



## **Laboratory for Fire Safety**

*Fire resistance test in accordance with EN 1365-2:2014 of a timber floor construction made of Wolf easi-joist® system, chipboard flooring and gypsum plasterboard (15 mm Gyproc Wallboard type A) ceiling incorporating eight JCC downlights*

*Test report*

## Laboratory for Fire Safety

*Fire resistance test in accordance with EN 1365-2:2014 of a timber floor construction made of Wolf easi-joist® system, chipboard flooring and gypsum plasterboard (15 mm Gyproc Wallboard type A) ceiling incorporating eight JCC downlights*

### Test report

Client JCC Lighting Products Ltd.  
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United Kingdom

Issued by Peutz bv  
Lindenlaan 41  
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Notified body nr. NB 2264



Product Timber floor construction incorporating 8 downlights

Report number Y 2271-3E-RA-001  
Date August 19, 2020  
Reference HL/TBr//Y 2271-3E-RA-001  
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This test report including 4 appendices consists of 39 pages and may only be used or reproduced in its entirety.

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## 1 Introduction

On behalf of *JCC Lighting Products Ltd.* a test was performed with respect to the fire resistance of the loadbearing floor construction consisted of Wolf easi-joist® system, chipboard flooring and gypsum plasterboard ceiling incorporating eight JCC downlights.

The test was performed in the Laboratory for Fire Safety of Peutz bv at Mook in accordance with EN 1365-2:2014, further referenced as EN 1365-2 and EN 1363-1:2020 further referenced as EN 1363-1.

This report provides a description of the construction tested (hereinafter also called the test specimen), the method used and the test results.

Relevant contact details are given in Appendix 1.



For this type of measurements the Laboratory for Fire safety has been accredited by the Dutch "Raad voor Accreditatie" (RvA).

The RvA is member of EA MLA (**EA MLA: European Accreditation Organisation MultiLateral Agreement**: <http://www.european-accreditation.org>).

*EA: "Certificates and reports issued by bodies accredited by MLA and MRA members are considered to have the same degree of credibility, and are accepted in MLA and MRA countries."*

## 2 Description of the construction tested

### 2.1 General

The materials for the test specimen were delivered on July 20, 2020. *Wolf Systems* installed the test specimen in the test frame on July 20, 21 and 22, 2020.

Drawings and descriptions of the materials used were supplied by the *Wolf Systems* and *JCC Lighting Products Ltd.* beforehand. During the assembly of the test specimen in the laboratory, the dimensions, the materials used and method of assembly of the specimen were checked by Peutz using the available drawings and recorded by means of photos. Peutz was not involved in the selection of the test specimen (or of its materials). Additional material was supplied by the client, Peutz has determined which material was used for the construction of the test specimen and which material was used for as sample material. The Laboratory cannot make any declaration about the representativeness of the specimen provided and the samples made available.

All values mentioned in this report relate to the nominal values provided by the client. If checks during the period of construction show that actual values deviate significantly from these nominal values, the measured values (MV) are given as well.

### 2.2 Construction of the test specimen

For the dimensions and structure of the test specimen, reference is made to descriptions and drawings supplied by the *Wolf Systems*, included in Appendix 3. The most relevant dimensions are gathered in Table 2.1 below. Appendix 2 includes some photos taken during the construction in the Laboratory. The test specimen is mounted in the test frame with two free edges.

The test frame consists of a steel frame with heat-resistant concrete elements inside. The installation opening of the test frame is 4.05 m × 3.00 m (w × h).

The *Wolf Systems* easi-joists® were positioned at 600 mm centres and were fixed on one side to the supporting construction.

#### t2.1 Outer dimensions of the construction

– Exposed length	4050 mm
– Span length	4150 mm
– Joists length	4250 mm
– Floor length:	4344 mm
– Floor width:	3000 mm
– Floor depth:	256 mm

The materials used are given in the tables below.

## t2.2 Construction materials (from top to bottom)

Material	Type, dimensions
Deck	Chipboards 22 mm thick NORBORD E1 P5, 600 x 2400 mm (w x l).
Beams/joists	Wolf Systems easi-joists®, 219 mm high, 72 mm wide. Fabricated from TR26 two rectangular white wood flanges (72 mm x 47 mm) connected to each other with metal webs (Wolf WS200) and TR26 white wood blocks (72 x 45 x 125 mm, two blocks at each bearing side and one block on the middle) which were connected to the easi-joist® flanges with rectangular metal nail plates Wolf 101 (100 x 48 mm).
Strongback	97 mm x 35 mm, C24M Derome.
Ceiling	Gypsum plasterboards 15 mm thick, GYPROC WALLBOARD type A – EN520; 2400 x 1200 mm (l x w) of a full board.

## t2.3 Fixing materials (from top to bottom)

Material	Type, dimensions, centre to centre distance
Deck: plates mutually	CaberFix D4 glue – in the tongue and groove of the boards.
Deck to joists	4.0 x 60 mm ECA Woodscrews (ca. 200 mm centres) and CaberFix D4 glue.
Joists	All easi-joists® connected at mid span with strongback (97 mm x 35 mm) with two screws (4.0 x 60 mm) at each mid-column of each easi-joist®.
Ceiling	3.5 x 55 mm DRYWALL screws with centre-to-centre distance of ca. 150 mm. Joints of the plasterboards are taped with fibre tape (Gyproc FibaTape, 48 mm) and filled with Gyproc joint filler (Ready Mix Joint Cement) which is also used to cover heads of the screws.

## t2.4 Lighting fixtures

Material	Type, size of aperture in the ceiling
JCC downlights	1 x JC94110CH with GU10C-5W-WW-D60° 3000K in Ø74 mm, 1 x JC94113WH with GU10C-4W-WW-60° 3000K in Ø74 mm, 1 x JC1002/BN in Ø85 mm, 1 x JC010023BN with GU10C-5W-WW-60° 3000K in Ø84mm, 1 x JC1001/WH in Ø70 mm, 1 x JC94114BN with GU10C-5W-NW-D-60° 4000K in Ø85mm, 1 x JC010010WH with GU10C-5W-WW-D-38° 3000K in Ø72mm, 1 x JC010016CH with GU10C-5W-NW-D-38° 4000K in Ø72mm. All downlights have been installed in accordance with the manufacturer's instructions.

## t2.5 Other materials

Material	Type, dimensions, location
Rimboard	White wood (C24) rimboard (l x h x d = 3080 mm x 219 mm x 45 mm) at both bearing sides – screwed to each easi-joist® with two 5.0 x 100 mm ECA Woodscrews.
Filler blocks (bearing sides)	White wood (C24) 'filler blocks' (h x d = 219 mm x 45 mm) installed between easi-joists® at both bearing sides – screwed to each easi-joist® with two (one in the top flange and one in the bottom flange) 4.0 x 60 mm ECA Woodscrews.
Insulation	ROCKWOOL FLEXI insulation, Euroclass A1, 50 mm thick on the free edges and cavity between 'filler blocks' and rimboard.

## 2.3 Supporting construction

For the purpose of the test a vertical section made of aerated concrete (class G4/600) has been added on top of a (horizontally positioned) frame. The aperture size of the vertical section was 4.05 m × 3.08 m. The vertical section was 200 mm thick and 250 mm high at the short sides where the joists were resting (simple support). In the longitudinal direction the section was 150 mm thick and 600 mm high. In this section two inspection windows were included. The space between the floor construction and the longitudinal sections (free edges) was filled with stone wool (50 mm thick, Rockwool Flexi Insulation, compressed up to approx. 40-45 mm).

On one of the bearing edges the easi-joists® were mounted to the supporting construction with one screw (5 x 100 mm ECA Woodscrew) per joist.

## 2.4 Loading conditions

The specimen was provided with a loading system, existing of a combination of steel plates resting on bricks directly on the surface of the floor. A load of 112 kg/m<sup>2</sup> was requested by the client. The total weight of the applied load was 110 kg/m<sup>2</sup> (total weight 1327 kg). The difference (-1.8 %) is within the tolerances according to the standard EN 1363-1 (± 2.5 %). The distribution of the weights including a description of the composition of the weights of each position are given in Appendix 3.4.

## 2.5 Conditioning of the test specimen

From the moment of delivery of the materials until the time of testing, the materials and the test specimen were kept in the laboratory under normal environmental conditions.

## 2.6 Determination of the moisture condition and the density

In table 2.6 the measured values for the moisture content (determined by drying) and the density (determined before drying) of the relevant materials of the test specimen are given.

t2.6 *Determination of moisture content and density*

Material	Density [kg/m <sup>3</sup> ]	Moisture content [%]
	(determined before drying)	(determined by drying)
Easi-joist® flanges and blocks (TR26, white wood)	434	11.7
Chipboard 22 mm (Nordboard, E1 P5)	671	8.4
Gypsum plasterboard 15 mm (British Gypsum type A)	700	0.8
Strongback (C24, Derome)	518	11.3
Rimboard and 'filler blocks' (C24, white wood)	472	13.2
Stone wool (Rockwool Flexi Insulation)	27	0.4

## 2.7 Remarks

The moisture content of the rimboard and 'filler blocks' is slightly higher than written in the guidelines according to Appendix F of EN 1363-1 (9 – 12%). The extra moisture in the wood might have an influence on the test results. Because of the overrun time of 6 minutes it is not expected to have any consequences for a possible classification of the tested construction.

## 3 Test

### 3.1 General

The test was performed on August 5, 2020 in accordance with EN 1365-2 and assessed according to the following criteria:

- load bearing capacity (R)
- integrity (E);
- insulation (I).

The test specimen was heated from below using the standard heating curve as defined in EN 1363-1.

Some photographs taken during the test are shown in Appendix 2.

### 3.2 Test conditions

#### *Change in temperature over time in the furnace*

The change in temperature over time in the furnace throughout the test and the permissible margins for the recorded temperature of the individual furnace thermocouples in relation to the heating curve to be realised are shown in Appendix 4, graph numbers 1 and 2.

The relative deviation of the average furnace temperature in relation to the heating curve to be realised and the permitted deviation are shown in Appendix 4, graph number 3.

#### *Overpressure in the furnace*

The required overpressure in the furnace results in a set point of 18.7 Pa, measured 0.250 m below the ceiling of the test specimen. The pressure in the furnace is measured every 6 seconds, the graph shows the moving average, determined over 90 seconds.

The pressure during the test and the permissible margins for the recorded pressure are shown in Appendix 4, graph number 4.

#### *Ambient temperature*

Before the start of the test the temperature in the test area was approximately 20.1 °C. At the end of the test, this was approximately 21.3 °C. See Appendix 4, graph number 5.

### 3.3 Loadbearing capacity (R)

The calculations of the permissible deflection and the permissible rate of deflection are based on a distance from the extreme fibre of the cold design compression zone to the extreme fibre of the cold design tension zone of the structural section 'd' of 219 mm.

The permissible deflection of the construction during the test is limited at a maximum of 197 mm and the ultimate limit at maximum of 295.5 mm in accordance with EN 1363-1. The permissible rate of deflection of the floor construction is limited at a maximum of 8.7 mm/min.

The locations of the measurement points are shown in Appendix 3.3. The measured values related to the deflection and the rate of deflection are given in Appendix 4, graph numbers 8 and 9.

During the test, the limit for the rate of deflection was met after 31 minutes. After 36 minutes of testing (at the moment the floor collapsed) the limit for the deflection was met.

### **3.4 Integrity (E)**

The results for the integrity criterion are listed in Table 3.1 and Chapter 4.

### **3.5 Insulation (I)**

The positions of the thermocouples (also called TC) on the unexposed face are illustrated in Appendix 3.3. The temperatures measured on the unexposed face are given in Appendix 4, graphs number 6 and 7. The limit for the average temperature rise and limit for the maximum temperature rise were not met during the test.

### **3.6 Observations**

Table 3.1 lists the most important observations in chronological order during the test. If the observation is made from the exposed face by our furnace camera, EF is indicated in parentheses. Unless stated otherwise the observations are made from the inside of the furnace.

## t3.1 Observations and proceedings during the test

Time [min]	Observations
0	Commencement of the test.
1	Paper of the gypsum boards begins to turn black.
1:30	Green flames in the oven.
2	Paper of gypsum boards fully black.
2:10	The bezel of downlight 6 starts to melt.
2:30	Dripping material from downlight 2, 5 and 8.
3:30	Paper of the gypsum boards slowly getting loose.
4:30	Dripping material from downlight 4.
5	Filler slowly getting loose, some pieces of filler falling down.
7	Downlight 4 slips slightly from the cut-out hole in the gypsum board.
7	Bigger pieces of filler falling down.
9	Downlight 5 slips slightly from the cut-out hole in the gypsum board.
13	The light bulb of downlight 7 comes loose. Lot of flames coming out.
13:30	The light bulb of downlight 2 comes loose. Some flames coming out.
15	Gypsum boards start to curve between screws.
17	Piece of downlight 5 falls into the oven.
18	Flames coming out from downlight 1, 5 and 8.
18:30	Downlight 1 falls into the oven. Lot of flames coming out from that aperture.
18:40	Piece of downlight 8 falls into the oven.
21	Joints between gypsum boards start to open.
23	Downlight 7 is sliding down from the cut-out hole in the gypsum board.
26	Flames coming out from the joints of the gypsum boards.
27	First piece of gypsum board falls into the oven.
27	Crackling sounds coming out from the burning wood.
28	Another piece of the gypsum board falls into the oven.
29	Furnace is if full of black smoke, observations from the inside are not longer possible.
31	<b>Limit for rate of deflection has been reached.</b>
32	Grey smoke coming out from the construction on both bearing sides (observation outside the furnace).
35	Amount of smoke coming out increases (observation outside the furnace).
36	Floor construction collapses. <b>Criterion Integrity (E) reached.</b>
36	End of the test.

### 3.7 Remarks

After 27 minutes of the test some of the gypsum boards fall into the furnace causing intense burning of exposed easi-joists® and chipboards. As a consequence deviations are visible on the graphs presenting the temperature inside the furnace and the overpressure in the furnace (respectively graphs number 1 and 2 and graph number 4 in Appendix 4). The pressure exceeding the upper tolerance during less than 3 minutes. In accordance with §5.2 of the EN 1363-1 pressure tolerances may be exceeded for a period of maximum 5 minutes if they are clearly identified as being associated with the sudden ignition of significant quantities of combustible materials. Therefore it will not be of influence for a possible classification of the test specimen.

The measurement taken by TC 3 did not reflect the actual temperature value during the test. This can be seen on graph number 6 in Appendix 4. Therefore, after approximately 24 minutes TC 3 was removed from further measurements. Considering the number of thermocouples used to measure the average temperature rise we have collected sufficient data to expect that this deviation will not have any consequences for a possible classification.

## 4 Summary

On behalf of *JCC Lighting Products Ltd.*, a test was performed to determine the fire resistance with respect to the separating function of the loadbearing floor construction consisted of *Wolf Systems* easi-joists®, chipboard flooring and gypsum plasterboard ceiling incorporating eight JCC downlights.

The test was performed in the Laboratory for Fire Safety of Peutz B.V. at Mook in accordance with EN 1365-2. Heating occurred from below using the standard heating curve.

Table 4.1 shows the time during which each of the criteria was met ('pass') or when a criterion was exceeded ('fail'), as appropriate. The elapsed time is the time in whole minutes that has elapsed since the commencement of the test.

The test was finished after 36 minutes.

### t4.1 Fire resistance test results

Criterion	Elapsed time	Pass / Fail
Loadbearing capacity (R)		
– limiting deflection * 1.5	36 minutes	fail (due to collapsing)
– limiting deflection	36 minutes	fail (due to collapsing)
– limiting rate of deflection	31 minutes	fail
Integrity (E)		
– sustained flaming	36 minutes	fail (due to failing R)
– cotton pad	36 minutes	fail (due to failing R)
– gap gauges	36 minutes	fail (due to failing R)
Insulation (I)		
– average temperature rise	36 minutes	fail (due to failing R)
– maximum temperature rise	36 minutes	fail (due to failing R)

## 5 Conditions and field of application

### 5.1 Field of direct application

The test results obtained are only valid for constructions that are identical to the construction described in this report. You are referred to EN 1365-2, chapter 13 for the field of direct application.

### 5.2 In conclusion

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested 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 method is not covered by this report.

Because of the nature of fire resistance testing and the 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.

Mook,

H.H.A. Leenders, BSc.  
Head of Laboratory for Fire Safety



M. Vercammen, Ph.D.  
Management



This report contains 14 pages and 4 Appendices:

Appendix 1: Relevant address details	(1 page)
Appendix 2: Photographs of the test specimen	(7 pages)
Appendix 3: Drawings and measurements	(12 pages)
Appendix 4: Graphs	(5 pages)

## **Appendix 1**

### **Relevant address details**



#### **Testing Laboratory**

Peutz Laboratory for Fire Safety  
Lindenlaan 41  
NL-6584 AC MOLENHOEK  
Nederland

#### **Testing body**

Peutz BV  
Lindenlaan 41  
NL-6584 AC MOLENHOEK  
Postbus 66  
NL-6585 ZH MOOK  
Nederland

#### **Client**

JCC Lighting Products Ltd.  
Innovation Centre Southern Cross Trading Estate,  
Beeding Close, Bognor Regis,  
West Sussex, PO22 9TS  
United Kingdom

#### **Manufacturer test specimen (floor construction)**

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Shilton Industrial Estate  
Coventry CV7 9QL  
United Kingdom

#### **Manufacturer of the downlights**

JCC Lighting Products Ltd.  
Innovation Centre Southern Cross Trading Estate,  
Beeding Close, Bognor Regis,  
West Sussex, PO22 9TS  
United Kingdom

## Appendix 2 Photographs



Photograph 1: Easi-joist® system during build up.



Photograph 2: Easi-joist® system during build up.



Photograph 3: Installation of the chipboards.



Photograph 4: Finished installation of the chipboards.



Photograph 5: Finished installation of the chipboards – view from underneath.

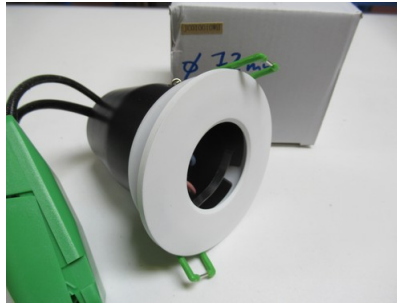


Photograph 6: Installation of the gypsum boards.

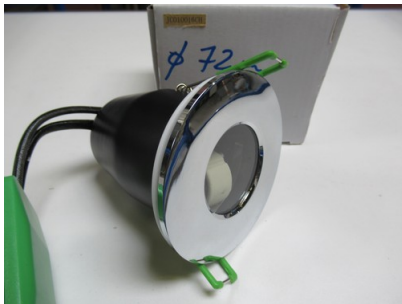
## Appendix 2 Photographs



Photograph 7: Downlight 1 (JC94110CH).



Photograph 8: Downlight 2 (JC010010WH).



Photograph 9: Downlight 3 (JC010016CH).



Photograph 10: Downlight 4 (JC1002/BN).



Photograph 11: Downlight 5 (JC94113WH).



Photograph 12: Downlight 6 (JC1001/WH).



Photograph 13: Downlight 7 (JC010023BN).



Photograph 14: Downlight 8 (JC94114BN).

## Appendix 2 Photographs



Photograph 15: Exposed side before the test with all six downlights installed in the ceiling.



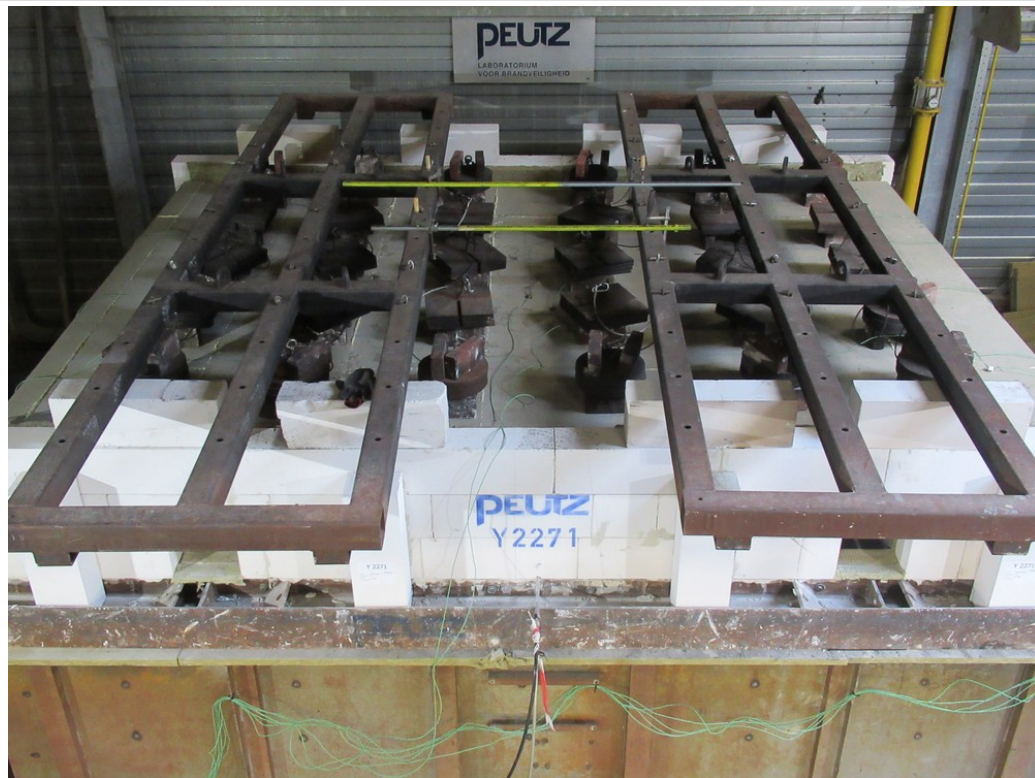
Photograph 16: Example of loading system.



Photograph 17: Top view on the loading system.

## Appendix 2 Photographs

# PEUTZ



Photograph 18: Arrangement of the test with the loading system before the test.



Photograph 19: During the test after 1 minute.



Photograph 20: During the test after 1 minute – green flames in the oven.

## Appendix 2 Photographs



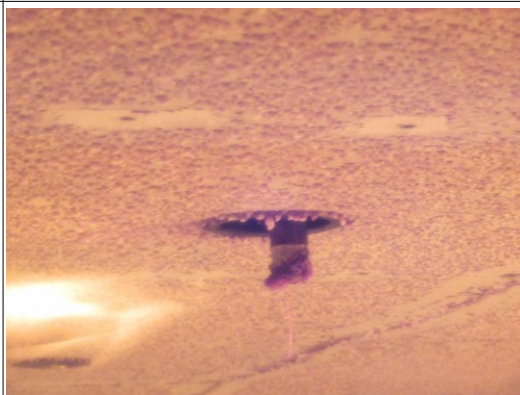
Photograph 21: During the test after 3 minutes.



Photograph 22: During the test after 4 minutes – dripping material from downlight 4.



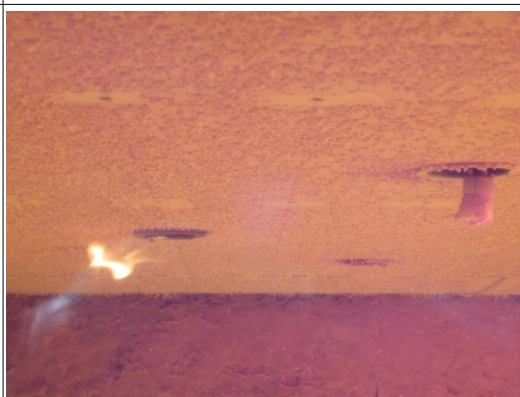
Photograph 23: During the test after 9 minutes.



Photograph 24: During the test after 13 minutes – the light bulb of downlight 7 come loose.



Photograph 25: During the test after 16 minutes.

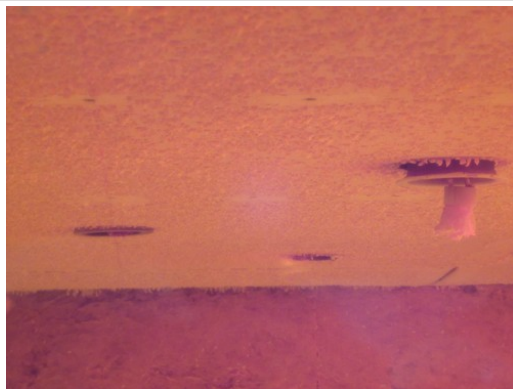


Photograph 26: During the test after 18 minutes – flames coming out from downlight 8.

## Appendix 2 Photographs



Photograph 27: During the test after 21 minutes.



Photograph 28: During the test after 23 minutes – downlight 7 is sliding down from the cut out hole.



Photograph 29: During the test after 27 minutes – first piece of gypsum board falls into the oven.



Photograph 30: During the test after 30 minutes.



Photograph 31: During the test after 32 minutes.



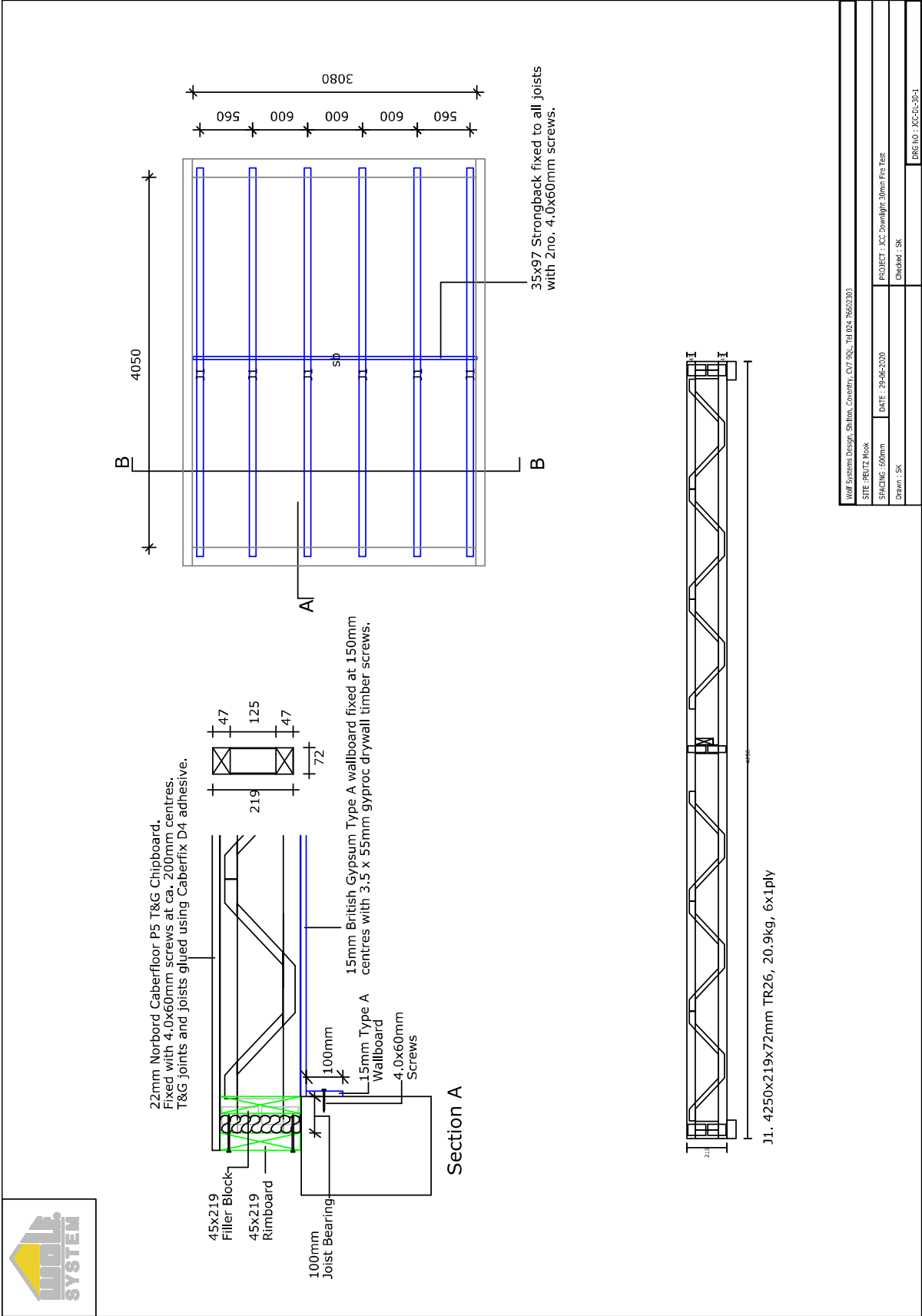
Photograph 32: During the test after 36 minutes.

## Appendix 2 Photographs

# PEUTZ



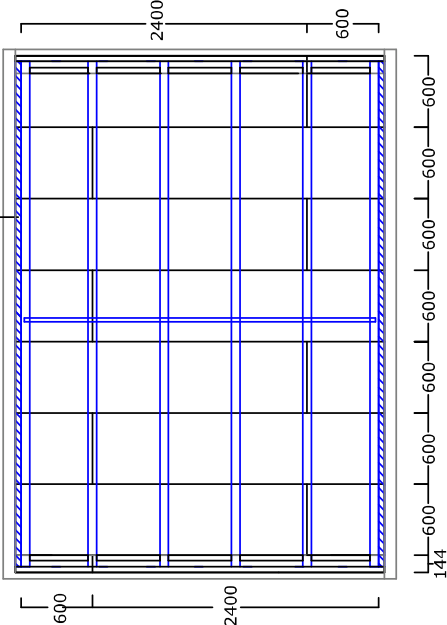
Photograph 33: During the test after 36 minutes: seconds before floor construction collapses.



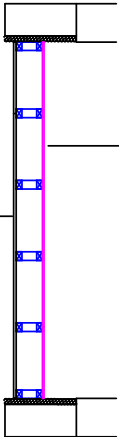


Floor layout from above

50mm Rockwool Flexi Insulation  
slabs between joists and wall.



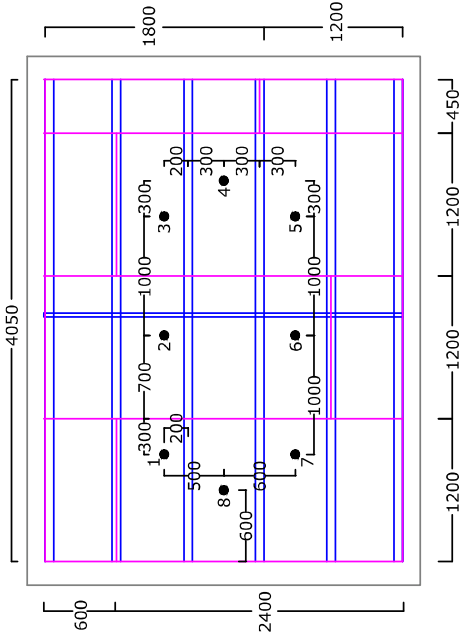
22mm T&G chipboard screwed and glued to the joists  
with 4.0x60mm screws at ca. 200mm centres and  
Caberfix D4 joint and joist adhesive.



Section B

15mm British Gypsum Type A wallboard fixed at 150mm centres  
with 3.5 x 55mm gyproc drywall timber screws.

Ceiling layout from below



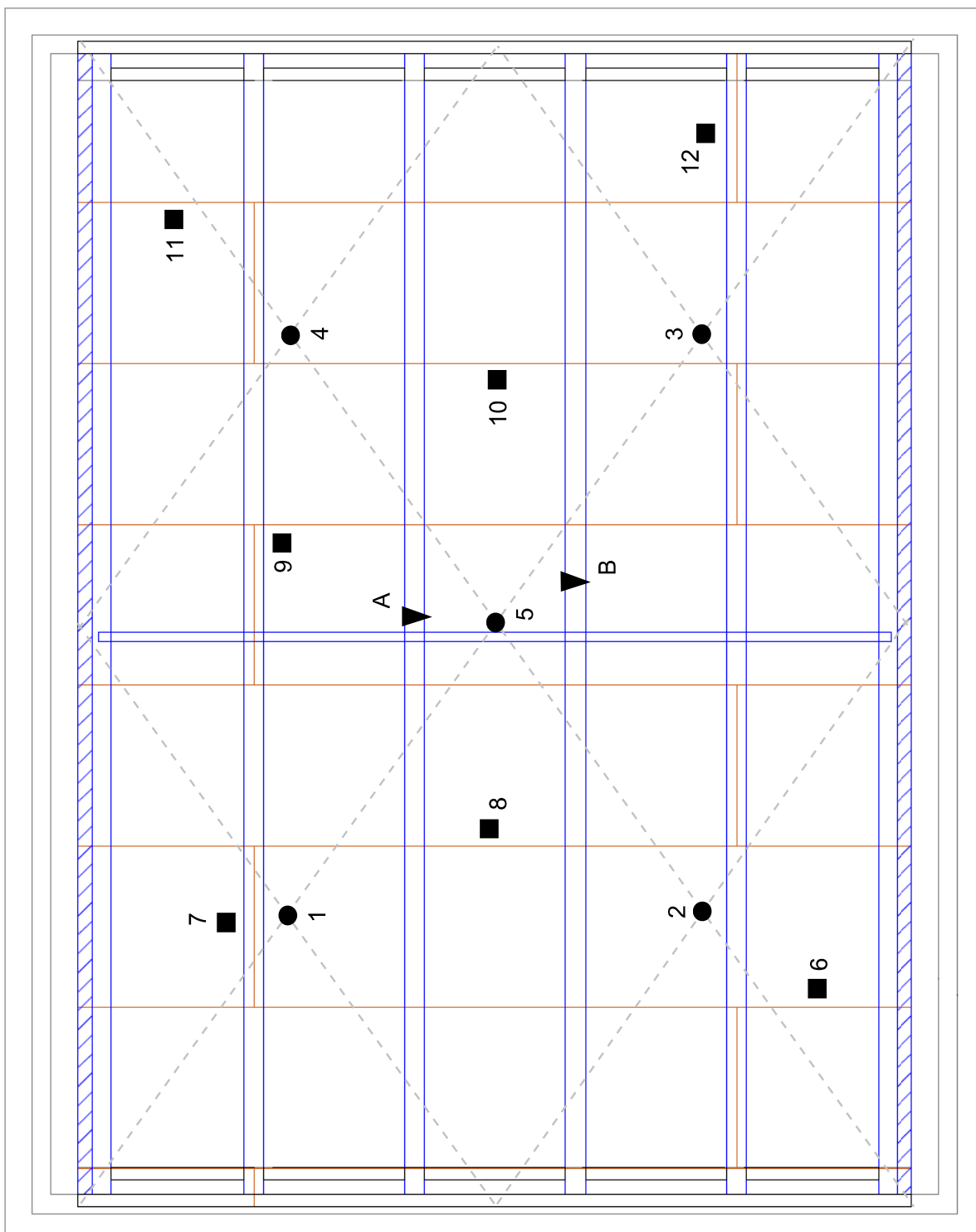
2400x1200x15mm British Gypsum Type A wallboard.  
Fixed at 150mm centres with 3.5 x 55mm gyproc drywall timber screws  
All plasterboard joints and edges taped with 48mm Gyproc FibraTape  
and filled with Gyproc Ready Mix Joint Cement.

●—Downlight key:

- 1. JC94110CH
- 2. JC010010WH
- 3. JC010016CH
- 4. JC1002/BN
- 5. JC94113WH
- 6. JC1001/WH
- 7. JC010023BN
- 8. JC94114BN

Wolf Systems Design, Shiloh, Coventry, CV7 9QJ, Tel 024 76602303			
SITE: PEUTZ Moss			
SPACING: 600mm	DATE: 29-06-2020	PROJECT: JCC Downlight 30min Fire Test	
Drawn: SK		Checked: SK	
			DWG NO.: JCC-01-30-2

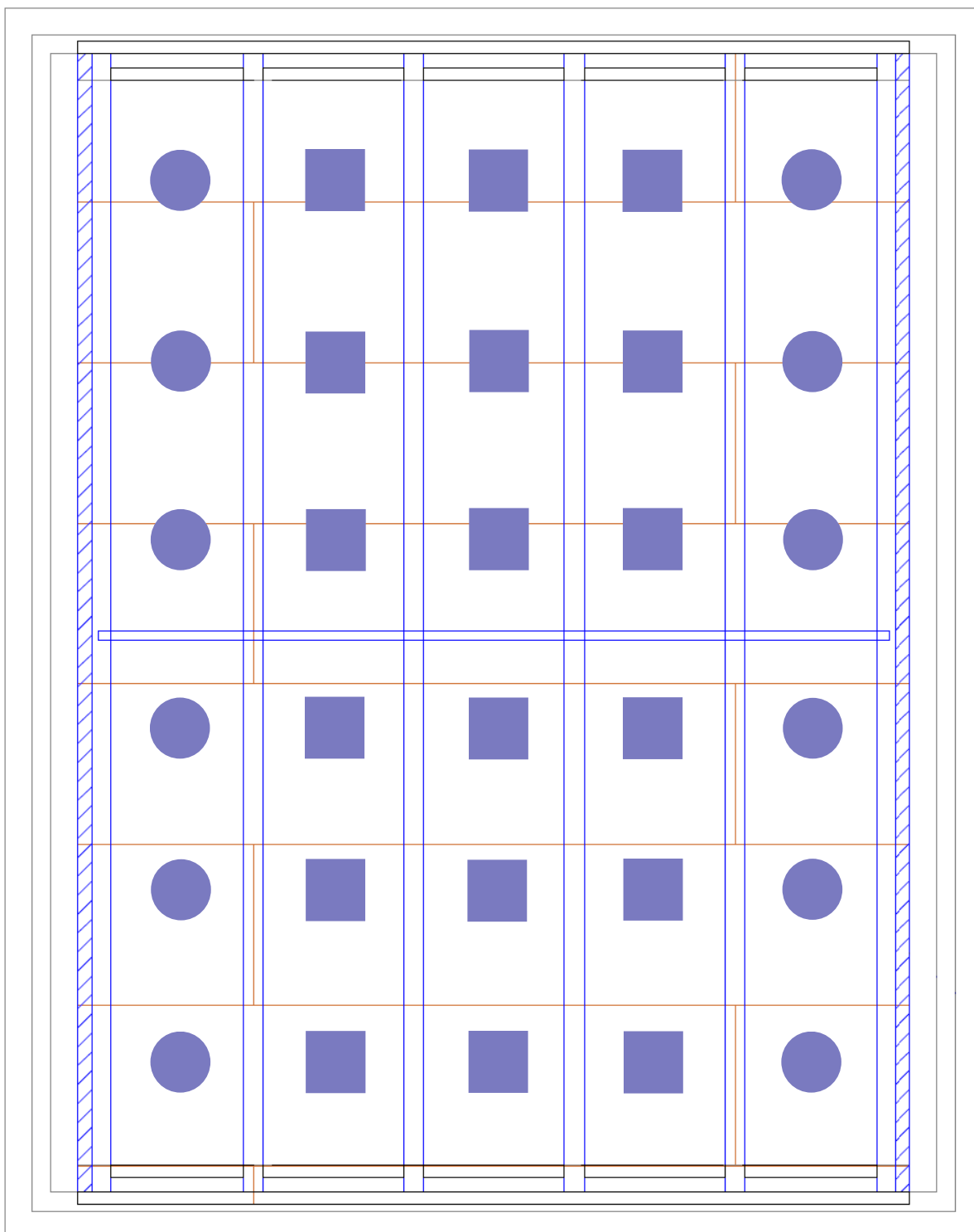
## Positions of thermocouples and deflection points




### List of symbols:


- Thermocouple average temperature [ TC 1-5 ]
- Thermocouple maximum temperature [ TC 6-12 ]
- ▼ Deflection measurement point

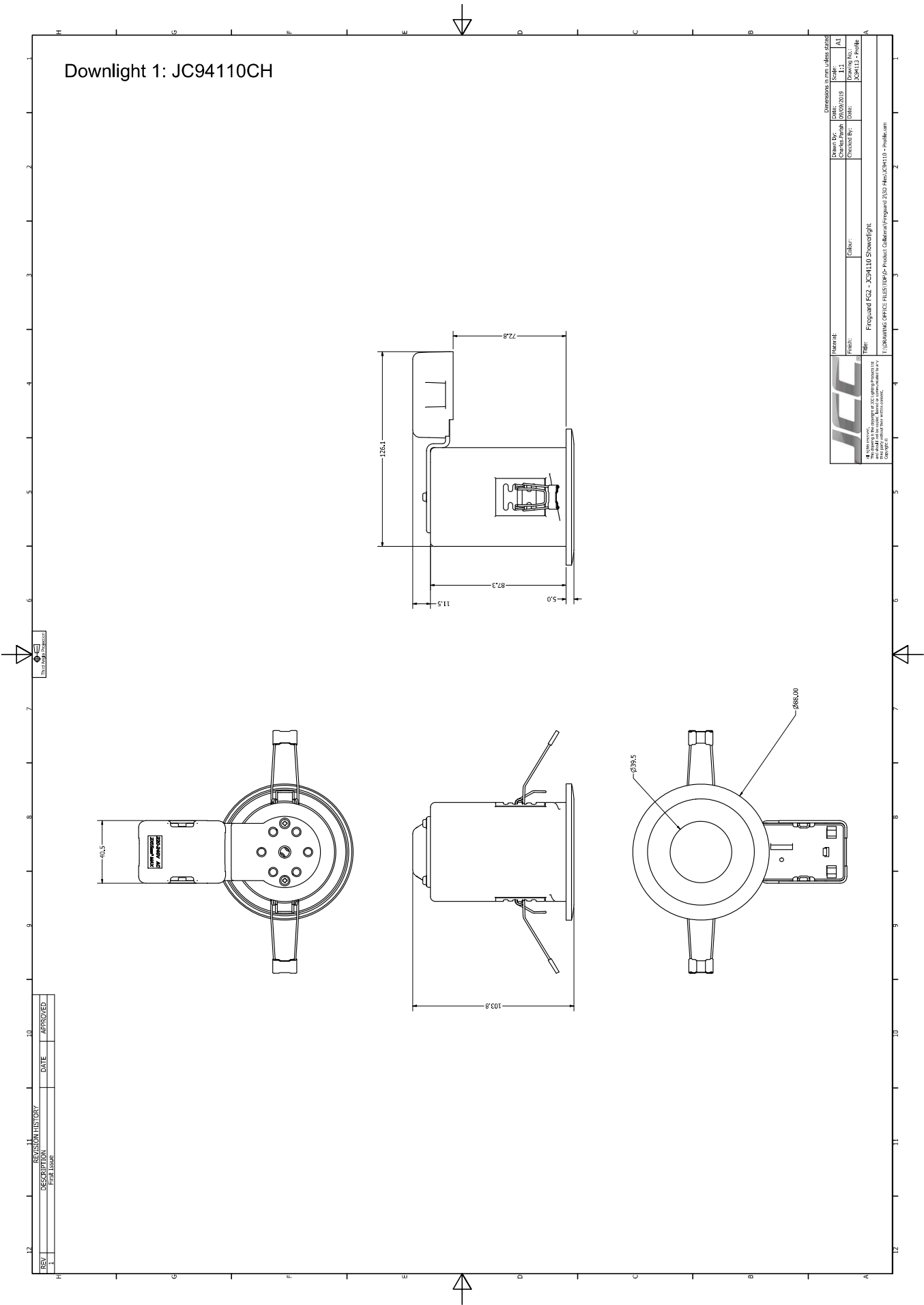
## Arrangement of loading system



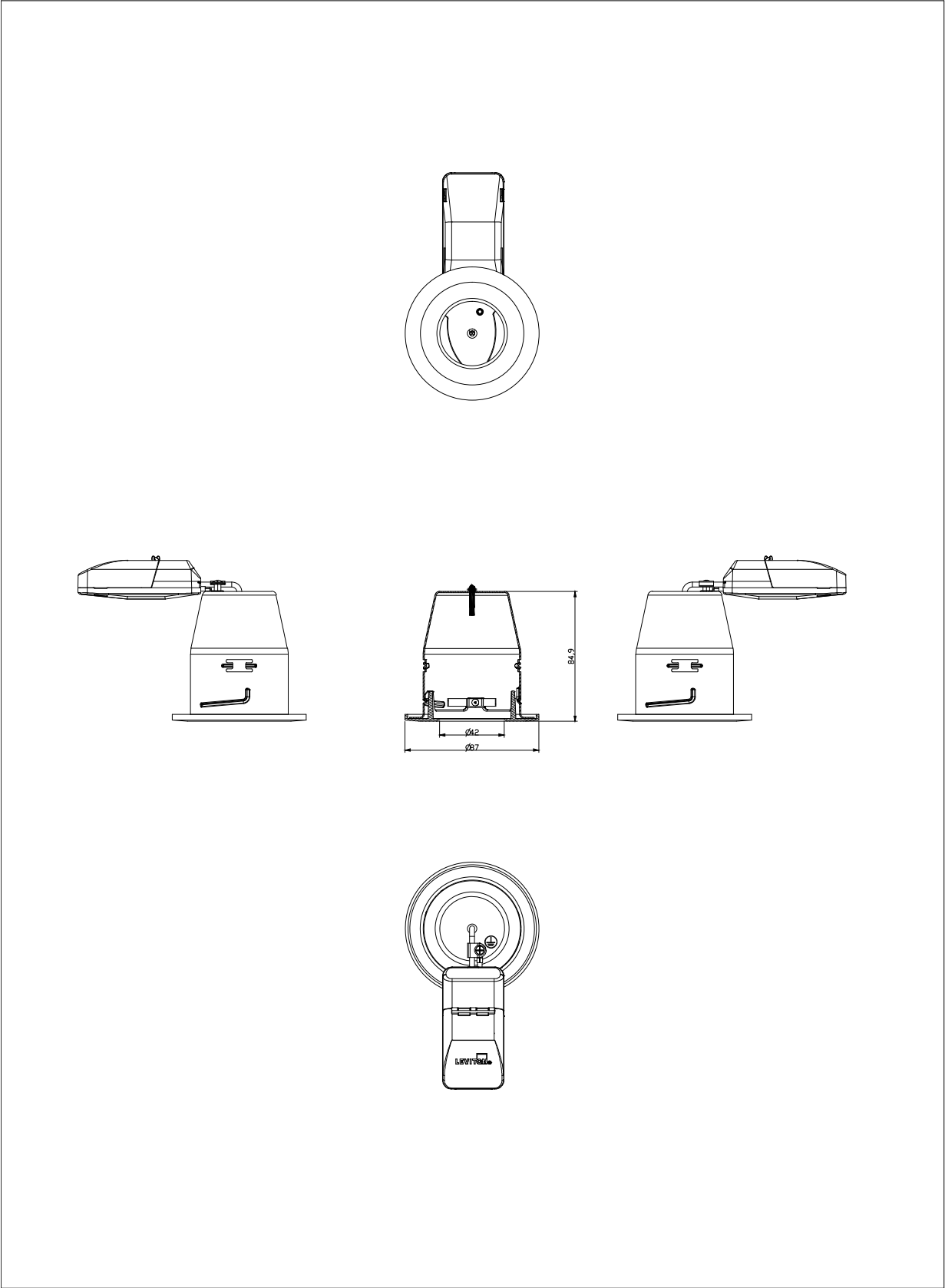
### List of symbols:

 12 x 44.6 kg

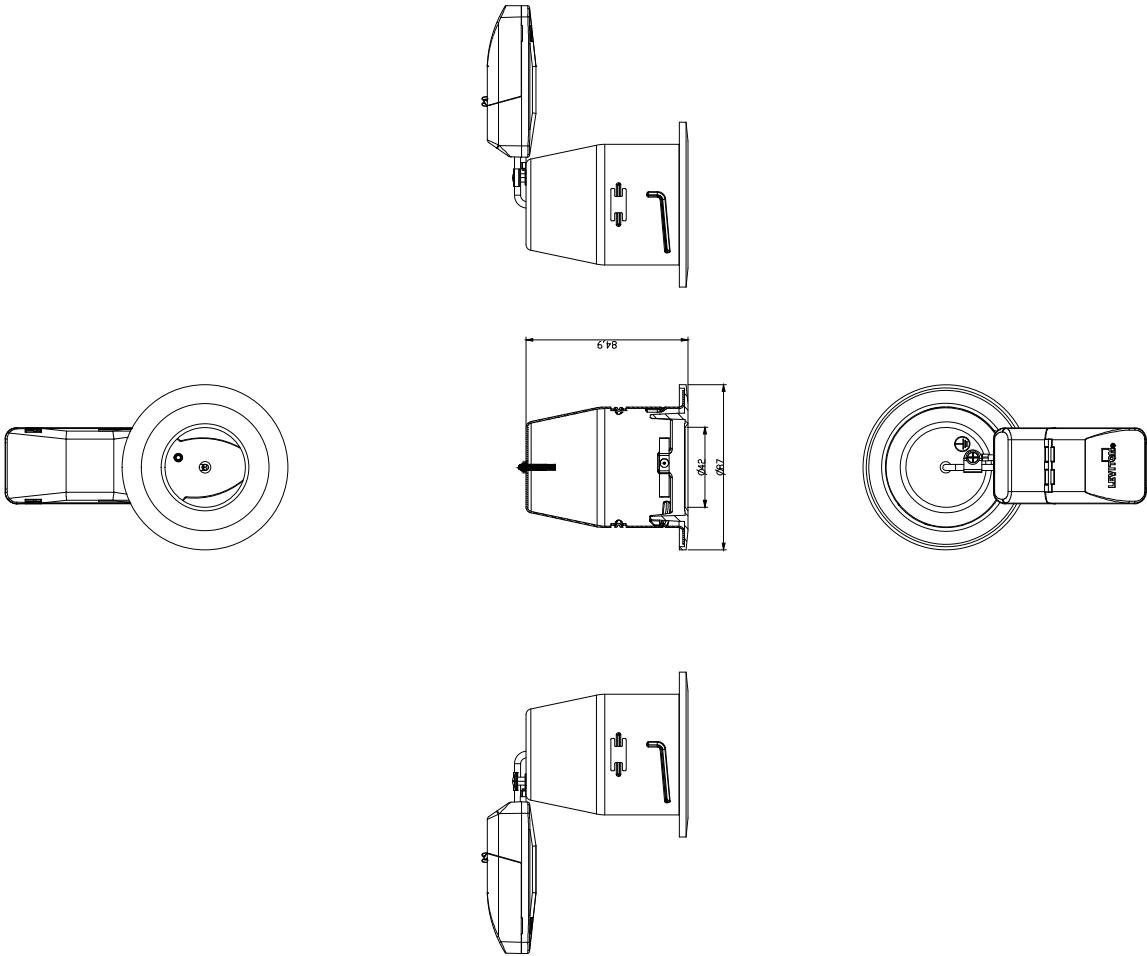
 18 x 44.0 kg



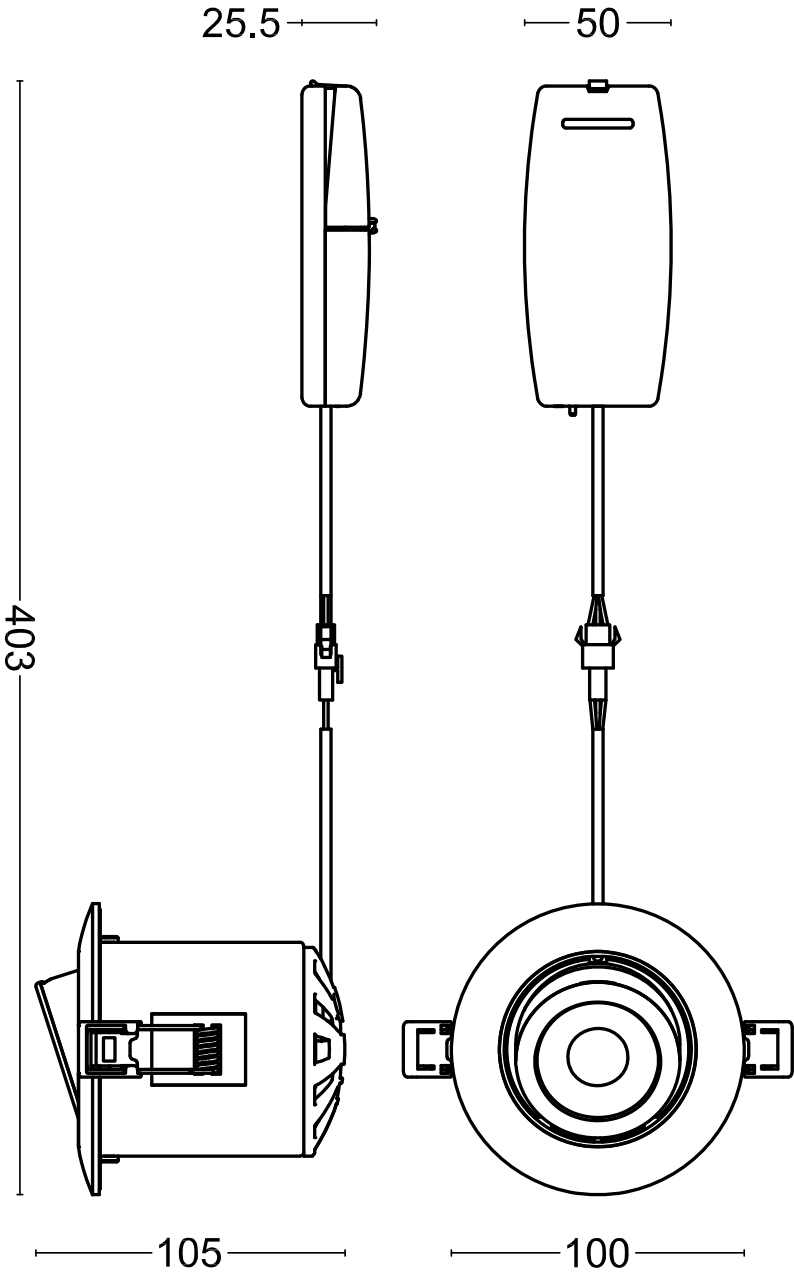
Downlight 2: JC010010WH

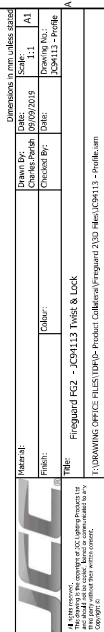


Downlight 3: JC010016CH



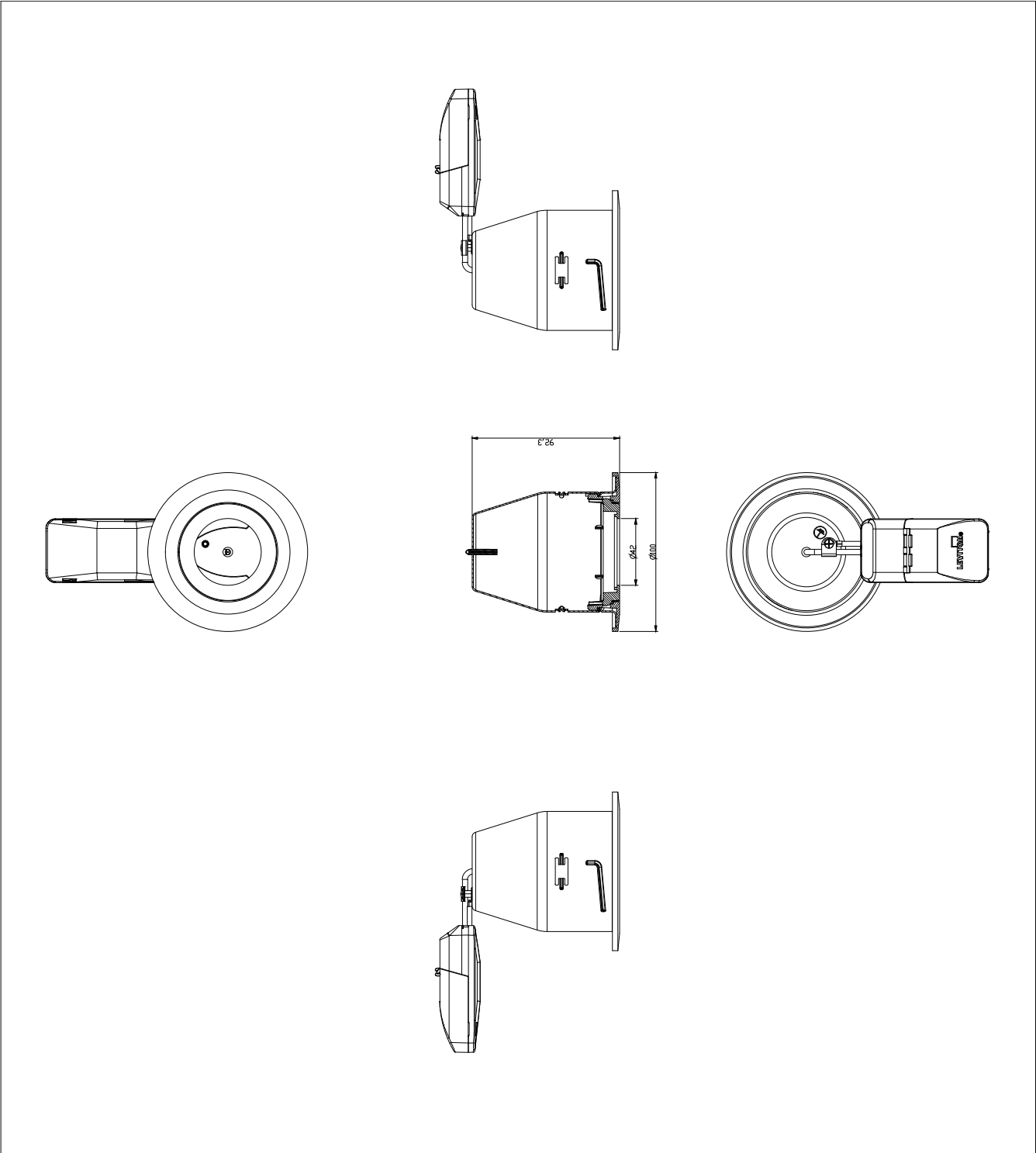
Downlight 4: JC1002/BN

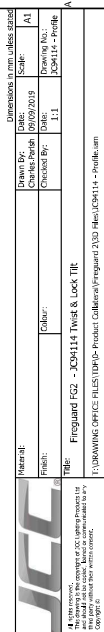




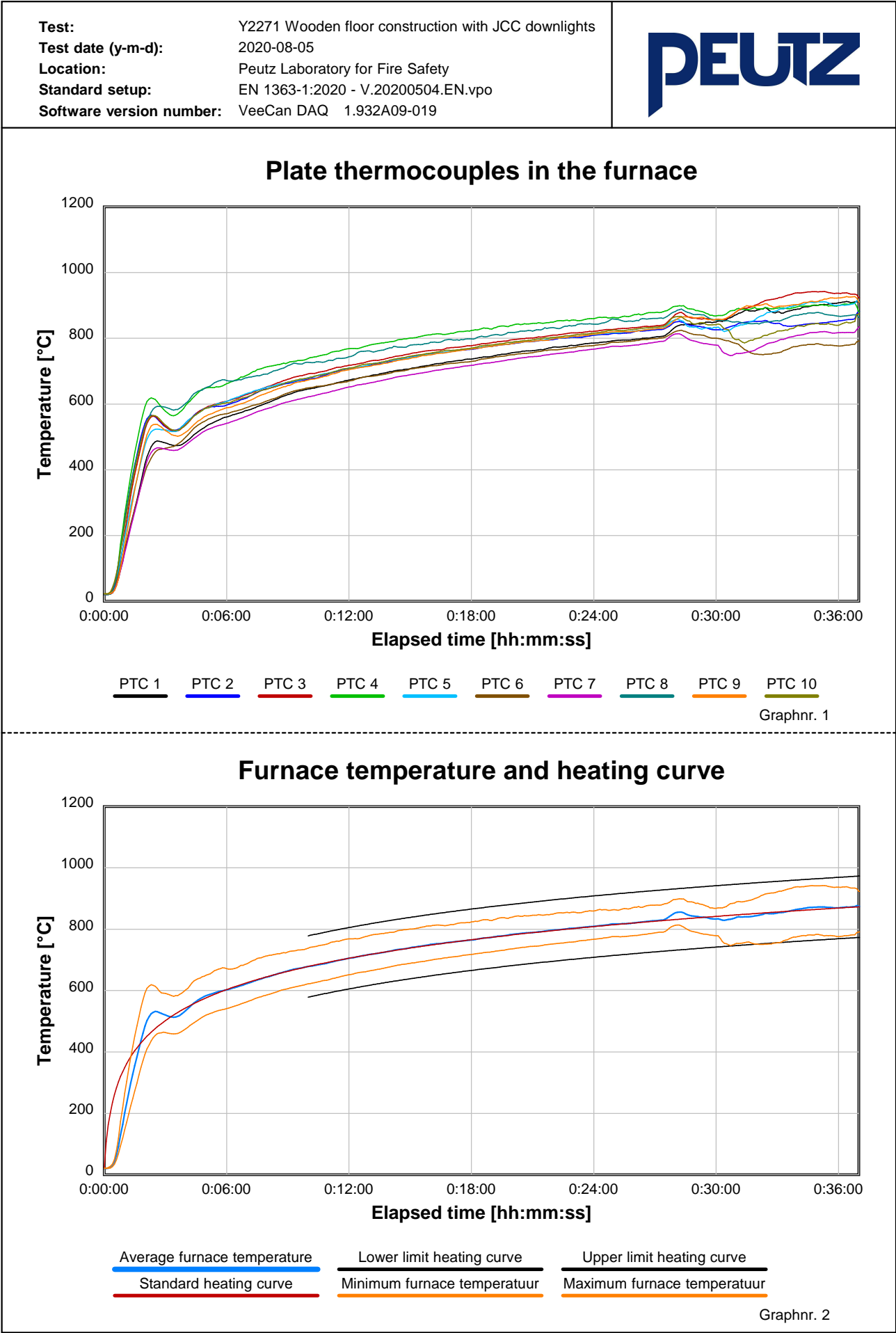


Downlight 7: JC010023BN

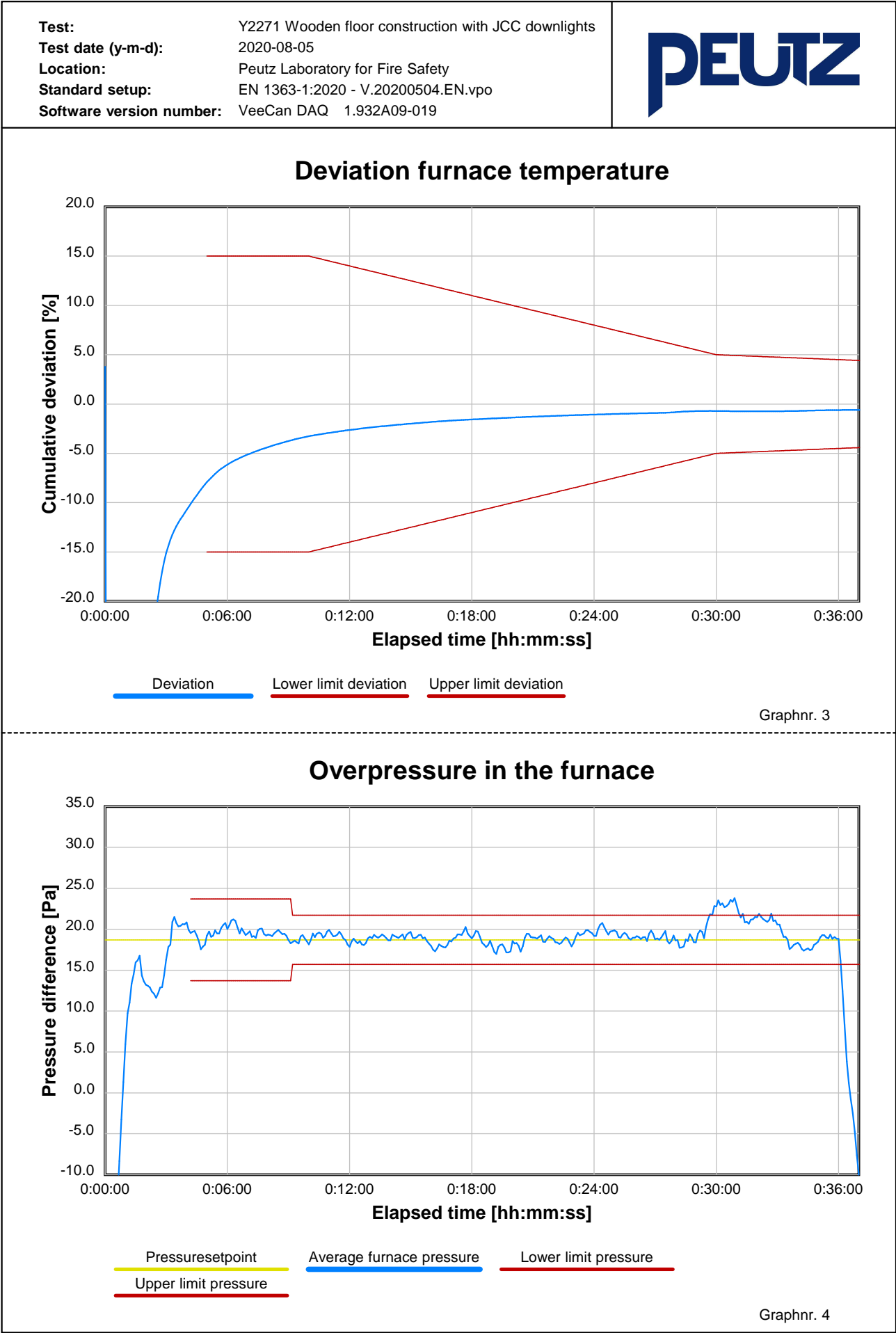




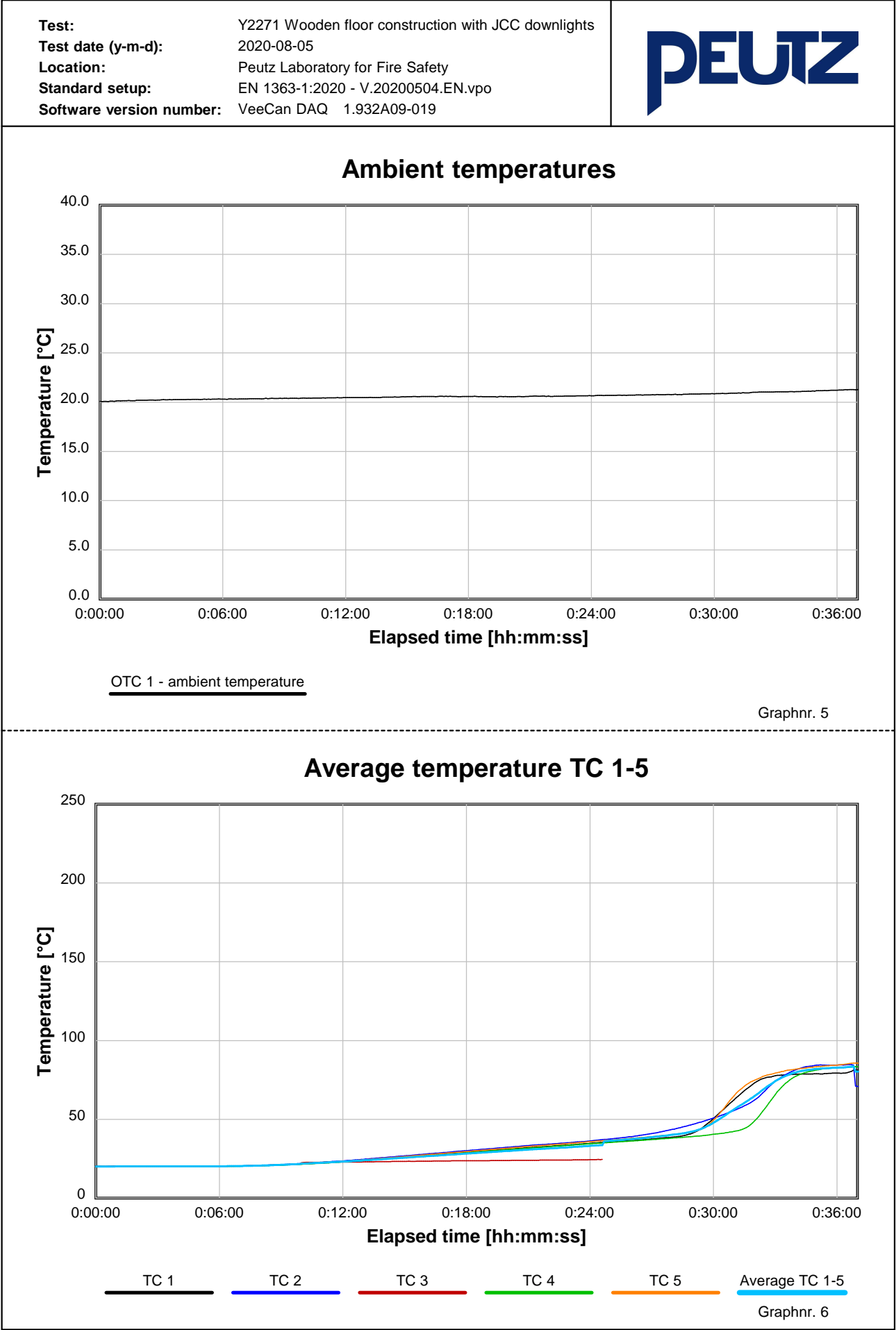
Appendix 4    Graphs



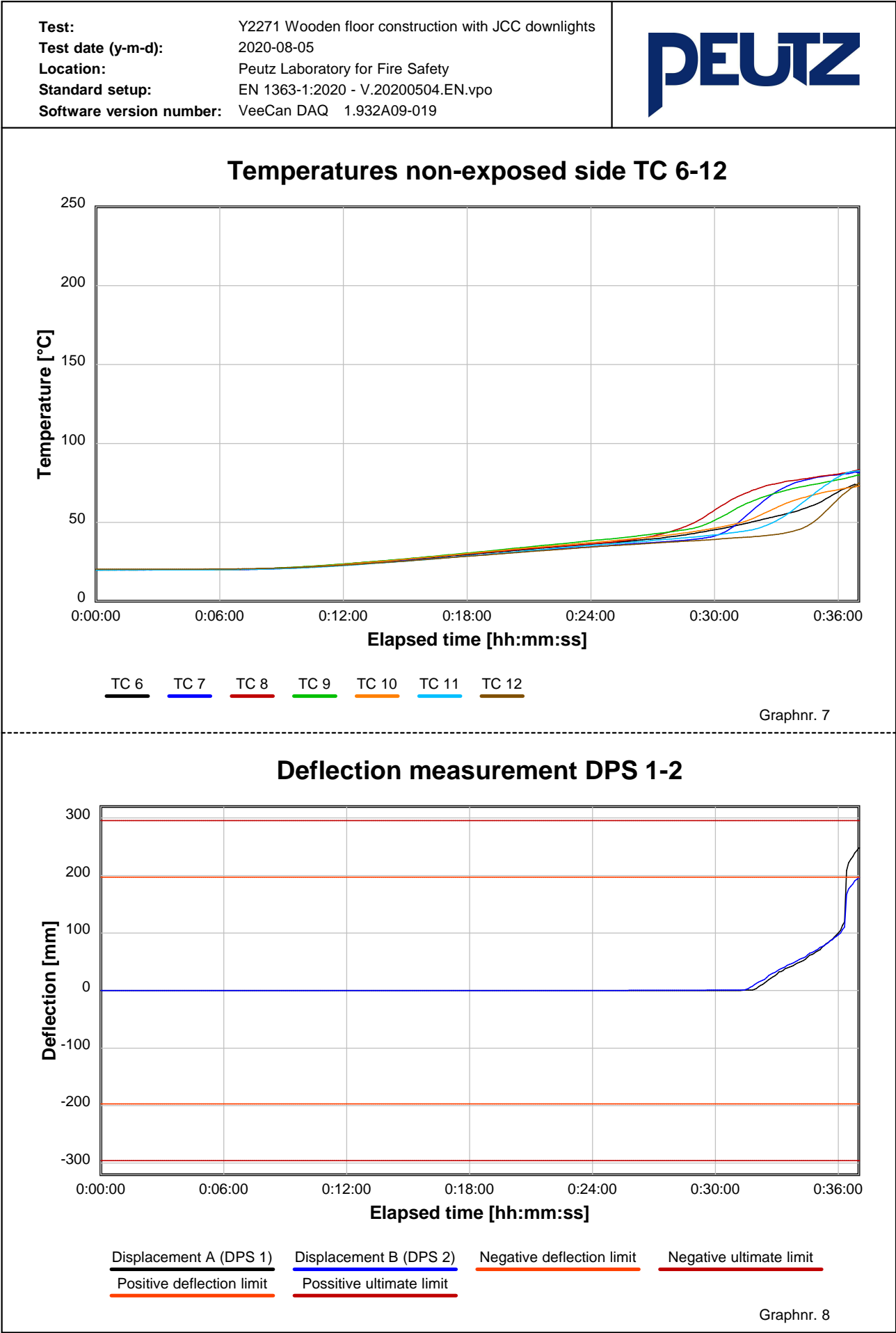
Appendix 4    Graphs



Appendix 4    Graphs



Appendix 4    Graphs



Temperatures non-exposed side TC 6-12

Temperature [°C]

Elapsed time [hh:mm:ss]

TC 6    TC 7    TC 8    TC 9    TC 10    TC 11    TC 12

Graphnr. 7

Deflection measurement DPS 1-2

Deflection [mm]

Elapsed time [hh:mm:ss]

Displacement A (DPS 1)    Displacement B (DPS 2)    Negative deflection limit    Negative ultimate limit  
Positive deflection limit    Possitive ultimate limit

Graphnr. 8

Appendix 4    Graphs

