EUROLAB Laboratory Services

# TEST/MUAYENE RAPORU

## EUROLAB LABORATUVAR HİZMETLERİ

**TÜRCERT TEKNİK KONTROL VE BELGELENDİRME A.Ş.**

UNITED ACCREDITATION FOUNDATION UAF

EUROLAB Accredited Laboratory APPROVED

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**Test Result :** PASS

**Report No :** 2020030602
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| | TEST | METHOD | RESULT |
|---|---|---|---|
| * | **Thermal insulation; determination of steady-state thermal resistance and related properties; guarded hot plate apparatus** | **ISO 8302** | **0.082 W/(m.K)** |
| * | **Heat Resistance** | **Inhouse Method** | **PASS** |

TÜRCERT TEKNİK KONTROL VE BELGELENDİRME A.Ş. TÜRCERT

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### Environment

**The requirements and standards apply to equipment intended for use in**

| | |
|---|---|
| X | Residential (domestic) environment |
| X | Commercial and light-industrial environment |
| X | Industrial environment |
| X | Medical environment |



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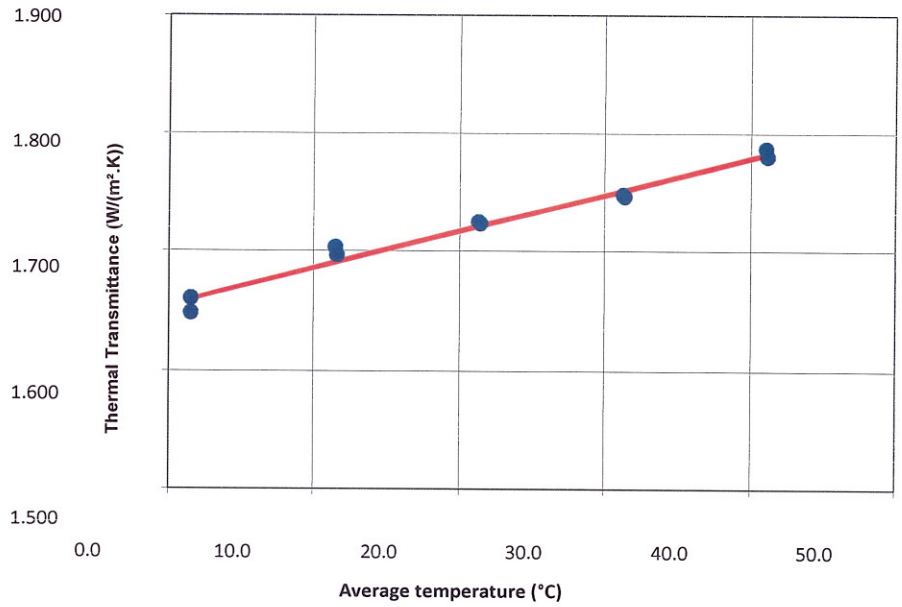
## Method

The thermal resistance of the samples was measured with a heat flow meter for 30x30 cm samples as described in ISO 8302 (Figure 1). The device consists of a central hot plate with a cold plate above and below. Round heat flow meters with a diameter of 10 cm are positioned centrally in the lower part of the upper plate, on both sides of the central plate and in the upper part of the lower plate. These heat flow counters are embedded in a neoprene sheet that is the same thickness as the counters and is as large as the area of the plates. In the middle of each plate side, extremely thin Cu / Co thermocouples are glued against the heat flow counters. Samples are then mounted between the top plate and the center plate and between the bottom plate and the center plate. All of them are finally packaged in a thermally insulated box to create close to adiabatic conditions around the installation. Before the measurements start, heat flow meters are recalibrated using reference samples of the EU's BCR.

The temperature difference between the thermostatic bath that keeps the upper and lower cold plate at temperature and the thermostatic bath that keeps the central hot plate at temperature is set to 10 ° C. The temperatures and heat fluxes on both surfaces of the samples are not fixed, all data are recorded in the 10 "time interval and stored on the hard disk. All calculations are done in Excel. Values are converted in averages lasting three hours and the resistance is calculated using the equation below.

$$R = \frac{\square 2\Delta\theta}{C_1E_1 + C_2E_2.}$$

| | |
|---|---|
| $C_1$, $C_2$ | Calibration constants of heat flow meters W / (m².mV)) |
| $E_1$, $E_2$ | Electric voltage difference measured on heat flow meters at mV |
| ?? | Temperature difference on samples in K (measured with Cu / Co thermocouples) |



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## Results of the measurement

| Sample | Thickness m | Vol. humidity $\%m^3/m^3$ | Average Tempetature °C | Temperature Difference °C | Thermal Resistance $m^2.K/W_{1)}$ |
|---|---|---|---|---|---|
| 1 | 0.02 | 0 | 1.5 | 9.0 | $0.58^2$ |
| | | | 10.5 | 9.2 | $0.60^7$ |
| | | | 21.2 | 9.2 | $0.60^0$ |
| | | | 31.1 | 9.3 | $0.59^2$ |
| | | | 40.8 | 9.2 | $0.58^0$ |
| 2 | 0.02 | 0 | 1.5 | 8.9 | $0.61^7$ |
| | | | 10.5 | 9.1 | $0.58^0$ |
| | | | 21.2 | 9.2 | $0.57^0$ |
| | | | 31.1 | 9.2 | $0.57^2$ |
| | | | 40.8 | 9.2 | $0.56^2$ |
| 3 | 0.02 | 0 | 1.5 | 9.2 | $0.61^5$ |
| | | | 10.3 | 8.7 | $0.53^2$ |
| | | | 24.2 | 9.3 | $0.62^1$ |
| | | | 31.2 | 9.4 | $0.55^2$ |
| | | | 40.6 | 9.2 | $0.54^2$ |

(1) The last number in the superscript is uncertain

| Sample | $\frac{\partial q}{q}$ % | $\frac{\partial \theta}{\theta}$ % | $\frac{qR_n}{\Delta\theta}$ % | Maximum Uncertainty % | Most Possible Uncertainty % |
|---|---|---|---|---|---|
| 1 | 1.4 | 0.55 | 1 | 3.1 | 1.9 |
| 2 | 1.4 | 0.55 | 1 | 3.1 | 1.9 |
| 3 | 1.4 | 0.55 | 1 | 3.1 | 1.9 |

***Thermal conductivity at different average temperatures***



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These are given in the table below:

| Average Temperature °C | Thermal Conductivity W/(m.K) |
|---|---|
| -10 | 0.062 |
| 0 | 0.060 |
| 10 | 0.060 |
| 20 | 0.062 |
| 30 | 0.063 |
| 50 | 0.066 |
| 100 | 0.072 |
| 200 | 0.085 |
| 300 | 0.094 |
| 400 | 0.107 |
| 500 | 0.116 |

SAMPLE decreases to 36 W / m, i.e. it decreases by 77.3%.
The average thermal conductivity in SAMPLE then reaches 0.082 W / (m.K).

**In the test environment, the relative humidity in the environment is 50%.**
**In the test environment, the air temperature is about 21 degrees Celsius.**



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## Heat Resistance

The test started on October 11, 2019 at 15.30. The ambient temperature at which the test is carried out is 24 ° C relative humidity 60%. 200 ° C dry hot air was introduced into the sample and changes were observed. Observations during the test are described below.

| Time (dk:sn) | Observations |
|---|---|
| 0:00 | The device was switched on and dry hot air was introduced into the sample. |
| 0:05 | No changes were observed. |
| 0:10 | No changes were observed. |
| 0:15 | No changes were observed. |
| 0:20 | No changes were observed. |
| 0:30 | No changes were observed. |
| 0:45 | No changes were observed. |
| 1:00 | No changes were observed. |
| 1:30 | No changes were observed. |
| 2:10 | No changes were observed. |
| 3:30 | No changes were observed. |
| 5:00 | No changes were observed. |
| 5:15 | Slight color change was observed. |
| 5:20 | Slight color change was observed. |
| 5:40 | Slight color change was observed. |
| 6:30 | Slight color change was observed. |
| 8:10 | Slight color change was observed. |
| 9:30 | Slight color change was observed. |
| 11:00 | Slight color change was observed. |
| 13:00 | Slight color change was observed. |
| 14:00 | Color change progressed. |
| 15:00 | Color change progressed. |

**Overall Assessment:** The color change observed after 15 minutes is below the expected level. Sample is resistant to 200 ° C.

***** End of Report*****

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