STEICO protect (inthermo) wood-fibre wool on the other side.

b) Sample dimensions:

- Sample height 2.01 m;
- Sample width 1.20 m;
- Sample area 2.55 m;
- Frame thickness 270 mm;

c) Sample cross-sections:

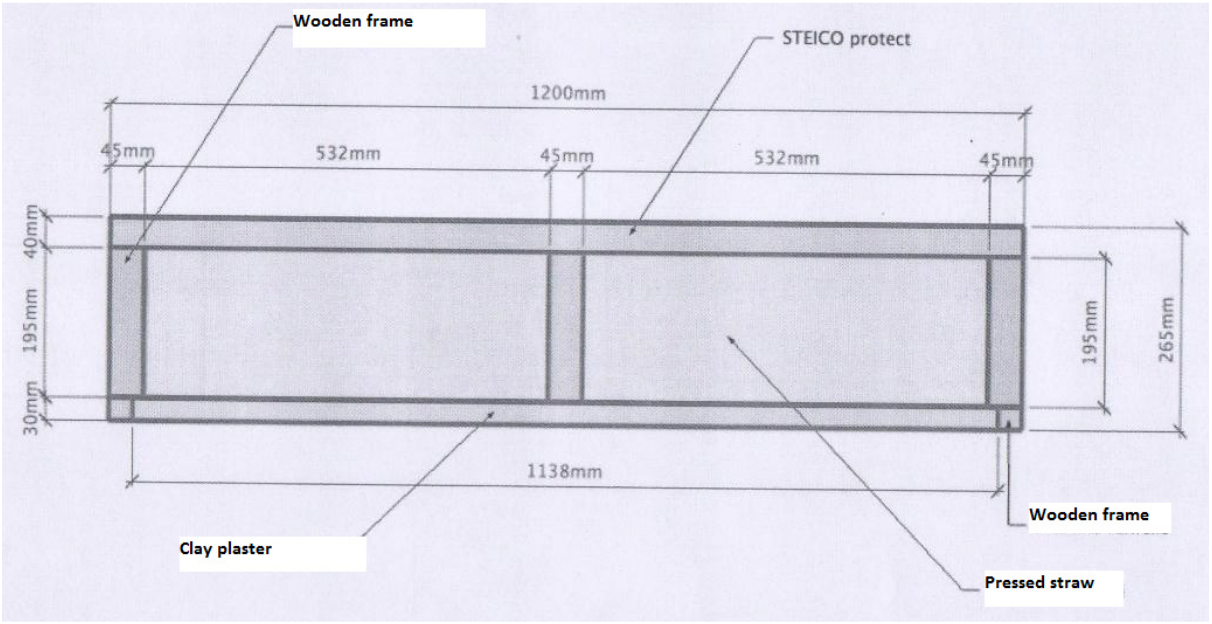
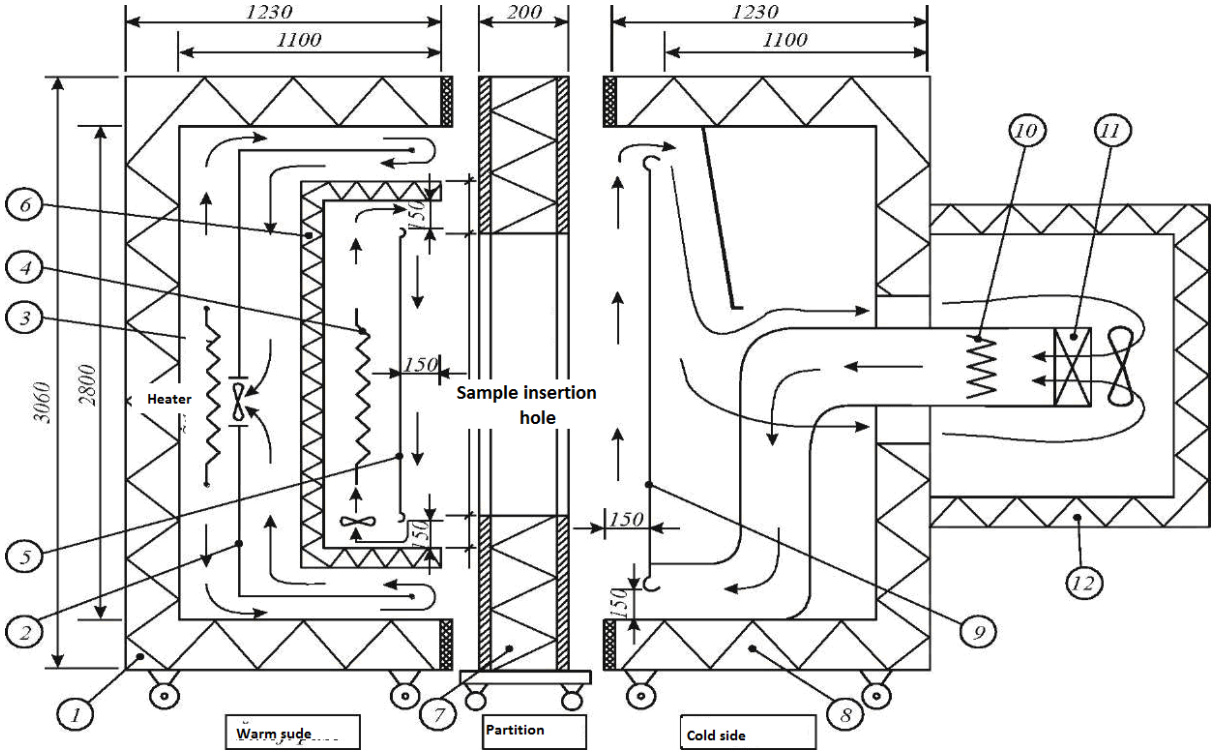


Figure 1: Cross-section of pressed straw fragment

Annex 4. Test Equipment Data

Climatic chamber "Hot box" scheme in the layer



1. Warm protection box:
   - Internal dimensions 2,800 x 2,800 x 1,100 mm;
   - Wall thickness 130 mm, thermal resistance around 3 m²·K/W.
2. Protective tin screen directing air flow.
3. Electric controllable heater, max power 660W, regulated according to internal temperature set in the measurement box (6).
4. Electric heater inside the measurement box, adjustable power from 13÷660W.
5. Measurement box guide (screen) with surface temperature and air temperature measuring thermoelectric converters.
6. Measurement box – internal dimensions 2,400 x 2,400 x 1,100 mm.
7. Partition (surrounding plate) 200 mm thick, made from EPS polystyrene (covered with 3-mm PVC sheet from both sides), resistance around 5.5 m²·K/W. Windows and other samples under test are let into the screen hole.
8. Cold protective box:
   - Internal dimensions 2,800 x 2,800 x 1,100 mm;
   - Wall thickness 130 mm, thermal resistance around 3 m²·K/W.
9. Cold box screen with surface temperature and air temperature measuring thermoelectric converters.
10. Cold box-controlled electric heating spiral, max power 2kW.
11. Cold box-controlled cooling section, max cooling power up to 3 kW.
12. Cold side temperature processing unit with 5-speed ventilator.

Surface radiation capacity: reveal $\varepsilon_\rho = 0.88$; monitor $\varepsilon_\rho = 0.8$

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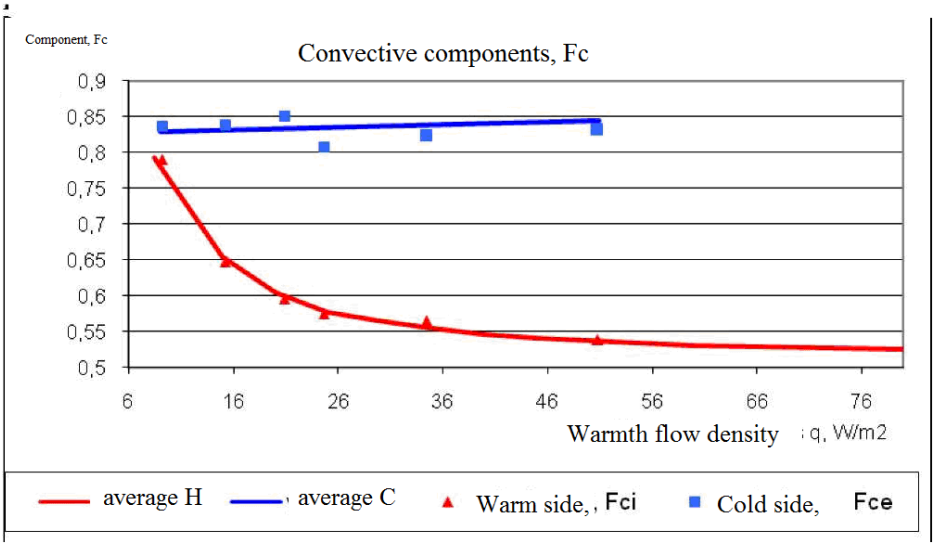
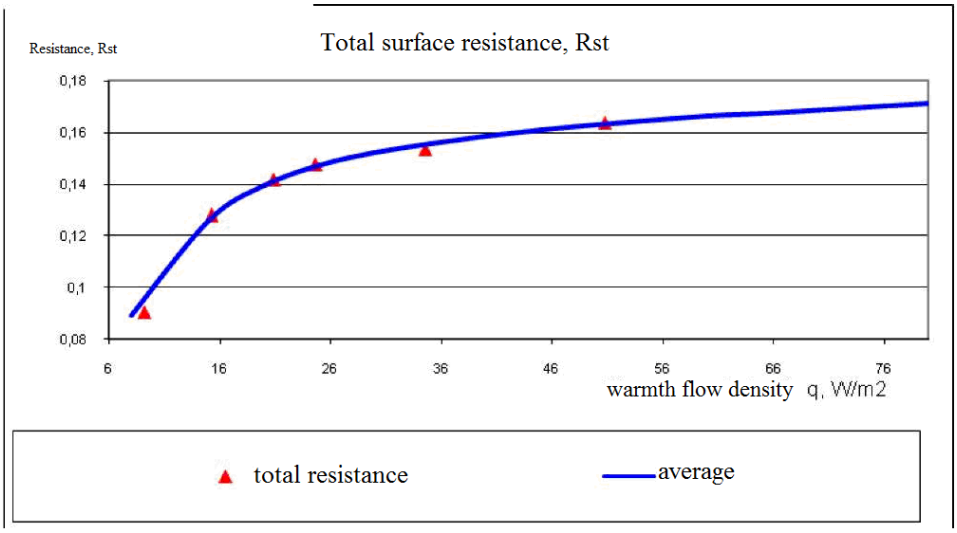
Calibration curves:
Surface exchange convective components:



Total surface resistance



Screen resistance: $R_{sur} = 6.1918555 + 0.0518 \cdot t - 0.0075635 \cdot t^2$.