

TEST REPORT

Order no: 05.07.2024_R.Christ Signature: SL/Z-811/EN45545-R1/0795a/2024 Police, 20.09.2024

Test methods:

1. ISO 5658-2:2006/Amd. 1:2011. Reaction to fire tests – Spread of flame – Part 2: Lateral spread on building and transport products in vertical configuration.
2. EN-ISO 5659-2:2017. Plastic – Smoke generation – Part 2: Determination of optical density by a single – chamber test.
3. ISO 5660-1:2015/Amd.1:2019. Reaction to fire tests – Heat release, smoke production and mass loss rate – Part 1: Heat release rate (cone calorimeter method).
4. EN 17084:2018. Railway applications – Fire protection of railway vehicles – Toxicity test of materials and components.
5. EN 45545-2:2020+A1:2023. Railway applications – Fire protection on railway vehicles – Part 2: Requirements for fire behavior of materials and components.

Content of request: Tests according to EN 45545-2:2020+A1:2023 - requirement R1, R7.

Sponsor: Continenta Grafix AG
Lettenstrasse 2
6343 Rotkreuz
Switzerland

Material: panoRama Green / panoRama Green Laminate

Composition: Perforated Self-adhesive PET- film / Printable white front side and black back side / with an Ultra Clear PET Overlamine

Manufacturer/supplier: Continenta Grafix AG
Lettenstrasse 2
6343 Rotkreuz
Switzerland

Assessment: The tested product fulfils the requirements R1 and R7 according to EN 45545-2:2020+A1:2023 for hazard level HL1, HL2 and HL3.

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Report applies only to the sample tested and is not necessarily indicative of the qualities of apparently identical or similar products.

Content of test report: eight pages with signature and numbers.

1. Spread of flame according to ISO 5658-2

Substrate: glass 4,0 mm thick.

Tested side: laminated foil side (white).

Table 1.1. Findings of critical heat flux at extinguishment CFE

Name of measured quantity	Unit	Specimen			Average	Standard deviation
		1	2	3		
Mass of the specimen	g	26,1	26,3	26,2	26,2	0,1
Specimen thickness	mm	0,2	0,2	0,2	0,2	0
Ignition time	s	17	12	15	15	3
Extinction time	s	213	284	187	228	50
Duration of the test	s	815	885	790	830	49
Flame-spread distance	mm	300	330	280	303	25
Critical heat flux at extinguishment CFE	$\text{kW}\cdot\text{m}^{-2}$	30,2	26,4	32,7	29,8	3,2
Flaming particles or droplets	YES/NO	NO	NO	NO	NO	

Table 1.2. Time of the movement of the flame front

Distance from exposed of the specimen	Calibration flux levels at the specimen	Time of arrival of the flame front		
		Specimen		
mm	$\text{kW}\cdot\text{m}^{-2}$	1	2	3
		s		
50	50,5	32	30	34
100	48,5	38	40	39
150	46,4	46	49	50
200	41,4	54	55	58
250	36,4	68	72	72
300	30,2	199	107	-
350	23,9	-	-	-
400	18,2	-	-	-
450	12,5	-	-	-

Remarks: none.

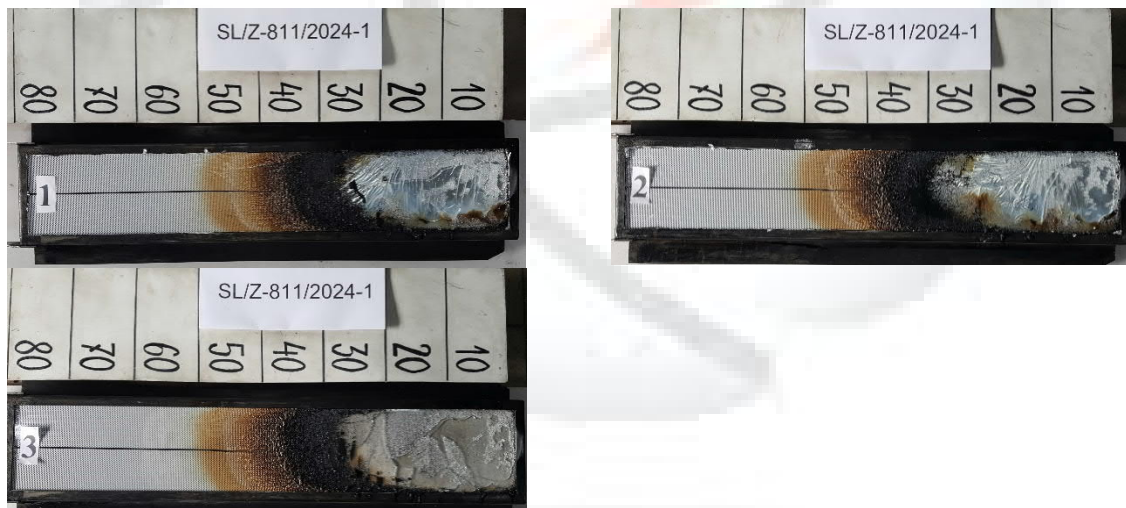


Figure 1. Appearance of the specimens after the test

2. Smoke generation according to EN-ISO 5659-2 + EN 45545-2

Test conditions - irradiance of $50 \text{ kW} \cdot \text{m}^{-2}$

Table 2. Final findings of smoke generation

Name of measured quantity	Unit	Specimen			Average	Standard deviation
		1	2	3		
Mass of specimen	g	1,2	1,2	1,2	1,2	0
Specimen thickness	mm	0,2	0,2	0,2	0,2	0
Ignition time - t_z	s	115	113	-	-	-
Extinction time	s	149	144	-	-	-
Duration of the test	s	600	600	600	600	0
Maximum of specific optical density - $D_{s,max}$	-	85	100	155	113	37
Time of arrival of the maximum of $D_{s,max}$	s	600	560	560	573	23
Specific optical density in the first 4 min of the test - $D_s(4)$	-	57	61	114	77	32
Cumulative specific optical densities in the first 4 min of the test - VOF_4	min	91	93	144	109	30

Remarks: none.

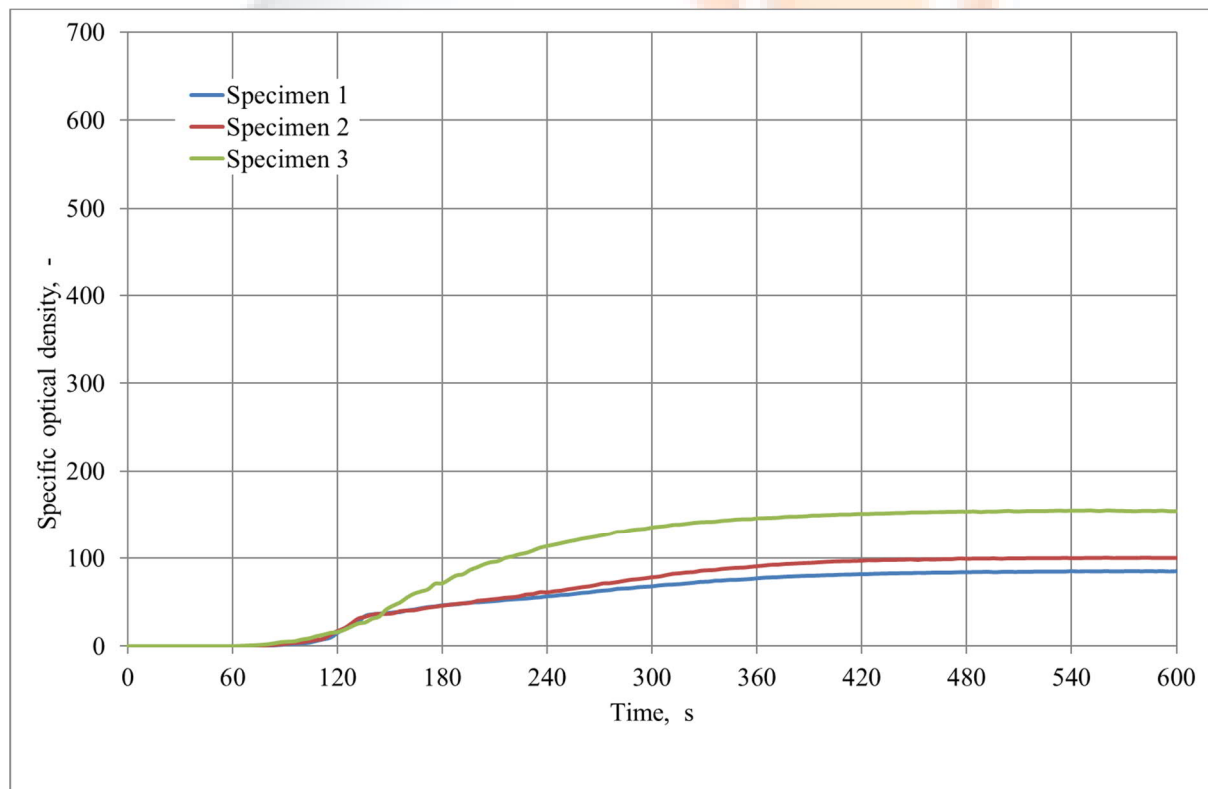


Figure 2. Specific optical density in the time

3. Results of toxic products emission of material decomposition and burning according to EN 17084, Method 1

Test conditions - irradiance of $50 \text{ kW} \cdot \text{m}^{-2}$

Table 3.1. Concentration of toxic products of material decomposition and burning after 4 min

Toxic component of burning products	Concentration of toxic products after 4 min				
	Specimen no.			Average	Standard deviation
	1	2	3		
	mg·m ⁻³				
CO ₂	2486	1867	173	1509	1197
CO	33	31	39	34	4
HCN	0	0	0	0	0
NO ₂	0	0	0	0	0
NO	0	0	0	0	0
HCL	0	0	0	0	0
SO ₂	0	0	0	0	0
HF	0	0	0	0	0
HBr	0	0	0	0	0

Table 3.2. Concentration of toxic products of material decomposition and burning after 8 min

Toxic component of burning products	Concentration of toxic products after 8 min				
	Specimen no.			Average	Standard deviation
	1	2	3		
	mg·m ⁻³				
CO ₂	3513	2129	573	2072	1471
CO	109	100	156	122	30
HCN	0	0	0	0	0
NO ₂	0	0	0	0	0
NO	0	0	0	0	0
HCL	0	0	0	0	0
SO ₂	0	0	0	0	0
HF	0	0	0	0	0
HBr	0	0	0	0	0

Table 3.3. Conventional index of toxicity

Name of measured quantity	Unit	Specimen			Average	Standard deviation
		1	2	3		
Conventional index of toxicity CIT _G at 4 min	-	0,00	0,00	0,00	0,00	0,00
Conventional index of toxicity CIT _G at 8 min	-	0,01	0,01	0,01	0,01	0,00

Remarks: none.

4. Heat release rate of specimen according to ISO 5660-1

Test conditions - irradiance of $50 \text{ kW} \cdot \text{m}^{-2}$

Table 4. Heat release rate

Name of measured quantity	Unit	Specimen			Average	Standard deviation
		1	2	3		
Mass of the specimen	g	5,1	2,2	2,2	3,2	1,6
Specimen thickness	mm	0,2	0,2	0,2	0,2	0
Ignition time	s	76	72	74	74	2
Extinction time	s	112	112	116	113	2
Duration of the test	s	1200	1200	1200	1200	0
Maximum heat release rate	$\text{kW} \cdot \text{m}^{-2}$	123	122	119	121	2
Total heat release	$\text{MJ} \cdot \text{m}^{-2}$	4,7	4,0	5,1	4,6	0,6
Maximum average rate of heat emission MARHE	$\text{kW} \cdot \text{m}^{-2}$	26,1	28,0	28,3	27,4	1,2
Fire integrity acc. 5.2.2.2 EN 45545-2	YES/NO	YES	YES	YES	YES	-

Remarks: none.

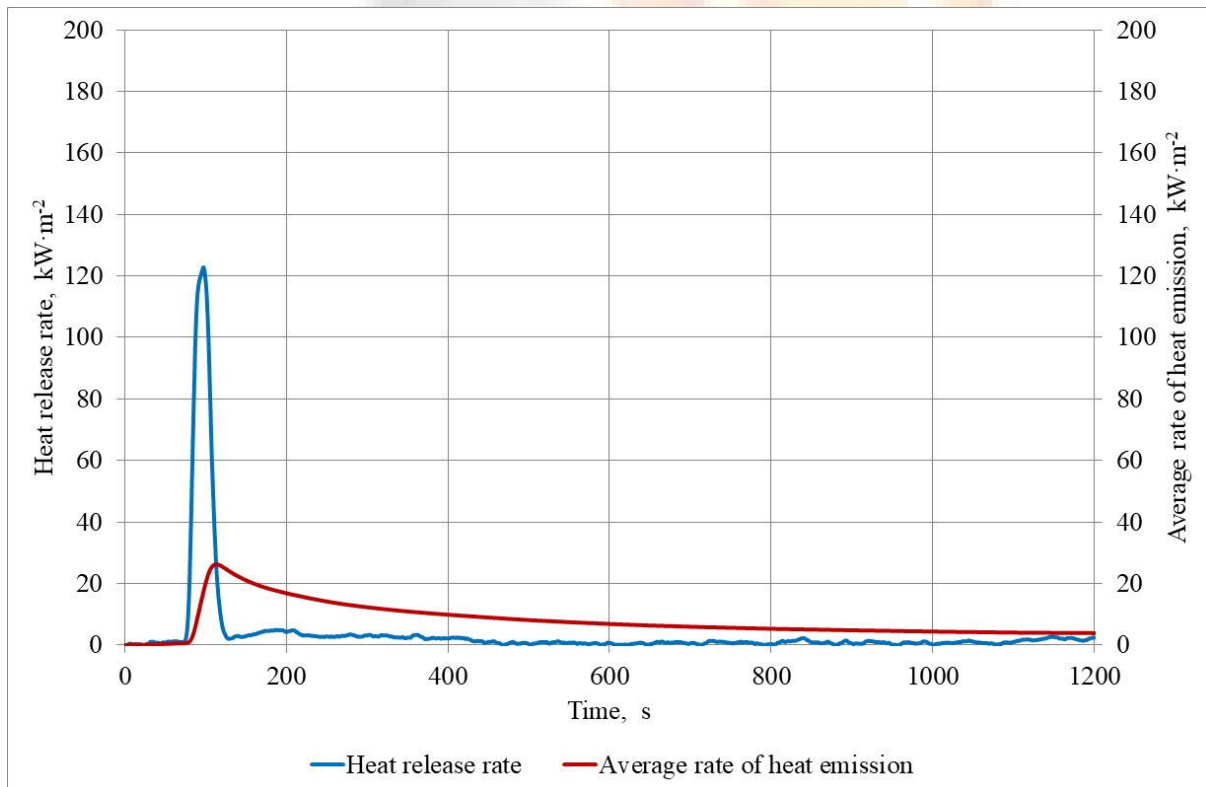


Figure 4.1. The relation of heat release rate and the time – specimen 1

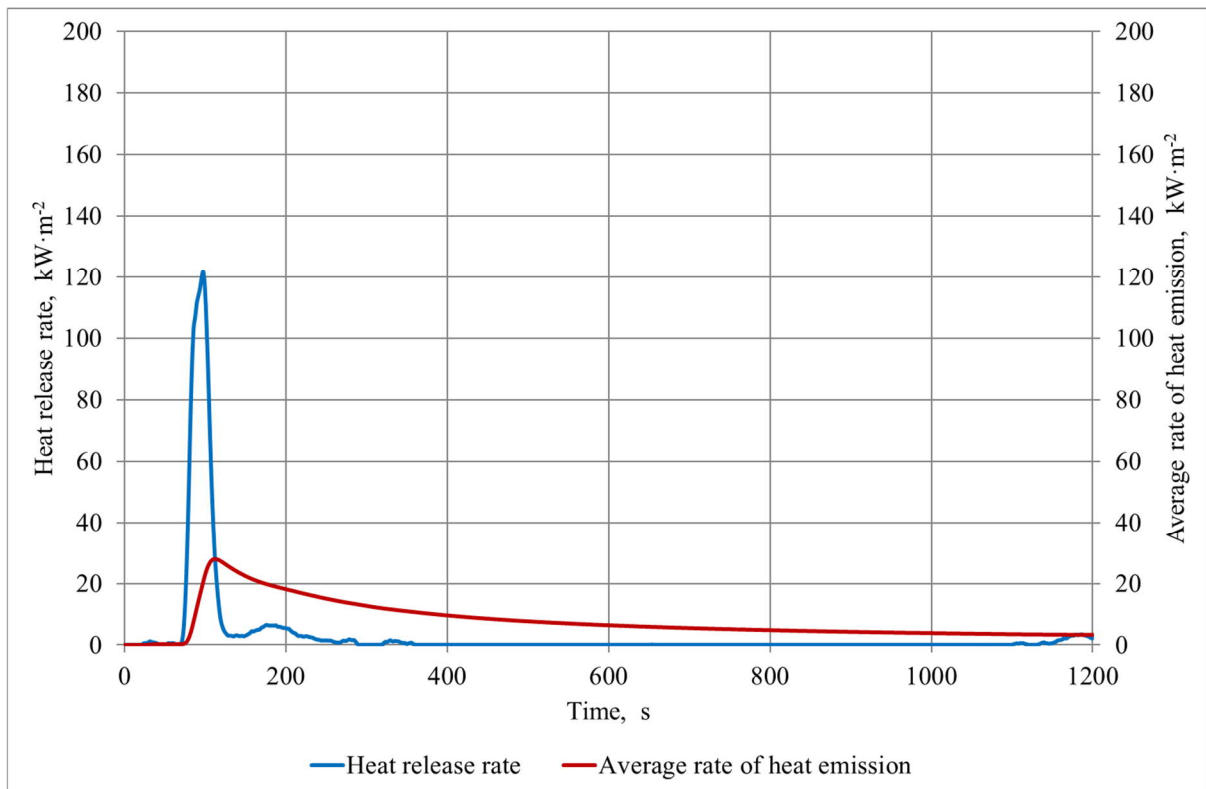


Figure 4.2. The relation of heat release rate and the time – specimen 2

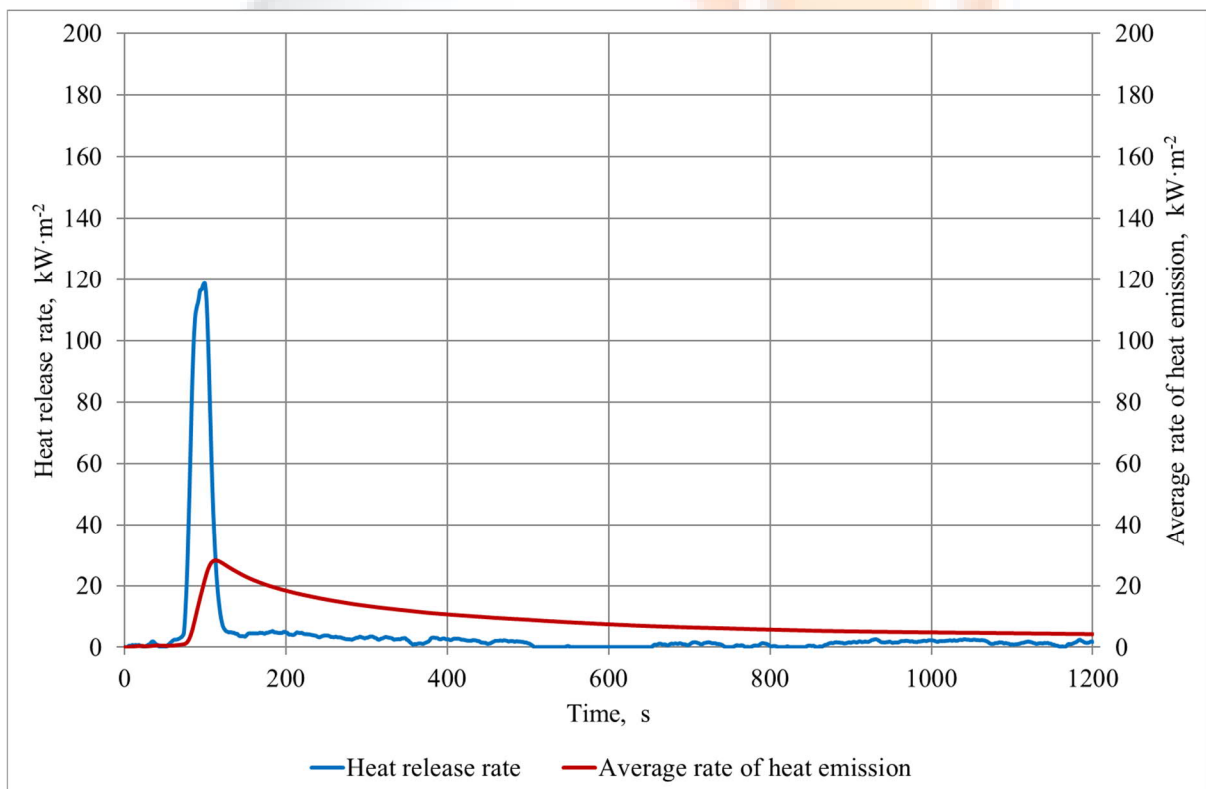


Figure 4.3. The relation of heat release rate and the time – specimen 3

5. Final findings

Requirement	Method/norm	Measured quantity	Unit	Measured value	Critical value			Crossing coefficient		
					HL1	HL2	HL3	HL1	HL2	HL3
R1	T02 ISO 5658-2	CFE	kW·m ⁻²	29,8	20	20	20	0,67	0,67	0,67
	T03.01 ISO 5660-1: 50 kW·m ⁻²	MARHE	kW·m ⁻²	27,4	-	90	60	-	0,30	0,46
	T10.01 EN ISO 5659-2: 50 kW·m ⁻²	D _s (4)	-	77	600	300	150	0,13	0,26	0,51
	T10.02 EN ISO 5659-2: 50 kW·m ⁻²	VOF ₄	min	109	1200	600	300	0,09	0,18	0,36
	T11.01 EN 17084 Method 1 50 kW·m ⁻²	CIT _G (4)	-	0,00	1,2	0,9	0,75	0,00	0,00	0,00
		CIT _G (8)	-	0,01	1,2	0,9	0,75	0,01	0,01	0,01

The tested product fulfils the requirement R1 according to EN 45545-2:2020+A1:2023 for hazard level HL1, HL2 and HL3.

Requirement	Method/norm	Measured quantity	Unit	Measured value	Critical value			Crossing coefficient		
					HL1	HL2	HL3	HL1	HL2	HL3
R7	T02 ISO 5658-2	CFE	kW·m ⁻²	29,8	20	20	20	0,67	0,67	0,67
	T03.01 ISO 5660-1: 50 kW·m ⁻²	MARHE	kW·m ⁻²	27,4	-	90	60	-	0,30	0,46
	T10.04 EN ISO 5659-2: 50 kW·m ⁻²	D _s max	-	113	-	600	300	-	0,19	0,38
	T11.01 EN 17084 Method 1 50 kW·m ⁻²	CIT _G (4)	-	0,00	-	1,8	1,5	-	0,00	0,00
		CIT _G (8)	-	0,01	-	1,8	1,5	-	0,01	0,01

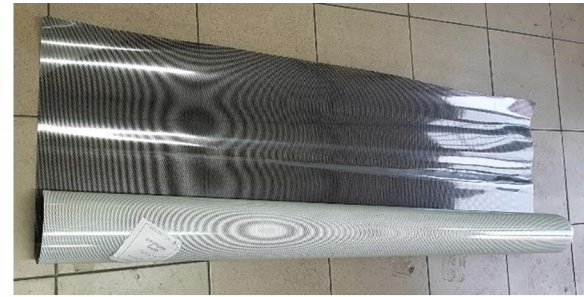
The tested product fulfils the requirement R7 according to EN 45545-2:2020+A1:2023 for hazard level HL1, HL2 and HL3.

6. Remaining required information

Date of receipt of samples: 09.09.2024

Sampling: sponsor took and delivered samples.

Description of the test material: Perforated white self-adhesive film laminated on the top side with a transparent, glossy coating, self-adhesive side in black (~0,27 mm thick), laid on a clear, two-layer backing (from self-adhesive side perforated film approximately 0,07 mm thick, bottom side rigid, smooth, film approx. 0,09 mm thick), total thickness approx. 0,43 mm and weight per unit area approx. 220 g/m² (without substrate). Marked: 'panoRama Green'. Sponsor delivered 1 roll of 1370 mm width. The laboratory prepared the samples.



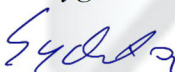
Conditioning of specimens: constant mass at a temperature of 23±2°C, and relative humidity of 50±5 %.

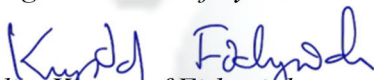
Declarations:

1. The test results relate to the behaviour of the test specimens under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential fire hazard of the products in use.
2. The information provided on the first page of the report concerning the scope of research and identification of the tested object/objects were provided by the Sponsor.

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dr inż. Krzysztof Sychta

Date and place of test - 17.09.2024, Police