# TEST REPORT

SQM_407_2025

CUSTOMER

## Kebe S.A.

PRODUCT NAME

## ORTHOBLOCK MK180

TYPE OF PRODUCT

**Masonry unit**

TYPE OF TEST

**DETERMINATION OF THE DESIGN THERMAL CONDUCTIVITY VALUES OF THE UNIT (EN ISO 10456) AND OF THE MANSONRY MADE WITH IT**

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**Ordering** Kebe S.A.
**Product placed on the market from** Kebe S.A. - 61100 Nea Santa - Kilkis - GREECE
**Data related to the sample examined** Masonry unit
**Sample origin** sampled and provided from the Customer
**Manufacturing plant** Kebe S.A. - 61100 Nea Santa - Kilkis - GREECE

**Estimate** prot. 25349/lab of 06/04/2025
**Order confirmation** email of 06/04/2025
**Receipt of the samples** June 2025
**Test execution** June 2025
**Laboratory and location of test execution** Certimac - via Ravegnana, 186 - Faenza (RA)

**Report issued** 16/06/2025
**Revision n°** 00

**Test executed by**: Eng. Sebastiano Marianini
**Report drafted by**: Eng. Sebastiano Marianini
**Approval**: Technical director Eng. L. Laghi



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*This test report is part of a file in PDF format digitally signed by Luca Laghi*

Chief Technical Officer
(Eng. Luca Laghi)

## 1. Object of the test

The following test report describes the determination of thermal design values of a masonry brick. The calculations were performed by means of a Finite Element Model implemented in Ansys 18.2 (Ref. 2-b), applied to a planar cross section (unit length), perpendicular to the holes axis and parallel to the thermal flux. In this calculation, the input data have been modified taking into account the effect of humidity as indicated by the technical standard in Ref. 2-a.

## 2. Reference standards and documents

The tests have been executed according to the methods defined in the following documentations and reference standards:

a. EN ISO 10456:2007. Building materials and products - Hygrothermal properties -Tabulated design values and procedures for determining declared and design thermal values (ISO 10456:2007)
b. CertiMaC calibration report 040219-C-17/Rev01. Calibration of a two-dimensional model for the calculation of the equivalent thermal conductivity of a masonry unit.
c. EN 6946:2008. Building components and building elements – Thermal resistance and thermal transmittance – Calculation method.
d. Test report SQM_406_2025 - Determination of the dry thermal conductivity values of the unit (EN ISO 6946) and of the masonry made with it - Orthoblock MK180.

## 3. Input data

The technical drawing of the block and the thermal conductivity of fired clay were supplied by the client (Figure 1). All input data used for the calculation are shown in Table 1 and 2.

**Figure 1.** Geometry of the block

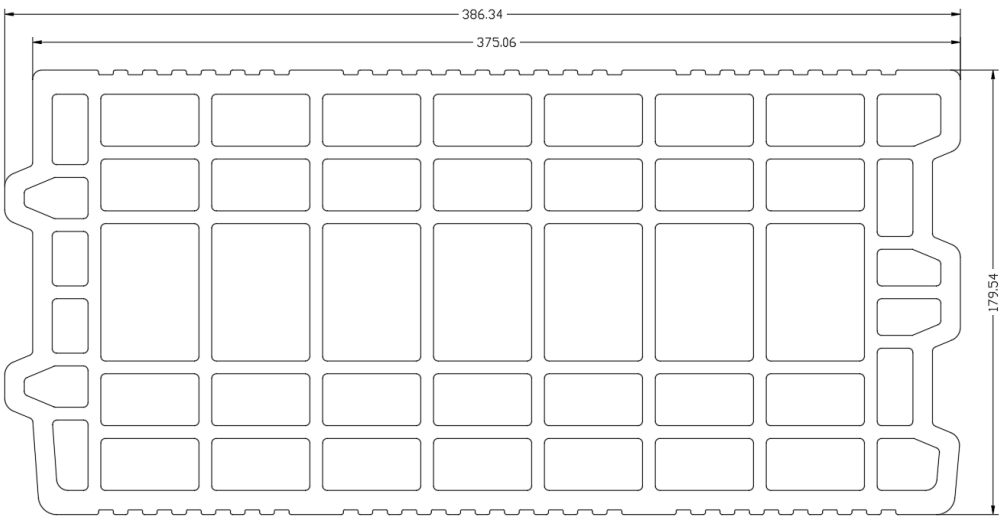

**Table 1.** Input data

| Physical quantity | Nominal value | Ref. |
|---|---|---|
| Brick dimensions | 380 x 180 x 240 mm | Provided by the Customer |
| Material thermal conductivity $\lambda_{10,dry,mat}$ | 0.401 W/mK | Provided by the Customer |
| Equivalent thermal conductivity of voids | Test Report Orthoblock MK180 | Ref. 2-d |

## 4. Determination of the thermal design values

Thermal design values of the masonry are determined as defined by the standards at Ref. 2-a and 2-c, increasing the thermal conductivity of the materials in relation to the moisture content, using the following conversion coefficient (moisture content volume by volume):

$$F_m = e^{f_\psi(\psi_2-\psi_1)}$$

The standard sets as operating conditions a temperature of 23 ° C and a relative humidity of 80% (precautionary hypothesis), which is related to the test condition at 10 ° C, dry.

## 5. Results

Table 3 shows the results of the Finite Elements Analysis performed with design thermal values at Ref. 2-a.

**Table 3.** FEM results

| **Heat flow** [W/m] | **Thermal coupling coefficient** $L^{2D}$ [W/mK] | **Thermal transmittance U** [W/m²K] | **Total thermal resistance** $R_T$ [m²K/W] | **True thermal resistance of the masonry unit** $R_t$ [m²K/W] | **Equivalent thermal conductivity** $\lambda_{10,dry,unit}$ [W/mK] |
|---|---|---|---|---|---|
| 7.2254 | 0.3613 | 0.9632 | 1.0382 | 0.8682 | 0.2068 |

## 6. Determination of thermal values of the masonry

To conduct a comprehensive assessment of the thermal performance of the masonry, only the horizontal mortar joints were taken into account, without plaster layers. Given the interlocking geometry of the blocks, the vertical joints were not considered in the analysis, as they do not contribute significantly to the overall thermal behavior. In order to ensure a thorough evaluation, the thermal properties of the masonry were analyzed by studying the configuration as detailed in Table 3. The adopted mortar properties refer to the product "**ORTHOBLOCK BOND**", drawing on thermophysical data made available by the Client.

**Table 3.** Masonry configurations

| Masonry | Description | | |
|---|---|---|---|
| 1 | Horizontal mortar joints | Thickness = 3 mm<br>$\lambda_{mortar}$ = 0.61 W/mK | Provided by the Costumer |
| | Internal plaster | Not present | Provided by the Costumer |
| | External plaster | Not present | Provided by the Costumer |

Table 4 shows the thermal values of the masonry, in the configuration described above.

**Table 4.** Results of the calculation for the masonry no. 1

| Physical quantity | Result |
|---|---|
| True thermal resistance of the masonry<br>$\mathbf{R_t}$ [$m^2K/W$] | 0.8395 |
| Equivalent thermal conductivity<br>$\boldsymbol{\lambda_{design,masonry}}$ [W/mK] | 0.2138 |
| Total thermal resistance<br>$\mathbf{R_T}$ [$m^2K/W$] | 1.0095 |
| Thermal transmittance<br>**U** [$W/m^2K$] | 0.9906 |

# SUMMARY TABLE OF RESULTS

The tests previously described gave the following results:

| **Product** | Equivalent thermal conductivity $\lambda_{design,masonry}$ [W/mK] | Thermal transmittance **U** [W/m²K] |
|---|---|---|
| **Orthoblock MK180** | **0.2068** | **0.9632** |
| **Masonry no. 1** | **0.2138** | **0.9906** |

## 7. List of distribution

| | | |
|---|---|---|
| **ENEA** | Archive | 1 copy |
| **Certimac** | Archive | 1 copy |
| **Kebe S.A.** | Archive | 1 copy |

| **In charged of technical test execution** | **In charged of technical report drafting** | **Technical director Approval** |
|---|---|---|
| Eng. Sebastiano Marianini | Eng. Sebastiano Marianini | Ing. Luca Laghi |
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*-------- End of the Test Report ------*