

TEST REPORT FIRES-FR-031-17-AUNE

Horizontal fire resistant shutter with loft ladder, type EI60 - 66mm/18mm
Horizontal fire resistant shutter with loft ladder, type EI60 - 66mm/32mm

This is an electronic version of a test report which was made as a copy of test report officially issued in a paper form. The electronic version of a test report shall be used only for informative purposes. Any information listed in this test report is the property of the sponsor and shall not be used or published without written permission. Contents of this file may only be modified by the editor i.e. Testing laboratory FIRES s.r.o. Batizovce. Sponsor is allowed to publish this test report in parts only with written permission of the editor.



TEST REPORT

FIRES-FR-031-17-AUNE

Tested property: Fire resistance
Test method: EN 1634-1:2014
Type of test: Accredited / Notified (NB 1396)
Date of issue: 23. 02. 2017

Name of the product: Horizontal fire resistant shutter with loft ladder, type EI60 - 66mm/18mm
Horizontal fire resistant shutter with loft ladder, type EI60 - 66mm/32mm

Manufacturer: OMAN Sp. z o.o., ul. Zamkowa 11, 47-400 Racibórz, Poland
Sponsor: OMAN Sp. z o.o., ul. Zamkowa 11, 47-400 Racibórz, Poland

Test carried out by: FIRES, s.r.o., Testing laboratory
Task No.: PR-16-0500
Specimens received: 17. 01. 2017
Date of the test: 02. 02. 2017

Technician responsible for the technical side of this report: Ing. Miroslav Hudák

Number of pages: 35
Test reports: 3

Copy No.: 2

Distribution list:

Copy No. 1 FIRES, s. r. o., Osloboditeľov 28 2, 059 35 Batizovce, Slovak Republic
(electronic version)
Copy No. 2 OMAN Sp. z o.o., ul. Zamkowa 11, 47-400 Racibórz, Poland
(electronic version)
Copy No. 3 OMAN Sp. z o.o., ul. Zamkowa 11, 47-400 Racibórz, Poland

This report includes accreditation mark SNAS with additional mark ILAC-MRA. SNAS is signatory of ILAC-MRA, Mutual recognition agreement (of accreditation), which is focused on promoting of international acceptance of accredited laboratory data and reducing technical barriers to trade, such as the retesting of products on markets of signatories. More information about ILAC-MRA is on www.ilac.org. Signatories of ILAC-MRA are e.g. SNAS (Slovakia), CAI (Czech Republic), PCA (Poland), DakKS (Germany) or BMWA (Austria). Up to date list of ILAC-MRA signatories is on <http://ilac.org/ilac-mra-and-signatories/>. FIRES, s.r.o. Batizovce is full member of EGOLF also, more information www.egolf.org.uk. Test reports issued by FIRES, s.r.o. are valid in United Arab Emirates based on list of laboratories approved by United Arab Emirates Ministry of Interior Civil Defence (up-to-date list is available on: www.dcd.gov.ae/eng/).



1. INTRODUCTION

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

Deviation from standard EN 1634-1:2014: horizontal shutters are out of the scope of the standard. Testing laboratory choose this standard as a most suitable test method for this specimens.

Sponsor's representatives witnessing the test:

| | |
|-------------------|-----------------|
| Stanisław Bedryj | OMAN Sp. z o.o. |
| Daniel Krakowczyk | OMAN Sp. z o.o. |

| | |
|------------------------------|---|
| test carried out by operator | Ing. Miroslav Hudák Bc. Dávid Šubert |
|------------------------------|---|

2. MEASURING EQUIPMENT

| Identification number | Measuring equipment | Note |
|-----------------------|--|---|
| F 90 002 | Horizontal 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 71 008, F 71 009 | Transducer of differential pressure (- 50 to + 150) Pa | pressure inside the test furnace |
| F 54 054 | Digital calliper (0 to 150) mm | - |
| F 54 051 | Racking meter | - |
| F 73 002 | Suspension load 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 60 013 | Sensors of temperature and relative air humidity | climatic conditions measuring |
| F 13 511 - F 13 518 | Plate thermometers | temperature inside the test furnace, according to EN 1363-1 |
| F 13 002 - F 13 200 | Unsheathed thermocouples type K 2 x Ø 0,5 mm | temperatures on the unexposed surface of the specimen |
| F 13 701 | Sheathed thermocouple type K Ø 3 mm | ambient temperature |
| F 13 001 | Roving thermocouple | - |
| F 90 005 | Gap gauge for fire resistance testing Ø 25 mm | - |
| F 90 006 | Gap gauge for fire resistance testing Ø 6 mm | - |
| F 90 007 | Frame for supporting the cotton pad (100 x 100) mm for fire resistance tests | - |
| F 57 002 | Digital stop-watch | - |



3. PREPARATION OF THE SPECIMENS

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

| | |
|---------------------|---|
| Place of production | OMAN Factory No. 1, ul. Gamowska 3a, Pawłów, 47-480 Pietrowice Wielkie, Poland |
| Production number | Specimen No. 1 - 012017, Specimen No. 2 - 022017 |
| Date of production | 09. 01. 2017 |
| Date of check out | 10. 01. 2017 |

Specimens were delivered to the testing laboratory in complete state by test sponsor. Installation of the specimens to the supporting construction was carried out by workers of the sponsor.

4. PREPARATION OF THE TEST

4.1 DESCRIPTION OF THE SPECIMENS STRUCTURE

Two specimens of horizontal fire resistant shutter, specimen No. 1 Horizontal fire resistant shutter with loft ladder, type EI60 - 66mm/18mm and specimen No. 2 Horizontal fire resistant shutter with loft ladder, type EI60 - 66mm/32mm were used for fire resistance test.

Specimen No. 1



Dimensions

| | |
|-------------------------------|---|
| Overall dimensions of shutter | (1250 x 700) mm (height x width) |
| Dimensions of shutter leaf | (678 x 1228 x 66) mm (width x height x thickness) |
| Dimensions of shutter opening | (1214 x 664) mm (height x width) |
| Weight of shutter | 17,3 kg (measured in testing laboratory) |

Shutter frame

Frame of specimen is made of timber slabs, with dimensions (170 x 18) mm (width x thickness) with bulk density 520 kg.m⁻³ (manufacturer: OMAN Sp. Z o. o., Poland).

Dimensions of rebate (10 x 23) mm with milled groove (3,2 x 7) mm for sealing gasket, type S7442 (manufacturer: Inter-Deventer Sp. z o.o., Poland), around perimeter of the shutter frame.

Construction of shutter leaf

Frame of shutter leaf

Frame of shutter leaf is made of timber slabs, with dimensions (50 x 60) mm (width x thickness) with bulk density 520 kg.m⁻³ (manufacturer: OMAN Sp. Z o. o., Poland). Dimensions of rebate (10 x 48) mm. Around perimeter of the shutter leaf frame is two milled grooves, one groove for intumescent tape with



dimensions (20 x 2) mm and one groove for sealing gasket with dimensions (3 x 8) mm, type S6782 (manufacturer: Inter-Deventer Sp. z o.o., Poland).

Core of shutter leaf

Mineral wool board, type Rocklit 150, 60 mm thick, with bulk density $>150 \text{ kg.m}^{-3}$ (manufacturer: Rockwool Polska Sp. zo.o., Poland).

Casing of shutter leaf

Construction of the shutter leaf including the core is covered from both faces by layer of HDF board, type LHDF 3, 3 mm thick, with bulk density 800 kg.m^{-3} (manufacturer: Kronospan Szczecinek Sp.z o.o., Poland).

Intumescent tape

Intumescent tape (20 x 2) mm (width x thickness), type Promaseal LFC SK (manufacturer: Promat GmbH) is placed in milled groove around perimeter of shutter leaf frame.



Hinges

Lever mechanism with spring, type 66mm/16mm (manufacturer: OMAN Sp. Z o. o., Poland).

Ladder

Shutter ladder type 11 (manufacturer: OMAN Sp. Z o. o., Poland) placed on shutter leaf surface from top side.



Static load was applied on specimen No. 1 surface by means of loft ladder of total weight 13,2 kg before and during the fire test.



Specimen No. 2



Dimensions

| | |
|-------------------------------|---|
| Overall dimensions of shutter | (1240 x 1040) mm (height x width) |
| Dimensions of shutter leaf | (990 x 1190 x 66) mm (width x height x thickness) |
| Dimensions of shutter opening | (1176 x 976) mm (height x width) |
| Weight of shutter | 23,7 kg (measured in testing laboratory) |

Shutter frame

Frame of specimen is made of timber slabs, with dimensions (180 x 32) mm (width x thickness) with bulk density 520 kg.m⁻³ (manufacturer: OMAN Sp. Z o. o., Poland).

Dimensions of rebate (10 x 35) mm with milled groove (3,2 x 7) mm for sealing gasket, type S7442 (manufacturer: Inter-Deventer Sp. z o.o., Poland), around perimeter of the shutter frame.

Construction of shutter leaf

Frame of shutter leaf

Frame of shutter leaf is made of timber slabs, with dimensions (50 x 60) mm (width x thickness) with bulk density 520 kg.m⁻³ (manufacturer: OMAN Sp. Z o. o., Poland). Dimensions of rebate (12 x 36) mm. Around perimeter of the shutter leaf frame is two milled grooves with dimensions (20 x 2) mm, both grooves are for intumescent tapes.

Core of shutter leaf

Mineral wool board, type Rocklit 150, 60 mm thick, with bulk density >150 kg.m⁻³ (manufacturer: Rockwool Polska Sp. zo.o., Poland).

Casing of shutter leaf

Construction of the shutter leaf including the core is covered from both faces by layer of HDF board, type LHDF 3, 3 mm thick, with bulk density 800 kg.m⁻³ (manufacturer: Kronospan Szczecinek Sp.z o.o., Poland).

Intumescent tape

Two Intumescent tapes (20 x 2) mm (width x thickness), type Promaseal LFC SK (manufacturer: Promat GmbH) are placed in milled grooves around perimeter of shutter leaf frame.





Hinges

Lever mechanism with spring, type 66mm/32mm (manufacturer: OMAN Sp. Z o. o., Poland).



Static load was applied on specimen No. 2 surface by means of weight of total weight 12,0 kg before and during the fire test.

More detailed information about construction of specimens is shown in the drawings which form an integral part of this test report. Drawings were delivered by 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 of the specimens verification. Parameters which were verified are quoted in paragraph 4.3.

4.2 DESCRIPTION OF THE SPECIMENS FIXATION

Specimens were fixed to horizontal test furnace in horizontal position; in ceiling construction made of aerated concrete blocks, 150 mm thick and with bulk density 613 kg.m^{-3} .

Both specimens were fixed to supporting construction by means of steel crews ($\text{Ø}6 \times 80$) mm, maximum distance 400 mm.

Gap between shutter frame and supporting construction is filled by mineral wool with bulk density 60 kg.m^{-3} and sealed from exposed side by PROMASEAL[®]-A (manufacturer: Promat GmbH).

Number of anchoring points and their location are shown in the drawings.

Orientation of the specimens during the test

| | |
|-----------------------|--|
| Specimen No. 1 | opening of shutter towards test furnace (<i>fire from bottom side</i>) |
| Specimen No. 2 | opening of shutter towards test furnace (<i>fire from bottom side</i>) |

Supporting construction, its thickness, orientation of the specimens and type of specimens fixing to the supporting construction was chosen by the sponsor of the test.

4.3 VERIFICATION OF THE SPECIMENS

The conformity of the drawings and the test specimens was verified before and after the fire resistance test. It was possible to carry out this verification on the test specimens. The specimens corresponded to the drawings which are part of this test report. The visual review of the test specimens, the used materials as well as the size verification (basic dimensions) and also the way of specimens fixation to supporting construction were subject of this verification.



4.4 CLIMATIC CONDITIONING OF THE SPECIMENS

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

Ambient air temperature [°C]

| | |
|--------------------|------|
| mean | 19,3 |
| standard deviation | 1,1 |

Relative air humidity [%]

| | |
|--------------------|------|
| mean | 42,2 |
| standard deviation | 1,5 |

The humidity equilibrium state of test specimens was determined by repetitive balancing of specimens. The humidity equilibrium state of test specimens was achieved.

4.5 PRE-TEST CONDITIONING OF THE SPECIMENS

The test specimens were submitted to mechanical testing according EN 16034 Annex A before fire resistance test.

Operability test according EN 16034 A.2.2: 25 cycles (opening from fully closed position to maximum possible opening position and closing back to fully closed position).

Gap measurement: Measured values of gaps around the perimeter of leaves of shutters:

Specimen No. 1

| Measured values "a" [mm] | | | Mean [mm] | Maximum [mm] |
|--------------------------|----------|---------|-----------|--------------|
| 1 : 4,7 | 2 : 5,2 | 3 : 5,5 | 5,1 | 5,5 |
| 4 : 5,8 | 5 : 6,0 | | 5,9 | 6,0 |
| 6 : 4,3 | 7 : 4,8 | 7 : 5,3 | 4,8 | 5,3 |
| 9 : 4,1 | 10 : 4,4 | | 4,3 | 4,4 |

| Measured values "b" [mm] | | | Mean [mm] | Maximum [mm] |
|--------------------------|----------|---------|-----------|--------------|
| 1 : 3,5 | 2 : 3,9 | 3 : 4,0 | 3,8 | 4,0 |
| 4 : 2,1 | 5 : 2,5 | | 2,3 | 2,5 |
| 6 : 2,4 | 7 : 2,1 | 8 : 1,8 | 2,1 | 2,4 |
| 9 : 2,2 | 10 : 2,5 | | 2,4 | 2,5 |

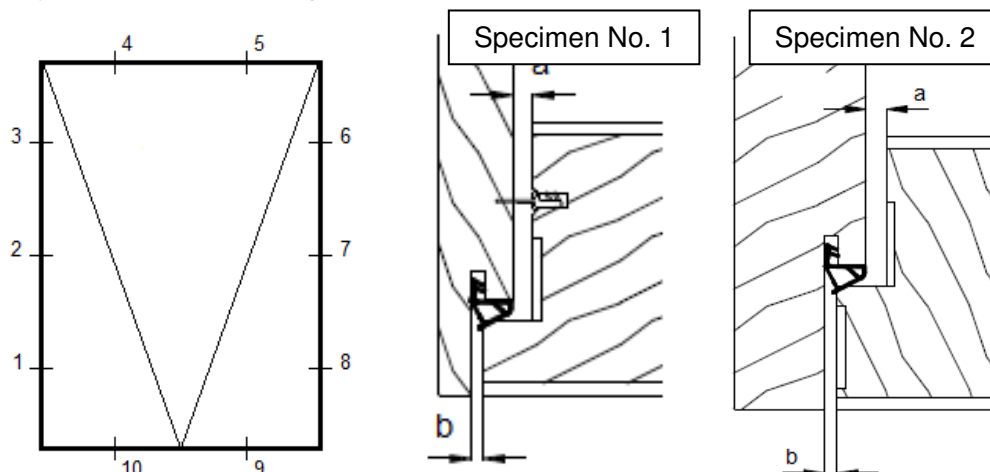
Specimen No. 2

| Measured values "a" [mm] | | | Mean [mm] | Maximum [mm] |
|--------------------------|----------|---------|-----------|--------------|
| 1 : 4,4 | 2 : 4,1 | 3 : 3,8 | 4,1 | 4,4 |
| 4 : 4,0 | 5 : 4,7 | | 4,4 | 4,7 |
| 6 : 5,0 | 7 : 5,5 | 7 : 5,9 | 5,5 | 5,9 |
| 9 : 4,2 | 10 : 4,6 | | 4,4 | 4,6 |

| Measured values "b" [mm] | | | Mean [mm] | Maximum [mm] |
|--------------------------|----------|---------|-----------|--------------|
| 1 : 1,8 | 2 : 2,2 | 3 : 2,5 | 2,2 | 2,5 |
| 4 : 2,6 | 5 : 2,8 | | 2,7 | 2,8 |
| 6 : 3,6 | 7 : 3,4 | 8 : 3,0 | 3,3 | 3,6 |
| 9 : 3,2 | 10 : 3,0 | | 3,1 | 3,2 |



Layout of measurement points:



The retention force according to EN 1634-1 cl. 10.1.3 was measured on leaves of shutters before the fire test. Measured values before the test: specimen No. 1: 252,3 [N], specimen No. 2: 390,3 [N].

5. CARRYING OUT OF THE TEST

5.1 CONDITIONS OF THE TEST

Conditions in the test furnace (temperature – standard temperature/time curve, pressure, content of O₂) as well as in the testing room (ambient temperature) corresponded to EN 1363-1 during the test. Detailed information is part of this test report, or in record from the test.

Values characterizing environment in the testing room directly before the test:

| Relative air humidity [%] | Ambient air temperature [°C] |
|---------------------------|------------------------------|
| 41,8 | 20,8 |

5.2 RESULTS OF THE TEST

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

Specimen No. 1

| Time [min:s] | Face of specimen | Observation |
|--------------|------------------|--|
| 04:00 | ES | flaming of specimen surface; |
| 15:00 | NS | no significant changes visible; |
| 30:00 | NS | no significant changes visible; |
| 45:00 | NS | no significant changes visible; |
| 60:00 | NS | no significant changes visible; |
| 62:00 | NS | darkening of shutter frame all along perimeter of shutter leaf; |
| 70:00 | NS | extruding of intumescent tape around perimeter of shutter leaf; |
| 70:50 | NS | sustained flaming from shutter leaf edges - integrity failure ; |
| 71:20 | | termination of the test. |

Specimen No. 2

| Time [min:s] | Face of specimen | Observation |
|--------------|------------------|------------------------------|
| 04:00 | ES | flaming of specimen surface; |



| Time [min:s] | Face of specimen | Observation |
|--------------|------------------|--|
| 15:00 | NS | no significant changes visible; |
| 30:00 | NS | no significant changes visible; |
| 45:00 | NS | no significant changes visible; |
| 55:30 | NS | extruding of intumescent tape all along perimeter of shutter leaf; |
| 60:00 | NS | no further significant changes visible; |
| 61:50 | NS | sustained flaming from shutter leaf edges - integrity failure ; |
| 71:20 | | termination of the test. |

ES exposed face of specimen
NS unexposed face of specimen

6. CLOSING

Evaluation of the test:

Specimen No. 1

| Performance criterion | Time till the performance criterion is achieved |
|--|---|
| integrity – sustained flaming | 70 minutes |
| integrity – gap gauges Ø 6 mm and Ø 25 mm | 70 minutes no failure |
| integrity – cotton pad | 70 minutes |
| insulation – average temperature (140 K) | 70 minutes |
| insulation – maximal temperature (180 K) | 70 minutes |
| insulation – maximal temperature (supplementary procedure) (180 K) | 70 minutes |

Specimen No. 2

| Performance criterion | Time till the performance criterion is achieved |
|--|---|
| integrity – sustained flaming | 61 minutes |
| integrity – gap gauges Ø 6 mm and Ø 25 mm | 61 minutes no failure |
| integrity – cotton pad | 61 minutes |
| insulation – average temperature (140 K) | 61 minutes |
| insulation – maximal temperature (180 K) | 61 minutes |
| insulation – maximal temperature (supplementary procedure) (180 K) | 61 minutes |
| insulation – maximal temperature (shutter frame) (180 K / 360 K) | 61 minutes / 61 minutes |

The fire test was terminated in the 72nd minute. The test continued after the specimen No. 2 integrity failure in the 62nd minute at the request of test sponsor and was terminated after the specimen No. 1 integrity failure.

The performance criteria of insulation are automatically assumed not to be satisfied when the criterion of integrity ceases to be satisfied (acc. to clause 11.4.2 of EN 1363-1).

Regarding to low temperatures on unexposed specimens surface below 300 °C the performance criteria of radiation is to be complied as satisfied.

7. DIRECT APPLICATION OF TEST RESULTS

Direct field of application is valid in accordance with clause 13 of EN 1634-7: 2014. Validity of individual items of field of direct application shall be determined in classification process.

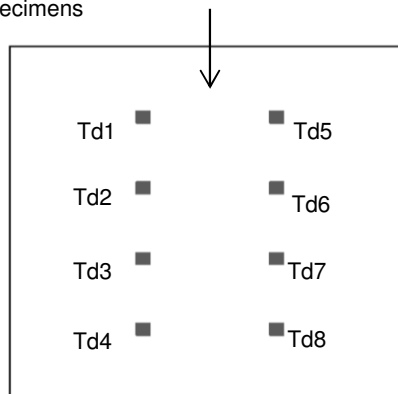


Measured values inside the test furnace

| Time t [min] | Temperature [°C] | | | | | | | | | | | Deviation | Pressure |
|-----------------|------------------|-------|--------|-------|-------|--------|--------|--------|-------|-------|------|--------------------|----------|
| | Td1 | Td2 | Td3 | Td4 | Td5 | Td6 | Td7 | Td8 | Tave | Tn | To | d _e [%] | p [Pa] |
| 0 | 18,5 | 17,7 | 16,6 | 17,6 | 18,5 | 19,7 | 19,4 | 20,1 | 18,5 | 20,0 | 17,2 | 0,0 | 0,0 |
| 5 | 569,8 | 596,6 | 579,8 | 584,7 | 557,5 | 560,6 | 552,3 | 557,0 | 569,8 | 576,0 | 17,2 | -7,1 | 18,9 |
| 10 | 673,1 | 662,9 | 673,0 | 668,8 | 655,4 | 678,6 | 690,7 | 682,2 | 673,1 | 678,0 | 17,2 | -6,6 | 19,7 |
| 15 | 752,2 | 739,8 | 756,2 | 747,9 | 725,7 | 759,5 | 771,7 | 764,6 | 752,2 | 739,0 | 17,6 | -3,8 | 17,5 |
| 20 | 786,2 | 779,5 | 789,5 | 780,7 | 761,9 | 794,3 | 801,9 | 795,8 | 786,2 | 781,0 | 17,7 | -2,5 | 17,5 |
| 25 | 829,8 | 822,2 | 838,8 | 842,6 | 800,5 | 833,6 | 852,6 | 850,7 | 833,9 | 815,0 | 18,0 | -1,7 | 18,4 |
| 30 | 847,8 | 843,8 | 844,3 | 841,6 | 833,9 | 855,6 | 858,8 | 856,9 | 847,8 | 842,0 | 18,2 | -1,3 | 17,8 |
| 35 | 865,9 | 865,1 | 864,0 | 858,3 | 851,6 | 872,4 | 875,8 | 874,3 | 865,9 | 865,0 | 18,3 | -1,0 | 17,9 |
| 40 | 882,1 | 880,8 | 876,1 | 872,0 | 872,0 | 891,6 | 891,4 | 890,5 | 882,1 | 885,0 | 18,4 | -0,9 | 17,0 |
| 45 | 906,6 | 904,3 | 897,2 | 898,2 | 895,0 | 915,5 | 917,4 | 918,3 | 906,6 | 902,0 | 18,7 | -0,7 | 18,3 |
| 50 | 913,4 | 912,0 | 898,0 | 903,3 | 923,0 | 943,9 | 937,9 | 935,8 | 920,9 | 918,0 | 18,7 | -0,6 | 17,6 |
| 51 | 914,7 | 912,8 | 896,9 | 903,4 | 917,9 | 938,3 | 933,1 | 930,8 | 918,5 | 921,0 | 18,7 | -0,6 | 19,7 |
| 52 | 916,3 | 913,6 | 907,7 | 908,1 | 906,4 | 927,1 | 928,4 | 927,6 | 916,9 | 924,0 | 18,7 | -0,6 | 19,5 |
| 53 | 917,0 | 914,1 | 908,5 | 909,1 | 908,5 | 929,3 | 929,3 | 928,8 | 918,1 | 927,0 | 18,7 | -0,6 | 19,3 |
| 54 | 918,2 | 915,4 | 904,0 | 916,4 | 911,7 | 934,3 | 937,2 | 936,5 | 921,7 | 930,0 | 18,7 | -0,6 | 18,8 |
| 55 | 922,2 | 916,5 | 898,3 | 915,7 | 912,0 | 942,0 | 928,0 | 926,5 | 920,2 | 932,0 | 18,7 | -0,7 | 17,5 |
| 56 | 925,9 | 921,0 | 915,8 | 919,8 | 913,0 | 934,9 | 938,5 | 938,6 | 925,9 | 935,0 | 18,7 | -0,7 | 19,5 |
| 57 | 927,2 | 925,3 | 920,4 | 929,0 | 917,8 | 940,4 | 944,2 | 944,3 | 931,1 | 938,0 | 18,8 | -0,7 | 19,3 |
| 58 | 931,6 | 925,3 | 911,1 | 885,7 | 900,1 | 953,8 | 957,4 | 957,0 | 927,8 | 940,0 | 18,8 | -0,7 | 20,0 |
| 59 | 935,6 | 930,5 | 915,5 | 906,4 | 906,3 | 949,9 | 968,4 | 972,1 | 935,6 | 943,0 | 18,8 | -0,7 | 18,1 |
| 60 | 938,8 | 930,6 | 898,3 | 924,3 | 929,9 | 959,8 | 964,6 | 964,3 | 938,8 | 945,0 | 18,8 | -0,7 | 18,9 |
| 61 | 943,3 | 932,1 | 921,2 | 906,6 | 945,7 | 961,3 | 967,4 | 968,6 | 943,3 | 948,0 | 18,8 | -0,7 | 17,2 |
| 62 | 954,0 | 944,9 | 936,8 | 941,1 | 919,6 | 959,0 | 984,7 | 991,9 | 954,0 | 950,0 | 18,8 | -0,7 | 17,1 |
| 63 | 958,1 | 948,7 | 941,0 | 958,7 | 933,4 | 966,4 | 977,4 | 981,0 | 958,1 | 953,0 | 18,8 | -0,6 | 19,5 |
| 64 | 963,9 | 952,0 | 918,9 | 979,5 | 943,7 | 967,9 | 990,2 | 994,9 | 963,9 | 955,0 | 18,9 | -0,6 | 17,1 |
| 65 | 965,1 | 954,3 | 957,7 | 972,0 | 935,4 | 967,9 | 982,2 | 986,3 | 965,1 | 957,0 | 19,1 | -0,6 | 18,0 |
| 66 | 966,6 | 954,7 | 968,4 | 977,5 | 938,0 | 973,5 | 988,8 | 988,9 | 969,6 | 960,0 | 19,1 | -0,5 | 17,6 |
| 67 | 967,5 | 955,7 | 944,1 | 969,8 | 954,5 | 976,1 | 978,3 | 987,7 | 966,7 | 962,0 | 19,2 | -0,5 | 19,2 |
| 68 | 970,0 | 957,5 | 955,1 | 978,4 | 935,2 | 969,8 | 986,1 | 990,6 | 967,8 | 964,0 | 19,2 | -0,5 | 17,1 |
| 69 | 970,8 | 963,4 | 949,1 | 940,7 | 993,4 | 1011,9 | 970,4 | 966,8 | 970,8 | 966,0 | 19,2 | -0,5 | 19,8 |
| 70 | 980,7 | 967,3 | 984,2 | 979,7 | 946,3 | 975,6 | 1003,3 | 1008,3 | 980,7 | 968,0 | 19,3 | -0,5 | 19,1 |
| 71 | 989,3 | 985,9 | 1002,5 | 985,0 | 948,4 | 991,3 | 1003,1 | 1009,1 | 989,3 | 971,0 | 19,3 | -0,4 | 18,3 |

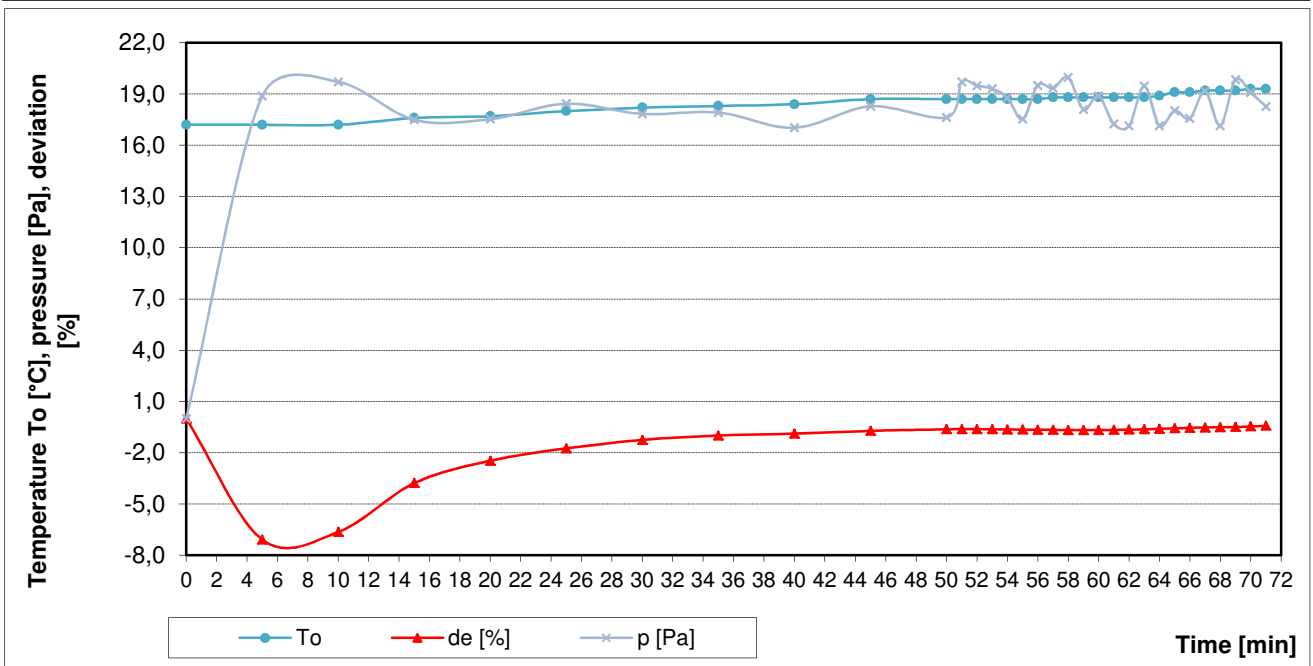
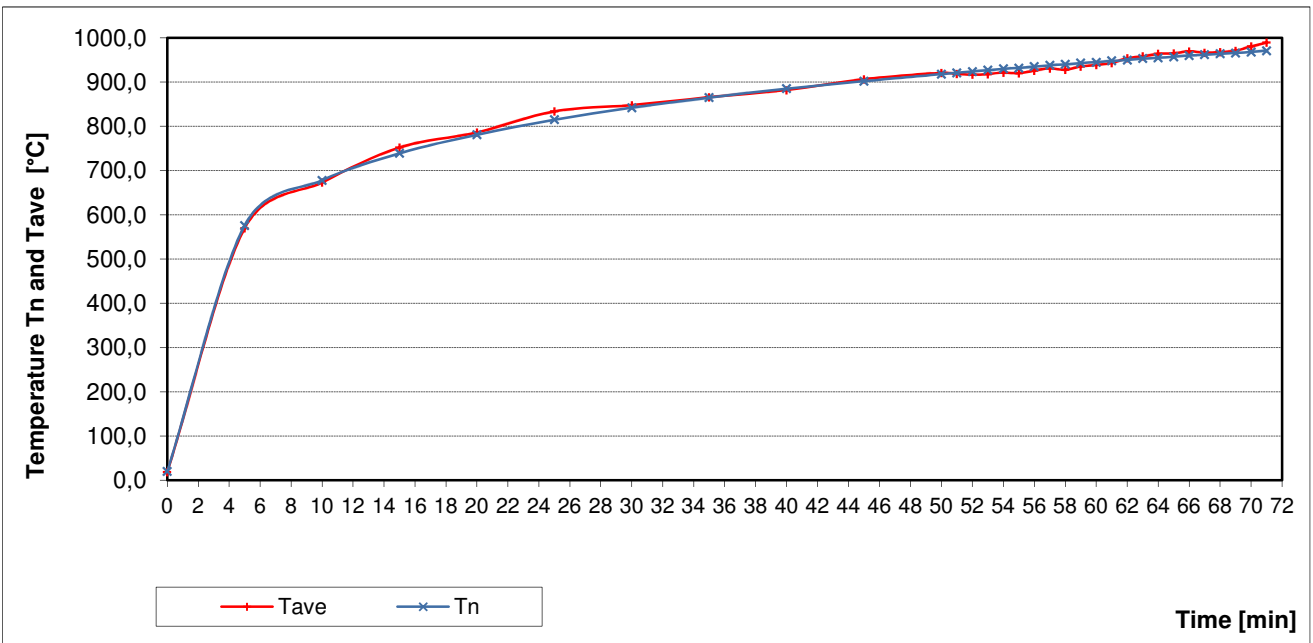
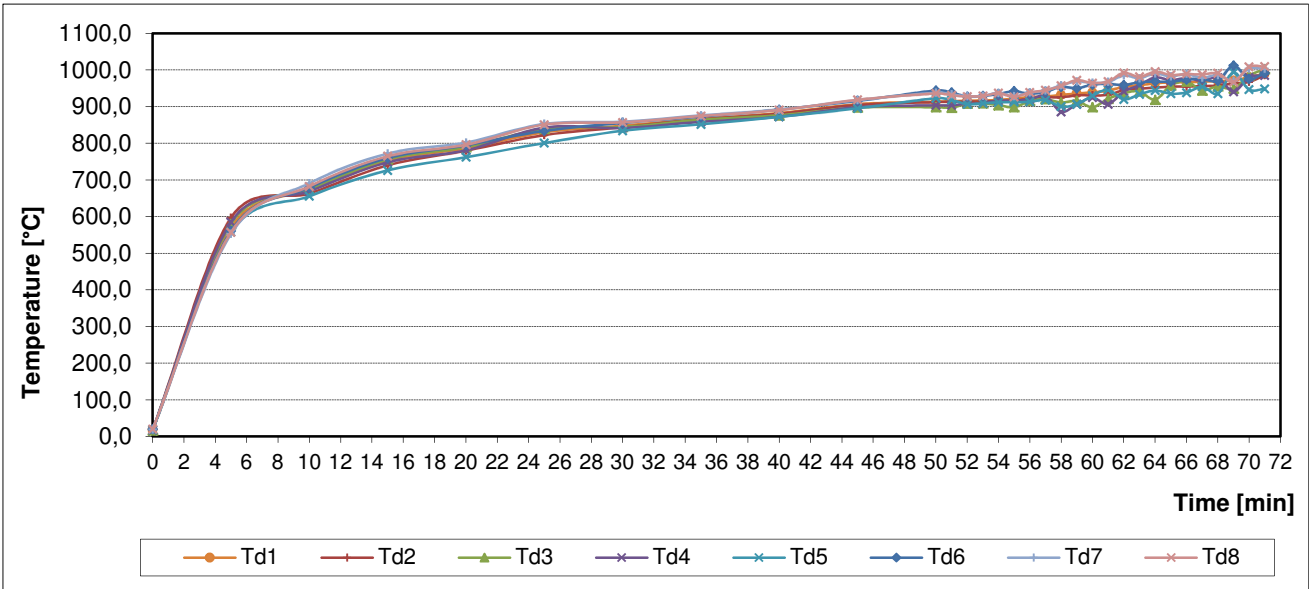
- Tave** Average temperature in the test furnace calculated from individual thermometers
- Tn** Standard temperature in the test furnace laid down according to test guideline
- d_e** Deviation of the average temperature from the standard temperature calc. acc. to test guideline
- To** Ambient temperature
- p** Pressure inside the test furnace measured 100 mm under the specimens

Layout of measuring points in the test furnace:





Measured values inside the test furnace / graph





Measured values on the unexposed surface of the test specimen No. 1

The initial average temperature of the unexposed specimen surface: **19,5 °C**

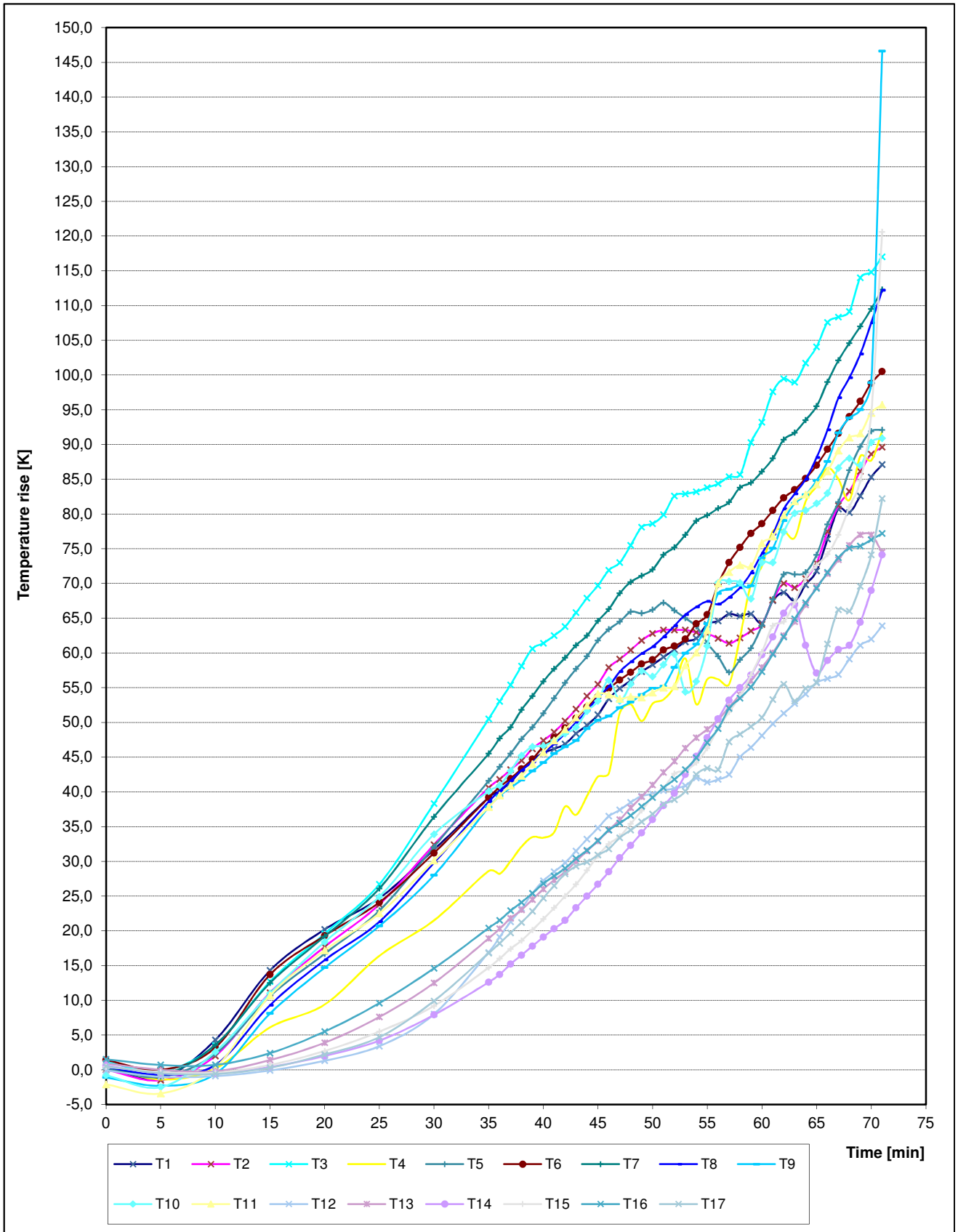
| Time t [min] | Temperature rise [K] | | | | | | | | | | | | | | | | |
|-----------------|----------------------|------|-------|------|------|-------|-------|-------|-------|------|------|------|------|------|-------|------|------|
| | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 | T10 | T11 | T12 | T13 | T14 | T15 | T16 | T17 |
| 0 | 0,4 | 0,0 | 1,1 | 0,5 | 0,1 | 1,4 | 0,4 | 0,4 | -1,1 | -0,8 | -2,1 | -0,1 | 0,9 | 0,6 | 0,4 | 1,5 | 0,5 |
| 5 | -1,2 | -1,5 | -0,2 | -1,4 | -1,0 | 0,0 | -0,8 | -0,7 | -2,3 | -2,5 | -3,4 | -1,0 | 0,0 | -0,5 | -0,3 | 0,7 | -0,5 |
| 10 | 4,3 | 2,0 | 3,5 | 0,2 | 2,3 | 3,2 | 3,6 | 0,7 | -0,6 | 2,6 | 0,3 | -0,9 | -0,2 | -0,5 | -0,4 | 0,7 | -0,6 |
| 15 | 14,3 | 11,1 | 12,7 | 6,1 | 10,6 | 13,7 | 12,5 | 9,3 | 8,1 | 11,0 | 10,7 | -0,1 | 1,4 | 0,4 | 0,7 | 2,4 | 0,3 |
| 20 | 20,2 | 17,7 | 19,6 | 9,4 | 16,7 | 19,3 | 19,2 | 15,8 | 14,7 | 18,4 | 17,2 | 1,3 | 3,9 | 2,0 | 2,7 | 5,5 | 2,2 |
| 25 | 24,7 | 23,8 | 26,7 | 16,4 | 22,9 | 24,1 | 26,1 | 21,3 | 20,7 | 24,9 | 22,5 | 3,4 | 7,6 | 4,2 | 5,5 | 9,6 | 4,7 |
| 30 | 31,7 | 32,4 | 38,3 | 21,5 | 32,1 | 31,2 | 36,4 | 29,8 | 28,0 | 33,9 | 30,1 | 8,0 | 12,5 | 7,9 | 9,2 | 14,6 | 9,9 |
| 35 | 39,2 | 40,6 | 50,5 | 28,6 | 41,6 | 39,2 | 45,5 | 38,6 | 37,8 | 40,1 | 37,8 | 16,9 | 18,9 | 12,6 | 14,7 | 20,4 | 16,8 |
| 36 | 40,1 | 41,8 | 53,0 | 28,2 | 43,6 | 40,7 | 47,7 | 40,1 | 39,4 | 40,9 | 39,5 | 19,1 | 20,3 | 13,7 | 16,0 | 21,5 | 18,2 |
| 37 | 41,4 | 43,2 | 55,4 | 30,0 | 45,5 | 41,9 | 49,3 | 41,6 | 40,6 | 43,0 | 40,9 | 21,3 | 21,8 | 15,2 | 17,4 | 22,9 | 19,7 |
| 38 | 43,1 | 44,5 | 58,1 | 32,1 | 47,6 | 43,3 | 51,8 | 43,1 | 41,7 | 45,2 | 42,3 | 23,2 | 23,0 | 16,5 | 18,6 | 24,1 | 21,2 |
| 39 | 44,6 | 46,2 | 60,6 | 33,5 | 49,3 | 44,7 | 53,8 | 44,3 | 43,0 | 46,5 | 44,0 | 25,4 | 24,5 | 17,8 | 20,1 | 25,4 | 22,8 |
| 40 | 45,6 | 47,4 | 61,4 | 33,4 | 51,3 | 46,5 | 55,9 | 45,6 | 44,2 | 46,6 | 45,7 | 27,2 | 26,0 | 19,1 | 21,7 | 26,8 | 24,7 |
| 41 | 46,2 | 48,6 | 62,5 | 34,2 | 53,5 | 47,8 | 57,7 | 46,9 | 45,5 | 47,4 | 47,4 | 28,5 | 27,3 | 20,3 | 23,3 | 27,9 | 26,5 |
| 42 | 46,9 | 50,2 | 63,8 | 37,9 | 55,7 | 49,2 | 59,3 | 48,4 | 46,5 | 48,4 | 49,0 | 29,8 | 28,5 | 21,5 | 25,0 | 29,0 | 28,2 |
| 43 | 48,4 | 51,9 | 65,8 | 36,7 | 57,7 | 50,6 | 61,1 | 50,0 | 47,4 | 49,3 | 50,7 | 31,5 | 30,0 | 23,3 | 26,7 | 30,4 | 29,3 |
| 44 | 49,6 | 53,8 | 67,9 | 39,4 | 59,5 | 52,2 | 62,5 | 51,7 | 49,1 | 51,6 | 52,4 | 33,2 | 31,5 | 25,0 | 28,7 | 31,6 | 29,9 |
| 45 | 51,1 | 55,5 | 69,7 | 42,2 | 61,8 | 53,7 | 64,6 | 53,6 | 50,3 | 53,1 | 54,1 | 34,8 | 32,9 | 26,7 | 30,8 | 33,0 | 30,9 |
| 46 | 53,4 | 57,9 | 71,9 | 42,7 | 63,4 | 54,9 | 66,3 | 55,2 | 50,9 | 56,1 | 54,0 | 36,5 | 34,5 | 28,5 | 32,5 | 34,5 | 31,8 |
| 47 | 54,9 | 59,1 | 73,0 | 51,4 | 64,5 | 56,1 | 68,6 | 57,3 | 52,1 | 53,1 | 53,4 | 37,4 | 36,0 | 30,5 | 33,6 | 35,5 | 33,4 |
| 48 | 56,0 | 60,4 | 75,5 | 52,6 | 65,9 | 57,2 | 70,2 | 58,7 | 52,9 | 55,5 | 53,7 | 38,5 | 37,7 | 32,3 | 35,4 | 36,6 | 34,5 |
| 49 | 57,3 | 61,8 | 78,1 | 50,2 | 65,7 | 58,4 | 71,1 | 59,9 | 54,0 | 57,4 | 53,6 | 39,4 | 39,3 | 34,1 | 37,3 | 37,9 | 35,7 |
| 50 | 58,3 | 62,8 | 78,6 | 52,7 | 66,2 | 59,0 | 72,0 | 60,9 | 54,9 | 56,6 | 54,3 | 39,7 | 41,0 | 36,0 | 39,3 | 39,2 | 36,8 |
| 51 | 59,4 | 63,3 | 79,9 | 53,3 | 67,2 | 60,4 | 74,1 | 62,3 | 55,2 | 58,3 | 55,0 | 40,2 | 42,8 | 38,0 | 40,5 | 40,6 | 38,2 |
| 52 | 60,5 | 63,3 | 82,6 | 55,2 | 66,1 | 61,0 | 75,2 | 63,9 | 57,9 | 59,8 | 55,2 | 40,5 | 44,4 | 39,8 | 42,6 | 41,8 | 38,9 |
| 53 | 61,6 | 63,3 | 82,9 | 59,2 | 65,0 | 62,0 | 77,0 | 65,5 | 60,0 | 54,4 | 58,2 | 40,9 | 46,3 | 42,5 | 43,1 | 43,2 | 40,1 |
| 54 | 62,1 | 63,0 | 83,2 | 52,6 | 63,8 | 64,2 | 79,0 | 66,6 | 61,3 | 55,9 | 60,1 | 42,0 | 47,8 | 45,1 | 44,2 | 44,9 | 42,5 |
| 55 | 64,1 | 62,8 | 83,8 | 56,2 | 61,4 | 65,5 | 79,8 | 67,4 | 64,2 | 61,0 | 63,3 | 41,4 | 49,0 | 47,8 | 46,3 | 47,1 | 43,4 |
| 56 | 64,6 | 62,1 | 84,4 | 56,2 | 59,5 | 69,9 | 80,8 | 67,0 | 68,6 | 70,1 | 70,0 | 41,8 | 50,4 | 50,5 | 49,2 | 49,1 | 43,2 |
| 57 | 65,6 | 61,4 | 85,4 | 55,5 | 57,2 | 73,0 | 81,7 | 68,0 | 69,2 | 70,3 | 71,7 | 42,5 | 52,2 | 53,2 | 51,5 | 52,0 | 47,2 |
| 58 | 65,3 | 62,2 | 85,7 | 62,3 | 59,0 | 75,2 | 83,8 | 69,4 | 69,8 | 70,1 | 72,7 | 45,0 | 54,0 | 55,0 | 53,8 | 53,5 | 48,3 |
| 59 | 65,6 | 63,2 | 90,3 | 69,9 | 60,7 | 77,2 | 84,5 | 71,5 | 69,7 | 67,8 | 72,5 | 46,4 | 56,0 | 56,8 | 56,8 | 55,1 | 49,4 |
| 60 | 64,3 | 64,1 | 93,2 | 72,5 | 63,9 | 78,6 | 86,1 | 74,3 | 73,7 | 73,0 | 75,8 | 48,1 | 57,9 | 59,7 | 60,1 | 57,3 | 50,7 |
| 61 | 67,5 | 67,6 | 97,6 | 77,5 | 67,7 | 80,5 | 88,0 | 77,1 | 75,1 | 73,0 | 76,8 | 49,8 | 60,0 | 62,3 | 63,9 | 59,8 | 53,3 |
| 62 | 68,7 | 70,0 | 99,5 | 77,6 | 71,3 | 82,3 | 90,7 | 80,7 | 79,1 | 77,4 | 79,9 | 51,3 | 62,5 | 65,7 | 64,5 | 62,3 | 55,5 |
| 63 | 67,5 | 69,4 | 99,0 | 76,6 | 71,3 | 83,5 | 91,7 | 82,9 | 81,5 | 80,1 | 81,8 | 52,7 | 64,5 | 66,9 | 67,3 | 64,9 | 53,1 |
| 64 | 69,8 | 70,7 | 101,7 | 81,8 | 71,6 | 85,1 | 93,5 | 85,0 | 82,8 | 80,5 | 82,8 | 54,1 | 66,9 | 61,1 | 70,7 | 67,2 | 54,9 |
| 65 | 71,8 | 73,0 | 104,1 | 84,0 | 74,1 | 87,0 | 95,5 | 88,1 | 84,8 | 81,5 | 84,3 | 55,7 | 69,5 | 57,1 | 72,6 | 69,3 | 55,8 |
| 66 | 76,4 | 77,5 | 107,6 | 86,6 | 78,5 | 89,3 | 99,0 | 92,1 | 87,6 | 83,0 | 86,2 | 56,3 | 71,4 | 58,9 | 74,2 | 71,6 | 61,3 |
| 67 | 80,7 | 81,2 | 108,4 | 85,0 | 81,7 | 91,6 | 102,1 | 96,7 | 91,7 | 86,6 | 89,1 | 56,9 | 73,4 | 60,5 | 77,0 | 73,7 | 66,2 |
| 68 | 80,2 | 83,3 | 109,2 | 82,0 | 86,3 | 94,0 | 104,6 | 99,6 | 93,8 | 88,0 | 91,0 | 59,1 | 75,5 | 61,1 | 81,0 | 75,1 | 66,0 |
| 69 | 82,6 | 86,2 | 114,0 | 88,3 | 89,7 | 96,2 | 107,0 | 103,0 | 95,0 | 87,0 | 91,6 | 61,1 | 77,0 | 64,4 | 84,8 | 75,4 | 69,6 |
| 70 | 85,3 | 88,6 | 114,8 | 87,7 | 91,9 | 98,8 | 109,5 | 107,5 | 98,9 | 90,3 | 94,6 | 62,0 | 77,0 | 69,0 | 94,4 | 76,3 | 74,1 |
| 71 | 87,1 | 89,6 | 117,0 | 91,9 | 92,1 | 100,5 | 112,3 | 112,2 | 146,6 | 90,9 | 95,7 | 63,9 | 74,5 | 74,1 | 120,6 | 77,2 | 82,2 |

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

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



Measured values on the unexposed surface of the test specimen No. 1 / graph





Calculated values from measured values on specimen No. 1 surface

The initial average temperature of the specimen surface: 19,5 °C

| Time t [min] | Temperature rise [K] | | |
|-----------------|----------------------|--------|---------|
| | Trave1 | Trmax1 | TRmaxS1 |
| 0 | 0,4 | 1,4 | 1,5 |
| 5 | -1,1 | 0,0 | 0,7 |
| 10 | 2,5 | 4,3 | 4,3 |
| 15 | 11,0 | 14,3 | 14,3 |
| 20 | 16,7 | 20,2 | 20,2 |
| 25 | 22,9 | 26,7 | 26,7 |
| 30 | 31,2 | 38,3 | 38,3 |
| 35 | 40,1 | 50,5 | 50,5 |
| 36 | 41,3 | 53,0 | 53,0 |
| 37 | 43,1 | 55,4 | 55,4 |
| 38 | 45,1 | 58,1 | 58,1 |
| 39 | 46,8 | 60,6 | 60,6 |
| 40 | 47,8 | 61,4 | 61,4 |
| 41 | 49,0 | 62,5 | 62,5 |
| 42 | 50,9 | 63,8 | 63,8 |
| 43 | 52,1 | 65,8 | 65,8 |
| 44 | 54,0 | 67,9 | 67,9 |
| 45 | 56,1 | 69,7 | 69,7 |
| 46 | 57,9 | 71,9 | 71,9 |
| 47 | 60,6 | 73,0 | 73,0 |
| 48 | 62,1 | 75,5 | 75,5 |
| 49 | 62,6 | 78,1 | 78,1 |
| 50 | 63,7 | 78,6 | 78,6 |
| 51 | 64,6 | 79,9 | 79,9 |
| 52 | 65,5 | 82,6 | 82,6 |
| 53 | 66,4 | 82,9 | 82,9 |
| 54 | 64,9 | 83,2 | 83,2 |
| 55 | 65,7 | 83,8 | 83,8 |
| 56 | 65,4 | 84,4 | 84,4 |
| 57 | 65,0 | 85,4 | 85,4 |
| 58 | 66,9 | 85,7 | 85,7 |
| 59 | 69,9 | 90,3 | 90,3 |
| 60 | 71,6 | 93,2 | 93,2 |
| 61 | 75,6 | 97,6 | 97,6 |
| 62 | 77,4 | 99,5 | 99,5 |
| 63 | 76,8 | 99,0 | 99,0 |
| 64 | 79,1 | 101,7 | 101,7 |
| 65 | 81,4 | 104,1 | 104,1 |
| 66 | 85,3 | 107,6 | 107,6 |
| 67 | 87,4 | 108,4 | 108,4 |
| 68 | 88,2 | 109,2 | 109,2 |
| 69 | 92,2 | 114,0 | 114,0 |
| 70 | 93,7 | 114,8 | 114,8 |
| 71 | 95,5 | 146,6 | 146,6 |

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

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

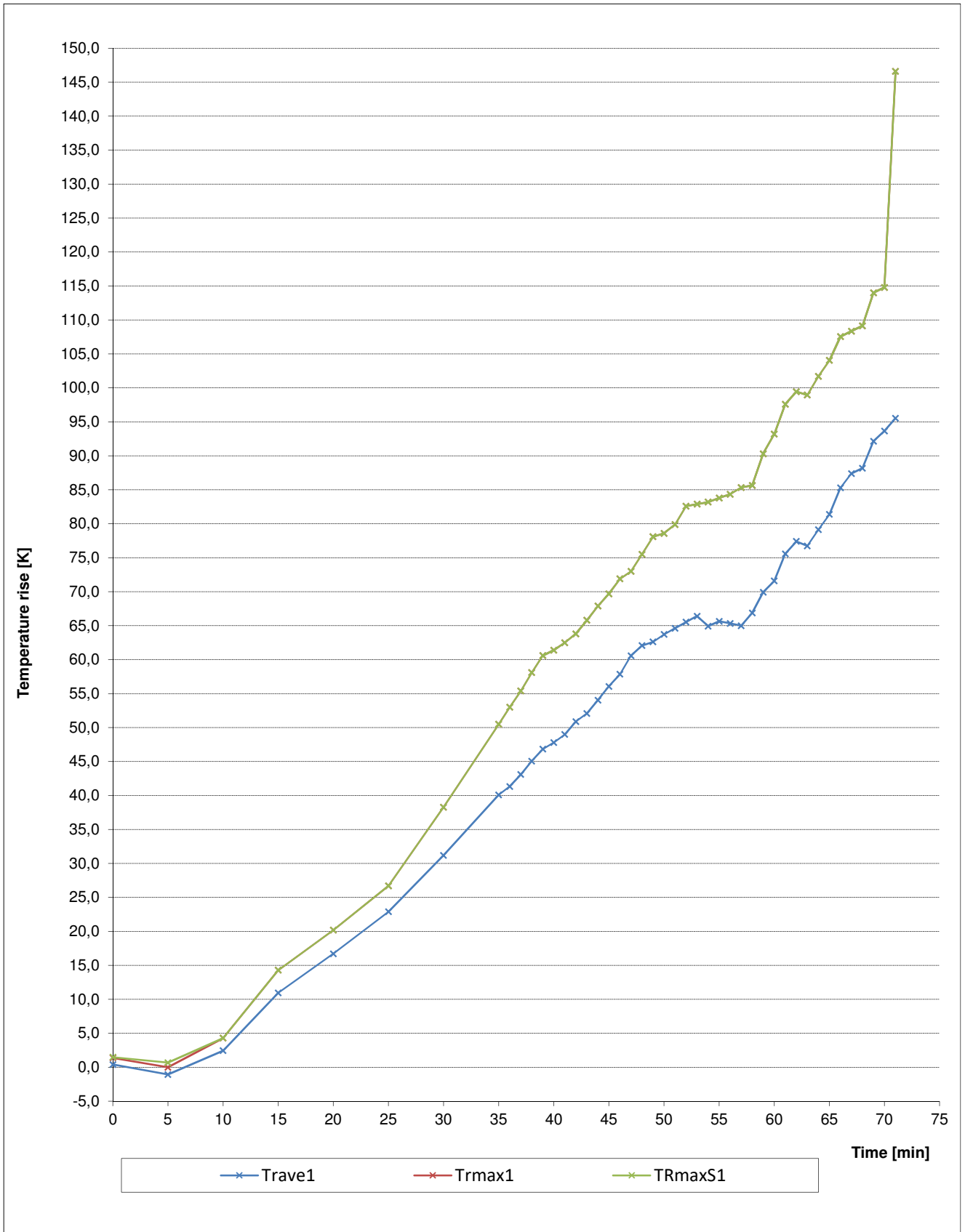
Trave1 average temperature rise above initial average temperature calculated from T1-T5

Trmax1 maximal temperature rise above initial average temperature calculated from T1-T11

TRmaxS1 maximal temperature rise above initial average temperature calculated from T1-T17 - supplementary procedure



Calculated values from measured values on specimen No. 1 surface / graph





Layout of measuring points on the unexposed specimen No. 1 surface



- Thermocouples attached for the average and maximum temperature rise evaluation according to EN 1634-1
- Thermocouples attached for the maximum temperature rise evaluation according to EN 1634-1
- Thermocouples attached for the maximum temperature rise evaluation (supplementary procedure) according to EN 1634-1



Measured values on the unexposed surface of the test specimen No. 2

The initial average temperature of the unexposed specimen surface: 19,3 °C

| Time t [min] | Temperature rise [K] | | | | | | | | | | | | | | | | | | | | |
|-----------------|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|------|------|------|------|-------|------|------|
| | T61 | T62 | T63 | T64 | T65 | T66 | T67 | T68 | T69 | T70 | T71 | T72 | T73 | T74 | T75 | T76 | T77 | T78 | T79 | T80 | T81 |
| 0 | -0,2 | -0,7 | -1,1 | 0,2 | -0,2 | 0,5 | 0,4 | 0,4 | -0,9 | -0,9 | -0,7 | 1,3 | 1,0 | -0,7 | -0,9 | -1,2 | -0,8 | 0,4 | 1,1 | 1,5 | -0,4 |
| 5 | -1,3 | -1,7 | -2,1 | -0,7 | -1,3 | -0,4 | -0,9 | -0,4 | -1,6 | -2,1 | -1,4 | 0,4 | -0,2 | -1,5 | -1,4 | -1,7 | -1,3 | -0,7 | 0,2 | 0,6 | -2,1 |
| 10 | 0,0 | -0,5 | 0,1 | 0,5 | 0,3 | 2,7 | 0,8 | 3,4 | 1,7 | -0,5 | 0,7 | 0,0 | -0,6 | -0,5 | -1,3 | -2,1 | -2,0 | -1,8 | -0,8 | -0,2 | -3,0 |
| 15 | 6,1 | 6,3 | 7,5 | 6,9 | 6,9 | 11,5 | 8,1 | 14,4 | 11,5 | 6,0 | 8,5 | 1,9 | 0,1 | 4,4 | 1,5 | -0,7 | -0,6 | -1,1 | 0,1 | 1,1 | -2,3 |
| 20 | 12,4 | 13,6 | 15,4 | 14,1 | 13,9 | 19,4 | 14,8 | 21,8 | 19,7 | 12,2 | 16,6 | 4,3 | 2,4 | 8,4 | 5,3 | 2,3 | 1,8 | 0,1 | 1,2 | 3,1 | -2,0 |
| 25 | 19,1 | 21,3 | 27,9 | 23,5 | 25,0 | 28,6 | 21,1 | 29,6 | 28,4 | 18,6 | 26,1 | 8,9 | 7,1 | 12,9 | 9,4 | 6,9 | 4,6 | -0,2 | 0,7 | 1,4 | -2,1 |
| 30 | 27,6 | 30,8 | 45,3 | 37,4 | 42,0 | 40,2 | 31,6 | 38,8 | 39,4 | 27,7 | 38,3 | 14,2 | 12,1 | 18,3 | 13,5 | 11,7 | 12,7 | 1,3 | 1,0 | 1,4 | -0,9 |
| 35 | 35,0 | 38,9 | 64,6 | 53,1 | 60,3 | 52,2 | 41,7 | 46,9 | 48,0 | 37,6 | 53,8 | 20,8 | 17,4 | 24,8 | 19,1 | 18,9 | 17,5 | 1,4 | 1,4 | 2,3 | 0,0 |
| 36 | 36,3 | 40,4 | 67,6 | 56,3 | 63,2 | 54,7 | 43,8 | 48,6 | 49,8 | 39,7 | 57,0 | 22,5 | 18,6 | 26,1 | 20,5 | 20,4 | 20,4 | 1,5 | 1,3 | 2,6 | 0,6 |
| 37 | 37,9 | 41,8 | 70,4 | 59,4 | 65,7 | 57,7 | 46,4 | 50,1 | 51,8 | 42,0 | 59,4 | 24,3 | 19,9 | 27,3 | 21,9 | 21,6 | 23,1 | 1,6 | 1,4 | 2,9 | 0,7 |
| 38 | 39,1 | 43,1 | 72,3 | 62,5 | 68,2 | 60,1 | 48,7 | 51,8 | 53,6 | 43,9 | 61,5 | 26,6 | 21,4 | 28,8 | 23,7 | 23,1 | 24,9 | 1,8 | 1,5 | 3,0 | 0,8 |
| 39 | 40,5 | 44,7 | 74,1 | 65,3 | 69,9 | 62,7 | 51,3 | 53,7 | 55,6 | 46,0 | 63,5 | 28,9 | 22,7 | 30,0 | 25,3 | 24,4 | 27,2 | 1,8 | 1,5 | 3,2 | 0,9 |
| 40 | 42,1 | 45,9 | 75,6 | 67,8 | 71,4 | 65,4 | 53,9 | 55,5 | 57,7 | 48,2 | 65,4 | 31,2 | 24,2 | 31,5 | 27,6 | 25,7 | 28,5 | 2,1 | 1,6 | 3,2 | 1,3 |
| 41 | 43,5 | 47,3 | 77,1 | 70,3 | 72,8 | 68,0 | 56,4 | 57,0 | 59,5 | 49,0 | 67,3 | 33,9 | 25,7 | 32,9 | 29,9 | 27,3 | 29,7 | 2,4 | 1,6 | 3,2 | 1,5 |
| 42 | 44,7 | 48,4 | 78,7 | 72,1 | 74,0 | 70,5 | 58,5 | 58,4 | 61,4 | 50,5 | 69,0 | 36,3 | 27,2 | 34,2 | 32,3 | 28,5 | 31,0 | 2,8 | 1,6 | 3,4 | 1,4 |
| 43 | 46,3 | 49,6 | 80,1 | 74,2 | 75,6 | 73,4 | 61,1 | 60,0 | 62,9 | 51,3 | 70,8 | 38,7 | 28,7 | 35,8 | 34,3 | 30,0 | 32,2 | 3,2 | 1,6 | 3,5 | 1,2 |
| 44 | 48,2 | 51,3 | 81,9 | 76,1 | 77,1 | 75,3 | 63,3 | 61,4 | 64,8 | 52,1 | 73,1 | 40,8 | 30,1 | 37,5 | 36,3 | 31,7 | 34,3 | 3,5 | 1,6 | 3,6 | 1,3 |
| 45 | 49,9 | 53,0 | 83,5 | 77,8 | 78,4 | 77,3 | 65,4 | 63,1 | 66,4 | 52,0 | 74,6 | 42,8 | 31,4 | 39,5 | 38,3 | 33,3 | 35,3 | 3,5 | 1,9 | 3,6 | 1,2 |
| 46 | 51,3 | 54,9 | 85,4 | 79,5 | 80,0 | 79,4 | 67,1 | 64,3 | 68,3 | 52,8 | 75,9 | 44,9 | 32,9 | 41,1 | 39,8 | 34,7 | 36,1 | 3,6 | 1,8 | 3,7 | 1,0 |
| 47 | 53,4 | 56,1 | 87,8 | 81,2 | 82,3 | 81,5 | 67,3 | 65,7 | 70,1 | 54,8 | 77,7 | 46,6 | 34,8 | 43,0 | 41,9 | 36,4 | 37,8 | 3,6 | 1,8 | 3,8 | 1,1 |
| 48 | 55,2 | 57,8 | 90,1 | 82,7 | 84,6 | 83,6 | 68,5 | 66,9 | 71,8 | 55,0 | 79,6 | 48,4 | 36,7 | 44,9 | 43,8 | 38,1 | 39,5 | 3,9 | 1,7 | 3,8 | 1,3 |
| 49 | 56,9 | 59,0 | 92,8 | 84,0 | 86,6 | 85,8 | 69,9 | 67,8 | 73,1 | 56,0 | 81,7 | 50,1 | 38,7 | 47,2 | 45,6 | 39,8 | 41,2 | 4,3 | 1,7 | 3,9 | 1,4 |
| 50 | 58,7 | 60,1 | 95,7 | 85,6 | 89,1 | 87,6 | 70,8 | 69,1 | 74,4 | 55,6 | 83,3 | 51,6 | 41,0 | 49,4 | 47,9 | 42,0 | 43,5 | 4,4 | 1,8 | 3,9 | 1,9 |
| 51 | 60,8 | 61,8 | 99,0 | 87,7 | 91,2 | 89,6 | 72,2 | 70,1 | 75,6 | 56,9 | 85,2 | 53,1 | 43,5 | 51,3 | 49,7 | 44,1 | 46,2 | 4,4 | 1,8 | 4,1 | 2,2 |
| 52 | 62,6 | 63,5 | 102,5 | 89,7 | 93,8 | 91,1 | 73,5 | 71,5 | 76,6 | 57,8 | 86,9 | 54,1 | 46,1 | 53,6 | 51,8 | 46,4 | 49,0 | 4,2 | 1,9 | 4,0 | 2,6 |
| 53 | 64,7 | 65,3 | 105,7 | 92,0 | 96,1 | 92,8 | 74,8 | 72,6 | 77,7 | 58,9 | 87,9 | 55,5 | 48,9 | 55,4 | 53,9 | 48,8 | 51,3 | 3,8 | 2,1 | 4,2 | 2,0 |
| 54 | 66,8 | 67,6 | 109,5 | 94,7 | 97,0 | 95,0 | 76,2 | 73,6 | 79,5 | 60,1 | 89,8 | 56,3 | 52,0 | 56,9 | 56,1 | 51,1 | 54,2 | 3,6 | 2,0 | 4,5 | 2,2 |
| 55 | 69,6 | 68,8 | 113,0 | 97,5 | 99,5 | 96,9 | 75,5 | 74,3 | 81,9 | 55,4 | 88,0 | 56,5 | 53,9 | 58,9 | 58,4 | 54,4 | 52,7 | 3,9 | 2,5 | 5,2 | 2,4 |
| 56 | 70,4 | 70,8 | 115,3 | 98,4 | 100,5 | 96,3 | 75,0 | 75,2 | 83,0 | 53,5 | 90,4 | 58,1 | 56,2 | 61,5 | 64,5 | 57,3 | 55,1 | 4,0 | 2,6 | 8,4 | 6,1 |
| 57 | 69,2 | 73,3 | 119,4 | 103,8 | 100,6 | 99,5 | 77,0 | 77,9 | 84,6 | 53,7 | 90,4 | 59,9 | 59,5 | 63,7 | 62,8 | 59,5 | 57,4 | 4,0 | 3,1 | 9,4 | 8,4 |
| 58 | 62,8 | 73,4 | 120,9 | 105,7 | 99,0 | 96,4 | 77,3 | 80,6 | 85,7 | 54,9 | 90,7 | 61,2 | 65,6 | 64,6 | 68,0 | 61,0 | 58,3 | 7,6 | 4,4 | 10,7 | 10,3 |
| 59 | 62,8 | 77,3 | 123,6 | 109,3 | 99,2 | 99,7 | 79,0 | 79,6 | 88,1 | 57,7 | 95,8 | 64,5 | 64,4 | 67,9 | 65,8 | 66,1 | 62,4 | 7,5 | 4,3 | 10,6 | 11,1 |
| 60 | 64,3 | 81,3 | 126,0 | 112,8 | 96,7 | 103,0 | 82,2 | 81,4 | 92,0 | 62,2 | 100,6 | 66,5 | 66,8 | 72,1 | 70,0 | 71,3 | 67,8 | 10,1 | 4,4 | 10,7 | 11,4 |
| 61 | 64,7 | 84,8 | 129,0 | 114,1 | 101,3 | 106,6 | 82,8 | 83,3 | 93,2 | 58,6 | 101,5 | 68,0 | 64,2 | 73,5 | 69,9 | 72,5 | 68,8 | 7,9 | 3,5 | 10,4 | 9,0 |
| 62 | 64,2 | 88,1 | 130,6 | 117,4 | 104,6 | 107,2 | 85,0 | 87,7 | 95,9 | 60,1 | 102,1 | 68,6 | 63,4 | 78,0 | 74,9 | 76,4 | 67,7 | 8,2 | 4,1 | 10,3 | 8,0 |
| 63 | 60,4 | 91,4 | 131,8 | 119,8 | 109,0 | 103,1 | 83,2 | 89,9 | 98,4 | 56,5 | 104,5 | 70,3 | 54,1 | 80,0 | 77,1 | 77,1 | 68,7 | 7,5 | 4,6 | 10,2 | 6,4 |
| 64 | 61,8 | 95,6 | 133,5 | 122,9 | 107,2 | 105,8 | 85,5 | 93,3 | 101,5 | 57,5 | 106,4 | 70,7 | 51,6 | 79,4 | 78,2 | 76,8 | 72,2 | 6,9 | 5,7 | 10,5 | 6,4 |
| 65 | 68,9 | 101,5 | 135,9 | 125,3 | 113,2 | 111,3 | 89,3 | 96,6 | 106,6 | 60,1 | 110,4 | 74,1 | 55,0 | 80,1 | 82,1 | 77,4 | 77,7 | 7,6 | 6,3 | 11,2 | 6,5 |
| 66 | 75,0 | 107,4 | 138,4 | 127,7 | 117,7 | 116,8 | 93,8 | 100,7 | 112,4 | 63,8 | 112,9 | 79,7 | 57,9 | 82,7 | 86,7 | 78,1 | 85,4 | 8,4 | 6,7 | 10,9 | 6,8 |
| 67 | 111,9 | 136,8 | 158,7 | 153,3 | 194,4 | 131,9 | 209,2 | 396,4 | 130,2 | 78,1 | 121,8 | 141,1 | 160,6 | 306,4 | 99,8 | 84,3 | 96,4 | 73,9 | 394,4 | 13,1 | 19,3 |

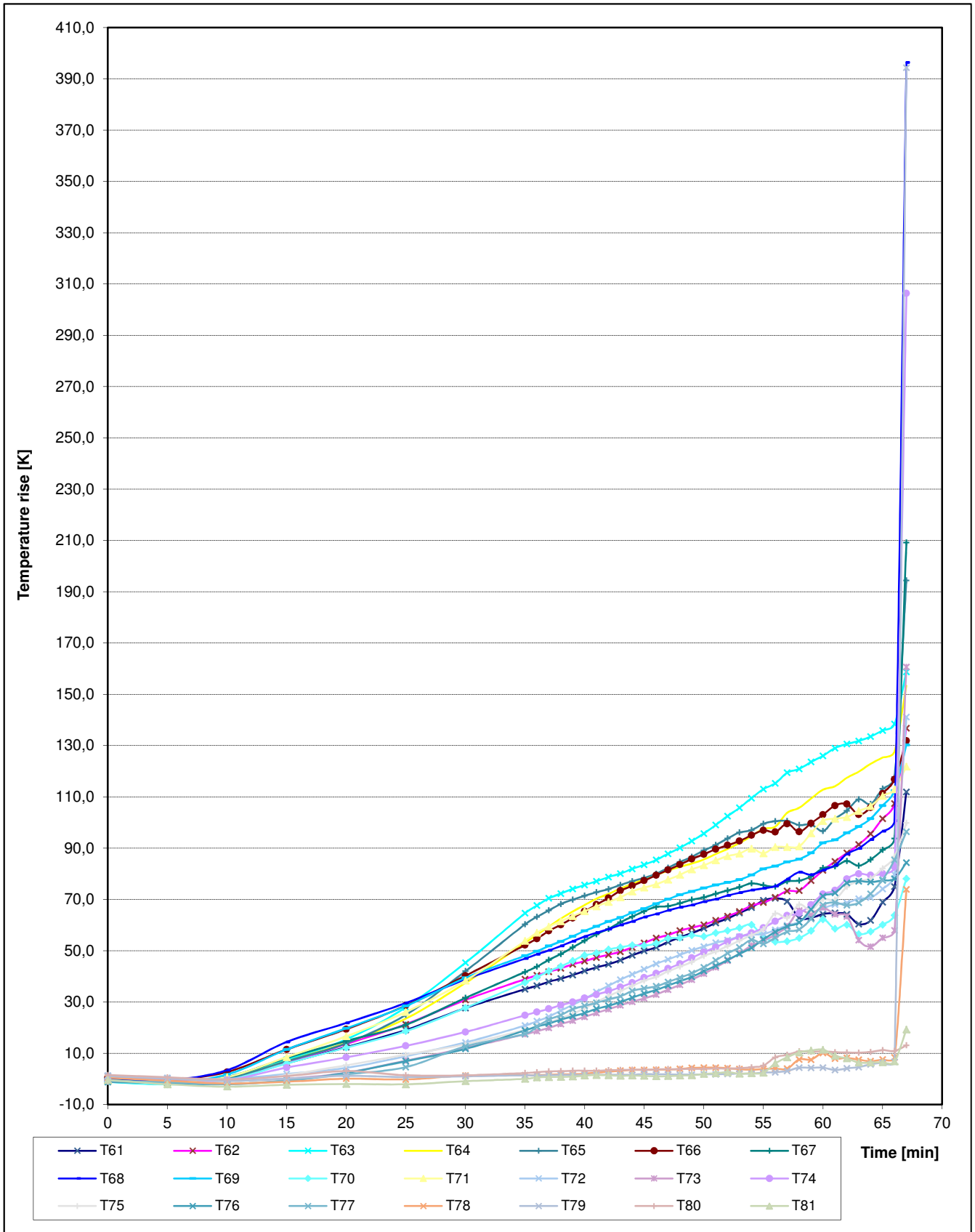
Only informative values because of integrity failure

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

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



Measured values on the unexposed surface of the test specimen No. 2 / graph





Calculated values from measured values on specimen No. 2 surface

The initial average temperature of the specimen surface: 19,3 °C

| Time t [min] | Temperature rise [K] | | | |
|-----------------|----------------------|--------|---------|---------|
| | Trave2 | Trmax2 | TRmaxS2 | TRmaxF2 |
| 0 | -0,4 | 0,5 | 1,3 | 1,5 |
| 5 | -1,4 | -0,4 | 0,4 | 0,6 |
| 10 | 0,1 | 3,4 | 3,4 | -0,2 |
| 15 | 6,7 | 14,4 | 14,4 | 1,1 |
| 20 | 13,9 | 21,8 | 21,8 | 3,1 |
| 25 | 23,4 | 29,6 | 29,6 | 1,4 |
| 30 | 36,6 | 45,3 | 45,3 | 1,4 |
| 35 | 50,4 | 64,6 | 64,6 | 2,3 |
| 36 | 52,8 | 67,6 | 67,6 | 2,6 |
| 37 | 55,0 | 70,4 | 70,4 | 2,9 |
| 38 | 57,0 | 72,3 | 72,3 | 3,0 |
| 39 | 58,9 | 74,1 | 74,1 | 3,2 |
| 40 | 60,6 | 75,6 | 75,6 | 3,2 |
| 41 | 62,2 | 77,1 | 77,1 | 3,2 |
| 42 | 63,6 | 78,7 | 78,7 | 3,4 |
| 43 | 65,2 | 80,1 | 80,1 | 3,5 |
| 44 | 66,9 | 81,9 | 81,9 | 3,6 |
| 45 | 68,5 | 83,5 | 83,5 | 3,6 |
| 46 | 70,2 | 85,4 | 85,4 | 3,7 |
| 47 | 72,2 | 87,8 | 87,8 | 3,8 |
| 48 | 74,1 | 90,1 | 90,1 | 3,9 |
| 49 | 75,9 | 92,8 | 92,8 | 4,3 |
| 50 | 77,8 | 95,7 | 95,7 | 4,4 |
| 51 | 80,1 | 99,0 | 99,0 | 4,4 |
| 52 | 82,4 | 102,5 | 102,5 | 4,2 |
| 53 | 84,8 | 105,7 | 105,7 | 4,2 |
| 54 | 87,1 | 109,5 | 109,5 | 4,5 |
| 55 | 89,7 | 113,0 | 113,0 | 5,2 |
| 56 | 91,1 | 115,3 | 115,3 | 8,4 |
| 57 | 93,3 | 119,4 | 119,4 | 9,4 |
| 58 | 92,4 | 120,9 | 120,9 | 10,7 |
| 59 | 94,4 | 123,6 | 123,6 | 11,1 |
| 60 | 96,2 | 126,0 | 126,0 | 11,4 |
| 61 | 98,8 | 129,0 | 129,0 | 10,4 |
| 62 | 101,0 | 130,6 | 130,6 | 10,3 |
| 63 | 102,5 | 131,8 | 131,8 | 10,2 |
| 64 | 104,2 | 133,5 | 133,5 | 10,5 |
| 65 | 109,0 | 135,9 | 135,9 | 11,2 |
| 66 | 113,2 | 138,4 | 138,4 | 10,9 |
| 67 | 151,0 | 396,4 | 396,4 | 394,4 |

Only informative values because of integrity failure

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

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

Trave2 average temperature rise above initial average temperature calculated from T61-T65

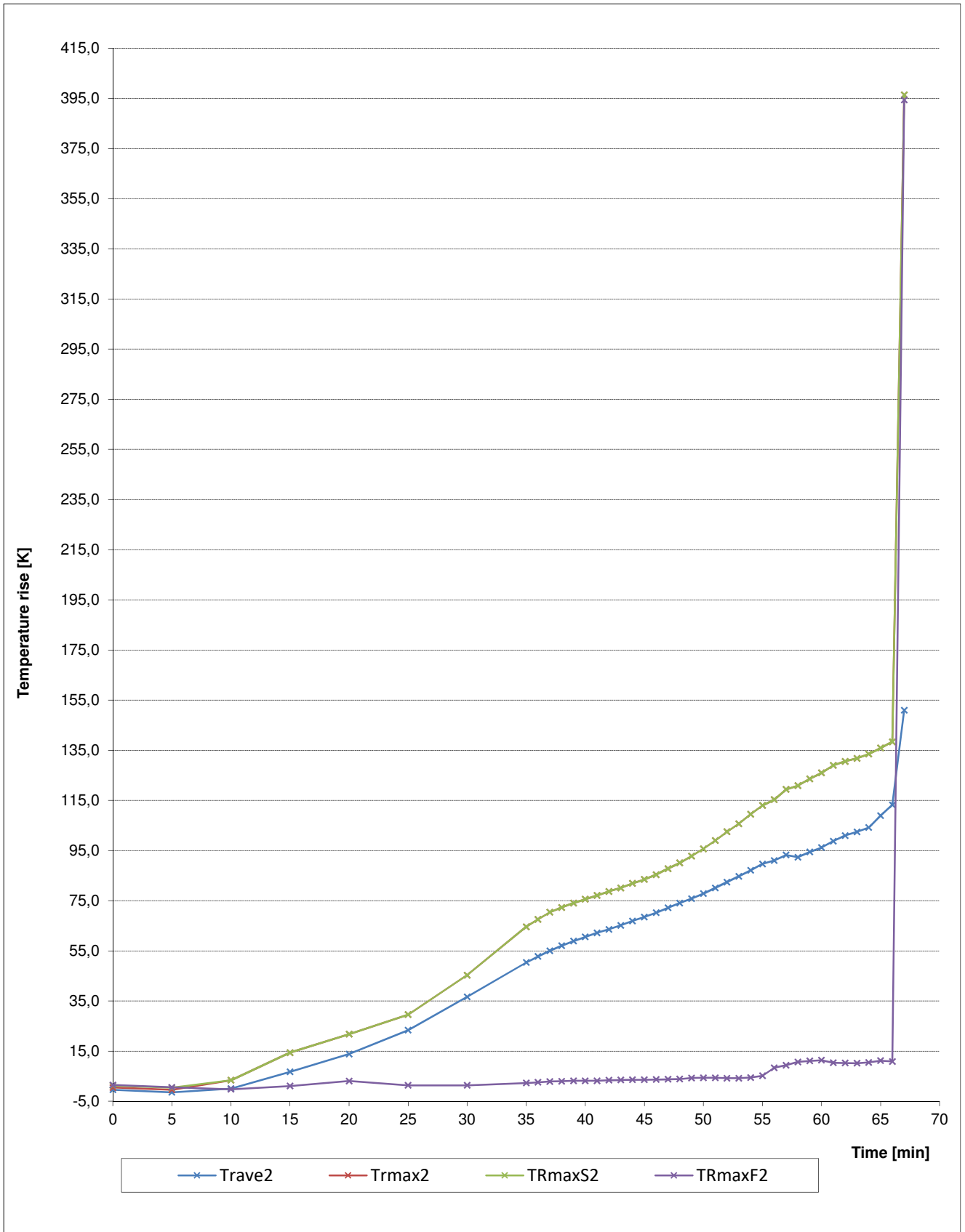
Trmax2 maximal temperature rise above initial average temperature calculated from T61-T71

TRmaxS2 maximal temperature rise above initial average temperature calculated from T61-T77 - supplementary procedure

TRmaxF2 maximal temperature rise above initial average temperature calculated from T78-T81 - frame

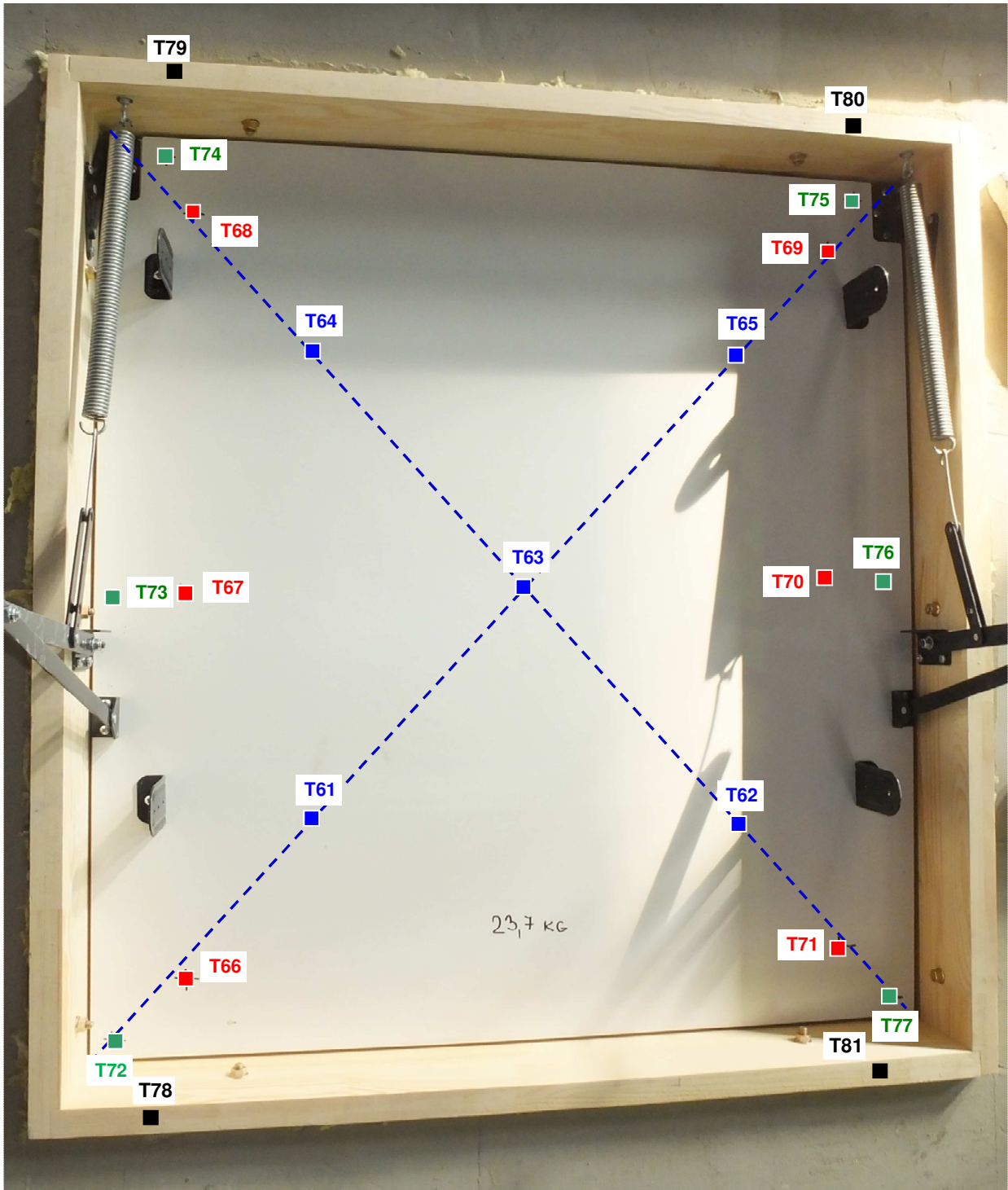


Calculated values from measured values on specimen No. 2 surface / graph





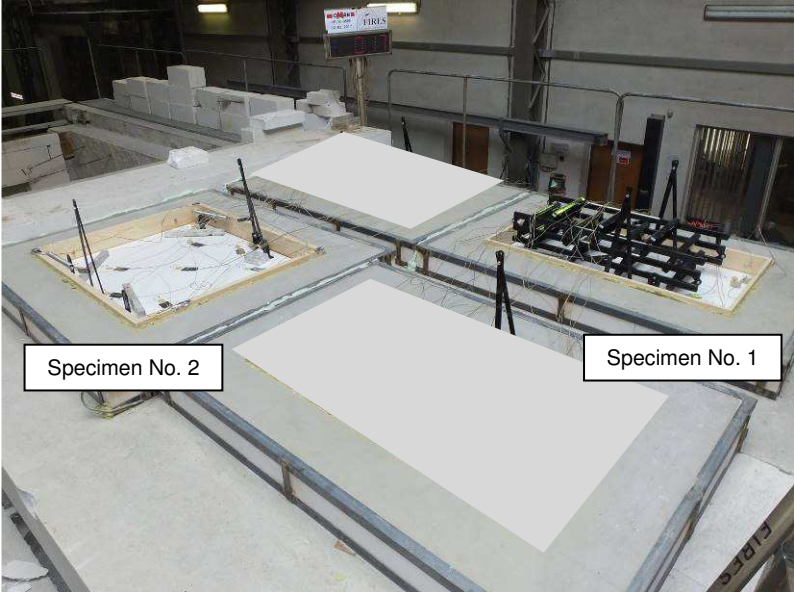
Layout of measuring points on the unexposed specimen No. 2 surface



- Thermocouples attached for the average and maximum temperature rise evaluation according to EN 1634-1
- Thermocouples attached for the maximum temperature rise evaluation according to EN 1634-1
- Thermocouples attached for the maximum temperature rise evaluation (supplementary procedure) according to EN 1634-1
- Thermocouples attached for the maximum temperature rise evaluation (on the frame) according to EN 1634-1



PHOTOS TAKEN DURING THE TEST



1st minute of the test.



16th minute of the test.



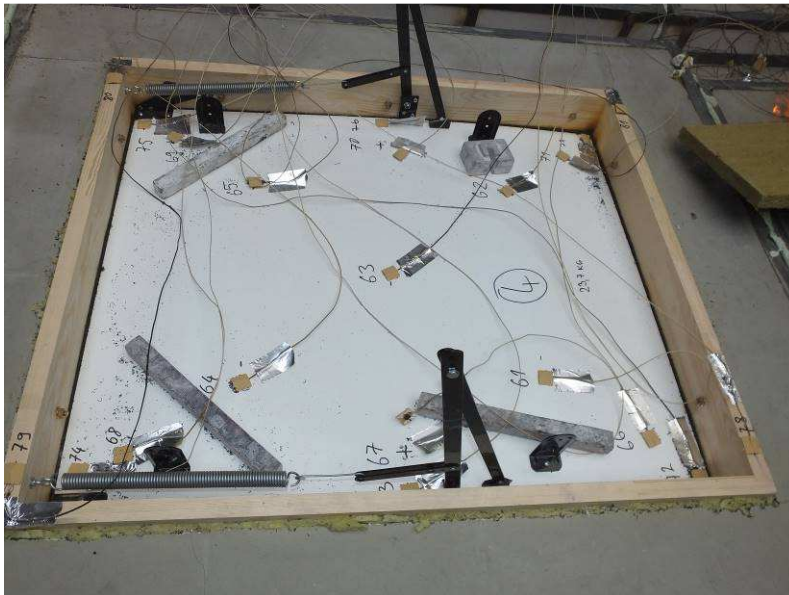
31st minute of the test.



PHOTOS TAKEN DURING THE TEST



46th minute of the test.



56th minute of the test.

Specimen No. 2

Extruding of intumescent tape all along perimeter of shutter leaf.



62nd minute of the test.

Specimen No. 2

Sustained flaming from shutter leaf edges - **integrity failure.**



PHOTOS TAKEN DURING THE TEST



71st minute of the test.

Specimen No. 1.

Sustained flaming from shutter leaf edges - **integrity failure.**

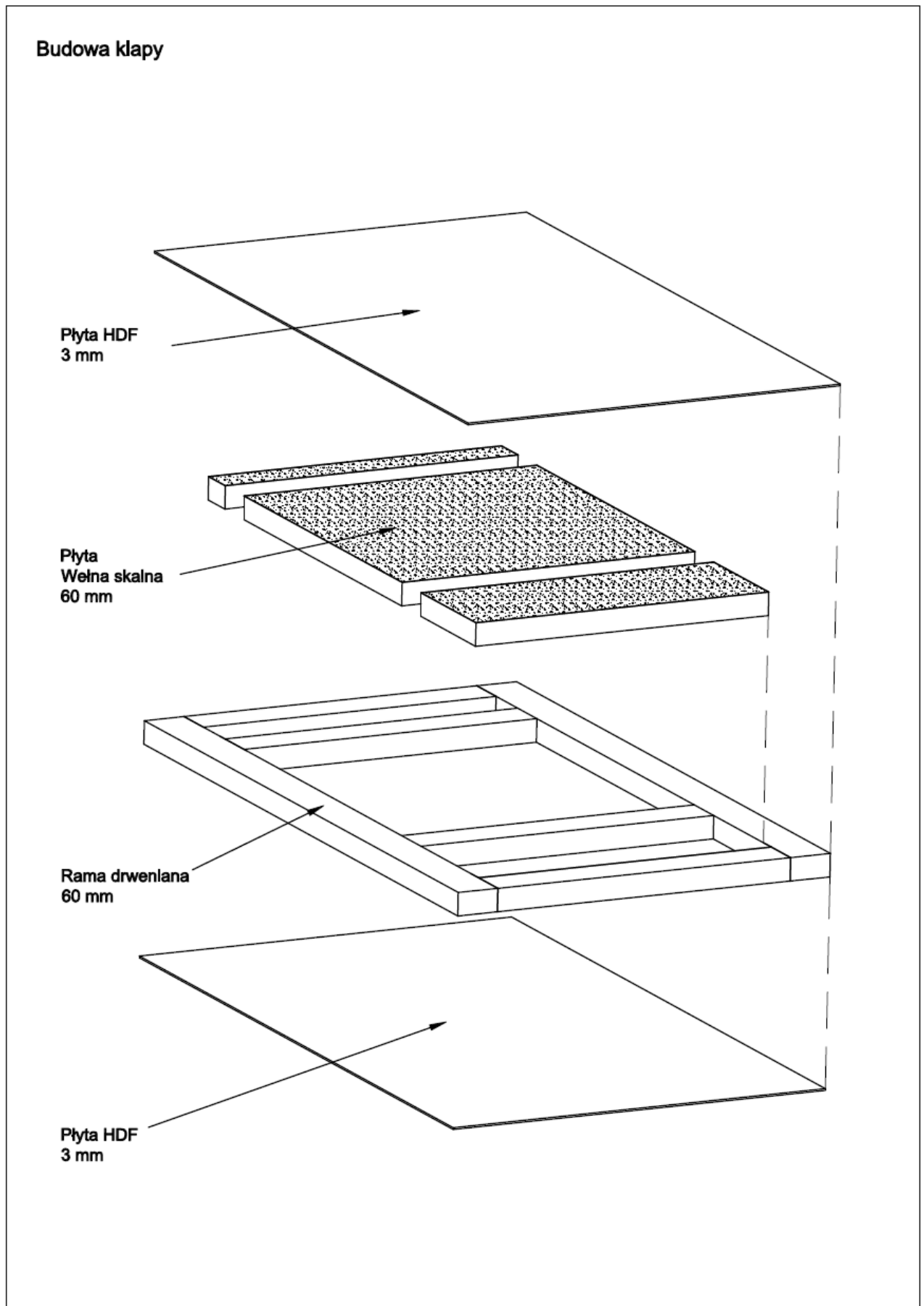


71st minute of the test.

Termination of the test.

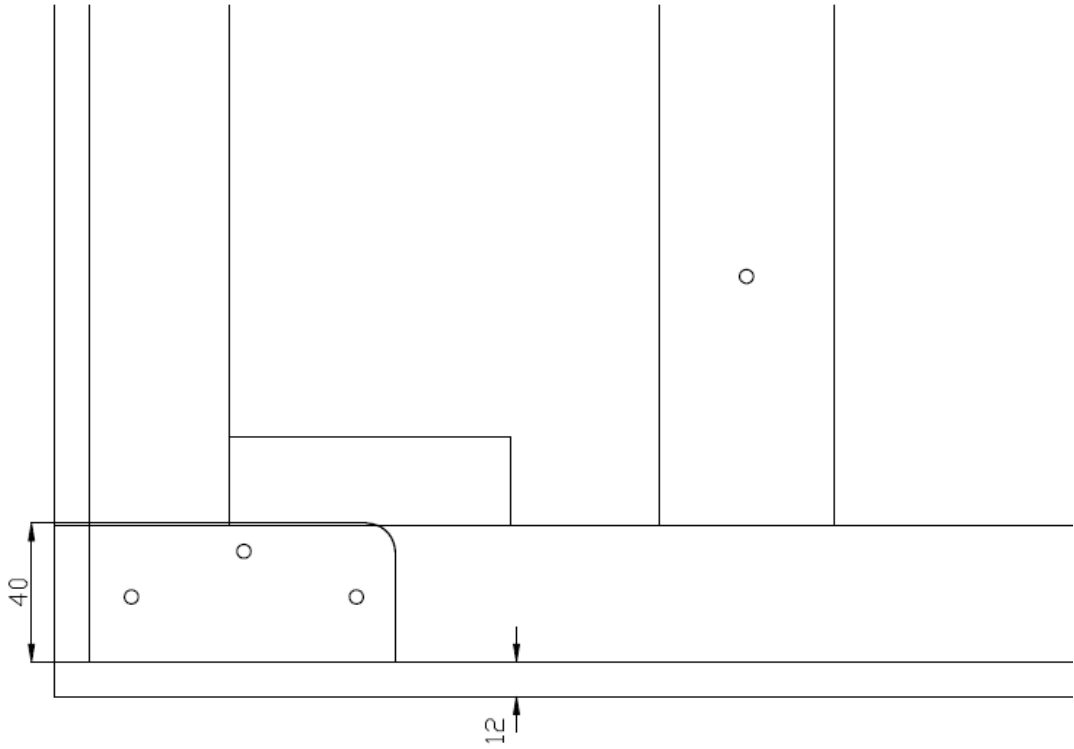
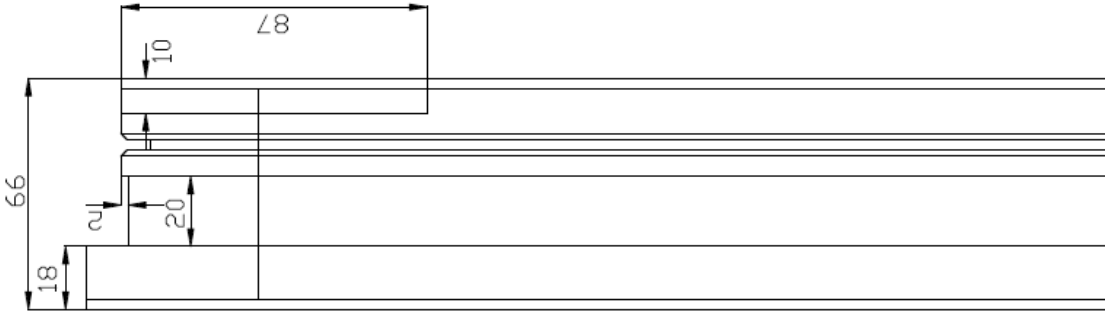


DRAWINGS OF SPECIMEN No. 1



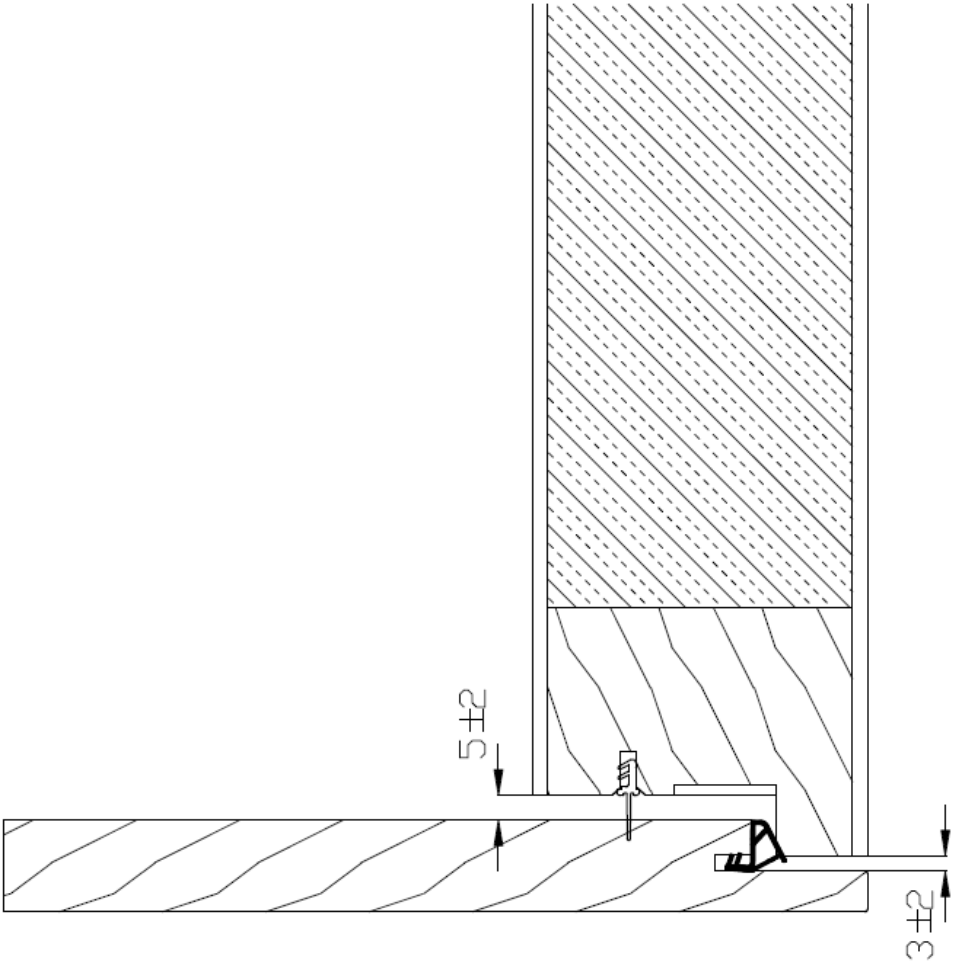


DRAWINGS OF SPECIMEN No. 1



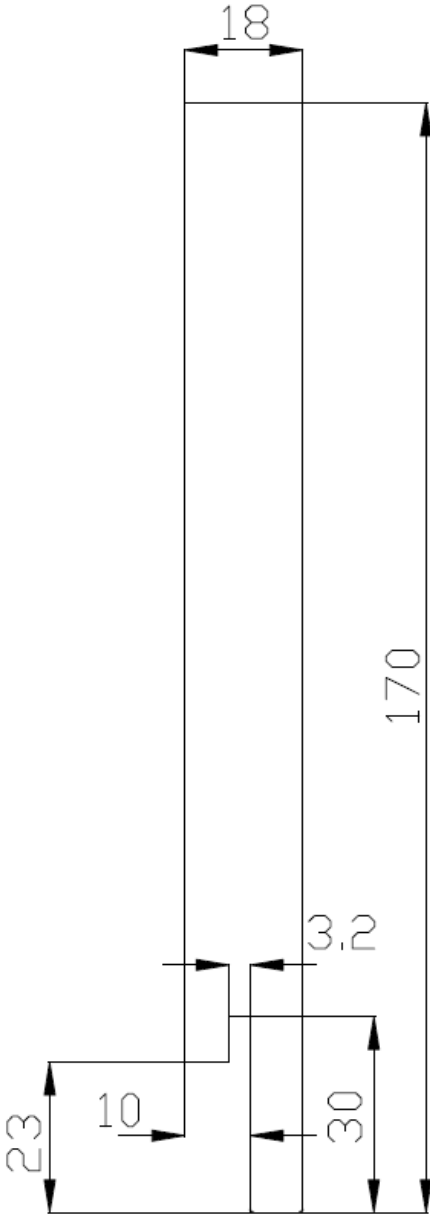


DRAWINGS OF SPECIMEN No. 1



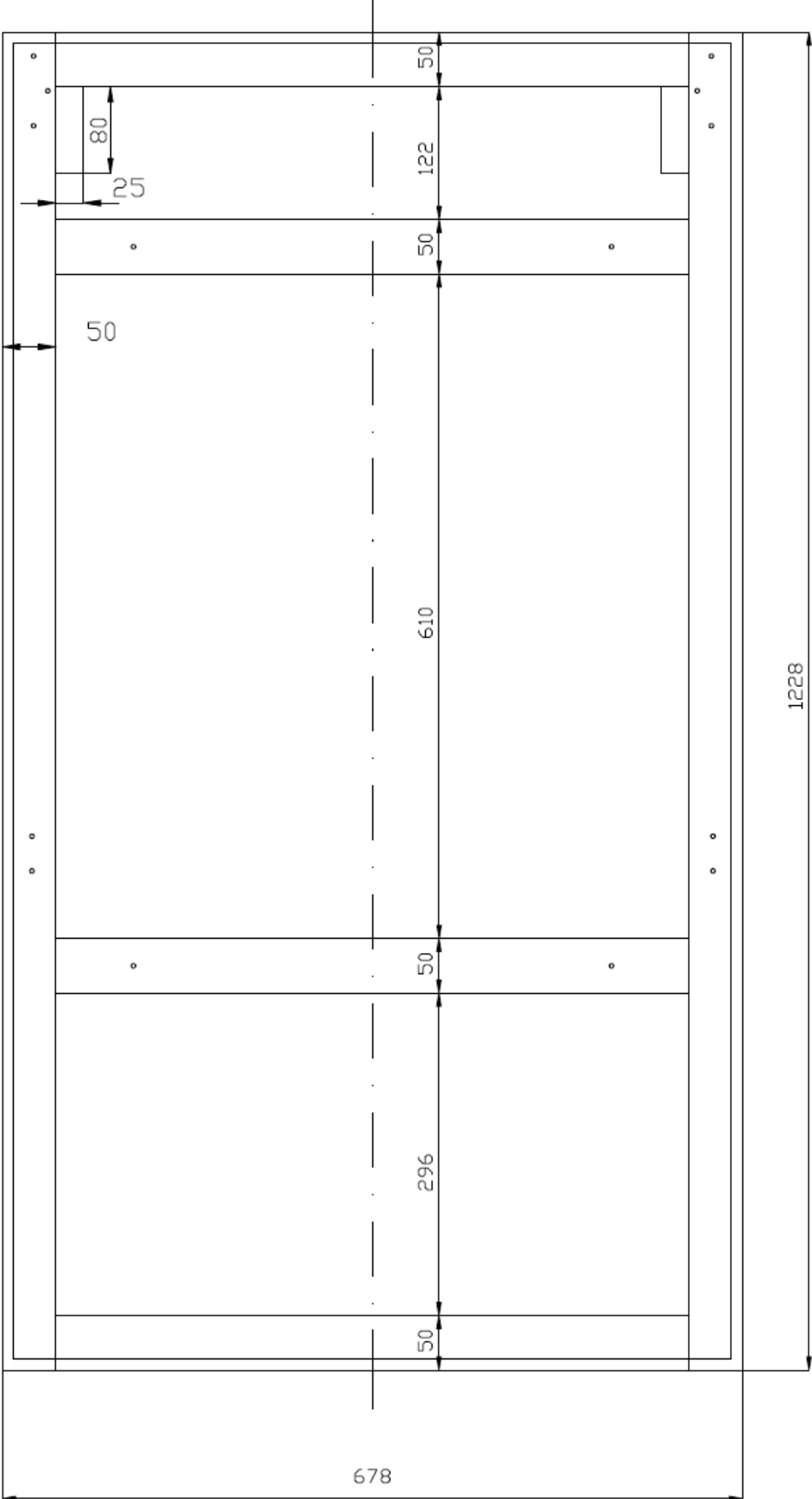


DRAWINGS OF SPECIMEN No. 1



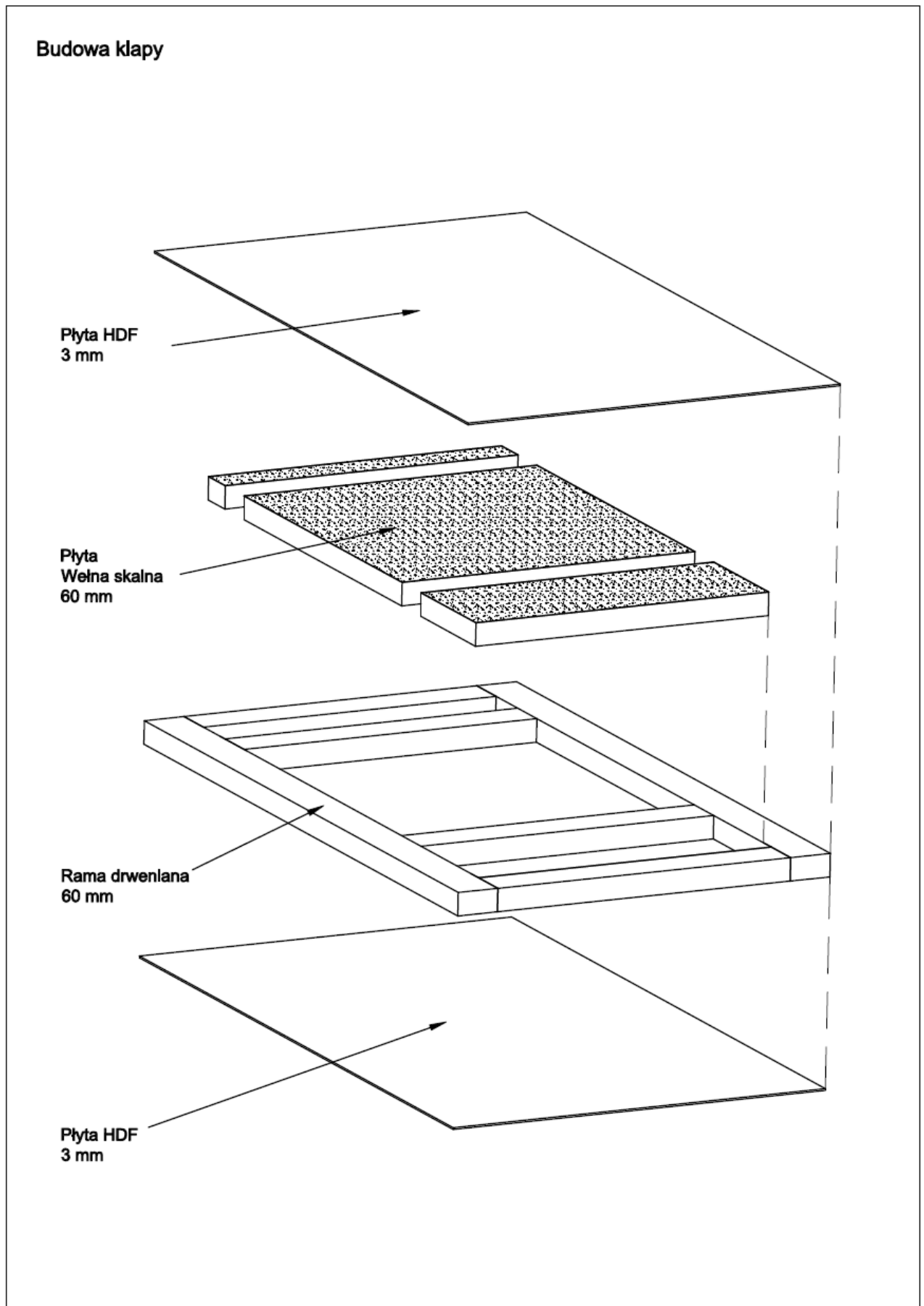


DRAWINGS OF SPECIMEN No. 1



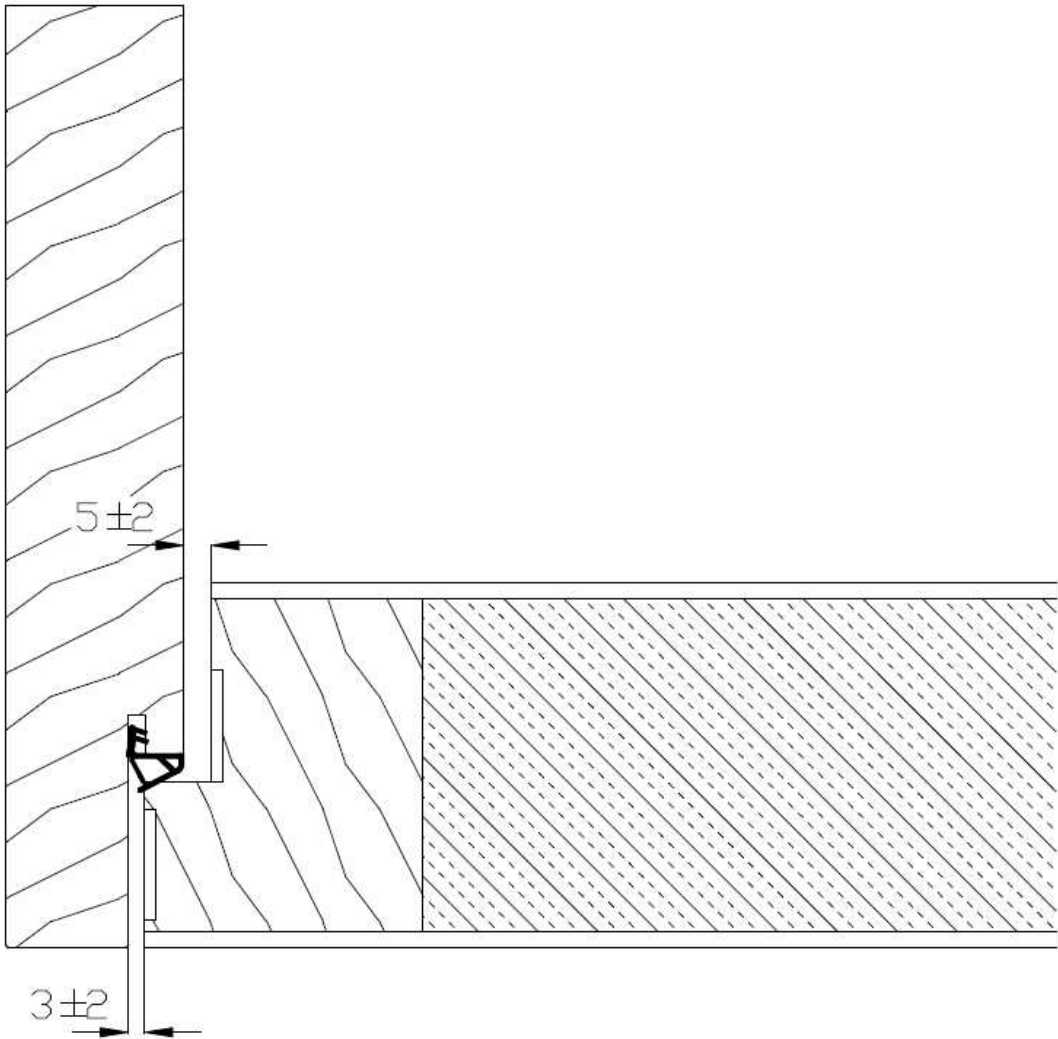


DRAWINGS OF SPECIMEN No. 2



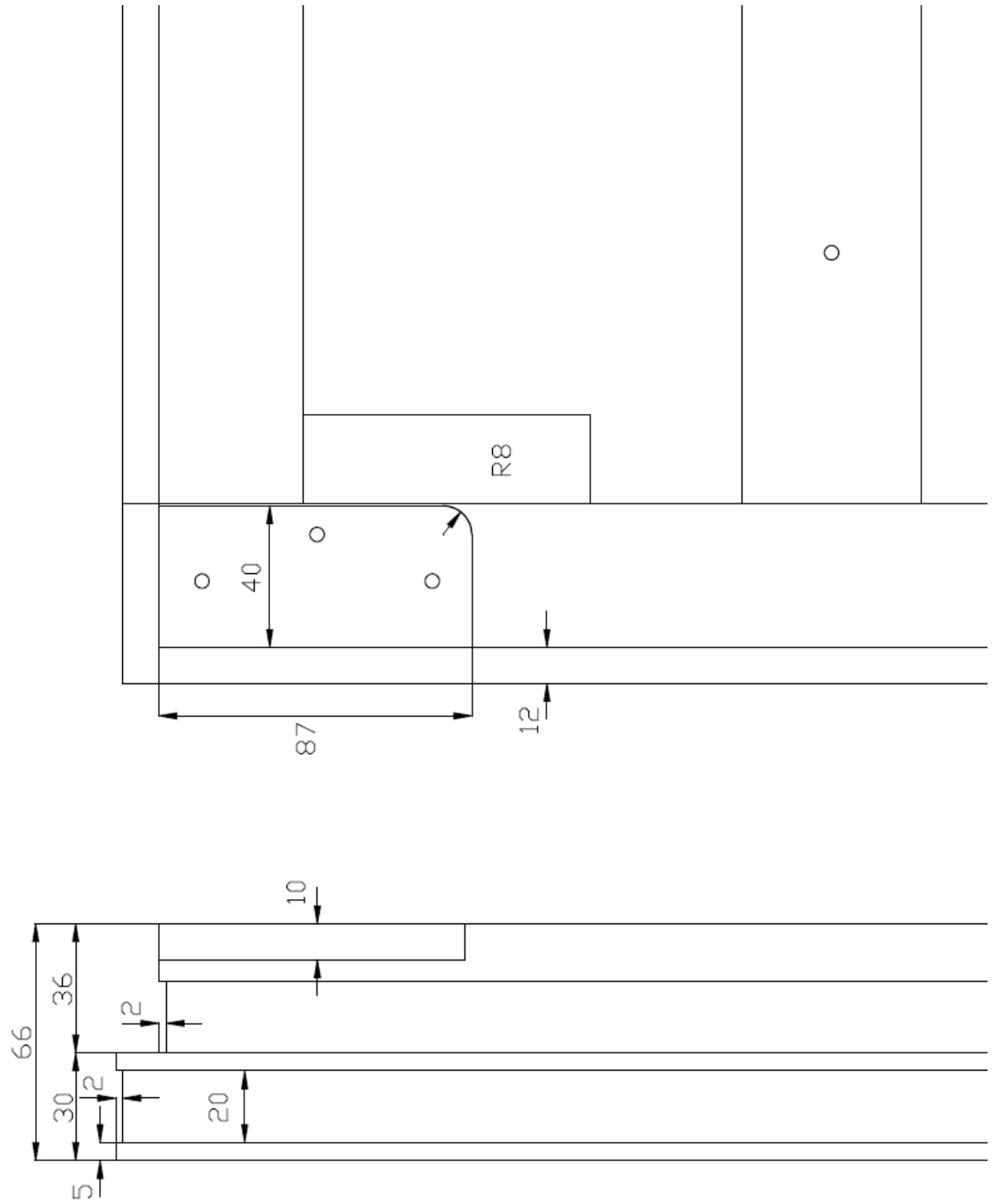


DRAWINGS OF SPECIMEN No. 2



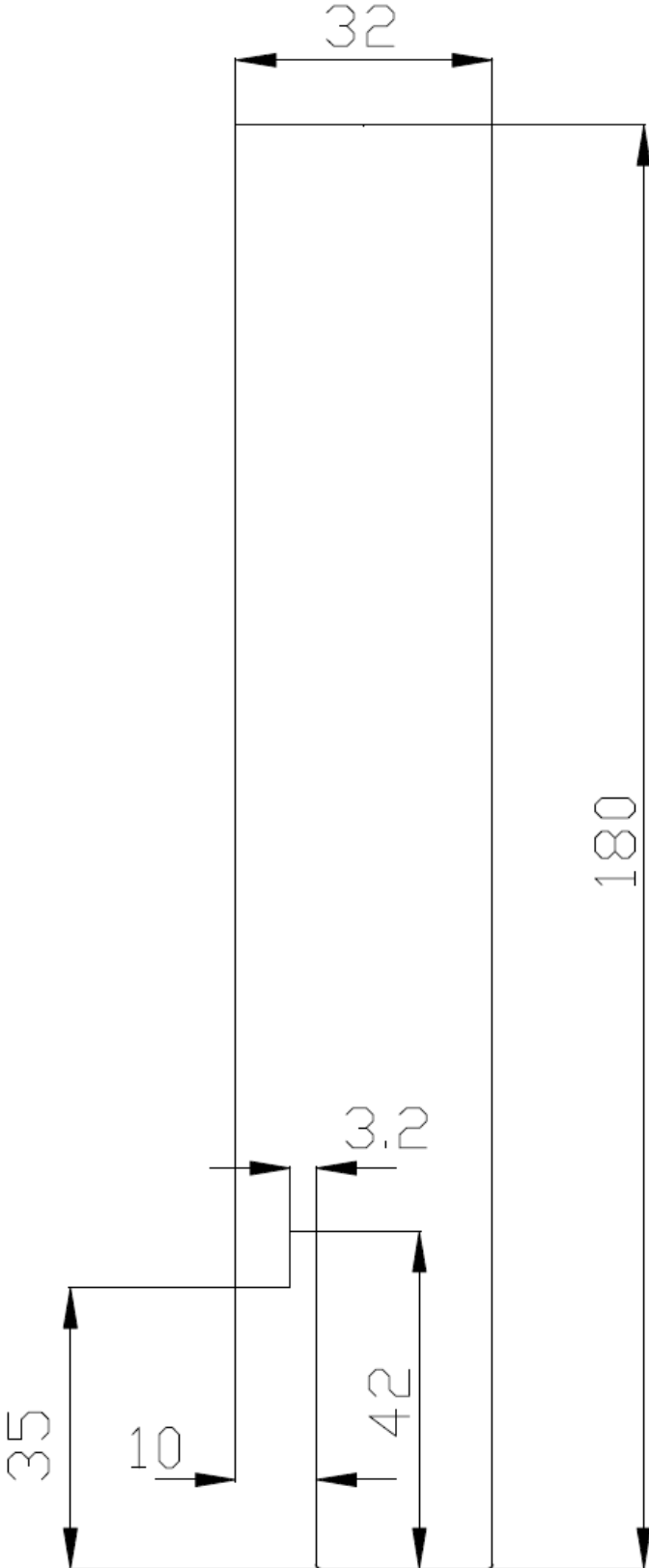


DRAWINGS OF SPECIMEN No. 2



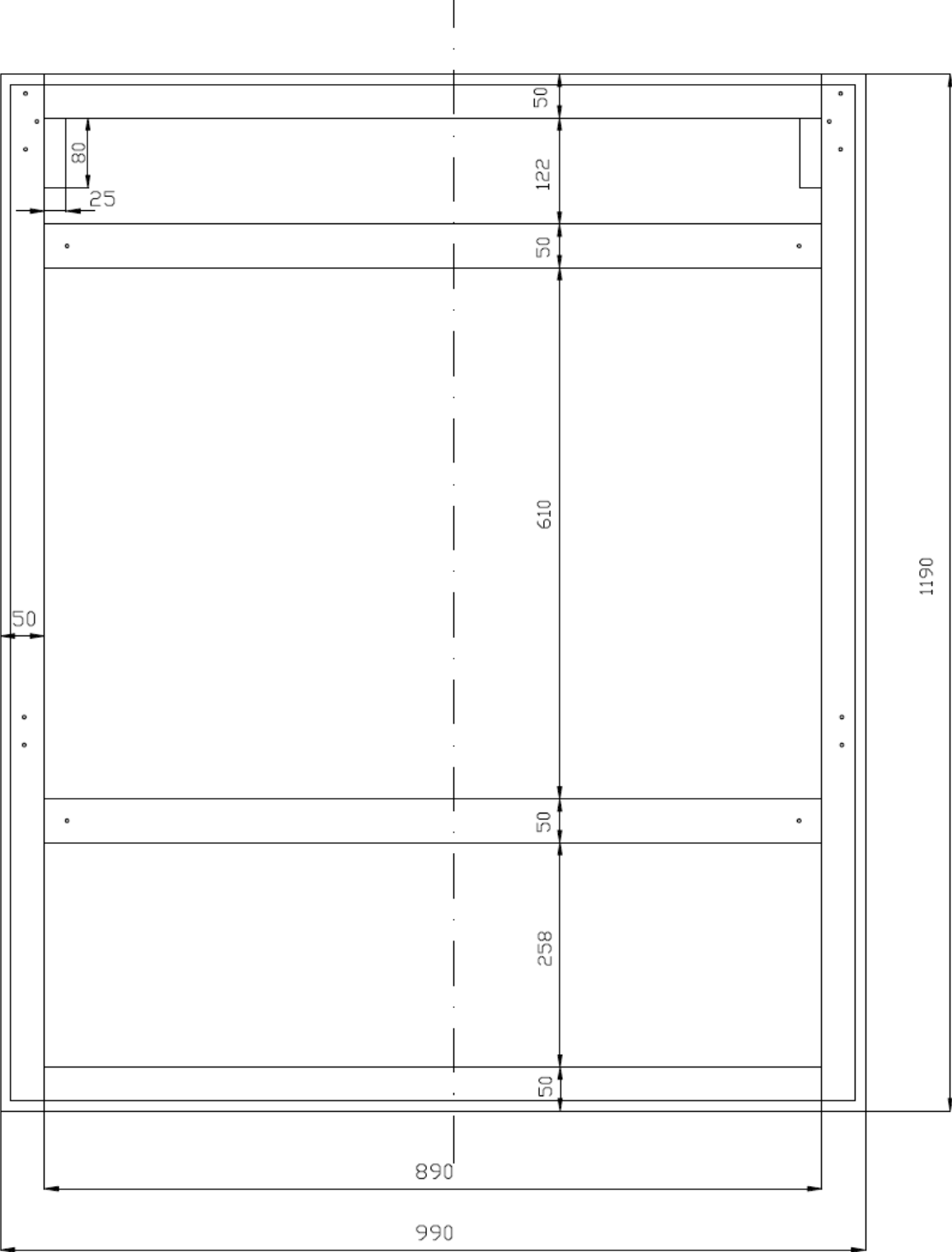


DRAWINGS OF SPECIMEN No. 2





DRAWINGS OF SPECIMEN No. 2





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:

Ing. Štefan Rástocký
leader of the testing laboratory



Prepared by:

Ing. Miroslav Hudák
technician of the testing laboratory

9. NORMATIVE REFERENCES

| | |
|-----------------|--|
| EN 1634-1: 2014 | Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware. Part 1: Fire resistance test for door and shutter assemblies and openable windows |
| EN 1363-1: 2012 | Fire resistance tests. Part 1: General requirements |
| EN 1363-2: 1999 | Fire resistance tests. Part 2: Alternative and additional procedures |
| EN 16034: 2014 | Pedestrian doorsets, industrial, commercial, garage doors and openable windows. Product standard, performance characteristics. Fire resisting and/or smoke control characteristics |

THE END OF THE TEST REPORT