# TEST REPORT FIRES-FR-111-20-AUNE

**Panels made of cement bonded particleboards CETRIS Basic**

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Reg. No. 041/S-159

The Experts on Fire Safety

# TEST REPORT

## FIRES-FR-111-20-AUNE

| | |
|---|---|
| **Tested property:** | Fire resistance |
| **Test method:** | EN 1364-1: 2015 |
| **Test type:** | Accredited and Notified (NB 1396) |
| **Date of issue:** | 03. 08. 2020 |
| **Name of the product:** | Panels made of cement bonded particleboards CETRIS Basic |
| **Manufacturer:** | CIDEM Hranice, a.s., Skalní ulice 1088, 753 01 Hranice, Czech Republic |
| **Sponsor:** | CIDEM Hranice, a.s., Skalní ulice 1088, 753 01 Hranice, Czech Republic |
| **Test carried out by:** | FIRES, s.r.o., Testing laboratory |
| **Task No.:** | PR-20-0205 |
| **Specimen received:** | 02. 07. 2020 |
| **Date of the test:** | 14. 07. 2020 |

**Technician responsible for the technical side of this report:** Martin Kráľ

Number of pages: 26
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FIRES, s.r.o., Osloboditeľov 282, 059 35 Batizovce, Slovak Republic
tel. 00421 52 285 1611, www.fires.sk
Notified Body No. 1396, Approved Body No. SK01, Member of EGOLF

## 1. INTRODUCTION

This test report contains the results of a test carried out by FIRES, s.r.o., Testing laboratory in Batizovce, accredited for testing by SNAS. Certificate of accreditation No.: S-159. The purpose of the test was to gain information for product classification.

Sponsor's representatives witnessing the test:

| | |
|---|---|
| Ing. Miroslav Vacula | CIDEM Hranice a.s. Divize CETRIS |
| test carried out by | Martin Kráľ |
| operator | Miroslav Hudák |

## 2. MEASURING EQUIPMENT

| Identification number | Measuring equipment | Note |
|---|---|---|
| F 90 001 | Vertical test furnace for fire resistance testing | - |
| F 69 010 | PLC system for data acquisition and control TECOMAT TC 700 | - |
| F 40 019 | Visual and calculating software to PLC TECOMAT TC 700 | - |
| F 40 017 | Control and communication software to PLC TECOMAT TC 700 | - |
| F 40 018 | SW Reliance | - |
| F 40 020 | Driver Tecomat - Reliance (SW) | - |
| F 71 041, F 71 042 | Transducer of differential pressure (–50 to + 150) Pa | measurement of pressure inside the test furnace |
| F 54 053 | Digital calliper (0 to 200) mm | - |
| F 54 055 | Racking meter | - |
| F 73 002 | Suspension load-cell scale | finding out of humidity equilibrium state |
| F 69 009 | PLC system for data acquisition and climate control TECOMAT TC 604 | - |
| F 60 001 - F 60 009 | Sensors of temperature and relative air humidity | measurement of climatic conditions |
| F 18 501 – F 18 508 | Plate thermometers | measurement of temperature inside the test furnace according to EN 1363-1 |
| F 18 002 - F 18 200 | Unsheathed thermocouples type K 2 x Ø 0,5 mm | measurement of temperatures on the unexposed surface of the specimen |
| F 18 701 | Sheathed thermocouple type K Ø 3 mm | measurement of ambient temperature |
| F 18 001 | Roving thermocouple | - |
| F 74 007 - F 74 012 | Cable position transducers (0 to 1250) mm | measurement of deflection |
| F 90 005 | Gap gauge for fire resistance testing ∅ 25 mm | - |
| F 90 006 | Gap gauge for fire resistance testing ∅ 6 mm | - |
| F 90 007 | Frame for supporting the cotton pad (100 x 100) mm for fire resistance tests | - |
| F 57 005 | Digital stop-watch | - |

## 3. PREPARATION OF THE SPECIMENS

Testing laboratory noted down production data of the specimens from a certified production.
Test specimens data are listed in following table:

| | |
|---|---|
| Place of production | CIDEM Hranice, a.s., Skalní ulice 1088, 753 01 Hranice, Czech Republic |
| Production number | 296/21 (cement bonded particleboards CETRIS Basic, thickness 40 mm) (specimens **No.: 1)**<br>296/21 (cement bonded particleboards CETRIS Basic, thickness 40 mm) (specimens **No.: 2)**<br>4963/14 (cement bonded particleboards CETRIS Basic, thickness 32 mm) (specimens **No.: 3)**<br>4814/8 (cement bonded particleboards CETRIS Basic, thickness 10 mm)<br>4129/21 (cement bonded particleboards CETRIS Basic, thickness 20 mm) (specimens **No.: 4)**<br>296/21 (cement bonded particleboards CETRIS Basic, thickness 40 mm) (specimens **No.: 5)** |
| Date of production | 15.1.2020 (cement bonded particleboards CETRIS Basic, thickness 40 mm) (specimens **No.: 1)**<br>28.4.2020 (cement bonded particleboards CETRIS Basic, thickness 32 mm) (specimens **No.: 2)**<br>15.1.2020 (cement bonded particleboards CETRIS Basic, thickness 40 mm) (specimens **No.: 3)**<br>24.4.2020 (cement bonded particleboards CETRIS Basic, thickness 10 mm)<br>11.4.2020 (cement bonded particleboards CETRIS Basic, thickness 20 mm) (specimens **No.: 4)**<br>15.1.2020 (cement bonded particleboards CETRIS Basic, thickness 40 mm) (specimens **No.: 5)** |
| Check-out date | 24.1.2020 (specimens **No.: 1)**<br>24.1.2020 (specimens **No.: 2)**<br>6.5.2020 (specimens **No.: 3)**<br>2.5.2020 (cement bonded particleboards CETRIS Basic, thickness 10 mm)<br>19.4.2020 (cement bonded particleboards CETRIS Basic, thickness 20 mm) (specimens **No.: 4)**<br>24.1.2020 (specimens **No.: 5)** |
| Number of certificate ISO 9001 | 321215043/2 |
| Issuing Body | DEKRA Certification GmbH |
| Date of issuing | 7.1.2019 |

Individual materials (boards, mineral wool, etc.) were delivered to the testing laboratory by test sponsor. Assembling of the test specimens to the supporting construction was carried out by representative of the sponsor.

## 4. PREPARATION OF THE TEST

### 4.1 DESCRIPTION OF THE SPECIMENS STRUCTURE

Five specimens of partitions made of Cement bonded particleboards CETRIS Basic were used for fire resistance test.

**Specimen No. 1**

| | |
|---|---|
| **Dimensions** | width x height x thickness |
| Overall dimensions of test specimen, (thickness of the CETRIS board 40 mm) | (2000 x 1000 x 40) mm |

**Construction of the specimen No. 1**
The specimen is made of Cement bonded particleboards CETRIS Basic, 40 mm thick (producer: CETRIS Hranice, a.s.) with nominal bulk density of 1350 kg.m$^{-3}$.
The specimen is installed into the prepared opening with dimensions (2000 x 1000) mm (width x height) by using the frame installed from inner side of the aperture. The frame is made from CETRIS Basic board with dimensions (32 x 60) mm (thickness x width). The frame is install from both sides of the specimen and is fixed to the opening by means of steel screws (Ø 6,0 x 80/50) mm placed in spacing of 350 mm. The horizontal oriented profile with length of 2000 mm and dimensions (50 x 50 x 3) mm is fixed in the middle of the height of the specimen, from unexposed side to the opening by using steel screws (Ø 6,0 x 80/50) mm.

**Specimen No. 2**

| **Dimensions** | width x height x thickness |
|---|---|
| Overall dimensions of test specimen, (thickness of the CETRIS board 40 mm) | (2000 x 1000 x 80) mm |

**Construction of the specimen No. 2**
The specimen is made of Cement bonded particleboards CETRIS Basic, 40 mm thick (producer: CETRIS Hranice, a.s.) with nominal bulk density of 1350 kg.m$^{-3}$.
The specimen is installed into the prepared opening with dimensions (2000 x 1000) mm (width x height) by using the frame installed from inner side of the aperture. The frame is made from CETRIS Basic board with dimensions (32 x 60) mm (thickness x width). The frame is install from both sides of the specimen and is fixed to the opening by means of steel screws (Ø 6,0 x 80/50) mm placed in spacing of 350 mm.
The exposed side of the specimen is filled by mineral wool boards type FKD RS (producer: Knauf Insulation), 30 mm thick with nominal bulk density 145 kg.m$^{-3}$. Mineral wool boards are fixed to CETRIS board by cement binder type Cemix special (producer: Cemix, s.r.o.) and mechanical fixing system (Bravoll insulating plate 60/5 + screw (Ø 6 x 60) mm). Cemix special together with reinforcement fiberglass fabric type Vertex R 117 A101 is applied on mineral wool boards. Mass per unit area of the Vertex R 117 A101 is 145 g.m$^{-2}$.

**Specimen No. 3**

| **Dimensions** | width x height x thickness |
|---|---|
| Overall dimensions of test specimen, (thickness of the CETRIS board 32 mm) | (2000 x 600 x 72) mm |

**Construction of the specimen No. 3**
The specimen is made of Cement bonded particleboards CETRIS Basic, 32 mm thick (producer: CETRIS Hranice, a.s.) with nominal bulk density of 1350 kg.m$^{-3}$.
The specimen is installed into the prepared opening with dimensions (2000 x 600) mm (width x height) by using the frame installed from inner side of the aperture. The frame is made from CETRIS Basic board with dimensions (32 x 60) mm (thickness x width). The frame is install from both sides of the specimen and is fixed to the opening by means of steel screws (Ø 6,0 x 80/50) mm placed in spacing of 350 mm.
The exposed side of the specimen is filled by mineral wool boards type FKD RS (producer: Knauf Insulation), 30 mm thick with nominal bulk density 145 kg.m$^{-3}$. Mineral wool boards are fixed to CETRIS board by cement binder type Cemix special (producer: Cemix, s.r.o.) and mechanical fixing system (Bravoll insulating plate 60/5 + screw (Ø 6 x 60) mm). Cemix special together with reinforcement fiberglass fabric type Vertex R 117 A101 is applied on mineral wool boards. Mass per unit area of the Vertex R 117 A101 is 145 g.m$^{-2}$.

**Specimen No. 4**

| **Dimensions** | width x height x thickness |
|---|---|
| Overall dimensions of test specimen,<br>(thickness of the CETRIS board from exposed side 20 mm)<br>(thickness of the CETRIS board from unexposed side 10 mm) | (800 x 1400 x 90) mm |

**Construction of the specimen No. 4**
The specimen is made of Cement bonded particleboards CETRIS Basic (producer: CETRIS Hranice, a.s.) with nominal bulk density of 1350 kg.m$^{-3}$. The specimen is installed into the prepared opening with dimensions (800 x 1400) mm (width x height) by using the frame installed from inner side of the aperture. The frame is made from CETRIS Basic board with dimensions (40 x 60) mm (thickness x width). The frame is fixed to the opening by means of steel screws (Ø 6,0 x 80/50) mm placed in spacing of 350 mm. Horizontal reinforcement made of the same board is installed in the middle of the height of the frame.

CETRIS Basic board, 20 mm thick is screwed to frame by means of steel screws (Ø 4,2 x 45) mm placed in spacing of 350 mm - from exposed side of the specimen. CETRIS Basic board, 10 mm thick is screwed to frame by means of steel screws (Ø 4,2 x 45) mm placed in spacing of 350 mm - from unexposed side of the specimen.
The core of panel is filled by mineral wool ISOVER UNI, 60 mm thick, with bulk density 40 kg.m$^{-3}$, (manufacturer: ISOVER Saint-Gobain).

**Specimen No. 5**

| | |
|---|---|
| **Dimensions** | width x height x thickness |
| Overall dimensions of test specimen, (thickness of the CETRIS board 40 mm) | (800 x 1400 x 40) mm |

**Construction of the specimen No. 5**
The specimen is made of Cement bonded particleboards CETRIS Basic, 40 mm thick (producer: CETRIS Hranice, a.s.) with nominal bulk density of 1350 kg.m$^{-3}$.
The specimen is installed into the prepared opening with dimensions (800 x 1400) mm (width x height) by using the frame installed from inner side of the aperture. The frame is made from CETRIS Basic board with dimensions (32 x 60) mm (thickness x width). The frame is install from both sides of the specimen and is fixed to the opening by means of steel screws (Ø 6,0 x 80/50) mm placed in spacing of 350 mm.

More detailed information about the construction of the specimen is shown in the drawings which are a part of this test report. Drawings were delivered by the sponsor.

All the information about technical specifications of used materials and semi-products, information about their type sign were delivered by sponsor. This information was not subject to the specimen verification. Parameters which were verified are quoted in paragraph 4.3.

## 4.2 DESCRIPTION OF THE SPECIMEN FIXATION

The test specimens are fixed in openings made by aerated concrete blocks 250 mm thick with bulk density in according to EN 1363-1: 650 kg/m$^3$ ±200 kg/m$^3$ (the manufacturer's stated value in the dried steady-state is 450 kg/m$^3$).

The test sponsor chose supporting construction, its thickness, specimen orientation and type of specimen fixation to the test frame. More details about specimen fixing are shown in drawings.

## 4.3 VERIFICATION OF THE SPECIMEN

The conformity of the drawings and the test specimens were verified before and after the fire resistance test. This verification has been carried out on extra delivered product for this purpose. The specimens corresponded to the drawings which are a part of this test report. The visual review of the test specimens, the used materials as well as the size verification of basic dimensions and the specimen's attachment to the supporting construction were subject to this verification.

## 4.4 CLIMATIC CONDITIONING OF THE SPECIMEN

Test specimens were stored in the hall of the testing laboratory and were conditioned according to EN 1363-1 under the following climatic conditions:

Ambient air temperature [°C]

| | |
|---|---|
| mean | 23,4 |
| standard deviation | 2,1 |

Relative air humidity [%]

| | |
|---|---|
| mean | 48,5 |
| standard deviation | 5,8 |

The humidity equilibrium state of test specimen was determined by repetitive balancing of a segment of the panel core. The humidity equilibrium state of the test specimen was achieved.

## 5. CARRYING OUT OF THE TEST

### 5.1 CONDITIONS OF THE TEST

Conditions during the test in the test furnace (temperature – external fire exposure curve, pressure, $O_2$ content) as well as in the testing room (ambient temperature) corresponded to EN 1363-1. Detailed information is a part of this test report, or can be found in the test record.

Values characterizing the testing room environment directly before the test:

| **Ambient air temperature [°C]** |
|---|
| 15,8 |

### 5.2 RESULTS OF THE TEST

Measured values are stated in this test report. Description of the specimen behaviour during the test:

| **Time [min:s]** | **Face of specimen** | **Observation** |
|---|---|---|
| 04:50 | NS | soft smoke release from upper edge of the specimen No.:5; |
| 14:40 | NS | soft smoke release from bottom edge of the specimen No.:1; |
| 15:00 | NS | no significant changes are visible; |
| 30:00 | NS | no significant changes are visible; |
| 30:50 | NS | smoke release from bottom and right edge of the specimen No.:4; |
| 45:00 | NS | no significant changes are visible; |
| 60:00 | NS | no significant changes are visible; |
| 60:30 | NS | darkening of the surface in edges of the specimens No.: 1 and 5; |
| 76:20 | NS | measuring by roving thermocouple on place of dark areas of the specimen No.: 5 – 186 K; |
| 78:30 | NS | measuring by roving thermocouple on place of dark areas of the specimen No.: 1 – 203 K; |
| 91:38 | NS | sustained flaming from the upper edge of the specimen No.: 1 – **specimen integrity failure;** |
| 120:00 | NS | no significant changes are visible; |
| 121:17 | termination of the test. | |

ES: exposed face of the specimen; NS: unexposed face of the specimen

## 6. CLOSING

**Evaluation of the test:**

**Evaluation of the specimen No.: 1**

| Performance criterion | Time till the performance criterion is achieved |
|---|---|
| integrity – sustained flaming | 91 minutes |
| integrity – gap gauges ∅ 6 mm and ∅ 25 mm | 91 minutes |
| integrity – cotton pad | 91 minutes |
| insulation – average temperature (140 K) | 91 minutes |
| insulation – maximal temperature (180 K) | 78 minutes |
| radiation 15 $kW.m^{-2}$ | 91 minutes no failure[1)] |

**Evaluation of the specimen No.: 2**

| Performance criterion | Time till the performance criterion is achieved |
|---|---|
| integrity – sustained flaming | 121 minutes no failure |
| integrity – gap gauges ∅ 6 mm and ∅ 25 mm | 121 minutes no failure |
| integrity – cotton pad | 121 minutes no failure |
| insulation – average temperature (140 K) | 121 minutes no failure |
| insulation – maximal temperature (180 K) | 121 minutes no failure |
| radiation 15 $kW.m^{-2}$ | 121 minutes no failure[1)] |

**Evaluation of the specimen No.: 3**

| Performance criterion | Time till the performance criterion is achieved |
|---|---|
| integrity – sustained flaming | 121 minutes no failure |
| integrity – gap gauges ∅ 6 mm and ∅ 25 mm | 121 minutes no failure |
| integrity – cotton pad | 121 minutes no failure |
| insulation – average temperature (140 K) | 121 minutes no failure |
| insulation – maximal temperature (180 K) | 121 minutes no failure |
| radiation 15 $kW.m^{-2}$ | 121 minutes no failure[1)] |

**Evaluation of the specimen No.: 4**

| Performance criterion | Time till the performance criterion is achieved |
|---|---|
| integrity – sustained flaming | 121 minutes no failure |
| integrity – gap gauges ∅ 6 mm and ∅ 25 mm | 121 minutes no failure |
| integrity – cotton pad | 121 minutes no failure |
| insulation – average temperature (140 K) | 121 minutes no failure |
| insulation – maximal temperature (180 K) | 121 minutes no failure |
| radiation 15 $kW.m^{-2}$ | 121 minutes no failure[1)] |

**Evaluation of the specimen No.: 5**

| Performance criterion | Time till the performance criterion is achieved |
|---|---|
| integrity – sustained flaming | 121 minutes no failure |
| integrity – gap gauges ∅ 6 mm and ∅ 25 mm | 121 minutes no failure |
| integrity – cotton pad | 121 minutes no failure |
| insulation – average temperature (140 K) | 121 minutes no failure |
| insulation – maximal temperature (180 K) | 76 minutes |
| radiation 15 kW.m$^{-2}$ | 121 minutes no failure[1)] |

[1)] Regarding to low temperatures on unexposed specimens surfaces below 300°C the performance criteria of radiation is to be complied as satisfied.

The fire test was terminated in the 122$^{th}$ minute at the request of test sponsor.

## 7. DIRECT APPLICATION OF TEST RESULTS

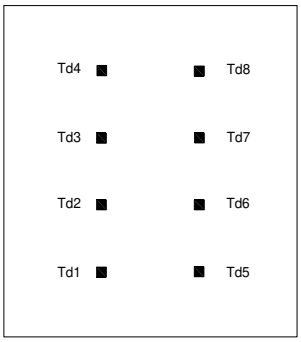
Direct field of application is valid in accordance with clause 13 of EN 1364-1: 2015. Validity of individual items of field of direct application shall be determined in the classification process.

## Measured values inside the test furnace

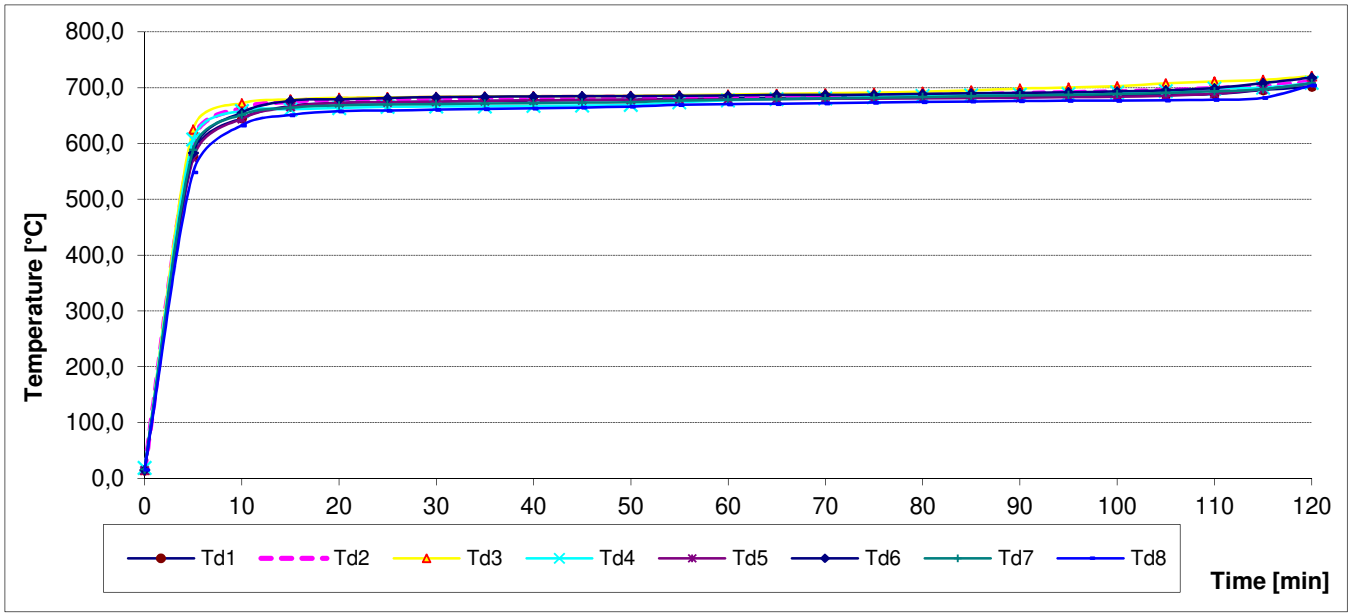
| Time | Temperature [°C] | | | | | | | | | | | Deviation | Pressure [Pa] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| t [min] | Td1 | Td2 | Td3 | Td4 | Td5 | Td6 | Td7 | Td8 | Tave | Tn | To | $d_e$ [%] | p1 | p2 |
| 0 | 14,3 | 14,8 | 15,1 | 18,8 | 14,7 | 14,8 | 15,9 | 15,3 | 15,5 | 20,0 | 14,9 | 0,0 | -1,2 | -1,1 |
| 5 | 577,6 | 606,5 | 625,3 | 607,3 | 573,3 | 583,5 | 589,0 | 548,2 | 588,8 | 588,0 | 14,9 | -7,8 | 18,1 | -2,0 |
| 10 | 645,1 | 662,5 | 671,9 | 658,2 | 644,2 | 655,2 | 651,3 | 632,7 | 652,6 | 662,0 | 15,0 | -3,6 | 18,5 | 1,6 |
| 15 | 667,2 | 675,3 | 678,8 | 661,2 | 665,7 | 676,5 | 663,9 | 651,0 | 667,4 | 676,0 | 15,1 | -2,7 | 19,0 | 2,3 |
| 20 | 672,9 | 679,0 | 681,9 | 663,6 | 672,9 | 679,1 | 668,4 | 657,9 | 672,0 | 679,0 | 15,1 | -2,3 | 19,8 | 2,4 |
| 25 | 674,2 | 680,2 | 682,8 | 665,7 | 674,0 | 681,6 | 669,8 | 659,1 | 673,4 | 680,0 | 15,4 | -2,0 | 19,5 | 1,5 |
| 30 | 675,3 | 680,9 | 683,6 | 666,3 | 675,3 | 682,9 | 670,8 | 660,6 | 674,5 | 680,0 | 15,6 | -1,8 | 18,7 | 2,5 |
| 35 | 676,1 | 681,8 | 684,2 | 666,6 | 676,4 | 683,9 | 671,5 | 661,7 | 675,3 | 680,0 | 15,7 | -1,6 | 19,8 | 2,7 |
| 40 | 676,9 | 682,4 | 684,8 | 667,3 | 677,3 | 684,3 | 672,3 | 663,0 | 676,0 | 680,0 | 15,8 | -1,5 | 19,6 | 1,7 |
| 45 | 677,8 | 682,6 | 685,0 | 668,1 | 677,9 | 684,8 | 673,2 | 664,5 | 676,7 | 680,0 | 15,8 | -1,4 | 20,0 | 2,5 |
| 50 | 678,4 | 683,2 | 685,6 | 669,2 | 678,5 | 685,0 | 674,2 | 666,2 | 677,5 | 680,0 | 15,9 | -1,3 | 19,8 | 1,9 |
| 55 | 679,6 | 683,4 | 686,7 | 674,0 | 678,8 | 685,5 | 676,7 | 669,4 | 679,3 | 680,0 | 15,9 | -1,2 | 18,8 | 0,3 |
| 60 | 680,7 | 684,2 | 687,7 | 677,2 | 679,3 | 686,1 | 678,4 | 670,7 | 680,5 | 680,0 | 16,1 | -1,1 | 19,8 | 1,2 |
| 65 | 681,7 | 685,1 | 688,7 | 679,4 | 679,8 | 687,0 | 679,6 | 671,2 | 681,6 | 680,0 | 16,2 | -1,0 | 19,4 | 3,0 |
| 70 | 682,6 | 685,6 | 689,8 | 681,0 | 680,0 | 687,4 | 680,7 | 672,1 | 682,4 | 680,0 | 16,2 | -0,9 | 19,8 | 1,7 |
| 75 | 683,4 | 686,3 | 691,1 | 683,2 | 680,5 | 687,6 | 682,1 | 673,3 | 683,4 | 680,0 | 16,3 | -0,8 | 20,0 | 2,6 |
| 80 | 683,7 | 686,8 | 692,7 | 685,4 | 681,0 | 688,8 | 683,4 | 674,5 | 684,5 | 680,0 | 16,5 | -0,7 | 19,8 | 2,9 |
| 85 | 684,3 | 687,2 | 695,1 | 686,5 | 681,4 | 689,8 | 684,6 | 675,4 | 685,5 | 680,0 | 16,8 | -0,6 | 18,7 | -0,9 |
| 90 | 685,2 | 689,5 | 698,5 | 687,7 | 682,0 | 690,7 | 686,2 | 676,3 | 687,0 | 680,0 | 16,9 | -0,5 | 17,2 | -0,9 |
| 95 | 685,5 | 691,2 | 700,3 | 688,9 | 683,0 | 692,0 | 687,2 | 676,7 | 688,1 | 680,0 | 17,1 | -0,4 | 18,4 | -0,9 |
| 100 | 685,9 | 692,7 | 702,8 | 691,5 | 683,6 | 693,3 | 688,6 | 677,0 | 689,4 | 680,0 | 17,3 | -0,4 | 19,1 | 0,9 |
| 105 | 687,3 | 695,1 | 707,7 | 693,7 | 685,4 | 695,4 | 690,9 | 677,5 | 691,6 | 680,0 | 17,4 | -0,3 | 17,4 | -1,3 |
| 110 | 688,7 | 698,6 | 711,0 | 698,6 | 689,2 | 699,4 | 693,5 | 678,5 | 694,7 | 680,0 | 17,5 | -0,2 | 19,1 | 0,0 |
| 115 | 695,8 | 702,8 | 714,0 | 700,2 | 697,0 | 708,3 | 697,3 | 681,8 | 699,6 | 680,0 | 17,6 | 0,0 | 18,5 | -0,2 |
| 120 | 701,7 | 711,0 | 720,7 | 708,6 | 707,5 | 718,1 | 708,1 | 704,3 | 710,0 | 680,0 | 17,7 | 0,1 | 17,1 | -1,3 |
| 121 | 703,2 | 715,1 | 724,2 | 715,6 | 709,4 | 720,7 | 712,1 | 708,4 | 713,6 | 680,0 | 17,7 | 0,2 | 19,4 | -0,2 |

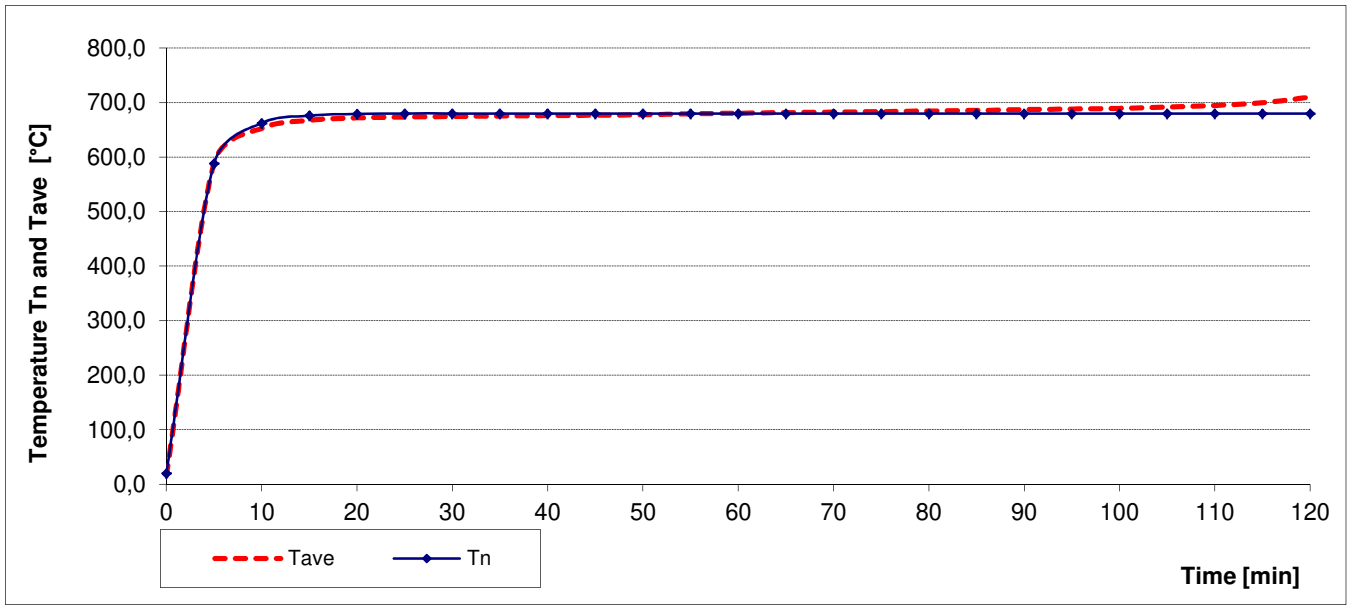
**Tave** Average temperature in the test furnace calculated from individual thermometers
**Tn** Standard temperature in the test furnace laid down according to test guideline
**$d_e$** Deviation of the average temperature from the standard temperature calc. acc. to test guideline
**To** Ambient temperature
**p1** Pressure inside the test furnace measured under the ceiling of test furnace
**p2** Pressure inside the test furnace at the height of neutral pressure level 500 mm above test furnace floor

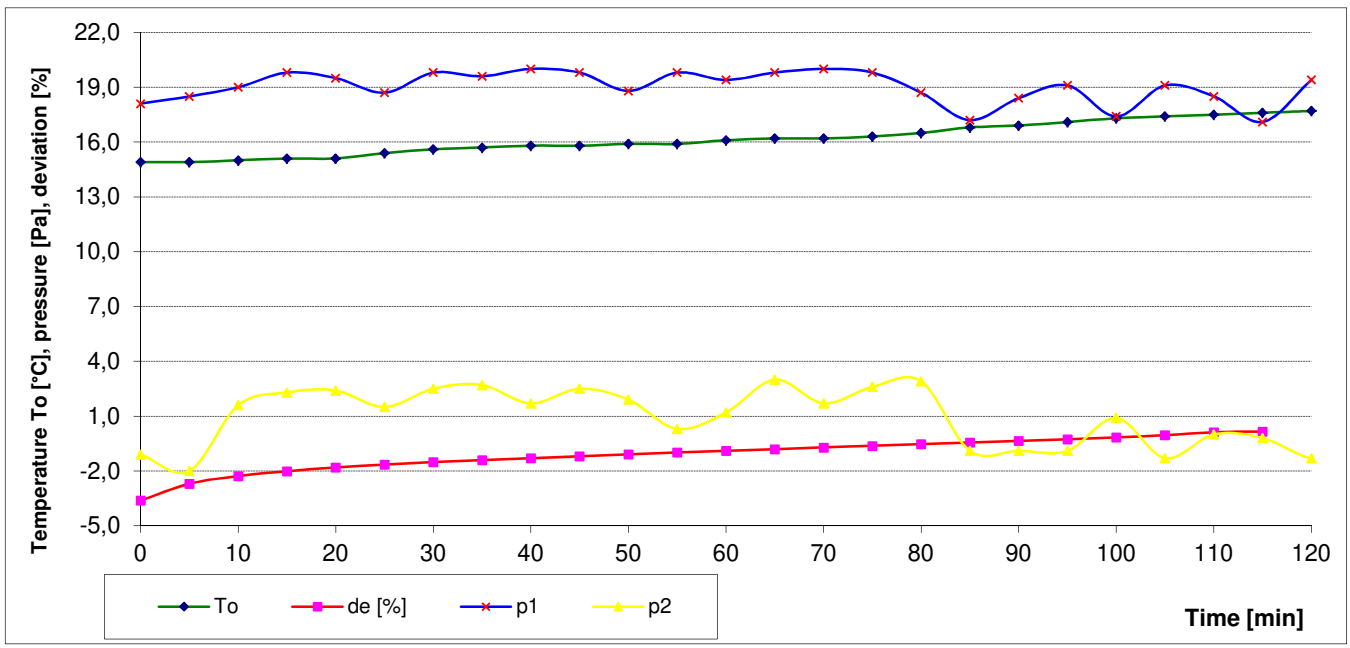
**Layout of measuring points in the test furnace:**



## Measured values inside the test furnace /graph



## Measured and calculated values from measured values on the specimen surface - specimen No. 2

**The initial average temperature of the unexposed specimen surface: 15,4 °C**

| Time | Temperature rise [K] | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| t [min] | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 | T10 | T11 | T12 | T13 | T14 | T15 | Trave | Trmax |
| **0** | 0,7 | -0,1 | -0,3 | -0,4 | 0,0 | 0,0 | -0,3 | -0,2 | 1,0 | 1,1 | 0,9 | 0,2 | 0,7 | 0,9 | 0,6 | 0,0 | 1,1 |
| **5** | 0,0 | -0,8 | -0,9 | -1,1 | -0,6 | -0,9 | -1,0 | -0,7 | 0,3 | 0,4 | 0,3 | -0,2 | -0,1 | 0,0 | -0,3 | -0,7 | 0,4 |
| **10** | 0,1 | -0,6 | -0,7 | -1,0 | -0,5 | -0,8 | -0,9 | -0,8 | 0,4 | 0,5 | 0,3 | -0,3 | 0,0 | 0,2 | -0,1 | -0,5 | 0,5 |
| **15** | 0,2 | -0,5 | 0,4 | -0,4 | -0,1 | -0,4 | -0,4 | -0,7 | 0,5 | 0,5 | 0,5 | -0,2 | 0,3 | 0,1 | 0,1 | -0,1 | 0,5 |
| **20** | 1,2 | 0,7 | 2,4 | 0,8 | 1,2 | 0,8 | 0,9 | 0,4 | 1,5 | 0,5 | 1,0 | 0,0 | 1,1 | 0,1 | 1,0 | 1,3 | 2,4 |
| **25** | 2,6 | 2,4 | 5,6 | 2,6 | 3,6 | 2,7 | 3,1 | 1,7 | 3,0 | 0,6 | 1,7 | 0,4 | 2,3 | 0,4 | 2,4 | 3,4 | 5,6 |
| **30** | 4,8 | 4,9 | 9,2 | 5,2 | 6,8 | 5,2 | 6,3 | 3,8 | 5,0 | 0,9 | 2,9 | 1,2 | 4,2 | 0,7 | 4,3 | 6,2 | 9,2 |
| **35** | 7,2 | 7,6 | 13,2 | 7,8 | 10,0 | 8,2 | 9,8 | 5,9 | 7,3 | 1,1 | 4,4 | 2,0 | 6,5 | 1,2 | 6,4 | 9,2 | 13,2 |
| **40** | 9,8 | 10,5 | 17,5 | 11,1 | 13,8 | 11,6 | 13,5 | 8,5 | 9,6 | 1,3 | 6,3 | 3,8 | 9,6 | 1,8 | 9,0 | 12,5 | 17,5 |
| **45** | 12,6 | 13,7 | 21,5 | 14,1 | 17,4 | 14,9 | 17,3 | 11,1 | 12,0 | 1,6 | 8,2 | 6,6 | 13,6 | 2,4 | 11,6 | 15,9 | 21,5 |
| **50** | 15,3 | 16,5 | 25,2 | 17,3 | 21,0 | 18,0 | 21,1 | 13,5 | 14,5 | 1,9 | 10,1 | 10,2 | 17,8 | 3,2 | 14,2 | 19,1 | 25,2 |
| **55** | 18,0 | 19,5 | 29,1 | 20,5 | 24,4 | 21,4 | 25,1 | 16,1 | 16,9 | 2,3 | 12,2 | 13,9 | 22,1 | 4,1 | 16,9 | 22,3 | 29,1 |
| **60** | 20,7 | 22,5 | 32,8 | 24,0 | 27,9 | 24,6 | 28,9 | 18,7 | 19,3 | 3,0 | 14,1 | 17,7 | 26,2 | 5,0 | 19,4 | 25,6 | 32,8 |
| **65** | 23,7 | 25,6 | 36,1 | 27,3 | 31,4 | 28,1 | 32,6 | 21,3 | 21,8 | 3,5 | 16,1 | 21,4 | 30,4 | 5,7 | 22,1 | 28,8 | 36,1 |
| **70** | 26,8 | 28,5 | 39,0 | 30,5 | 34,4 | 31,1 | 35,8 | 23,8 | 24,4 | 4,0 | 18,3 | 24,9 | 34,3 | 6,6 | 24,6 | 31,8 | 39,0 |
| **75** | 29,2 | 31,5 | 41,5 | 33,5 | 37,3 | 34,2 | 38,5 | 26,6 | 26,7 | 4,8 | 20,2 | 27,9 | 37,8 | 7,2 | 27,0 | 34,6 | 41,5 |
| **80** | 32,0 | 33,9 | 44,0 | 36,1 | 39,5 | 36,8 | 40,9 | 28,8 | 28,9 | 5,6 | 22,1 | 30,4 | 40,7 | 8,0 | 29,0 | 37,1 | 44,0 |
| **81** | 32,5 | 34,3 | 44,4 | 36,5 | 39,9 | 37,2 | 41,3 | 29,2 | 29,3 | 5,9 | 22,3 | 31,0 | 41,2 | 8,1 | 29,5 | 37,5 | 44,4 |
| **82** | 32,9 | 34,8 | 44,9 | 37,0 | 40,5 | 37,8 | 41,8 | 29,7 | 29,7 | 6,0 | 22,7 | 31,4 | 41,8 | 8,4 | 29,9 | 38,0 | 44,9 |
| **85** | 34,2 | 35,9 | 46,0 | 38,4 | 41,7 | 39,1 | 42,8 | 31,1 | 31,0 | 6,6 | 23,7 | 32,7 | 43,4 | 8,7 | 30,7 | 39,2 | 46,0 |
| **90** | 36,3 | 38,1 | 48,0 | 40,3 | 43,6 | 41,0 | 44,7 | 32,8 | 32,8 | 7,7 | 25,5 | 34,3 | 45,6 | 9,5 | 32,4 | 41,3 | 48,0 |
| **91** | 36,8 | 38,2 | 48,0 | 40,6 | 43,8 | 41,3 | 45,0 | 33,3 | 33,1 | 8,0 | 25,6 | 34,5 | 46,0 | 9,7 | 32,5 | 41,5 | 48,0 |
| **92** | 37,1 | 38,6 | 48,5 | 40,9 | 44,2 | 41,8 | 45,4 | 33,8 | 33,6 | 8,2 | 25,9 | 34,8 | 46,5 | 9,7 | 32,8 | 41,9 | 48,5 |
| **93** | 37,6 | 39,0 | 49,0 | 41,5 | 44,7 | 42,1 | 45,9 | 34,0 | 34,1 | 8,4 | 26,3 | 35,1 | 47,0 | 10,0 | 33,3 | 42,4 | 49,0 |
| **94** | 37,9 | 39,5 | 49,3 | 41,7 | 45,0 | 42,5 | 46,3 | 34,4 | 34,4 | 8,6 | 26,7 | 35,3 | 47,5 | 10,1 | 33,6 | 42,7 | 49,3 |
| **95** | 38,3 | 39,9 | 50,0 | 42,2 | 45,5 | 43,0 | 46,7 | 34,7 | 34,7 | 8,7 | 27,0 | 35,7 | 47,9 | 10,3 | 34,1 | 43,2 | 50,0 |
| **96** | 38,9 | 40,4 | 50,2 | 42,7 | 45,8 | 43,3 | 47,1 | 34,8 | 35,2 | 8,8 | 27,7 | 36,0 | 48,3 | 10,5 | 34,4 | 43,6 | 50,2 |
| **97** | 39,0 | 40,7 | 50,5 | 42,9 | 46,2 | 43,5 | 47,3 | 35,1 | 35,5 | 8,9 | 27,9 | 36,1 | 48,7 | 10,6 | 34,6 | 43,9 | 50,5 |
| **98** | 39,4 | 41,0 | 50,8 | 43,3 | 46,4 | 43,9 | 47,8 | 35,8 | 35,9 | 9,1 | 28,2 | 36,6 | 49,1 | 10,8 | 34,9 | 44,2 | 50,8 |
| **99** | 39,8 | 41,4 | 51,2 | 43,6 | 47,0 | 44,3 | 48,1 | 36,3 | 36,2 | 9,2 | 28,7 | 36,7 | 49,6 | 10,9 | 35,3 | 44,6 | 51,2 |
| **100** | 40,0 | 41,7 | 51,5 | 44,0 | 47,4 | 44,4 | 48,7 | 36,8 | 36,5 | 9,4 | 28,9 | 36,8 | 50,0 | 11,0 | 35,6 | 44,9 | 51,5 |
| **101** | 40,4 | 42,1 | 51,8 | 44,4 | 47,8 | 44,9 | 49,1 | 37,2 | 36,7 | 9,6 | 29,3 | 37,2 | 50,3 | 11,1 | 36,0 | 45,3 | 51,8 |
| **102** | 40,7 | 42,4 | 52,0 | 44,7 | 48,2 | 45,2 | 49,4 | 37,5 | 37,1 | 9,9 | 29,6 | 37,3 | 50,7 | 11,2 | 36,3 | 45,6 | 52,0 |
| **103** | 40,9 | 42,7 | 52,3 | 45,0 | 48,4 | 45,5 | 49,7 | 37,7 | 37,3 | 9,9 | 29,8 | 37,5 | 51,1 | 11,3 | 36,7 | 45,9 | 52,3 |
| **104** | 41,2 | 43,1 | 52,7 | 45,3 | 48,6 | 45,9 | 50,2 | 37,9 | 37,6 | 10,2 | 30,3 | 37,8 | 51,3 | 11,5 | 37,0 | 46,2 | 52,7 |
| **105** | 41,5 | 43,4 | 53,0 | 45,5 | 49,1 | 46,1 | 50,4 | 38,3 | 38,0 | 10,3 | 30,7 | 38,0 | 51,8 | 11,7 | 37,2 | 46,5 | 53,0 |
| **106** | 41,8 | 43,6 | 53,5 | 45,8 | 49,3 | 46,4 | 50,6 | 38,4 | 38,3 | 10,6 | 31,0 | 38,2 | 52,0 | 11,9 | 37,5 | 46,8 | 53,5 |
| **107** | 42,1 | 44,0 | 53,7 | 46,1 | 49,5 | 46,8 | 51,0 | 38,6 | 38,6 | 10,9 | 31,4 | 38,6 | 52,4 | 12,0 | 37,8 | 47,1 | 53,7 |
| **108** | 42,3 | 44,0 | 53,7 | 46,3 | 49,8 | 46,9 | 51,4 | 39,0 | 38,8 | 11,2 | 31,4 | 38,9 | 52,7 | 12,1 | 37,8 | 47,2 | 53,7 |
| **109** | 42,5 | 44,5 | 53,9 | 46,5 | 50,2 | 47,2 | 51,7 | 39,4 | 39,2 | 11,5 | 31,7 | 39,1 | 52,9 | 12,3 | 38,3 | 47,5 | 53,9 |
| **110** | 42,5 | 44,7 | 54,0 | 46,8 | 50,5 | 47,4 | 52,0 | 39,8 | 39,2 | 11,7 | 31,5 | 39,3 | 53,2 | 12,4 | 38,4 | 47,7 | 54,0 |
| **111** | 42,8 | 45,0 | 54,2 | 46,9 | 50,7 | 47,5 | 52,3 | 40,2 | 39,5 | 11,8 | 31,7 | 39,5 | 53,5 | 12,5 | 38,7 | 47,9 | 54,2 |
| **112** | 43,1 | 45,5 | 54,7 | 47,3 | 51,1 | 47,8 | 52,7 | 40,6 | 39,7 | 12,1 | 31,9 | 39,6 | 53,7 | 12,6 | 39,1 | 48,3 | 54,7 |
| **113** | 43,3 | 45,8 | 54,8 | 47,5 | 51,3 | 48,1 | 53,1 | 40,9 | 40,0 | 12,2 | 32,5 | 39,9 | 54,0 | 12,8 | 39,4 | 48,5 | 54,8 |
| **114** | 43,5 | 46,0 | 55,0 | 47,6 | 51,8 | 48,3 | 53,4 | 41,3 | 40,2 | 12,6 | 32,5 | 40,1 | 54,2 | 13,0 | 39,7 | 48,8 | 55,0 |
| **115** | 43,9 | 46,4 | 55,3 | 48,0 | 52,0 | 48,6 | 53,7 | 41,2 | 40,5 | 12,7 | 32,9 | 40,2 | 54,6 | 13,1 | 40,2 | 49,1 | 55,3 |
| **116** | 44,1 | 46,8 | 55,8 | 48,3 | 52,4 | 48,8 | 54,0 | 41,2 | 40,7 | 12,9 | 33,4 | 40,4 | 54,8 | 13,2 | 40,5 | 49,5 | 55,8 |
| **117** | 44,4 | 46,9 | 55,9 | 48,4 | 52,6 | 48,9 | 54,4 | 41,7 | 40,9 | 13,0 | 33,5 | 40,6 | 55,1 | 13,4 | 40,6 | 49,6 | 55,9 |
| **118** | 44,6 | 47,3 | 56,2 | 48,8 | 53,0 | 49,3 | 54,5 | 42,1 | 41,1 | 13,2 | 33,7 | 40,7 | 55,3 | 13,5 | 40,9 | 50,0 | 56,2 |
| **119** | 44,7 | 47,6 | 56,4 | 48,9 | 53,0 | 49,4 | 54,9 | 42,2 | 41,4 | 13,5 | 33,9 | 40,8 | 55,5 | 13,6 | 41,2 | 50,1 | 56,4 |
| **120** | 45,1 | 47,9 | 56,7 | 49,3 | 53,3 | 49,7 | 54,9 | 42,4 | 41,7 | 13,6 | 34,4 | 41,0 | 55,8 | 13,8 | 41,5 | 50,5 | 56,7 |
| **121** | 45,4 | 48,2 | 56,9 | 49,5 | 53,5 | 50,0 | 55,1 | 42,5 | 41,9 | 13,8 | 34,7 | 41,1 | 55,9 | 14,0 | 41,7 | 50,7 | 56,9 |

Negative values are quoted because temperature rises are calculated from the initial average temperature of the specimen surface.

**T1 - T5** Thermocouples distributed for average and maximum temperature rise evaluation

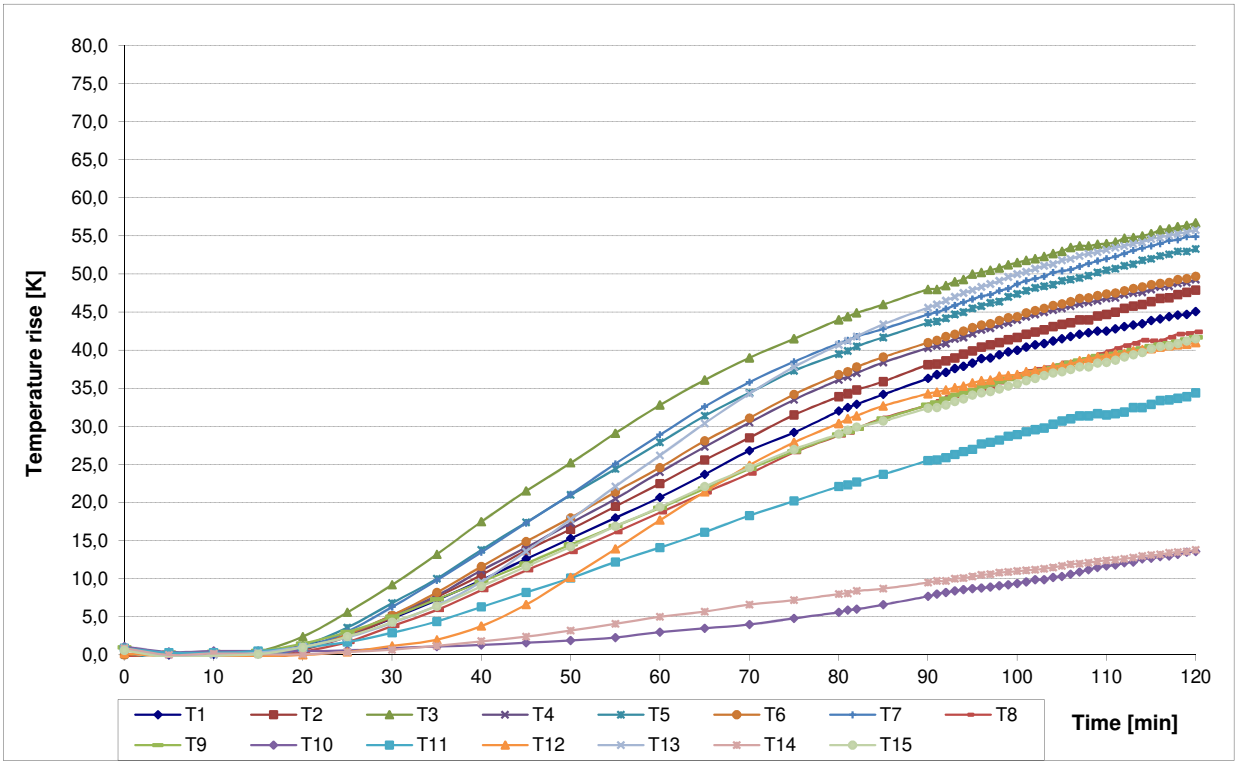
**T6 - T15** Thermocouples distributed for maximum temperature rise evaluation

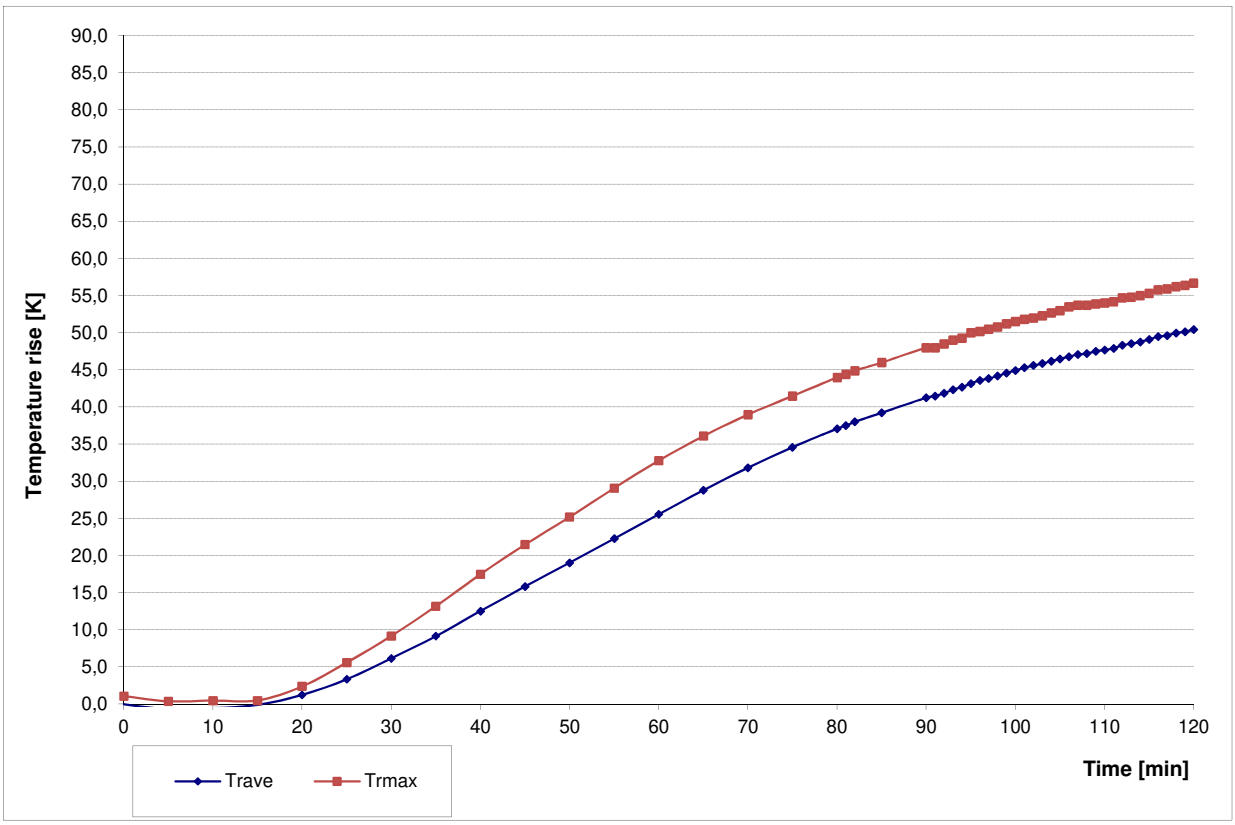
**TRave** average temperature rise above initial average temperature calculated from T1-T5

**TRmax** maximal temperature rise above initial average temperature calculated from T1-T15

**Please see figure showing the layout of measuring points on the specimen surface which is a part of this test report**

## Measured and calculated values from measured values on the specimen surface - specimen No. 2 /graph



## Measured and calculated values from measured values on the specimen surface - specimen No. 5

**The initial average temperature of the unexposed specimen surface: 15,4 °C**

| Time | Temperature rise [K] | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| t [min] | T16 | T17 | T18 | T19 | T20 | T21 | T22 | T23 | T24 | T25 | T26 | TRave | TRmax |
| 0 | 1,2 | 1,6 | 1,3 | 1,6 | 1,1 | 0,2 | 1,1 | 1,3 | 1,5 | 1,2 | 1,2 | 1,4 | 1,6 |
| 5 | 0,5 | 1,0 | 0,6 | 0,9 | 0,4 | -0,6 | 0,4 | 0,7 | 1,0 | 0,4 | 0,4 | 0,7 | 1,0 |
| 10 | 1,1 | 1,8 | 1,4 | 1,8 | 1,4 | -0,6 | 0,9 | 2,3 | 2,0 | 0,4 | 0,9 | 1,5 | 2,3 |
| 15 | 4,8 | 6,1 | 5,4 | 6,0 | 5,5 | -0,3 | 2,7 | 2,1 | 5,5 | 0,7 | 3,0 | 5,6 | 6,1 |
| 20 | 11,1 | 12,8 | 12,3 | 13,1 | 12,7 | 0,2 | 6,8 | 4,0 | 12,0 | 0,9 | 7,0 | 12,4 | 13,1 |
| 25 | 19,4 | 21,6 | 21,3 | 22,8 | 21,6 | 2,2 | 13,0 | 5,1 | 19,4 | 1,8 | 12,4 | 21,3 | 22,8 |
| 30 | 29,2 | 31,9 | 32,3 | 32,9 | 31,8 | 6,2 | 21,7 | 7,8 | 28,1 | 3,6 | 19,9 | 31,6 | 32,9 |
| 35 | 40,3 | 42,9 | 42,9 | 42,6 | 42,2 | 10,0 | 30,8 | 11,0 | 37,1 | 6,0 | 28,4 | 42,2 | 42,9 |
| 40 | 51,0 | 52,9 | 51,6 | 51,5 | 52,5 | 13,3 | 40,1 | 14,4 | 45,9 | 8,8 | 37,3 | 51,9 | 52,9 |
| 45 | 59,0 | 61,2 | 59,4 | 58,4 | 61,5 | 16,2 | 48,5 | 17,9 | 53,9 | 11,3 | 45,3 | 59,9 | 61,5 |
| 50 | 64,6 | 68,1 | 66,6 | 64,8 | 68,6 | 18,9 | 54,2 | 21,5 | 60,5 | 13,8 | 52,1 | 66,5 | 68,6 |
| 55 | 69,4 | 73,7 | 72,5 | 71,3 | 73,6 | 21,3 | 58,9 | 25,4 | 66,9 | 15,9 | 57,8 | 72,1 | 73,7 |
| 60 | 72,6 | 76,7 | 75,5 | 75,7 | 76,9 | 23,8 | 62,8 | 29,7 | 73,1 | 18,3 | 63,6 | 75,5 | 76,9 |
| 65 | 75,4 | 78,8 | 77,1 | 77,5 | 78,1 | 25,9 | 66,5 | 32,8 | 76,6 | 20,8 | 68,9 | 77,4 | 78,8 |
| 70 | 76,2 | 79,2 | 77,1 | 77,8 | 78,8 | 28,0 | 69,7 | 36,5 | 78,6 | 23,2 | 71,7 | 77,8 | 79,2 |
| 75 | 77,4 | 80,2 | 78,3 | 78,4 | 79,3 | 29,7 | 72,9 | 39,5 | 79,4 | 25,3 | 74,4 | 78,7 | 80,2 |
| 80 | 77,3 | 80,2 | 78,0 | 78,6 | 79,5 | 31,3 | 74,5 | 42,0 | 80,0 | 27,3 | 75,5 | 78,7 | 80,2 |
| 81 | 77,7 | 80,4 | 78,3 | 79,0 | 79,6 | 31,5 | 74,9 | 42,2 | 80,0 | 27,7 | 75,9 | 79,0 | 80,4 |
| 82 | 77,8 | 80,7 | 78,2 | 78,8 | 79,8 | 31,8 | 75,1 | 42,9 | 80,2 | 28,0 | 76,1 | 79,1 | 80,7 |
| 85 | 77,9 | 81,2 | 78,9 | 79,4 | 80,4 | 32,7 | 76,3 | 44,3 | 80,4 | 28,9 | 76,6 | 79,6 | 81,2 |
| 90 | 78,4 | 81,5 | 79,4 | 80,2 | 80,9 | 33,9 | 77,2 | 46,2 | 80,8 | 30,4 | 77,5 | 80,1 | 81,5 |
| 91 | 78,4 | 81,7 | 79,5 | 80,1 | 81,0 | 34,1 | 77,4 | 47,0 | 80,9 | 30,6 | 77,1 | 80,1 | 81,7 |
| 92 | 78,8 | 82,1 | 79,6 | 80,7 | 80,9 | 34,4 | 77,5 | 47,0 | 80,8 | 30,7 | 77,6 | 80,4 | 82,1 |
| 93 | 78,7 | 82,0 | 79,8 | 80,7 | 81,3 | 34,5 | 77,5 | 47,3 | 81,0 | 31,0 | 77,5 | 80,5 | 82,0 |
| 94 | 79,0 | 82,0 | 79,9 | 80,8 | 81,2 | 34,9 | 77,6 | 47,5 | 81,1 | 31,3 | 77,6 | 80,6 | 82,0 |
| 95 | 79,2 | 82,2 | 79,9 | 81,0 | 81,4 | 35,0 | 77,5 | 48,3 | 81,3 | 31,4 | 77,5 | 80,7 | 82,2 |
| 96 | 79,3 | 82,3 | 80,0 | 81,4 | 81,5 | 35,3 | 77,5 | 48,6 | 81,2 | 31,7 | 77,8 | 80,9 | 82,3 |
| 97 | 79,5 | 82,5 | 80,5 | 81,5 | 81,7 | 35,3 | 77,8 | 48,9 | 81,4 | 31,8 | 77,9 | 81,1 | 82,5 |
| 98 | 79,7 | 82,8 | 80,6 | 81,6 | 81,9 | 35,7 | 78,0 | 48,9 | 81,2 | 32,0 | 78,1 | 81,3 | 82,8 |
| 99 | 79,9 | 82,9 | 80,9 | 81,7 | 82,0 | 36,0 | 78,1 | 49,3 | 81,5 | 32,3 | 78,2 | 81,5 | 82,9 |
| 100 | 80,2 | 83,4 | 81,5 | 81,9 | 82,1 | 36,3 | 78,3 | 49,5 | 81,5 | 32,4 | 78,6 | 81,8 | 83,4 |
| 101 | 80,3 | 83,4 | 81,6 | 82,2 | 82,1 | 36,5 | 78,2 | 49,6 | 81,7 | 32,8 | 78,4 | 81,9 | 83,4 |
| 102 | 80,5 | 83,8 | 82,2 | 82,5 | 82,2 | 36,6 | 78,2 | 50,0 | 81,8 | 32,7 | 78,6 | 82,2 | 83,8 |
| 103 | 80,7 | 84,4 | 82,8 | 83,8 | 82,4 | 37,0 | 78,2 | 50,1 | 81,9 | 32,9 | 78,5 | 82,8 | 84,4 |
| 104 | 80,8 | 84,6 | 83,5 | 85,0 | 82,7 | 37,3 | 78,5 | 50,7 | 82,2 | 32,8 | 78,4 | 83,3 | 85,0 |
| 105 | 81,2 | 85,0 | 84,5 | 86,3 | 83,7 | 37,6 | 78,5 | 50,8 | 82,2 | 33,0 | 78,7 | 84,1 | 86,3 |
| 106 | 81,1 | 85,5 | 85,3 | 87,3 | 84,6 | 38,0 | 78,5 | 51,7 | 82,4 | 33,0 | 78,6 | 84,8 | 87,3 |
| 107 | 81,0 | 85,8 | 86,6 | 88,7 | 85,7 | 38,1 | 78,3 | 51,7 | 82,5 | 33,4 | 78,6 | 85,6 | 88,7 |
| 108 | 81,4 | 87,0 | 88,1 | 89,9 | 87,0 | 38,4 | 78,7 | 52,0 | 82,5 | 33,4 | 78,6 | 86,7 | 89,9 |
| 109 | 81,9 | 88,2 | 89,7 | 91,3 | 88,1 | 38,7 | 78,7 | 52,2 | 82,8 | 33,4 | 78,6 | 87,8 | 91,3 |
| 110 | 82,1 | 89,2 | 91,0 | 93,0 | 89,4 | 38,9 | 78,8 | 52,4 | 82,8 | 33,6 | 78,9 | 88,9 | 93,0 |
| 111 | 82,7 | 90,1 | 92,8 | 94,8 | 90,9 | 39,2 | 79,0 | 52,8 | 83,1 | 33,7 | 79,1 | 90,3 | 94,8 |
| 112 | 83,4 | 91,4 | 94,3 | 96,5 | 92,2 | 39,6 | 79,0 | 53,1 | 83,3 | 33,7 | 79,2 | 91,6 | 96,5 |
| 113 | 84,2 | 92,5 | 95,6 | 98,5 | 93,7 | 39,7 | 78,9 | 53,2 | 83,6 | 33,8 | 79,0 | 92,9 | 98,5 |
| 114 | 85,3 | 94,1 | 97,6 | 100,9 | 95,7 | 40,0 | 79,2 | 53,9 | 84,6 | 33,7 | 79,2 | 94,7 | 100,9 |
| 115 | 86,5 | 95,0 | 98,9 | 103,2 | 97,4 | 40,2 | 79,3 | 53,9 | 85,1 | 33,9 | 79,1 | 96,2 | 103,2 |
| 116 | 87,9 | 96,8 | 100,7 | 105,5 | 99,5 | 40,4 | 79,3 | 54,5 | 86,0 | 33,6 | 79,1 | 98,1 | 105,5 |
| 117 | 89,5 | 98,5 | 102,6 | 108,1 | 101,5 | 40,7 | 79,7 | 54,8 | 86,8 | 33,7 | 79,3 | 100,0 | 108,1 |
| 118 | 90,9 | 100,2 | 104,9 | 111,0 | 103,6 | 41,0 | 79,8 | 55,0 | 87,6 | 33,6 | 79,5 | 102,1 | 111,0 |
| 119 | 92,6 | 102,0 | 106,8 | 113,6 | 106,0 | 41,2 | 79,8 | 55,5 | 88,6 | 33,6 | 79,6 | 104,2 | 113,6 |
| 120 | 94,2 | 103,8 | 109,1 | 116,5 | 108,4 | 41,4 | 79,5 | 55,7 | 89,4 | 33,7 | 79,8 | 106,4 | 116,5 |
| 121 | 96,1 | 105,8 | 111,3 | 119,1 | 110,9 | 41,7 | 79,8 | 56,2 | 90,6 | 33,7 | 79,9 | 108,6 | 119,1 |

Negative values are quoted because temperature rises are calculated from the initial average temperature of the specimen surface.

**T16 - T20** Thermocouples distributed for average and maximum temperature rise evaluation

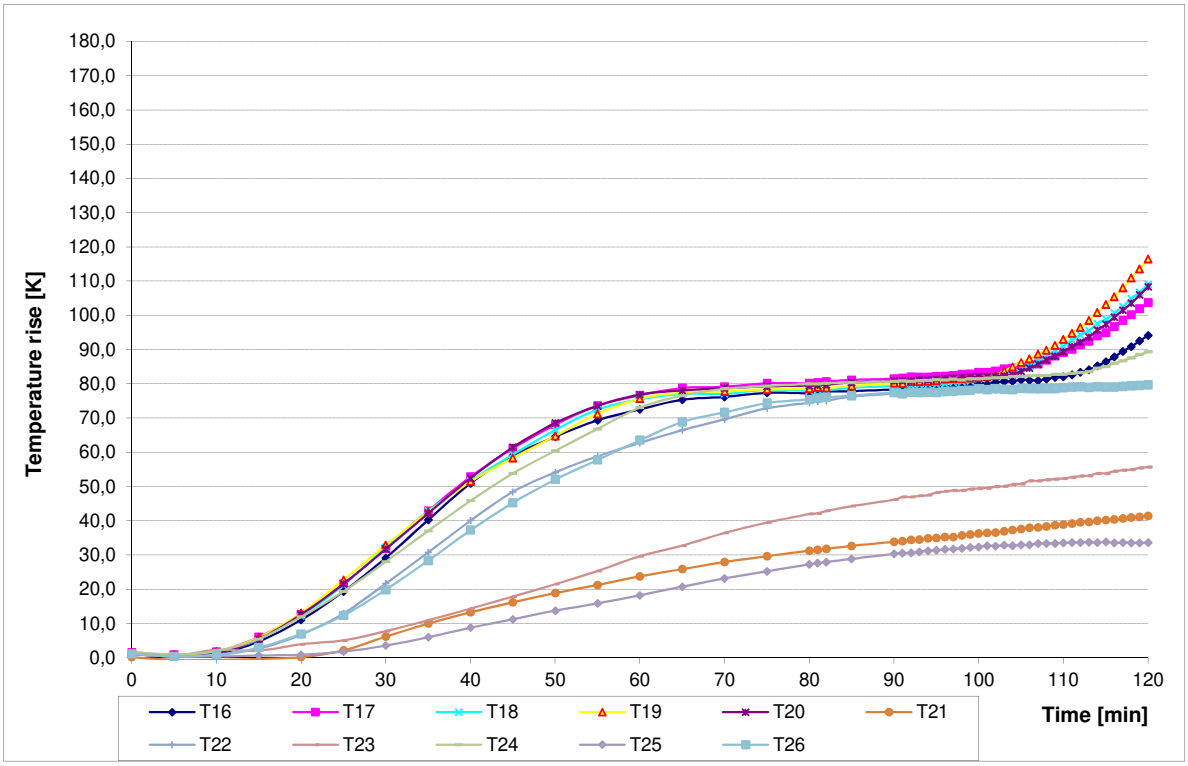
**T21 - T26** Thermocouples distributed for maximum temperature rise evaluation

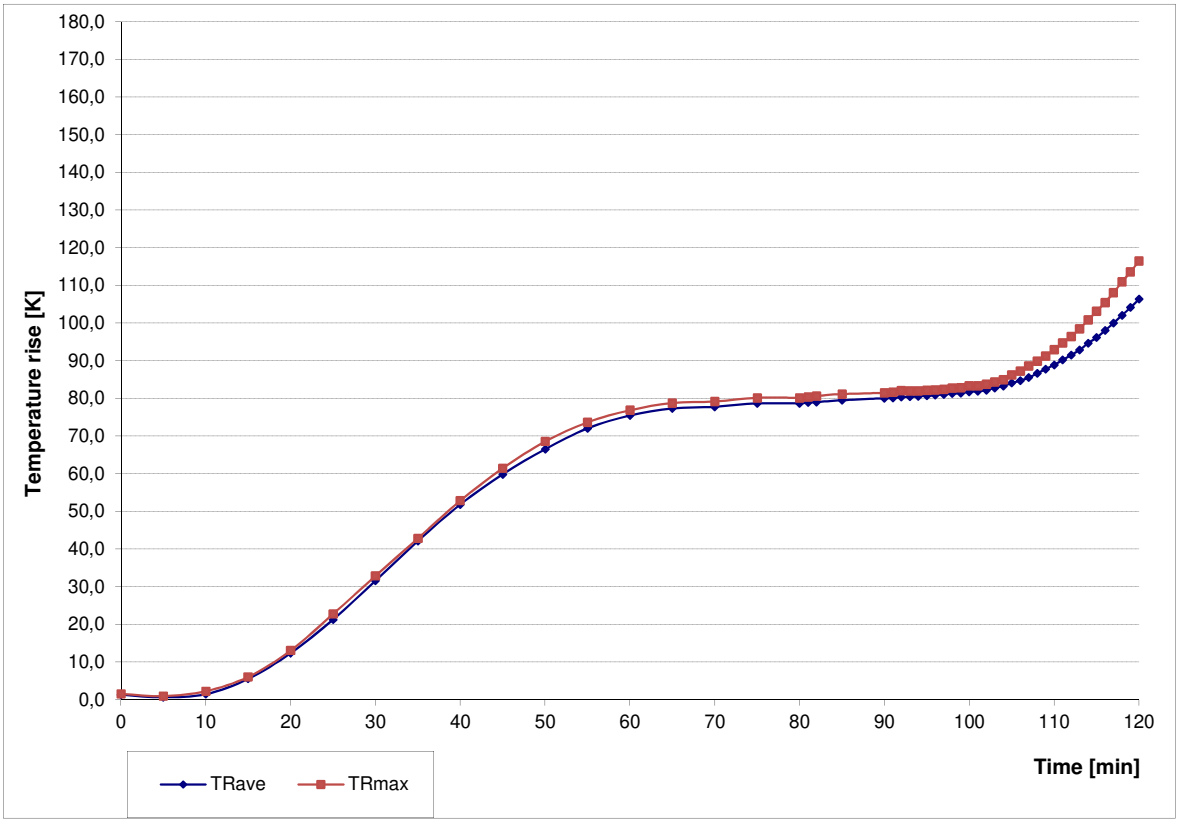
**TRave** average temperature rise above initial average temperature calculated from T16-T20

**TRmax** maximal temperature rise above initial average temperature calculated from T16-T26

**Please see figure showing the layout of measuring points on the specimen surface which is a part of this test report**

## Measured and calculated values from measured values on the specimen surface - specimen No. 5 /graph



## Measured and calculated values from measured values on the specimen surface - specimen No. 3

**The initial average temperature of the unexposed specimen surface: 15,4 °C**

| Time | Temperature rise [K] | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| t [min] | T27 | T28 | T29 | T30 | T31 | T32 | T33 | T34 | T35 | T36 | T37 | T38 | T39 | T40 | T67 | Trave | Trmax |
| **0** | 1,4 | 1,2 | 1,3 | 1,2 | 1,1 | 1,3 | 1,1 | 0,4 | 0,3 | -0,2 | -0,2 | 0,2 | -0,8 | 0,3 | 0,4 | 1,2 | 1,4 |
| **5** | 0,8 | 0,4 | 0,5 | 0,6 | 0,4 | 0,8 | 0,4 | -0,4 | -0,2 | -0,9 | -0,7 | -0,4 | -0,7 | -0,5 | -0,4 | 0,5 | 0,8 |
| **10** | 1,1 | 0,9 | 1,1 | 0,9 | 0,6 | 1,5 | 0,9 | -0,1 | 0,6 | -0,6 | -0,7 | 0,1 | -0,5 | -0,1 | -0,2 | 0,9 | 1,5 |
| **15** | 2,2 | 2,6 | 2,8 | 2,2 | 2,0 | 3,6 | 2,3 | 1,1 | 2,4 | 0,4 | -0,6 | 1,3 | 0,1 | 1,4 | -0,3 | 2,4 | 3,6 |
| **20** | 5,3 | 6,2 | 5,6 | 4,7 | 5,6 | 7,0 | 5,0 | 4,2 | 6,0 | 2,4 | -0,3 | 3,7 | 0,7 | 4,0 | 0,1 | 5,5 | 7,0 |
| **25** | 9,3 | 10,9 | 9,3 | 8,2 | 10,1 | 11,3 | 9,3 | 8,6 | 10,3 | 5,3 | 0,4 | 6,8 | 2,2 | 7,7 | 0,5 | 9,6 | 11,3 |
| **30** | 13,9 | 15,9 | 13,6 | 12,4 | 15,2 | 16,1 | 14,4 | 13,6 | 15,0 | 8,6 | 1,6 | 10,4 | 4,4 | 12,1 | 1,1 | 14,2 | 16,1 |
| **35** | 18,4 | 21,0 | 17,7 | 16,3 | 20,3 | 21,1 | 20,2 | 18,7 | 20,3 | 11,8 | 2,9 | 14,4 | 7,2 | 16,4 | 2,3 | 18,7 | 21,1 |
| **40** | 22,9 | 26,1 | 22,3 | 20,6 | 25,4 | 26,4 | 25,4 | 23,7 | 25,9 | 15,2 | 5,3 | 18,8 | 10,0 | 20,2 | 3,8 | 23,5 | 26,4 |
| **45** | 27,4 | 30,7 | 27,1 | 24,8 | 30,4 | 31,9 | 30,3 | 28,0 | 31,1 | 18,5 | 8,0 | 23,5 | 13,1 | 24,3 | 6,0 | 28,1 | 31,9 |
| **50** | 31,6 | 35,4 | 31,8 | 29,3 | 34,6 | 37,1 | 34,7 | 32,7 | 36,3 | 21,8 | 11,5 | 28,2 | 15,1 | 29,1 | 8,7 | 32,5 | 37,1 |
| **55** | 35,6 | 39,1 | 36,0 | 33,4 | 38,6 | 41,8 | 39,0 | 36,3 | 40,0 | 25,3 | 15,0 | 33,1 | 18,2 | 32,7 | 11,9 | 36,5 | 41,8 |
| **60** | 39,1 | 42,2 | 39,7 | 36,9 | 42,0 | 45,7 | 42,8 | 39,4 | 43,7 | 29,3 | 18,6 | 37,8 | 19,9 | 36,0 | 15,2 | 40,0 | 45,7 |
| **65** | 42,0 | 45,2 | 42,9 | 40,2 | 45,2 | 49,3 | 45,8 | 41,8 | 46,5 | 33,0 | 22,2 | 42,1 | 21,8 | 38,7 | 18,7 | 43,1 | 49,3 |
| **70** | 44,4 | 47,4 | 45,7 | 42,8 | 48,0 | 52,4 | 48,4 | 43,8 | 48,8 | 36,5 | 25,8 | 45,9 | 23,6 | 41,4 | 21,5 | 45,7 | 52,4 |
| **75** | 46,9 | 49,7 | 48,2 | 45,2 | 50,7 | 54,8 | 51,6 | 46,3 | 51,2 | 39,9 | 28,8 | 49,2 | 24,3 | 43,4 | 24,1 | 48,1 | 54,8 |
| **80** | 48,9 | 51,8 | 50,5 | 47,5 | 53,2 | 57,4 | 53,9 | 48,2 | 53,1 | 42,4 | 31,4 | 51,8 | 26,3 | 46,0 | 26,9 | 50,4 | 57,4 |
| **81** | 49,3 | 52,3 | 50,8 | 48,1 | 53,8 | 57,8 | 54,3 | 48,6 | 53,6 | 43,0 | 32,0 | 52,5 | 26,6 | 46,6 | 27,5 | 50,9 | 57,8 |
| **82** | 49,6 | 52,7 | 51,3 | 48,5 | 54,2 | 58,4 | 54,7 | 49,1 | 54,0 | 43,5 | 32,5 | 53,2 | 26,7 | 46,8 | 28,1 | 51,3 | 58,4 |
| **85** | 51,2 | 54,0 | 52,6 | 49,7 | 55,3 | 59,7 | 56,2 | 50,4 | 55,2 | 45,3 | 34,0 | 54,9 | 27,0 | 48,6 | 29,5 | 52,6 | 59,7 |
| **90** | 53,0 | 56,0 | 54,7 | 51,5 | 57,0 | 61,8 | 57,9 | 52,5 | 57,0 | 47,8 | 36,4 | 57,3 | 28,0 | 50,6 | 32,0 | 54,4 | 61,8 |
| **91** | 53,3 | 56,4 | 54,9 | 51,8 | 57,3 | 62,1 | 58,7 | 52,9 | 57,3 | 48,1 | 36,6 | 57,8 | 28,0 | 51,3 | 32,3 | 54,7 | 62,1 |
| **92** | 53,7 | 56,8 | 55,3 | 52,3 | 57,6 | 62,5 | 59,1 | 53,3 | 57,5 | 48,9 | 36,9 | 58,2 | 28,5 | 51,8 | 32,9 | 55,1 | 62,5 |
| **93** | 54,1 | 57,3 | 55,7 | 52,7 | 58,0 | 62,8 | 59,3 | 53,9 | 57,9 | 49,0 | 37,3 | 58,8 | 29,2 | 52,2 | 33,1 | 55,6 | 62,8 |
| **94** | 54,5 | 57,5 | 56,1 | 53,2 | 58,2 | 63,2 | 59,7 | 54,2 | 58,2 | 49,7 | 37,9 | 59,4 | 29,3 | 52,7 | 33,5 | 55,9 | 63,2 |
| **95** | 54,9 | 57,9 | 56,5 | 53,5 | 58,6 | 63,6 | 59,8 | 54,5 | 58,6 | 50,0 | 38,4 | 59,8 | 29,9 | 53,1 | 34,0 | 56,3 | 63,6 |
| **96** | 55,1 | 58,3 | 56,8 | 53,8 | 58,8 | 63,9 | 60,3 | 54,9 | 59,0 | 50,4 | 38,8 | 60,2 | 30,5 | 53,5 | 34,6 | 56,6 | 63,9 |
| **97** | 55,4 | 58,6 | 56,9 | 54,1 | 59,0 | 64,2 | 60,4 | 55,1 | 59,2 | 50,9 | 39,2 | 60,6 | 30,6 | 53,8 | 34,9 | 56,8 | 64,2 |
| **98** | 55,9 | 58,8 | 57,4 | 54,6 | 59,3 | 64,5 | 60,9 | 55,1 | 59,6 | 51,6 | 39,5 | 61,2 | 30,9 | 54,6 | 35,3 | 57,2 | 64,5 |
| **99** | 56,2 | 59,3 | 57,9 | 54,9 | 59,8 | 64,7 | 61,3 | 55,6 | 59,8 | 52,2 | 40,0 | 61,7 | 31,6 | 54,9 | 35,7 | 57,6 | 64,7 |
| **100** | 56,9 | 59,7 | 58,7 | 55,9 | 60,3 | 65,3 | 61,4 | 55,9 | 60,1 | 52,9 | 40,6 | 62,5 | 31,9 | 54,9 | 36,4 | 58,3 | 65,3 |
| **101** | 57,4 | 60,0 | 59,6 | 57,1 | 60,3 | 66,3 | 61,7 | 56,2 | 60,4 | 54,0 | 41,6 | 63,1 | 32,4 | 55,9 | 36,9 | 58,9 | 66,3 |
| **102** | 58,4 | 60,9 | 60,7 | 58,5 | 61,5 | 67,2 | 63,4 | 57,2 | 61,0 | 55,5 | 42,7 | 64,4 | 32,6 | 57,6 | 37,8 | 60,0 | 67,2 |
| **103** | 59,1 | 61,8 | 61,8 | 59,4 | 62,8 | 67,9 | 64,4 | 57,8 | 61,6 | 56,1 | 43,7 | 65,1 | 32,7 | 58,5 | 38,4 | 61,0 | 67,9 |
| **104** | 59,8 | 62,4 | 62,6 | 60,2 | 63,6 | 68,5 | 65,3 | 58,7 | 62,0 | 56,7 | 44,4 | 65,9 | 32,9 | 59,3 | 38,9 | 61,7 | 68,5 |
| **105** | 60,4 | 63,0 | 63,3 | 60,9 | 64,5 | 69,3 | 66,3 | 59,3 | 62,7 | 56,9 | 45,4 | 66,6 | 33,2 | 60,0 | 39,3 | 62,4 | 69,3 |
| **106** | 59,9 | 63,4 | 63,5 | 60,0 | 64,7 | 68,9 | 66,5 | 59,3 | 62,4 | 55,7 | 45,8 | 67,0 | 33,4 | 60,1 | 38,7 | 62,3 | 68,9 |
| **107** | 59,8 | 63,4 | 62,9 | 59,4 | 64,5 | 68,5 | 65,7 | 59,0 | 62,3 | 55,8 | 45,6 | 66,6 | 35,1 | 59,5 | 38,7 | 62,0 | 68,5 |
| **108** | 59,7 | 63,2 | 62,5 | 59,2 | 63,8 | 68,6 | 65,3 | 59,4 | 62,4 | 57,0 | 45,5 | 66,4 | 35,2 | 59,8 | 38,5 | 61,7 | 68,6 |
| **109** | 59,8 | 63,2 | 62,3 | 59,1 | 63,5 | 68,4 | 65,3 | 59,8 | 62,9 | 56,4 | 45,6 | 66,6 | 35,8 | 59,0 | 39,0 | 61,6 | 68,4 |
| **110** | 60,4 | 63,3 | 62,3 | 58,9 | 63,3 | 68,2 | 65,3 | 59,8 | 63,4 | 56,9 | 45,8 | 66,5 | 36,0 | 59,4 | 39,2 | 61,6 | 68,2 |
| **111** | 60,7 | 63,2 | 62,3 | 58,9 | 63,3 | 68,2 | 65,4 | 59,9 | 63,4 | 57,3 | 45,8 | 66,5 | 36,1 | 59,8 | 39,3 | 61,7 | 68,2 |
| **112** | 60,9 | 63,3 | 62,3 | 58,9 | 63,4 | 68,2 | 65,5 | 60,1 | 63,7 | 57,6 | 45,9 | 66,6 | 36,6 | 59,7 | 39,5 | 61,8 | 68,2 |
| **113** | 61,1 | 63,5 | 62,4 | 58,9 | 63,4 | 68,2 | 65,4 | 60,2 | 63,6 | 57,7 | 46,4 | 66,7 | 36,8 | 59,8 | 39,5 | 61,9 | 68,2 |
| **114** | 61,4 | 63,6 | 62,4 | 59,0 | 63,5 | 68,3 | 65,8 | 60,4 | 63,7 | 58,2 | 46,4 | 66,9 | 36,8 | 60,2 | 39,7 | 62,0 | 68,3 |
| **115** | 61,4 | 63,6 | 62,6 | 59,0 | 63,5 | 68,4 | 65,6 | 60,3 | 63,9 | 58,0 | 46,7 | 66,9 | 37,4 | 60,4 | 39,5 | 62,0 | 68,4 |
| **116** | 61,3 | 63,9 | 62,6 | 59,2 | 63,5 | 68,5 | 65,7 | 60,5 | 63,9 | 58,3 | 46,9 | 67,0 | 37,6 | 60,3 | 39,3 | 62,1 | 68,5 |
| **117** | 61,5 | 63,8 | 62,6 | 59,2 | 63,5 | 68,6 | 65,8 | 60,4 | 64,6 | 58,8 | 47,0 | 67,1 | 37,7 | 60,4 | 39,7 | 62,1 | 68,6 |
| **118** | 61,8 | 64,0 | 62,8 | 59,3 | 63,7 | 68,6 | 65,8 | 60,7 | 64,8 | 59,0 | 47,2 | 67,3 | 37,7 | 60,9 | 39,8 | 62,3 | 68,6 |
| **119** | 62,2 | 64,1 | 62,8 | 59,5 | 63,9 | 68,8 | 66,0 | 60,9 | 65,1 | 59,6 | 47,4 | 67,3 | 38,4 | 60,4 | 40,0 | 62,5 | 68,8 |
| **120** | 62,2 | 64,3 | 62,9 | 59,7 | 64,0 | 69,0 | 66,1 | 61,0 | 65,1 | 59,6 | 47,6 | 67,4 | 38,4 | 61,1 | 40,2 | 62,6 | 69,0 |
| **121** | 62,3 | 64,5 | 63,1 | 59,8 | 64,1 | 69,1 | 66,3 | 61,3 | 65,4 | 59,9 | 47,9 | 67,7 | 38,5 | 61,8 | 40,0 | 62,8 | 69,1 |

Negative values are quoted because temperature rises are calculated from the initial average temperature of the specimen surface.

**T27 - T31** Thermocouples distributed for average and maximum temperature rise evaluation

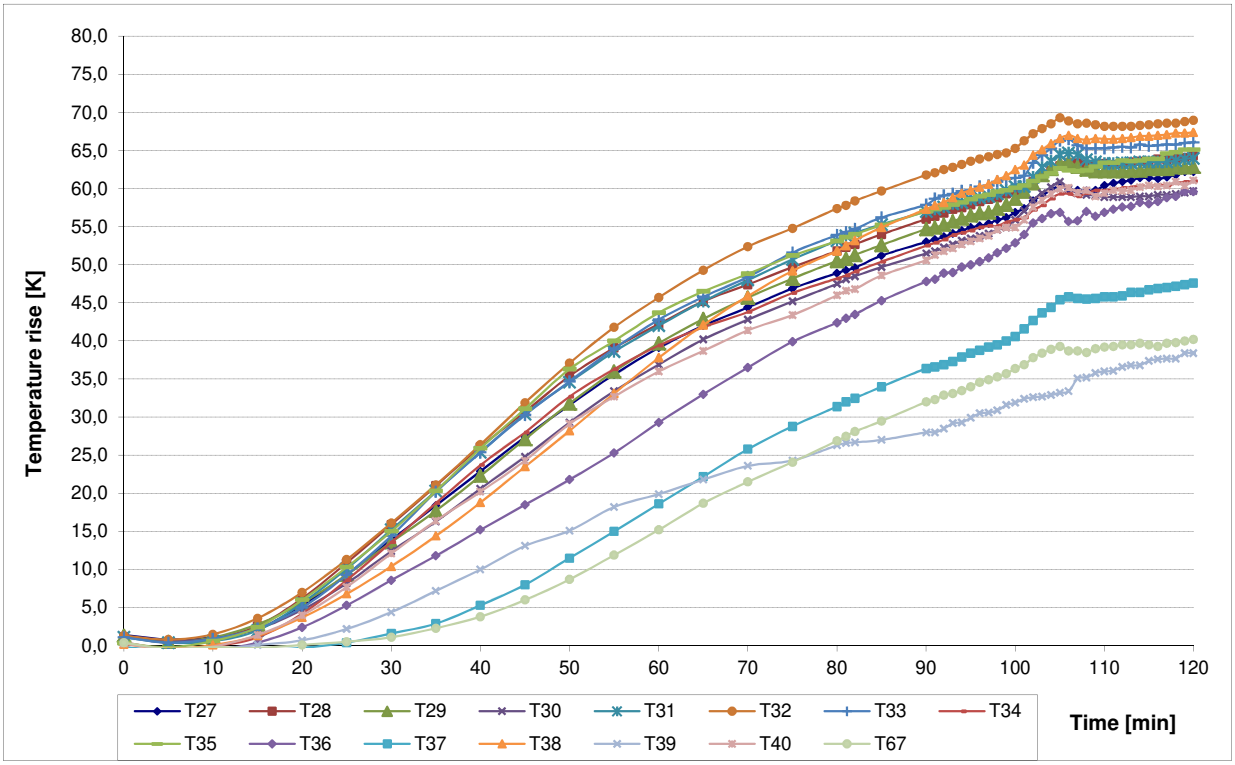
**T32 - T40, T67** Thermocouples distributed for maximum temperature rise evaluation

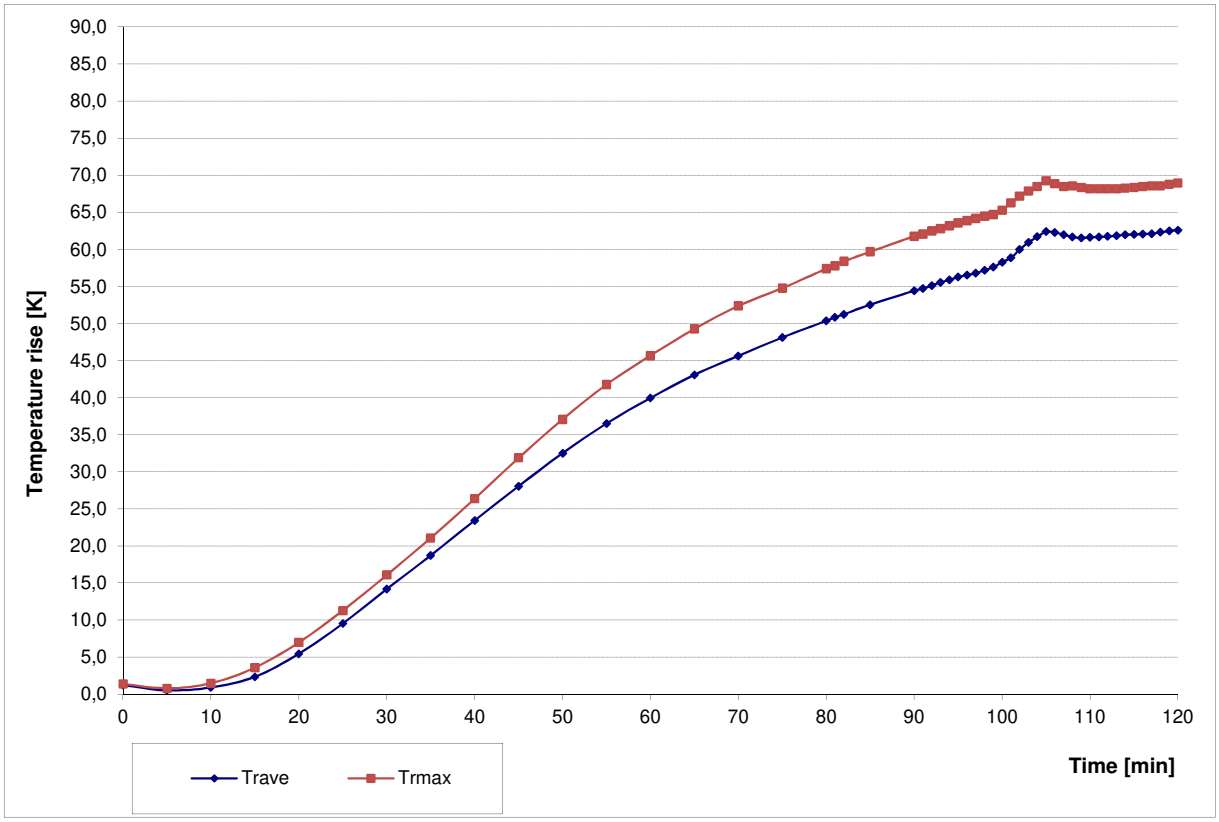
**TRave** average temperature rise above initial average temperature calculated from T27-T31

**TRmax** maximal temperature rise above initial average temperature calculated from T27-T40, T67

**Please see figure showing the layout of measuring points on the specimen surface which is a part of this test report**

## Measured and calculated values from measured values on the specimen surface - specimen No. 3 /graph



## Measured and calculated values from measured values on the specimen surface - specimen No. 1

**The initial average temperature of the unexposed specimen surface: 15,4 °C**

| Time | Temperature rise [K] | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| t [min] | T41 | T42 | T43 | T44 | T45 | T46 | T47 | T48 | T49 | T50 | T51 | T52 | T53 | T54 | T55 | Trave | Trmax |
| **0** | 1,3 | 0,6 | 0,5 | 0,5 | 0,2 | 0,1 | 0,6 | 0,4 | 2,1 | 0,9 | 0,7 | 0,8 | 1,3 | 0,4 | 0,5 | 0,6 | 2,1 |
| **5** | 0,7 | -0,1 | -0,2 | -0,2 | -0,3 | -0,5 | 0,0 | -0,1 | 1,4 | 0,1 | -0,1 | 0,1 | 0,5 | 0,0 | 0,0 | 0,0 | 1,4 |
| **10** | 1,1 | 0,6 | 0,4 | 0,4 | 0,6 | -0,1 | 2,2 | 0,4 | 3,3 | 4,1 | 6,5 | 0,5 | 1,2 | 14,5 | 12,7 | 0,6 | 14,5 |
| **15** | 3,8 | 3,8 | 2,7 | 2,8 | 3,4 | 1,6 | 5,9 | 3,2 | 6,8 | 8,8 | 19,9 | 1,0 | 4,8 | 24,2 | 23,3 | 3,3 | 24,2 |
| **20** | 8,9 | 9,7 | 7,6 | 8,0 | 8,2 | 5,1 | 11,4 | 8,6 | 12,2 | 12,2 | 25,4 | 7,4 | 11,3 | 26,9 | 27,6 | 8,5 | 27,6 |
| **25** | 16,0 | 17,0 | 13,6 | 14,3 | 14,7 | 10,3 | 18,5 | 14,5 | 18,5 | 13,2 | 21,4 | 11,5 | 18,1 | 31,8 | 32,8 | 15,1 | 32,8 |
| **30** | 24,6 | 25,9 | 20,9 | 22,1 | 22,3 | 18,1 | 26,0 | 22,2 | 26,0 | 15,7 | 25,9 | 12,5 | 24,4 | 38,1 | 39,3 | 23,2 | 39,3 |
| **35** | 33,5 | 34,6 | 28,4 | 30,1 | 30,2 | 23,1 | 34,2 | 30,5 | 33,6 | 18,1 | 30,8 | 13,7 | 30,6 | 39,3 | 49,6 | 31,4 | 49,6 |
| **40** | 41,8 | 42,5 | 36,3 | 38,4 | 39,1 | 29,2 | 41,9 | 39,6 | 42,0 | 18,4 | 35,1 | 16,5 | 37,1 | 38,6 | 47,9 | 39,6 | 47,9 |
| **45** | 48,3 | 49,0 | 44,6 | 45,8 | 46,4 | 35,2 | 49,0 | 47,6 | 49,9 | 19,4 | 40,2 | 19,0 | 43,7 | 37,3 | 52,4 | 46,8 | 52,4 |
| **50** | 53,3 | 54,1 | 50,8 | 51,6 | 52,1 | 40,1 | 55,4 | 53,9 | 56,8 | 20,5 | 46,1 | 21,7 | 50,2 | 37,4 | 59,4 | 52,4 | 59,4 |
| **55** | 57,0 | 58,2 | 55,0 | 56,9 | 56,9 | 44,8 | 62,3 | 59,3 | 62,8 | 22,1 | 51,3 | 23,9 | 57,1 | 38,2 | 65,8 | 56,8 | 65,8 |
| **60** | 60,7 | 62,1 | 59,0 | 62,1 | 61,2 | 49,4 | 68,8 | 64,5 | 67,8 | 24,6 | 55,7 | 26,7 | 64,1 | 41,0 | 71,4 | 61,0 | 71,4 |
| **65** | 65,1 | 66,6 | 62,4 | 65,3 | 65,6 | 53,0 | 73,8 | 69,0 | 71,9 | 27,2 | 61,0 | 28,8 | 69,4 | 45,7 | 74,8 | 65,0 | 74,8 |
| **70** | 68,6 | 69,9 | 66,3 | 68,2 | 69,0 | 55,5 | 77,4 | 72,3 | 75,2 | 30,5 | 65,1 | 29,1 | 74,1 | 53,6 | 77,6 | 68,4 | 77,6 |
| **75** | 71,7 | 72,5 | 69,1 | 71,7 | 71,6 | 58,5 | 79,7 | 74,3 | 84,3 | 33,8 | 68,8 | 36,2 | 101,4 | 63,3 | 80,6 | 71,3 | 101,4 |
| **80** | 73,8 | 74,5 | 71,2 | 72,7 | 74,6 | 59,7 | 81,4 | 75,9 | 110,5 | 37,3 | 70,8 | 50,6 | 178,7 | 78,1 | 83,9 | 73,4 | 178,7 |
| **81** | 73,9 | 74,7 | 71,7 | 72,6 | 75,0 | 60,0 | 81,7 | 76,3 | 113,7 | 37,9 | 71,1 | 54,9 | 192,4 | 82,2 | 85,0 | 73,6 | **192,4** |
| **82** | 74,3 | 74,8 | 71,7 | 72,8 | 75,4 | 60,4 | 81,9 | 76,7 | 115,5 | 38,8 | 71,7 | 59,0 | 205,5 | 86,9 | 85,6 | 73,8 | 205,5 |
| **85** | 75,1 | 75,2 | 72,6 | 73,4 | 76,2 | 61,2 | 82,2 | 77,5 | 115,7 | 40,9 | 73,0 | 70,0 | 236,8 | 102,6 | 93,6 | 74,5 | 236,8 |
| **90** | 75,8 | 75,7 | 74,5 | 74,1 | 78,6 | 62,8 | 82,4 | 80,3 | 203,6 | 46,7 | 79,1 | 84,5 | 282,5 | 139,3 | 172,5 | 75,7 | 282,5 |
| **91** | 75,8 | 75,7 | 75,0 | 74,1 | 79,1 | 62,9 | 82,5 | 79,5 | 215,3 | 50,7 | 84,6 | 87,6 | 289,0 | 142,6 | 180,6 | 75,9 | 289,0 |
| **92** | 75,8 | 75,7 | 75,3 | 74,4 | 79,6 | 62,9 | 82,4 | 79,1 | 225,9 | 57,4 | 86,7 | 90,7 | 295,2 | 147,1 | 191,7 | 76,2 | 295,2 |
| **93** | 75,9 | 76,0 | 76,0 | 74,2 | 80,1 | 62,9 | 82,6 | 78,8 | 236,4 | 63,9 | 87,7 | 93,7 | 302,3 | 154,0 | 201,3 | 76,4 | 302,3 |
| **94** | 75,8 | 75,9 | 76,4 | 74,4 | 80,4 | 63,0 | 82,8 | 78,6 | 244,7 | 69,8 | 88,3 | 96,7 | 310,8 | 156,3 | 212,5 | 76,6 | 310,8 |
| **95** | 75,9 | 75,8 | 76,7 | 74,3 | 81,2 | 62,9 | 83,0 | 78,7 | 252,8 | 74,0 | 89,0 | 99,8 | 319,7 | 159,8 | 223,6 | 76,8 | 319,7 |
| **96** | 76,0 | 75,6 | 76,7 | 74,5 | 81,9 | 62,6 | 83,8 | 78,3 | 256,6 | * | 88,1 | 102,9 | 327,3 | 152,2 | 207,9 | 76,9 | 327,3 |
| **97** | 76,1 | 75,7 | 76,8 | 74,9 | 84,9 | 62,1 | * | 78,2 | 250,7 | | 84,1 | 105,8 | 325,0 | 133,8 | 172,2 | 77,7 | 325,0 |
| **98** | 76,3 | 76,2 | 76,9 | 75,2 | 86,6 | 62,5 | | 78,2 | 252,8 | | 82,0 | 106,7 | 321,0 | 124,7 | 156,8 | 78,2 | 321,0 |
| **99** | 76,7 | 76,5 | 77,3 | 75,7 | 86,9 | 63,3 | | 78,3 | 260,7 | | 80,9 | 110,2 | 293,2 | 119,6 | 148,9 | 78,6 | 293,2 |
| **100** | 77,6 | 76,5 | 77,7 | 77,8 | 85,2 | 66,1 | | 85,4 | 266,7 | | 83,0 | 113,5 | 271,6 | 116,6 | 143,4 | 79,0 | 271,6 |
| **101** | 78,4 | 76,9 | 78,3 | 80,1 | 85,4 | 69,3 | | 89,5 | 283,4 | | 87,1 | 115,8 | 263,5 | 115,7 | 144,7 | 79,8 | 283,4 |
| **102** | 80,1 | 81,9 | 81,9 | 84,8 | 115,7 | 71,5 | | 91,9 | 358,7 | | 90,5 | 131,5 | 273,5 | 132,6 | 169,5 | 88,9 | 358,7 |
| **103** | 80,3 | 83,0 | 83,4 | 85,0 | 141,1 | 73,4 | | 94,7 | 448,5 | | 92,4 | 141,5 | 275,4 | 143,8 | 180,3 | 94,6 | 448,5 |
| **104** | 80,3 | 83,8 | 84,0 | 85,9 | 161,6 | 75,0 | | 98,6 | 537,7 | | 94,1 | 148,0 | 276,4 | 149,4 | 188,6 | 99,1 | 537,7 |
| **105** | 81,2 | 84,3 | 84,4 | 86,8 | 178,1 | 76,4 | | 103,3 | 541,9 | | 96,2 | 156,1 | 276,1 | 154,7 | 196,7 | 103,0 | 541,9 |
| **106** | 81,5 | 84,4 | 84,8 | 87,4 | 188,9 | 76,9 | | 108,4 | 547,4 | | 97,8 | 161,0 | 274,8 | 160,6 | 205,6 | 105,4 | 547,4 |
| **107** | 81,7 | 85,1 | 85,1 | 88,2 | 198,6 | 77,0 | | 113,3 | 552,9 | | 99,8 | 164,2 | 273,8 | 166,5 | 212,9 | 107,7 | 552,9 |
| **108** | 82,3 | 85,6 | 85,8 | 89,2 | 208,6 | 77,0 | | 117,7 | 560,1 | | 102,5 | 167,4 | 274,3 | 173,4 | 221,0 | 110,3 | 560,1 |
| **109** | 82,0 | 86,0 | 86,2 | 90,0 | 219,1 | 77,4 | | 122,3 | 565,8 | | 106,3 | 171,5 | 276,5 | 178,9 | 229,0 | 112,7 | 565,8 |
| **110** | 82,7 | 86,5 | 86,8 | 90,9 | 230,8 | 77,2 | | 126,8 | 569,7 | | 112,7 | 175,9 | 279,5 | 184,9 | 237,0 | 115,5 | 569,7 |
| **111** | 82,7 | 86,8 | 87,4 | 91,8 | 244,7 | 77,7 | | 130,9 | 571,4 | | 122,1 | 181,1 | 283,5 | 190,7 | 245,2 | 118,7 | 571,4 |
| **112** | 82,9 | 87,4 | 88,2 | 93,1 | 259,2 | 77,8 | | 136,4 | 572,5 | | 134,0 | 186,6 | 288,5 | 195,8 | 253,9 | 122,2 | 572,5 |
| **113** | 83,0 | 87,8 | 88,8 | 94,8 | 276,6 | 78,1 | | 142,0 | 572,5 | | 147,5 | 192,1 | 293,3 | 201,7 | 262,9 | 126,2 | 572,5 |
| **114** | 83,2 | 88,3 | 89,6 | 96,6 | 297,1 | 78,3 | | 148,7 | 576,7 | | 162,8 | 197,5 | 298,9 | 207,9 | 272,8 | 131,0 | 576,7 |
| **115** | 83,2 | 88,7 | 90,3 | 98,2 | 319,4 | 78,8 | | 156,7 | 582,6 | | 178,9 | 203,1 | 304,7 | 214,9 | 284,4 | 136,0 | 582,6 |
| **116** | 83,6 | 89,3 | 91,2 | 100,6 | 342,7 | 79,2 | | 165,7 | 589,3 | | 195,3 | 206,6 | 310,4 | 223,1 | 297,7 | **141,5** | 589,3 |
| **117** | 84,0 | 89,9 | 92,1 | 102,9 | 371,9 | 79,6 | | 175,7 | 611,1 | | 214,0 | 213,9 | 318,4 | 231,8 | 315,1 | 148,2 | 611,1 |
| **118** | 84,7 | 91,1 | 94,1 | 106,6 | 428,8 | 80,0 | | 187,7 | 315,7 | | 234,7 | 239,0 | 345,2 | 246,9 | 350,6 | 161,1 | 428,8 |
| **119** | 85,4 | 92,2 | 95,7 | 111,4 | 461,5 | 80,5 | | 200,0 | 300,2 | | 257,4 | 277,6 | 382,4 | 264,8 | 399,0 | 169,2 | 461,5 |
| **120** | 85,1 | 92,8 | 97,4 | 116,8 | 469,7 | 80,7 | | 214,2 | 295,1 | | 283,0 | 224,6 | 413,0 | 275,7 | 399,5 | 172,4 | 469,7 |
| **121** | 87,1 | 98,3 | 99,5 | 121,7 | 492,6 | 81,6 | | 228,9 | 203,9 | | 311,9 | 148,6 | 434,4 | 287,9 | 400,5 | 179,8 | 492,6 |

* failure of thermocouple

Negative values are quoted because temperature rises are calculated from the initial average temperature of the specimen surface.

**T41 - T45** Thermocouples distributed for average and maximum temperature rise evaluation

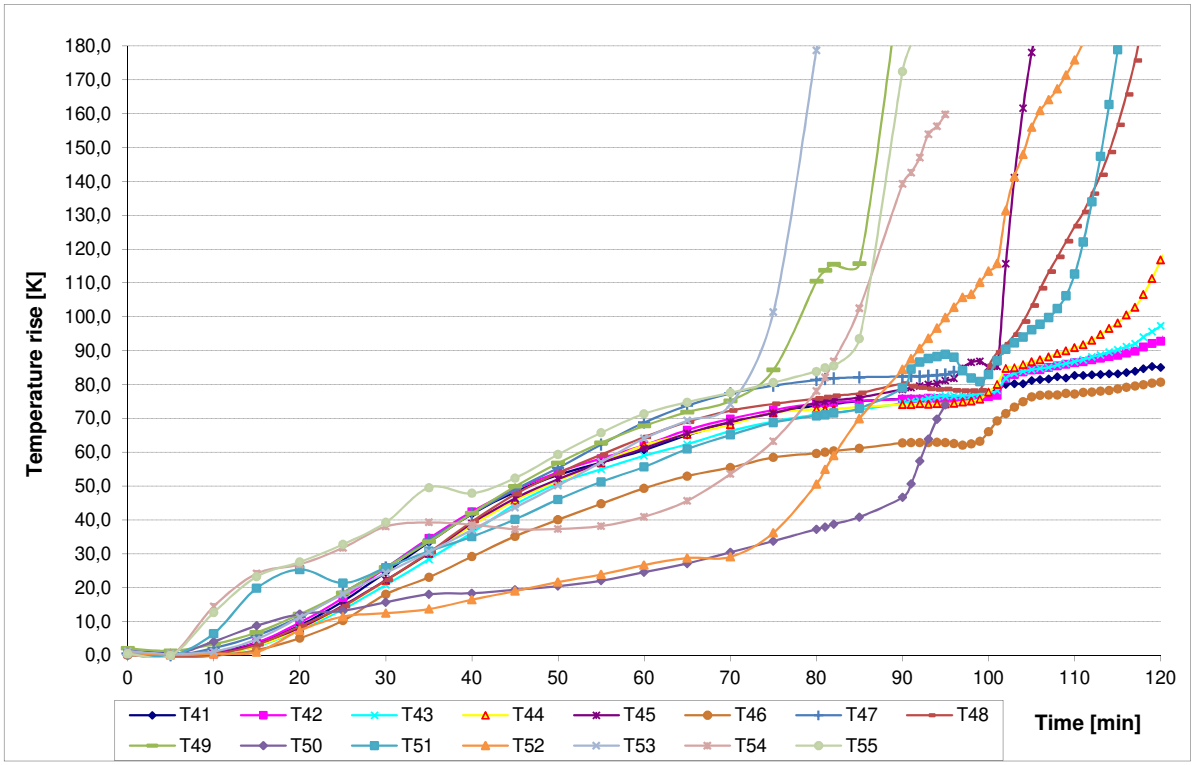
**T46 - T55** Thermocouples distributed for maximum temperature rise evaluation

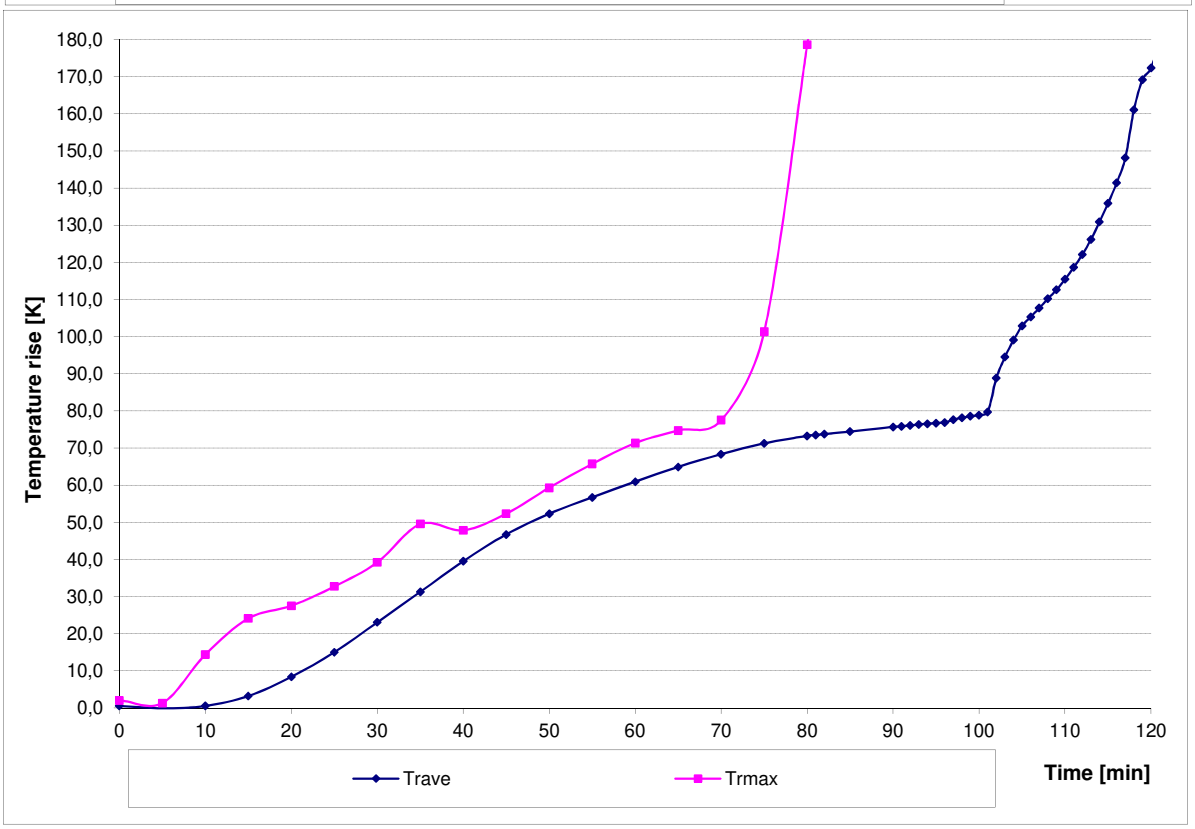
**TRave** average temperature rise above initial average temperature calculated from T41-T45

**TRmax** maximal temperature rise above initial average temperature calculated from T41-T55

**Please see figure showing the layout of measuring points on the specimen surface which is a part of this test report**

## Measured and calculated values from measured values on the specimen surface - specimen No. 1 /graph



## Measured and calculated values from measured values on the specimen surface - specimen No. 4

**The initial average temperature of the unexposed specimen surface: 15,4 °C**

| Time | Temperature rise [K] | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| t [min] | T56 | T57 | T58 | T59 | T60 | T61 | T62 | T63 | T64 | T65 | T66 | TRave | TRmax |
| **0** | 1,4 | 1,7 | 0,9 | 0,3 | 0,6 | -0,1 | 0,1 | 1,3 | 0,6 | 2,0 | 0,6 | 1,0 | 2,0 |
| **5** | 0,5 | 0,9 | 0,2 | -0,5 | -0,2 | 0,1 | -0,6 | 0,6 | -0,1 | 1,1 | -0,2 | 0,2 | 1,1 |
| **10** | 1,0 | 1,0 | 0,3 | -0,3 | 0,0 | 0,6 | -0,2 | 0,6 | 0,0 | 1,3 | 0,0 | 0,4 | 1,3 |
| **15** | 7,1 | 3,8 | 5,0 | 5,4 | 1,8 | 1,3 | 0,4 | 0,9 | 0,5 | 1,8 | 0,1 | 4,6 | 7,1 |
| **20** | 27,8 | 21,1 | 21,4 | 25,0 | 17,2 | 2,7 | 2,3 | 2,6 | 4,8 | 23,5 | 5,0 | 22,5 | 27,8 |
| **25** | 44,0 | 40,6 | 39,2 | 40,8 | 37,1 | 4,5 | 6,7 | 4,8 | 12,4 | 32,4 | 18,1 | 40,3 | 44,0 |
| **30** | 52,2 | 52,7 | 50,5 | 49,8 | 49,4 | 6,6 | 12,7 | 6,3 | 21,6 | 40,5 | 31,2 | 50,9 | 52,7 |
| **35** | 55,1 | 56,3 | 53,8 | 52,5 | 53,8 | 7,9 | 19,7 | 7,7 | 29,3 | 46,1 | 42,4 | 54,3 | 56,3 |
| **40** | 53,7 | 54,5 | 52,3 | 51,1 | 52,5 | 9,5 | 25,8 | 8,7 | 35,1 | 47,4 | 46,6 | 52,8 | 54,5 |
| **45** | 53,3 | 53,0 | 50,6 | 50,3 | 51,1 | 9,8 | 28,4 | 9,7 | 37,6 | 47,7 | 50,5 | 51,7 | 53,3 |
| **50** | 53,7 | 52,9 | 50,2 | 50,5 | 50,8 | 10,2 | 30,5 | 11,2 | 38,9 | 48,5 | 53,3 | 51,6 | 53,7 |
| **55** | 55,1 | 53,3 | 50,9 | 51,6 | 50,8 | 10,9 | 32,7 | 12,7 | 40,6 | 50,0 | 55,0 | 52,3 | 55,1 |
| **60** | 56,8 | 54,6 | 51,8 | 52,9 | 52,0 | 11,4 | 34,7 | 14,5 | 42,2 | 48,9 | 55,8 | 53,6 | 56,8 |
| **65** | 59,0 | 55,6 | 52,6 | 54,9 | 52,7 | 12,6 | 36,9 | 15,7 | 43,6 | 48,6 | 56,4 | 55,0 | 59,0 |
| **70** | 60,8 | 57,2 | 53,5 | 56,6 | 53,8 | 13,7 | 38,4 | 17,3 | 44,9 | 49,3 | 57,0 | 56,4 | 60,8 |
| **75** | 62,5 | 58,6 | 54,4 | 58,3 | 55,1 | 14,0 | 40,2 | 18,8 | 46,0 | 49,1 | 57,2 | 57,8 | 62,5 |
| **80** | 63,7 | 60,1 | 55,3 | 59,4 | 56,4 | 14,5 | 42,3 | 20,2 | 47,1 | 49,2 | 57,3 | 59,0 | 63,7 |
| **81** | 64,0 | 60,0 | 55,5 | 59,7 | 56,7 | 14,9 | 42,6 | 20,4 | 47,3 | 49,9 | 57,3 | 59,2 | 64,0 |
| **82** | 64,2 | 60,6 | 55,7 | 59,8 | 57,1 | 15,0 | 43,0 | 20,8 | 47,5 | 49,5 | 57,4 | 59,5 | 64,2 |
| **85** | 64,8 | 61,3 | 56,5 | 60,3 | 57,9 | 15,2 | 44,0 | 21,6 | 48,3 | 48,4 | 57,4 | 60,2 | 64,8 |
| **90** | 65,7 | 62,5 | 57,2 | 61,1 | 59,0 | 15,8 | 45,6 | 23,3 | 49,3 | 47,7 | 57,6 | 61,1 | 65,7 |
| **91** | 65,8 | 62,8 | 57,5 | 61,1 | 59,3 | 16,1 | 46,1 | 23,5 | 49,4 | 47,6 | 57,4 | 61,3 | 65,8 |
| **92** | 66,2 | 62,9 | 57,8 | 61,5 | 59,4 | 16,1 | 46,4 | 23,7 | 49,6 | 47,3 | 57,4 | 61,6 | 66,2 |
| **93** | 66,6 | 63,1 | 57,9 | 61,6 | 59,5 | 16,5 | 46,7 | 24,0 | 49,8 | 47,7 | 57,4 | 61,7 | 66,6 |
| **94** | 66,7 | 63,2 | 57,9 | 62,0 | 59,6 | 16,6 | 46,9 | 24,4 | 50,2 | 46,7 | 57,5 | 61,9 | 66,7 |
| **95** | 66,8 | 63,5 | 58,2 | 62,2 | 59,7 | 16,7 | 47,2 | 24,7 | 50,2 | 46,7 | 57,5 | 62,1 | 66,8 |
| **96** | 67,0 | 63,8 | 58,3 | 62,3 | 59,8 | 16,7 | 47,7 | 25,0 | 50,2 | 46,9 | 57,4 | 62,2 | 67,0 |
| **97** | 67,1 | 63,9 | 58,4 | 62,4 | * | 17,0 | 48,1 | * | 50,9 | 46,4 | 57,5 | 63,0 | 67,1 |
| **98** | 67,2 | 64,4 | 58,5 | 62,6 | | 17,0 | 48,3 | | 51,2 | 46,0 | 57,5 | 63,2 | 67,2 |
| **99** | 67,6 | 64,6 | 58,8 | 63,0 | | 17,1 | 48,6 | | 51,2 | 45,4 | 57,5 | 63,5 | 67,6 |
| **100** | 67,7 | 64,6 | 58,9 | 63,1 | | 17,2 | 48,8 | | 51,5 | 45,0 | 57,5 | 63,6 | 67,7 |
| **101** | 67,8 | 64,7 | 58,9 | 63,1 | | 17,8 | 49,0 | | 52,0 | 43,3 | 57,4 | 63,6 | 67,8 |
| **102** | 68,1 | 65,0 | 59,0 | 63,6 | | 17,8 | 50,2 | | 53,9 | 42,7 | 57,4 | 63,9 | 68,1 |
| **103** | 68,2 | 65,1 | 59,1 | 63,9 | | 17,9 | 51,0 | | 54,2 | 40,7 | 57,3 | 64,1 | 68,2 |
| **104** | 68,0 | 65,2 | 59,2 | 64,2 | | 18,0 | 51,6 | | 54,7 | 40,7 | 57,6 | 64,2 | 68,0 |
| **105** | 68,4 | 65,3 | 59,3 | 64,4 | | 18,1 | 52,1 | | 54,8 | 38,1 | 57,5 | 64,4 | 68,4 |
| **106** | 68,3 | 65,6 | 59,4 | 64,4 | | 18,3 | 51,8 | | 53,9 | 37,7 | 57,4 | 64,4 | 68,3 |
| **107** | 68,7 | 65,5 | 59,5 | 64,5 | | 18,5 | 51,9 | | 53,8 | 37,6 | 57,4 | 64,6 | 68,7 |
| **108** | 68,7 | 65,8 | 59,8 | 64,3 | | 18,5 | 52,2 | | 53,8 | 36,7 | 57,4 | 64,7 | 68,7 |
| **109** | 68,9 | 66,0 | 59,8 | 64,5 | | 18,6 | 52,2 | | 53,8 | 36,4 | 57,5 | 64,8 | 68,9 |
| **110** | 69,2 | 66,1 | 59,9 | 64,8 | | 18,8 | 52,4 | | 53,9 | 35,3 | 57,6 | 65,0 | 69,2 |
| **111** | 69,3 | 66,3 | 60,1 | 65,0 | | 18,9 | 52,6 | | 54,2 | 34,5 | 57,7 | 65,2 | 69,3 |
| **112** | 69,4 | 66,1 | 60,1 | 65,0 | | 18,9 | 52,7 | | 54,2 | 35,2 | 58,0 | 65,2 | 69,4 |
| **113** | 69,6 | 66,4 | 60,2 | 65,4 | | 19,0 | 53,0 | | 54,4 | 34,6 | 58,0 | 65,4 | 69,6 |
| **114** | 69,7 | 66,7 | 60,5 | 65,5 | | 19,3 | 53,0 | | 54,4 | 34,8 | 58,0 | 65,6 | 69,7 |
| **115** | 69,7 | 66,8 | 60,5 | 65,6 | | 19,6 | 53,3 | | 54,6 | 35,3 | 58,2 | 65,7 | 69,7 |
| **116** | 69,9 | 67,0 | 60,5 | 65,7 | | 19,7 | 53,5 | | 54,8 | 34,5 | 58,3 | 65,8 | 69,9 |
| **117** | 69,8 | 67,1 | 60,7 | 66,0 | | 20,0 | 53,7 | | 54,8 | 34,6 | 58,6 | 65,9 | 69,8 |
| **118** | 70,1 | 67,0 | 60,6 | 66,3 | | 20,2 | 53,9 | | 54,9 | 33,7 | 58,5 | 66,0 | 70,1 |
| **119** | 70,3 | 67,2 | 60,9 | 66,4 | | 20,3 | 54,2 | | 55,2 | 34,0 | 58,8 | 66,2 | 70,3 |
| **120** | 70,5 | 67,4 | 61,0 | 66,7 | | 20,9 | 54,3 | | 55,6 | 33,5 | 58,8 | 66,4 | 70,5 |
| **121** | 70,8 | 67,4 | 61,1 | 67,1 | | 21,5 | 54,8 | | 55,8 | 33,0 | 58,8 | 66,6 | 70,8 |

* failure of thermocouple

Negative values are quoted because temperature rises are calculated from the initial average temperature of the specimen surface.

**T56 - T60** Thermocouples distributed for average and maximum temperature rise evaluation

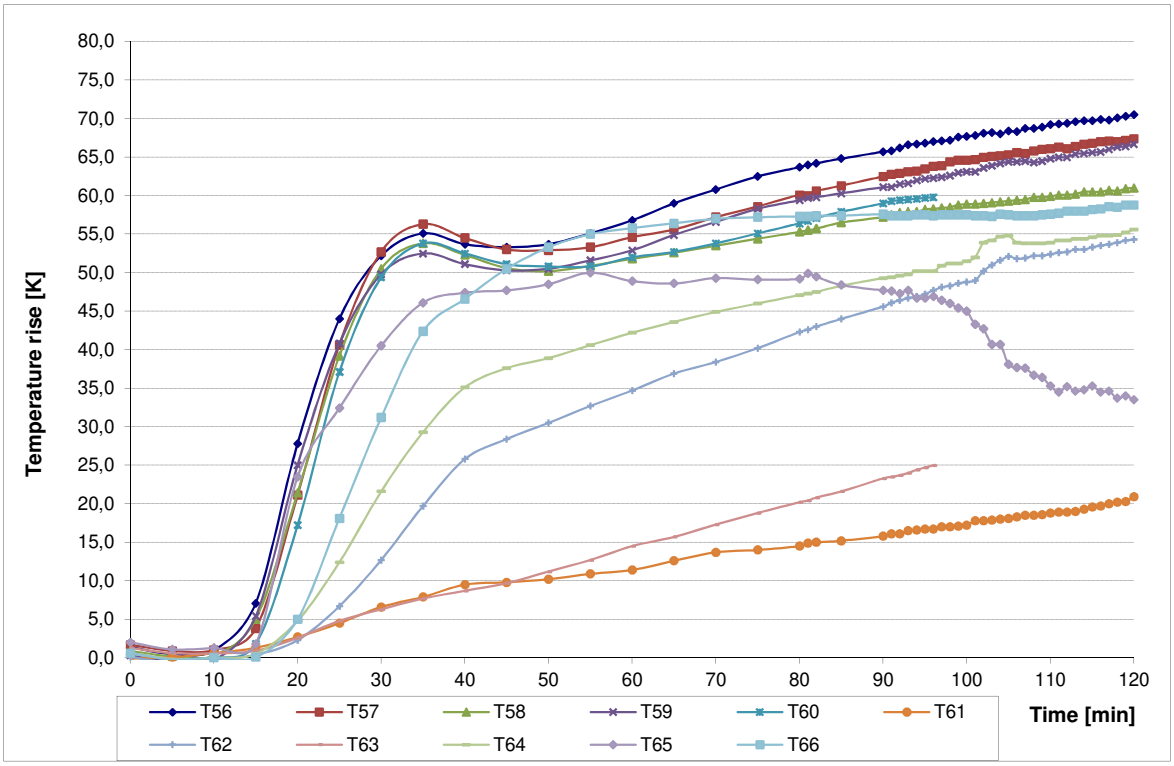
**T57 - T66** Thermocouples distributed for maximum temperature rise evaluation

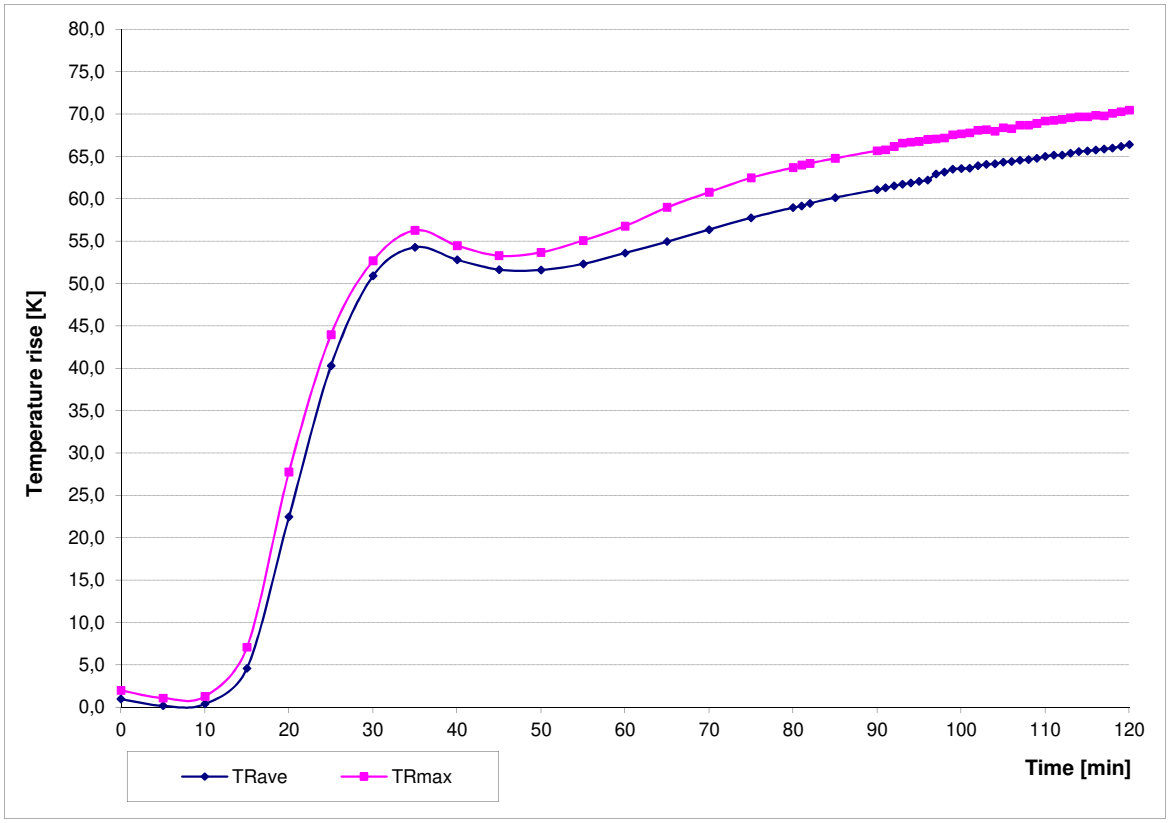
**TRave** average temperature rise above initial average temperature calculated from T56-T60

**TRmax** maximal temperature rise above initial average temperature calculated from T56-T66

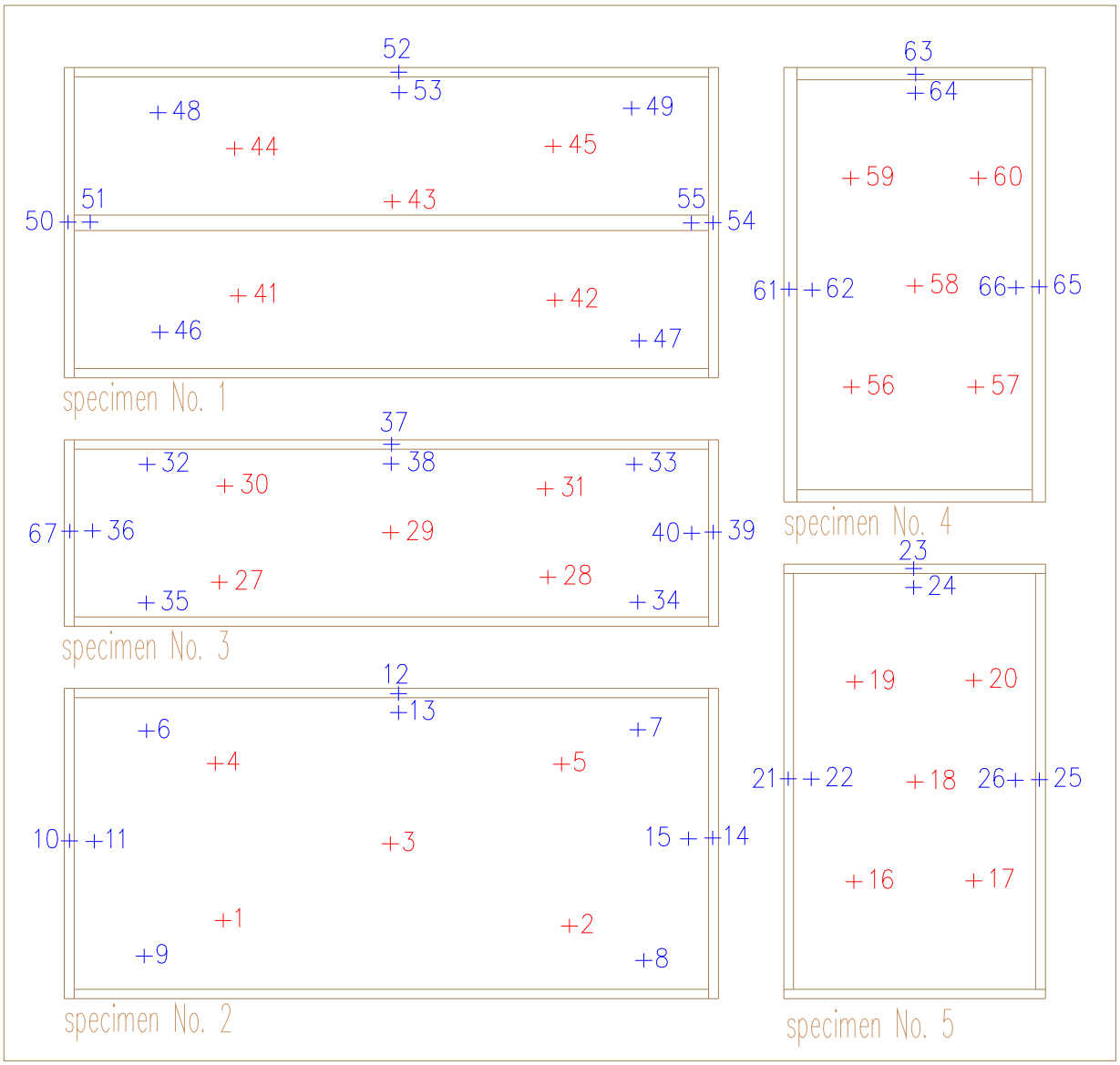
**Please see figure showing the layout of measuring points on the specimen surface which is a part of this test report**

## Measured and calculated values from measured values on the specimen surface - specimen No. 4 /graph



## Layout of measuring points on the unexposed specimen surface




+ thermocouples for evaluation of maximum temperature

+ thermocouples for evaluation of average and maximum temperature

**PHOTOS TAKEN DURING THE TEST**

Exposed specimens face before the test commencement.

15th minute of the test

30th minute of the test

**PHOTOS TAKEN DURING THE TEST**

45th minute of the test

60th minute of the test

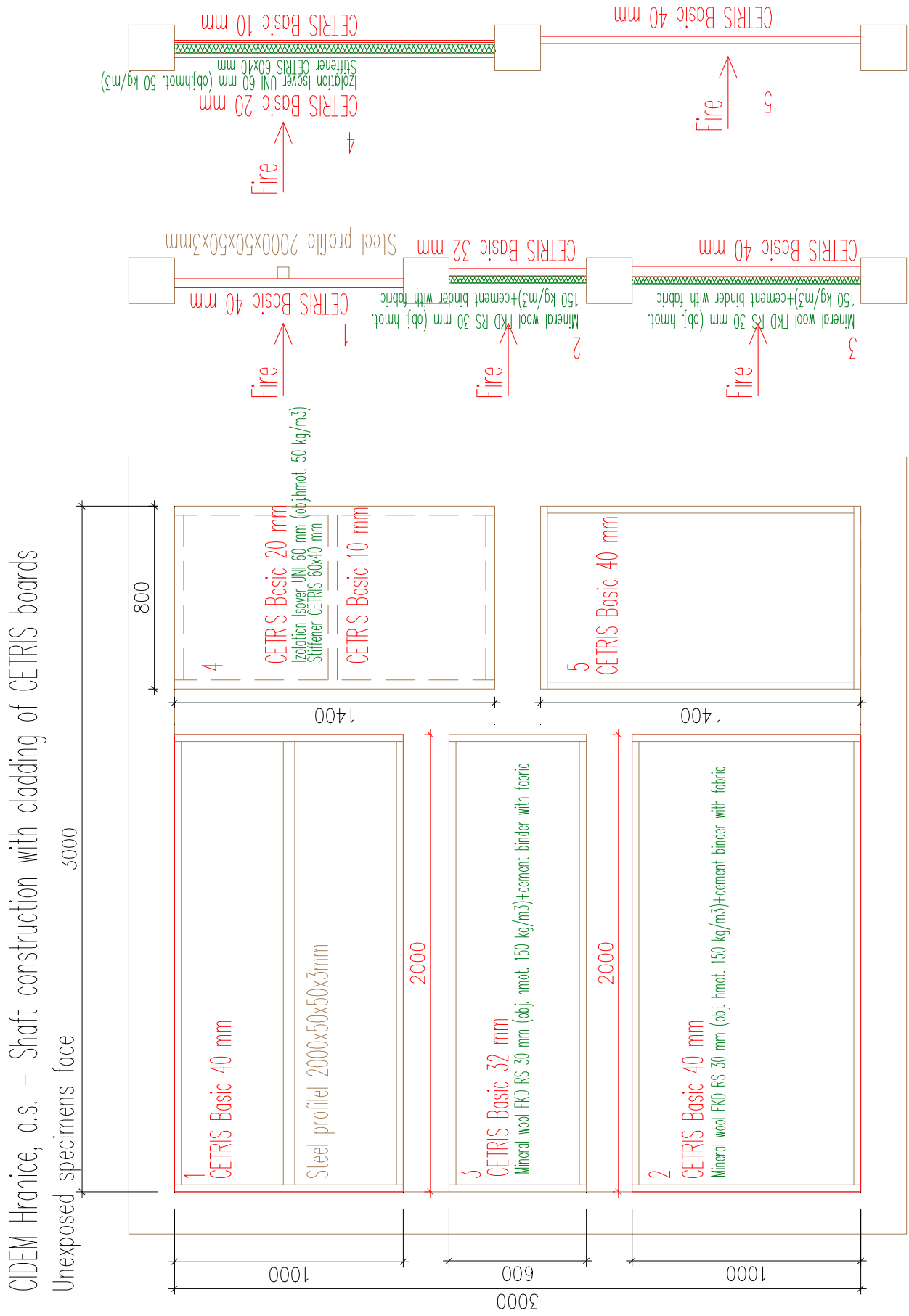
90th minute of the test

**PHOTOS TAKEN DURING THE TEST**

120th minute of the test

View of the exposed test specimens face after test.

**Drawing**


CIDEM Hranice, a.s. – Shaft construction with cladding of CETRIS boards
Unexposed specimens face
3000
800
1400
1400
1000
600
1000
3000
2000
2000
1
CETRIS Basic 40 mm
Steel profile 2000x50x50x3mm
2
CETRIS Basic 40 mm
Mineral wool FKD RS 30 mm (obj. hmot. 150 kg/m3)+cement binder with fabric
3
CETRIS Basic 32 mm
Mineral wool FKD RS 30 mm (obj. hmot. 150 kg/m3)+cement binder with fabric
4
CETRIS Basic 20 mm
Izolation Isover UNI 60 mm (obj.hmot. 50 kg/m3)
Stiffener CETRIS 60x40 mm
CETRIS Basic 10 mm
5
CETRIS Basic 40 mm
Fire
Fire
Fire
Fire
Fire

## 8. FINAL PROVISION

- This report details the method of construction, the test conditions and results obtained when the specific element of construction described herein was following the procedure outlined in EN 1363-1, and where appropriate EN 1363-2. Any significant deviation with respect to size, constructional details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report.
- Because of the nature of the fire resistance testing and consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.
- The test results refer only to the tested subjects. This test report is not an approval of the tested product by the test laboratory or the accreditation body overseeing the laboratory's activities. The test was carried out on testing equipment that is the property of FIRES, s.r.o., Batizovce. Without the written permission of the test laboratory this test report may be copied and/or distributed only as the whole. Any modifications of the test report can be made only by the fire resistance test laboratory FIRES, s.r.o., Batizovce.

Approved by:

Prepared by:

Ing. Štefan Rástocký
leader of the testing laboratory

Martin Kráľ
technician of the testing laboratory

## 9. NORMATIVE REFERENCES

| | |
|---|---|
| EN 1364-1: 2015 | Fire resistance tests for non-loadbearing elements - Part 1: Walls |
| EN 1363-1: 2020 | Fire resistance tests. Part 1: General requirements |
| EN 1363-2: 1999 | Fire resistance tests. Part 2: Alternative and additional procedures |

**THE END OF THE TEST REPORT**