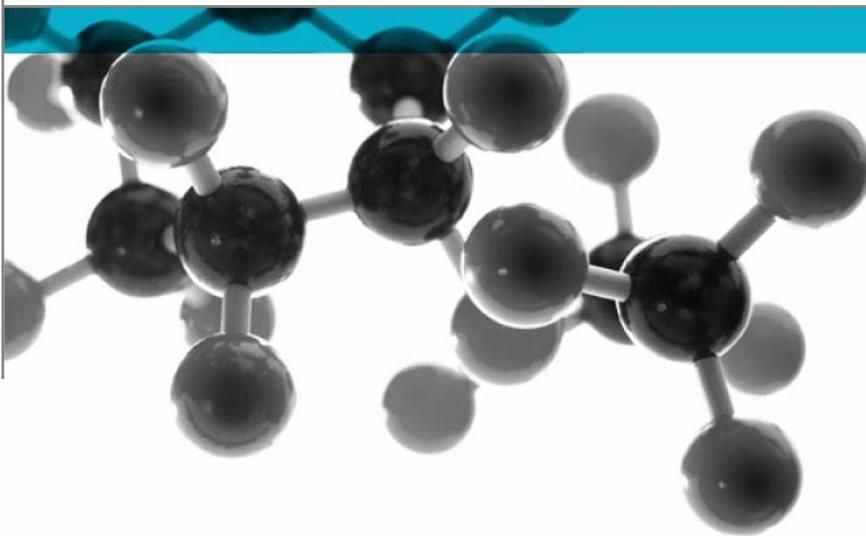


ISO 5660-1:2015



Heat release rate (Cone Calorimeter Method) & Smoke Production Rate (Dynamic Measurement)

A Report To: Camira Transport Fabrics Ltd.

Document Reference: 413565

Date: 21st August 2019

Issue No.: 2

Page 1



Executive Summary

Objective To determine the performance of the following product when tested in accordance with ISO 5660-1:2015

Generic Description	Product reference	Thickness	Weight per unit area
Fabric	"AURA + ACRYLIC BACKCOAT & FR TREATMENT (P) - WOOL RICH MOQUETTE – FACE TO FACE – WITH CRINKLE"	4.2mm	850g/m ²
Please see pages 5, 6 & 7 of this test report for the full description of the product tested			

Test Sponsor Camira Transport Fabrics Ltd., Meltham Mills, Meltham Mills Road, Meltham, West Yorkshire, HD9 4AY

Test Results:

Peak Heat Release Rate	=	78.53kW/m²
Total Heat Release	=	8.48MJ/m²
MARHE	=	19.8kW/m²

Please note that the averages stated are from six specimen runs. Please refer to page 7 of this test report for further information.

Date of Test 17th, 22nd and 23rd May 2019

Reason for Revision This document replaces Issue 1 (dated 31st May 2019) of the same number which has been withdrawn. The sponsor of the test has requested that the product reference is amended in this Issue 2 report

Signatories



Responsible Officer
T. Mort *
Senior Technical Officer



Authorised
S. Deeming *
Business Unit Head

* For and on behalf of [Warringtonfire](#).

Report Issued: 21st August 2019

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Test Details

Purpose of test	<p>To determine the performance of a product when it is subjected to the conditions of the test specified in ISO 5660-1:2015, “Heat release rate (Cone Calorimeter Method)” and “Smoke Production Rate (Dynamic Measurement)”.</p> <p>This test was performed in accordance with the procedures specified in ISO 5660-1:2015 and this report should be read in conjunction with these standards.</p>
Scope of test	<p>ISO 5660-1:2015 specifies a method for assessing the heat release rate of a specimen exposed in the horizontal orientation to controlled levels of irradiance with an external igniter. The heat release rate is determined by measurement of the oxygen consumption derived from the oxygen concentration and the flow rate in the combustion product stream. The time to ignition (sustained flaming) is also measured in this test.</p> <p>The dynamic smoke production rate is calculated from measurement of the attenuation of a laser light beam by the combustion product stream. Smoke obscuration is recorded for the entire test, regardless of whether the specimen is flaming or not.</p>
Fire test study group/EGOLF	<p>Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group and EGOLF have identified a number of such areas and has agreed Resolutions which define common agreement of interpretations between fire test laboratories which are members of the Groups. Where such Resolutions are applicable to this test they have been followed.</p>
Test procedure	<p>The apparatus consists of a cone shaped, radiant electric heater, capable of producing a uniform irradiance of up to 100kW/m² on the surface of a 100mm x 100mm specimen, situated on a load cell. The heater is controlled by a temperature controller capable of holding the element temperature steady to within $\pm 2^{\circ}\text{C}$. External ignition is facilitated by a spark igniter powered from a 10kV transformer. Exhaust gases are drawn through a hood and duct by a centrifugal fan. An orifice plate positioned across the exhaust duct and connected to a pressure transducer, measures the volume flow. A ring sampler, situated in the duct, allows a representative sample of the exhaust gases to be drawn off and the oxygen concentration measured using an in-line, paramagnetic oxygen analyser.</p> <p>The heat release rate is calculated using the relationship that approximately 13.1 x 10³kJ of heat are released per kilogram of oxygen consumed. Visible smoke release is determined by means of a laser extinction beam photometer situated in the duct.</p>
Instruction to test	<p>The test was conducted on the 17th, 22nd and 23rd May 2019 at the request of Camira Transport Fabrics Ltd., the sponsor of the test.</p>
Provision of test specimens	<p>The specimens were supplied by the sponsor of the test. Warringtonfire was not involved in any selection or sampling procedure. The specimens were prepared in accordance with EN 45545-2: 2013+A1:2015 Annex D.</p>

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Author:	T. Mort	Issue Date:	21 st August 2019
Client:	Camira Transport Fabrics Ltd.	Issue No.:	2

Conditioning of specimens	The specimens were received on the 25 th April 2019. Prior to test the specimens were conditioned to constant mass at a temperature of $23 \pm 2^{\circ}\text{C}$ and a relative humidity of $50 \pm 5\%$.
Test face	The decorative face of each specimen was exposed to the igniting flame.
Condition of specimen edges	Layered product, with no layer covering the edges.
Specimen preparation	A retaining frame was used, leaving an exposed specimen surface area of $8.836 \times 10^{-3}\text{m}^2$. Retaining wires were used in the case of specimens 2-6.
Number of replicate tests	Six specimens were subjected to an irradiance of $25\text{kW}/\text{m}^2$.
Frequency of measurement	The data was recorded every two seconds throughout the tests.
Orifice plate calibration factor	Specimens 1, 2 and 3 = 0.04366 Specimen 4 = 0.04459 Specimen 5 and 6 = 0.04378
Exhaust system flow rate	The exhaust flow rate was set to $0.024 \pm 0.002 \text{ m}^3/\text{s}$.
End of test criteria	The data was collected for a period of 1200 seconds.
Test operator	H. Harper

Description of Test Specimens

The description of the system given below has been prepared from information provided by the sponsor of the test. This information has not been independently verified by [Warringtonfire](#). All values quoted are nominal, unless tolerances are given.

Generic type	Fabric
Trade name	“AURA + ACRYLIC BACKCOAT & FR TREATMENT (P) - WOOL RICH MOQUETTE – FACE TO FACE – WITH CRINKLE”
Name of manufacturer	Camira Fabrics Ltd
Composition details	Pile: 70% Wool, 12% Nylon 18% Polyester Ground: 100% Cotton
Weight per unit area	850g/m ² (stated by sponsor) 1028.94g/m ² (determined by Warringtonfire)
Thickness	4.2mm (stated by sponsor) 4.17mm (determined by Warringtonfire)
Colour reference	“Cream/Blue (CAA321)”
Pattern reference	“Sixties VDW”
Type of weave	WOOL RICH MOQUETTE - FACE TO FACE - WITH CRINKLE
Thread count or threads per inch (TPI)	See Note 1 below
Yarn count	See Note 1 below
Trade name of flame retardant	“Pekoflam®”
Generic type of flame retardant	See Note 1 below
Amount of flame retardant	See Note 1 below
Brief description of manufacturing process	See Note 1 below

Note 1. The sponsor of the test was unwilling to provide this information.

Test Results

Results of test

The test results relate only to the behaviour of the test specimens of the product under the particular conditions of test, they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and will therefore invalidate the test results. It is the responsibility of the supplier of the product to ensure that the product which is supplied is identical to the specimens which were tested.

The data generated during the tests are contained in Table 1.

Graphs of heat release rate, total heat release, smoke production rate, total smoke production and average heat release rate are shown in Figures 1 to 5 respectively.

Section 11.3.7 of ISO 5660-1:2015 states that initially three specimens are tested and the 180 s mean heat release readings shall be compared. If any of these mean readings differ by more than 10% from the arithmetic mean of the three readings, then a further set of three specimens shall be tested. In such cases, the arithmetic mean of the set of six specimens shall be reported.

Observations

In the case of specimen No. 1, the spark arm made contact with the specimen after ignition. In the case of specimens 2-6, restraining wires were used.

Validity

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. Where this report is used to confirm compliance for use on European rolling stock as per the Technical Specification for Interoperability (LOC&PAS TSI (Commission Regulation (EU) No. 1302/2014)), all tests must have been conducted within the last 5 years or the test reports must have been reviewed within the last five years. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

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Author: T. Mort

Issue Date: 21st August 2019

Client: Camira Transport Fabrics Ltd.

Issue No.: 2



0249

Table 1

PARAMETER		Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Mean
Time to sustained flaming	seconds	63	263	304	74	152	59	153
Test duration	seconds	1200	1200	1200	1200	1200	1200	1200
Peak heat release rate	\dot{q}_{max} kWm ⁻²	48.7	89.44	65.62	78.73	131	57.69	78.53
Time to peak heat release rate	seconds	162	248	348	102	172	140	195
Total heat release	\dot{q}_{tot} MJm ⁻²	7.61	5.02	10.25	10.46	8.78	8.77	8.48
Average \dot{q}'' for 180 sec after ignition	$\dot{q}_{A,180}$ kWm ⁻²	20.12	11.51	20.51	33.20	29.27	30.17	24.13
Average \dot{q}'' for 300 sec after ignition	$\dot{q}_{A,300}$ kWm ⁻²	14.82	9.63	16.8	21.98	20.73	21.04	17.50
Initial specimen mass	$m_{initial}$ g	10.24	10.34	10.61	10.77	9.86	11.36	10.53
Final specimen mass	m_{final} g	3.69	1.75	2.07	2.18	1.39	2.69	2.30
Mass loss	g/m ²	1204	349.5	371.3	856.40	600.3	873.70	709.2
Average mass loss rate between ignition and end of test	m_A g m ⁻² s ⁻¹	50.92	0.36	0.42	0.76	0.57	0.76	8.97
Average mass loss rate between 10-90% of mass loss	g m ⁻² s ⁻¹	492.16	0.47	0.54	1.050	0.76	1.080	82.68
Mass at sustained flaming	g	9.29	4.84	5.36	9.76	6.7	10.42	7.7
Smoke production non flaming phase	S_1'' dimensionless (m ² /m ²)	34.3	340.5	312.3	40.90	160.9	29.00	153.0
Smoke production flaming phase	S_2'' dimensionless (m ² /m ²)	236.9	72.5	62.3	183.90	170.5	200.80	154.5
Total smoke production	$S_1'' + S_2''$ dimensionless (m ² /m ²)	271.2	412.9	374.5	224.70	331.4	229.80	307.4
CO ₂ Yield	kg/kg	0.03	1.29	1.75	0.93	0.92	0.77	0.95
CO Yield	kg/kg	0.0013	0.2291	0.2971	0.11	0.1486	0.11	0.1490

Supplementary calculations

Maximum average heat release (MARHE)	kW/m ²	15.3	10.9	9.7	33.50	23.9	25.70	19.8
Time to MARHE	seconds	252	322	786	158	206	196	320

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Author: T. Mort

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Figure 1

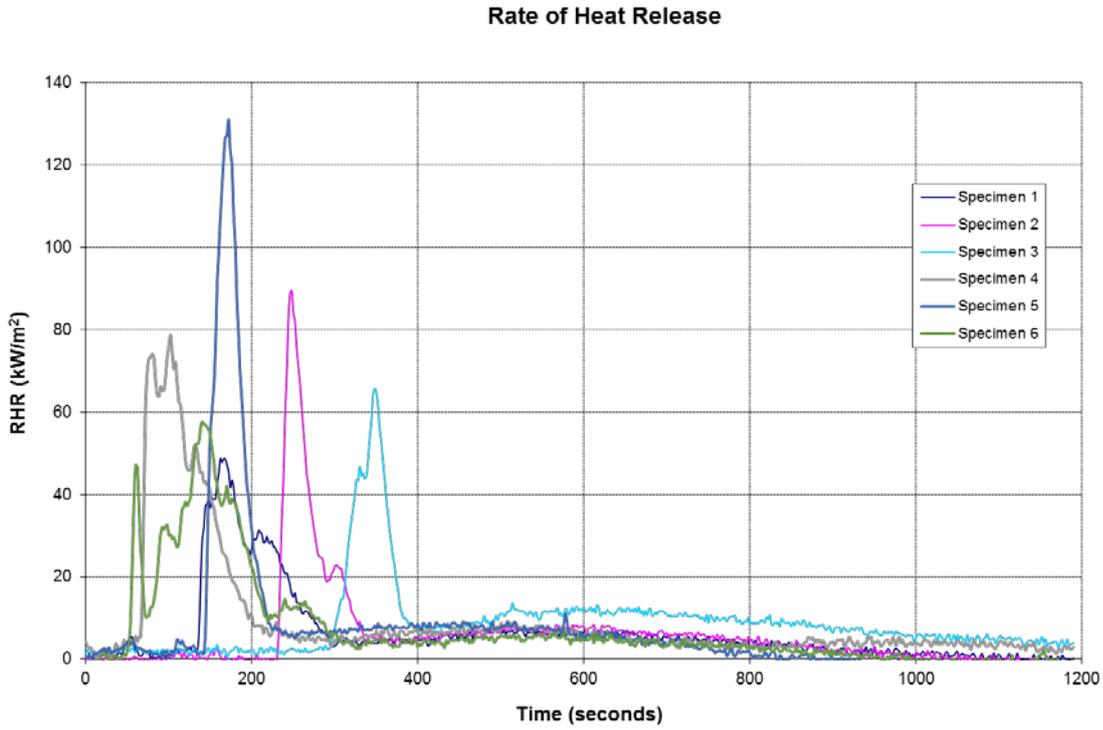


Figure 2

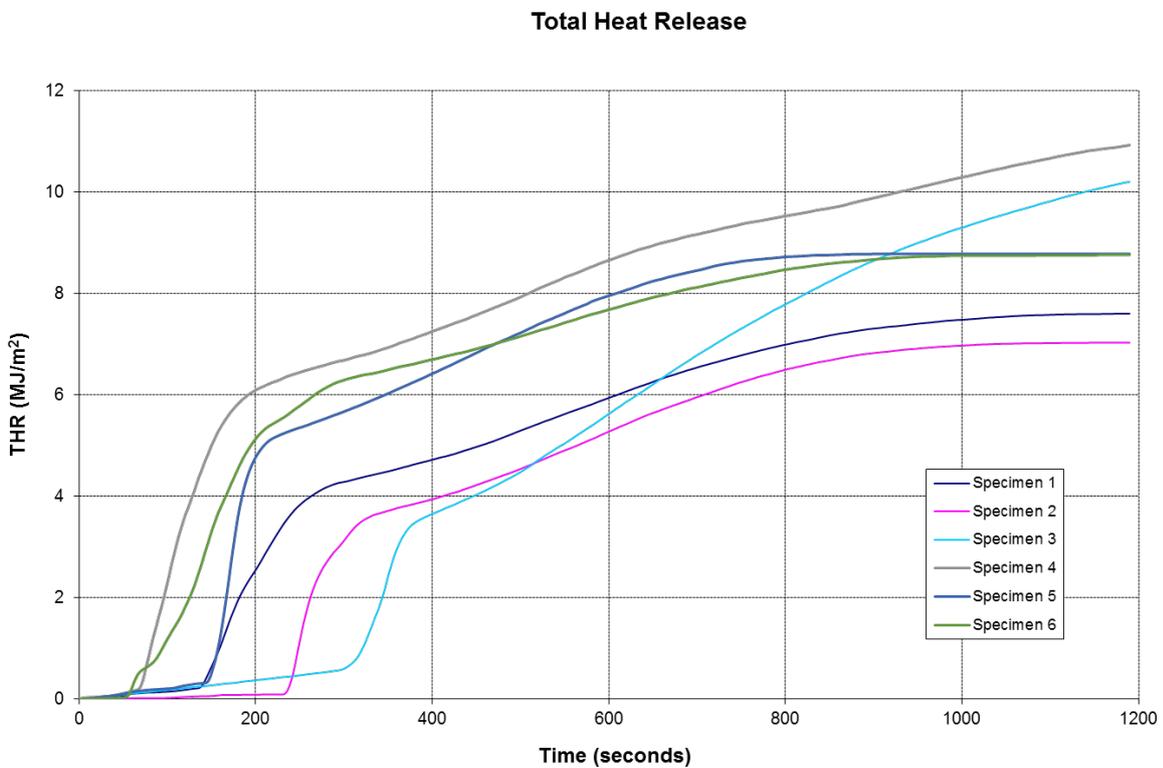


Figure 3

Rate of Smoke Production

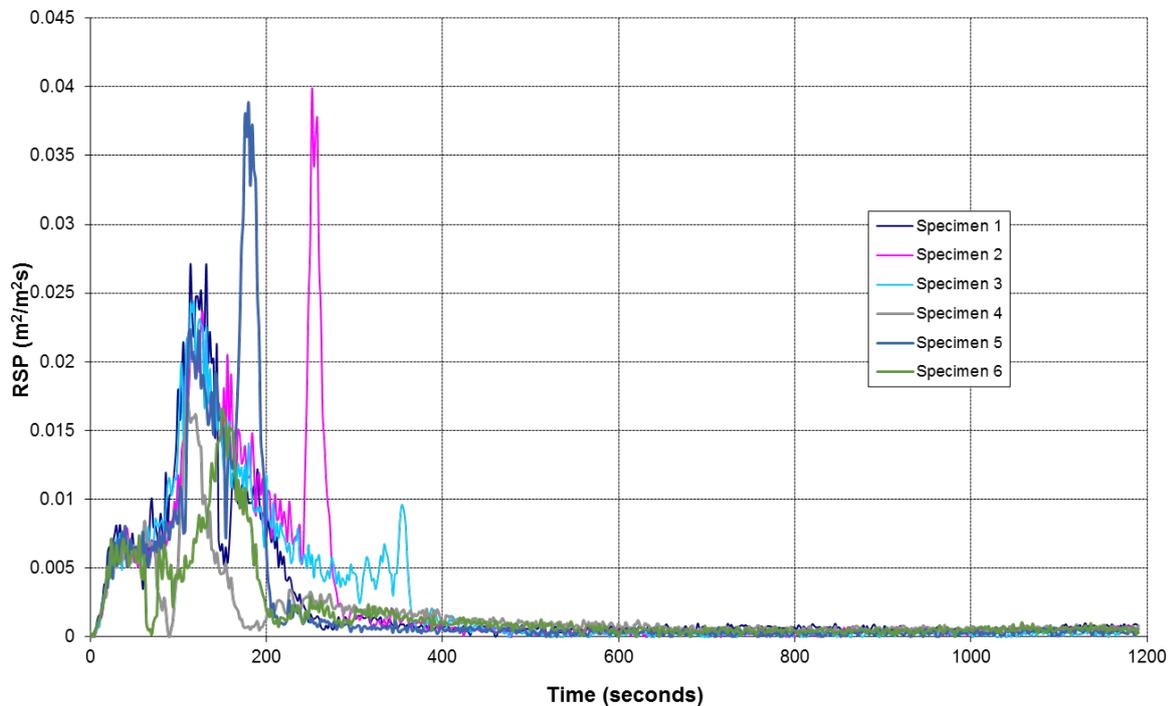


Figure 4

Total Smoke Production

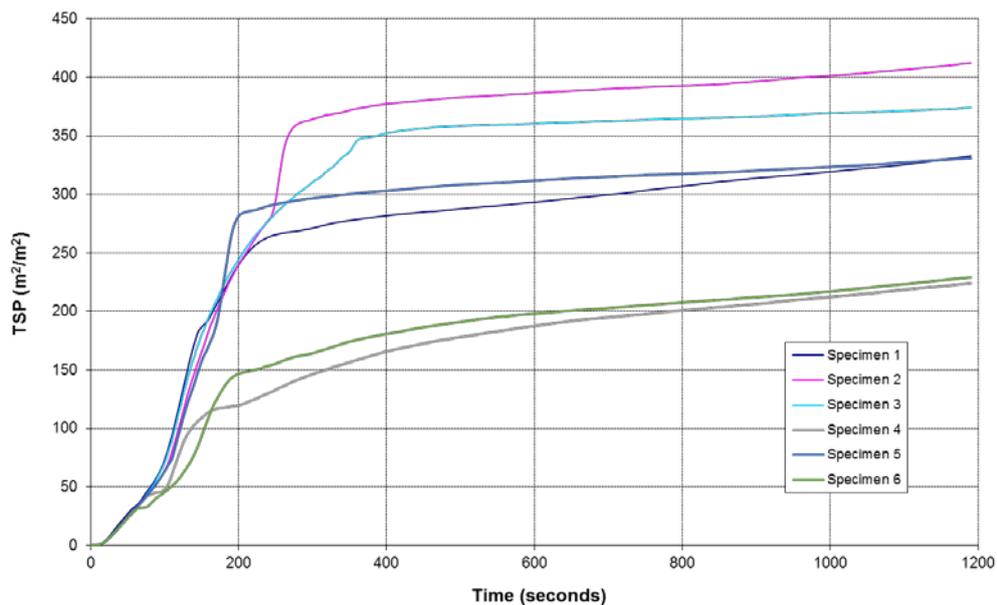
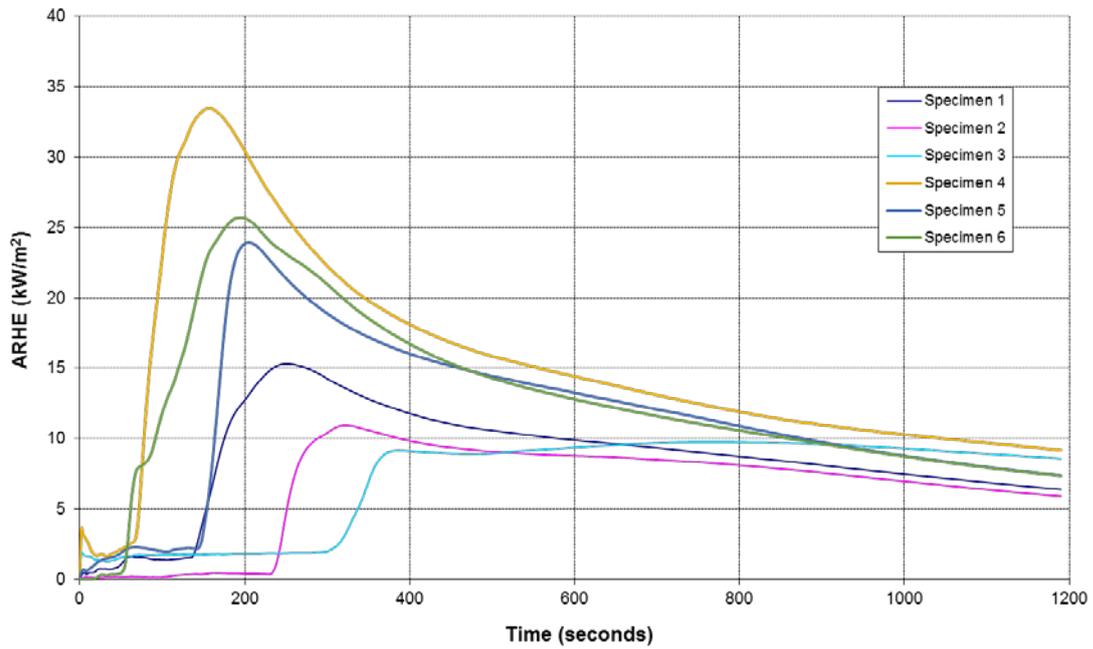


Figure 5

Average Rate of Heat Release



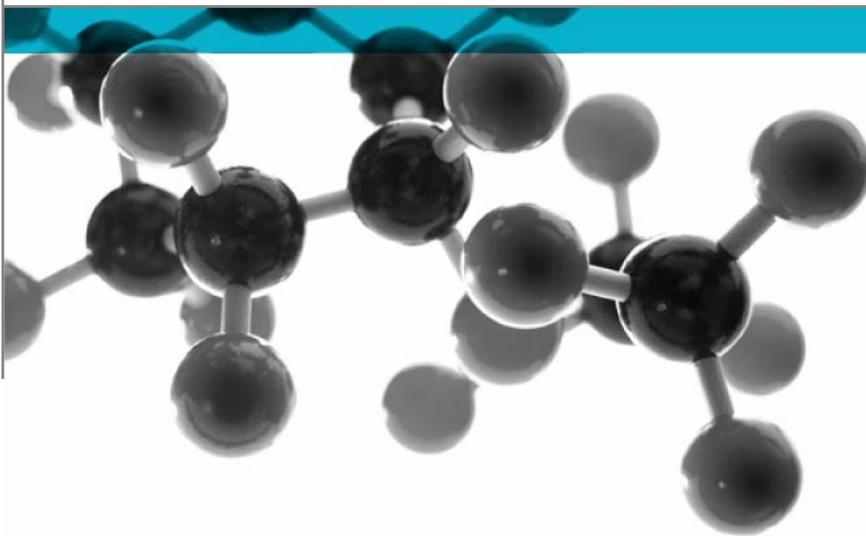
Revision History

Issue No : 2	Re-issue Date: 21 st August 2019
Revised By: S. Jones	Approved By: S Deeming
Reason for Revision: This document replaces Issue 1 (dated 31 st May 2019) of the same number which has been withdrawn. The sponsor of the test has requested that the product reference is amended in this Issue 2 report	

Issue No :	Re-issue Date:
Revised By:	Approved By:
Reason for Revision:	



BS EN 45545-2:2013+A1:2015 – Test Methods T10.03 & T11.02



Smoke and Toxicity Assessment

Test Method References “T10.03” (ISO 5659-2: 2017; Plastics – Smoke Generation. Part 2 Determination of Optical Density by a Single Chamber Method) and “T11.02” (Gas Analysis in the Smoke Box ISO, using FTIR Technique)

A Report To: Camira Transport Fabrics Ltd.

Document Reference: 413568

Date: 21st August 2019

Issue No.: 2

Page 1



Executive Summary

Objective To determine the toxic fume and optical density produced from the following product when tested in accordance with methods T10.03 and T11.02 as defined in BS EN 45545-2:2013+A1:2015 at an irradiance level of 25kW/m² with a pilot flame.

Generic Description	Product reference	Thickness	Weight per unit area
Fabric	"AURA + ACRYLIC BACKCOAT & FR TREATMENT (P) - WOOL RICH MOQUETTE – FACE TO FACE – WITH CRINKLE"	4.2mm	850g/m ²
Please see page 6 of this test report for the full description of the product tested			

Test Sponsor Camira Transport Fabrics Ltd., Meltham Mills, Meltham Mills Road, Meltham, West Yorkshire, HD9 4AY

Summary of Test Results:
The average Ds(max) value determined within 10 minutes was 70.
The average CIT value at four minutes was 0.20.
The average CIT value at eight minutes was 0.30.

Date of Test 30th May 2019

Reason for Revision This document replaces Issue 1 (dated 19th June 2019) of the same number which has been withdrawn. The sponsor of the test has requested that the product reference is amended in this Issue 2 report.

Signatories



Responsible Officer
S. Jones *
Technical Officer



Authorised
S. Deeming *
Business Unit Head

* For and on behalf of [Warringtonfire](#).

Report Issued: 21st August 2019

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Test Details

Introduction

Warringtonfire was commissioned to carry out an area based smoke and toxicity test in accordance with the method recommended in BS EN 45545-2:2013+A1:2015. This standard recommends that the test is carried out using the apparatus and procedures detailed in ISO 5659-2: 2017. The standard provides equations which should be calculated in relation to the smoke density. In addition to this the quantitative determination of the gases emitted should be carried out in accordance with the procedure specified in EN 45545 Annex C, Method 1 (Smoke Chamber).

The test was performed in accordance with the procedures specified in EN 45545 and EN ISO 5659-2 and this report should be read in conjunction with these and other related standards.

Test method

The principle of the test methods referenced "T10.03" and "T11.02" is to expose a material to specified thermal conditions of pyrolysis and combustion in a continuous procedure.

The test was conducted in an "ISO 5659-2 Smoke Chamber" supplied by Concept (operated with "Concept" software), in combination with an "IGS FTIR Analyser" supplied by Thermo Scientific (operated with Thermo "Result" software).

Specimens were tested in the flaming mode in a horizontal position by exposure to the heating arrangement specified in ISO 5659-2. The heat flux was 25kW/m^2 . The change in optical density of the smoke produced when dispersed within a fixed volume of air is recorded throughout the period of test utilising the Concept software in order to determine information relating to the smoke density.

Quantitative determination of toxic gases emitted is carried out using Fourier Transform Infra Red (FT-IR) analysis and the TQ Analyst software. The FT-IR has been calibrated, the calibration spectra were produced by the FTIR supplier (Thermo) using bottled gases and library spectrum, plus Warringtonfire using bottles gases and calibrated solutions via an evaporator.

In all cases, the sample gases are taken from 300mm from the centre of the top of the chamber with sample lines being kept as short as possible to minimise sample losses.

The test method provides a means for the comparative assessment of products, however, it does not model a real fire situation and the results cannot therefore be used to describe the fire hazard of materials under actual fire conditions.

Fire test study group/EGOLF

Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group and EGOLF have identified a number of such areas and have agreed Resolutions which define common agreement of interpretations between fire test laboratories which are members of the Groups. Where such Resolutions are applicable to this test they have been followed.

Document No.: 413568

Author: S. Jones

Client: Camira Transport Fabrics Ltd.

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Issue Date: 21st August 2019

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0249

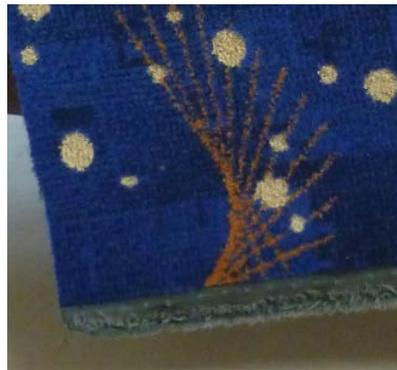
Instruction to test The test was conducted on the 30th May 2019 at the request of Camira Transport Fabrics Ltd., the sponsor of the test.

Provision of test specimens The specimens were supplied by the sponsor of the test. Warringtonfire was not involved in any selection or sampling procedure. The specimens were prepared in accordance with EN 45545-2: 2013+A1:2015 Annex D.

Test face The decorative face of the specimens was exposed to the heating conditions.

Condition of specimen edges Layered product, with no layer covering the edges.

Photograph of specimen



Conditioning of specimens The specimens were received on the 25th April 2019.
 The specimens were conditioned at temperatures of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\% \text{ RH}$, for a minimum period of 24 hours prior to testing.

Description of Test Specimens

The description of the system given below has been prepared from information provided by the sponsor of the test. This information has not been independently verified by Warringtonfire. All values quoted are nominal, unless tolerances are given.

Generic type	Fabric
Trade name	"AURA + ACRYLIC BACKCOAT & FR TREATMENT (P) - WOOL RICH MOQUETTE – FACE TO FACE – WITH CRINKLE"
Name of manufacturer	Camira Fabrics Ltd
Composition details	Pile: 70% Wool, 12% Nylon 18% Polyester Ground: 100% Cotton
Weight per unit area	850g/m ² (stated by sponsor) 1028.94g/m ² (determined by Warringtonfire)
Thickness	4.2mm (stated by sponsor) 4.17mm (determined by Warringtonfire)
Colour reference	"Cream/Blue (CAA321)"
Pattern reference	"Sixties VDW"
Type of weave	WOOL RICH MOQUETTE - FACE TO FACE - WITH CRINKLE
Thread count or threads per inch (TPI)	See Note 1 below
Yarn count	See Note 1 below
Trade name of flame retardant	"Pekoflam®"
Generic type of flame retardant	See Note 1 below
Amount of flame retardant	See Note 1 below
Brief description of manufacturing process	See Note 1 below

Note 1. The sponsor of the test was unwilling to provide this information.

Test Results

Applicability of test results

The test results relate only to the behaviour of the specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential smoke and toxicity hazard of the product in use.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and will therefore invalidate the test results. It is the responsibility of the supplier of the product to ensure that the product which is supplied is identical with the specimens which were tested.

Smoke Density

Test method referenced "T10.03" requires the $D_s(\max)$ to be calculated. That is the maximum specific optical density within the first 10 minutes test duration.

	Specimen 1	Specimen 2	Specimen 3	Mean Average
$D_s(\max)$ within 10 minutes	63	85	62	70

Toxic Gas Emission

Test method referenced "T11.02" required the CIT to be calculated. That is the conventional index of toxicity, a summation term from the analysis of gases taken at four minutes and eight minutes test duration.

	Specimen 1	Specimen 2	Specimen 3	Mean Average
CIT (4 minutes)	0.21	0.24	0.16	0.20
CIT (8 minutes)	0.31	0.32	0.28	0.30

Additional Test Data

Additional test data relating to the smoke & toxicity performance of the product is detailed in Appendix I of this report.

A graph of the results obtained is illustrated in Appendix II of this report.

Summary of results

The average $D_s(\max)$ value determined within 10 minutes was 70.

The average CIT value at four minutes was 0.20.

The average CIT value at eight minutes was 0.30.

Validity

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. Where this report is used to confirm compliance for use on European rolling stock as per the Technical Specification for Interoperability (LOC&PAS TSI (Commission Regulation (EU) No. 1302/2014)), all tests must have been conducted within the last 5 years or the test reports must have been reviewed within the last five years. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

These results relate only to the behaviour of the specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential smoke obscuration hazard of the product in use.

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Client:	Camira Transport Fabrics Ltd.	Issue No.:	2



Appendix I

Gas Concentration At Four Minutes:

The concentration of each gas species for which analysis was conducted for at the four minute sampling point (expressed in ppm and kg/m³) is provided in the below table:

Gas	Specimen 1		Specimen 2		Specimen 3		Mean Average	
	ppm	kg/m ³	ppm	kg/m ³	ppm	kg/m ³	ppm	kg/m ³
Carbon Monoxide	54	0.0001	80	0.0001	49	0.0001	61	0.0001
Carbon Dioxide	4740	0.0077	4477	0.0073	3974	0.0065	4397	0.0071
Sulphur Dioxide	92	0.0002	50	0.0001	42	0.0001	61	0.0001
Hydrogen Chloride	ND	ND	ND	ND	ND	ND	ND	ND
Hydrogen Bromide	ND	ND	ND	ND	ND	ND	ND	ND
Hydrogen Fluoride	ND	ND	ND	ND	ND	ND	ND	ND
Hydrogen cyanide	ND	ND	22	0.0000	ND	ND	7	0.0000
Nitrogen Oxides	36	0.0001	43	0.0001	32	0.0001	37	0.0001

Where ND indicates None Detected

Gas Concentration At Eight Minutes:

The concentration of each gas species for which analysis was conducted for at the eight minute sampling point (expressed in ppm and kg/m³) is provided in the below table:

Gas	Specimen 1		Specimen 2		Specimen 3		Mean Average	
	ppm	kg/m ³	ppm	kg/m ³	ppm	kg/m ³	ppm	kg/m ³
Carbon Monoxide	121	0.0001	139	0.0001	121	0.0001	127	0.0001
Carbon Dioxide	7589	0.0121	7249	0.0116	7187	0.0115	7341	0.0117
Sulphur Dioxide	61	0.0001	51	0.0001	42	0.0001	51	0.0001
Hydrogen Chloride	ND	ND	ND	ND	ND	ND	ND	ND
Hydrogen Bromide	ND	ND	ND	ND	ND	ND	ND	ND
Hydrogen Fluoride	ND	ND	ND	ND	ND	ND	ND	ND
Hydrogen cyanide	38	0.0000	27	0.0000	33	0.0000	33	0.0000
Nitrogen Oxides	53	0.0001	63	0.0001	52	0.0001	56	0.0001

Where ND indicates None Detected

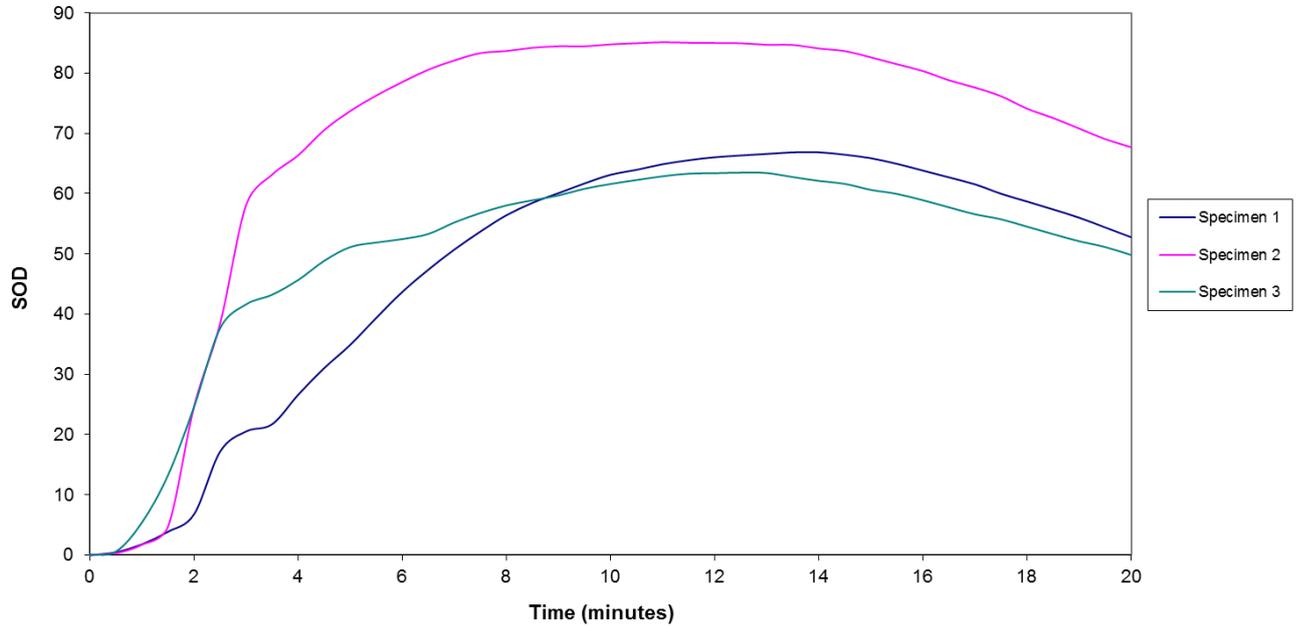
	SPECIMEN NUMBER			Mean
	1	2	3	
Clear Beam Correction Factor (D_c)	4	9	6	
Specific Optical Density at 10 minutes (D_{s10})	63	85	62	70
Specimen thickness	4.12	4.22	4.50	4.28
Initial specimen weight (g)	5.8	5.9	5.9	5.9
Final specimen weight (g)	0	0	1.3	0.4
Mass Loss (g)	5.8	5.9	4.6	5.8
Wire Grid (if applicable)	N/A	N/A	N/A	N/A
Neutral-density correction factor (C_f) (if applicable)	N/A	N/A	N/A	N/A
Test Duration (s)	1200	1200	1200	1200
Chamber back wall temperature	42	42	42	N/A
Test Operator	Daniel Richardson			N/A

Observations:

Specimen No.	25kW/m ² In The Presence Of A Pilot Flame		
	1	2	3
Colour of smoke produced	Light	Light	Light
Expansion distance towards heater (mm)	N/A	N/A	N/A
Ignition time in seconds (if applicable)	12	13	22
Extinction time in seconds (if applicable)	66	70	41
Re-ignition time in seconds (if applicable)	76	100	63
Extinction time in seconds (if applicable)	438	310	242
Re-ignition time (2) in seconds (if applicable)	*	*	310
Extinction time in seconds (if applicable)	N/A	N/A	431
Unusual or unexpected behavior?	N/A	N/A	N/A
Any difficulties during test?	N/A	N/A	N/A
* = Did Not Re-ignite N/A = Not Applicable			

Appendix II

25kW/m² in the presence of a pilot flame



Revision History

Issue No : 2	Re - Issue Date:21 st August 2019
Revised By: S. Jones	Approved By: S Deeming
Reason for Revision: This document replaces Issue 1 (dated 19 th June 2019) of the same number which has been withdrawn. The sponsor of the test has requested that the product reference is amended in this Issue 2 report	

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Reason for Revision:	

Document No.: 413568

Author: S. Jones

Client: Camira Transport Fabrics Ltd.

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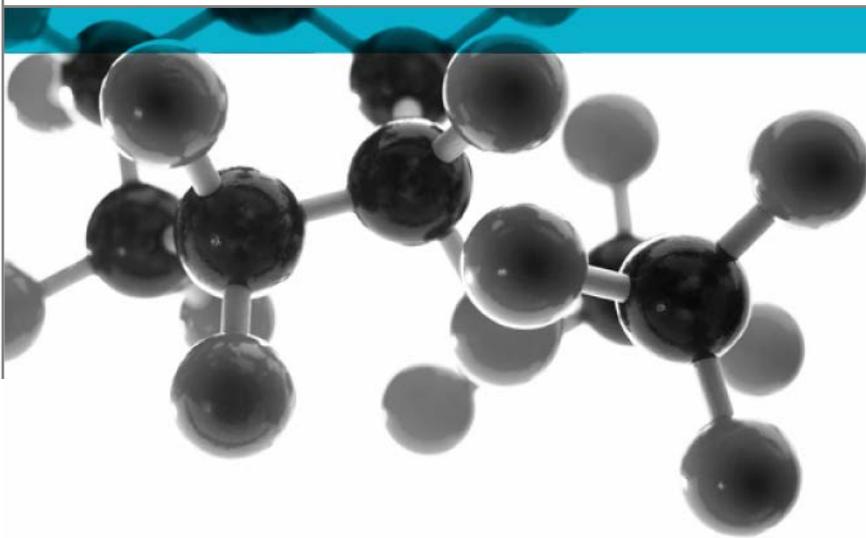
Issue Date: 21st August 2019

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0249

BS EN 45545-2:2013+A1:2015



Summary Test Report – BS EN 45545-2:2013+A1:2015 Requirement Table 5 (R21)

Test Method References “T03.02” (ISO 5660-1: Part 1; Heat Release Rate (Cone Calorimeter Method), “T10.03” (ISO 5659-2: 2017; Plastics – Smoke Generation. Part 2 Determination of Optical Density by a Single Chamber Method) and “T11.02” (Gas Analysis in the Smoke Box ISO, using FTIR Technique)

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A Report To: Camira Transport Fabrics Ltd.

Document Reference: 413569

Executive Summary

Objective To assess the results of tests performed in accordance with methods T03.02, T10.03 and T11.02 as defined in BS EN 45545-2:2013+A1:2015 at an irradiance level of 25kW/m² with a pilot flame, on specimens of a product and to provide an opinion of compliance with the requirements, as defined in BS EN 45545-2:2013+A1:2015.

Generic Description	Product reference	Thickness	Weight per unit area
Fabric	"AURA + ACRYLIC BACKCOAT & FR TREATMENT (P) - WOOL RICH MOQUETTE – FACE TO FACE – WITH CRINKLE"	4.2mm	850g/m ²
Please see page 5 of this test report for the full description of the product tested			

Test Sponsor Camira Transport Fabrics Ltd., Meltham Mills, Meltham Mills Road, Meltham, West Yorkshire, HD9 4AY

Opinion **The results of the tests confirmed in reports referenced 413565 & 413568, demonstrate that the fabric product as tested, in isolation, obtained results within the limits detailed for requirement set R21 (within Table 5 of EN 45545-2: 2013 + A1:2015) Hazard Level HL1, HL2 and HL3.**
Requirement set R21 should be conducted on the composite as used in practice.

Reason for Revision This document replaces Issue 1 (dated 19th June 2019) of the same number which has been withdrawn. The sponsor of the test has requested that the product reference is amended in this Issue 2 report

Signatories



Responsible Officer
S. Jones *
Technical Officer



Authorised
S. Deeming *
Business Unit Head

* For and on behalf of [Warringtonfire](#).

Report Issued: 21st August 2019

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Test Details

Terms Of Reference To assess the results of tests performed in accordance with methods T03.02, T10.03 and T11.02 as defined in BS EN 45545-2:2013+A1:2015 at an irradiance level of 25kW/m² with a pilot flame, on specimens of a product and to provide an opinion of compliance with the requirements, as defined in BS EN 45545-2:2013+A1:2015.

Introduction Specimens of a product have been tested in accordance with the test methods “T03.02” (ISO 5660-1: Part 1; Heat Release Rate (Cone Calorimeter Method), “T10.03” (ISO 5659-2: 2017; Plastics – Smoke Generation. Part 2 Determination of Optical Density by a Single Chamber Method) and “T11.02” (Gas Analysis in the Smoke Box ISO, using FTIR Technique) as specified in BS EN 45545-2:2013+A1:2015 “Requirements for Fire Behaviour of Materials and Components”. The results of the tests are fully reported in the [Warringtonfire](#) test reports No's 413565 & 413568.

This summary report has been prepared at the request of the sponsor and relates the results of the tests to the requirements for R21, as defined in Table 5 of BS EN 45545-2:2013+A1:2015.

This summary should be read in conjunction with, and not accepted as a substitute for the [Warringtonfire](#) test reports No's. 413565 & 413568. Those test reports may include additional information which may be relevant to the assessment of the potential fire hazard of the product. Where this assessment covers a system used on European rolling stock covered by the Technical Specification for Interoperability (LOC&PAS TSI (Commission Regulation (EU) No. 1302/2014)) all tests must have been conducted within the last 5 years or the test reports must have been reviewed within the last five years.

Face subjected to tests The specimens were mounted in the test positions such that decorative face was exposed to the heating conditions of the tests.

Results of test The following results were obtained for the specimens, which were tested.

“T03.02” ISO 5660-1

MARHE = 19.8kW/m²

“T10.03” ISO 5659-2: 2017

D_s max = 70

“T11.02” Gas Analysis in the Smoke Box ISO, Using FTIR Technique

CIT_{4mins} = 0.20
CIT_{8mins} = 0.30

The test results relate only to the behaviour of the test specimens of the product under the particular conditions of the test, they are not intended to be the sole criterion for assessing the potential hazard of the product in use.

Description of Test Specimens

The description of the specimens given below has been prepared from information provided by the sponsor of the test. This information has not been independently verified by Warringtonfire. All values quoted are nominal, unless tolerances are given.

Generic type	Fabric
Trade name	"AURA + ACRYLIC BACKCOAT & FR TREATMENT (P) - WOOL RICH MOQUETTE – FACE TO FACE – WITH CRINKLE"
Name of manufacturer	Camira Fabrics Ltd
Composition details	Pile: 70% Wool, 12% Nylon 18% Polyester Ground: 100% Cotton
Weight per unit area	850g/m ² (stated by sponsor) 1028.94g/m ² (determined by Warringtonfire)
Thickness	4.2mm (stated by sponsor) 4.17mm (determined by Warringtonfire)
Colour reference	"Cream/Blue (CAA321)"
Pattern reference	"Sixties VDW"
Type of weave	WOOL RICH MOQUETTE - FACE TO FACE - WITH CRINKLE
Thread count or threads per inch (TPI)	See Note 1 below
Yarn count	See Note 1 below
Trade name of flame retardant	"Pekoflam®"
Generic type of flame retardant	See Note 1 below
Amount of flame retardant	See Note 1 below
Brief description of manufacturing process	See Note 1 below

Note 1. The sponsor of the test was unwilling to provide this information.

Classification

Opinion

The results of the tests confirmed in reports referenced 413565 & 413568, demonstrate that the fabric product as tested, in isolation, obtained results within the limits detailed for requirement set R21 (within Table 5 of EN 45545-2: 2013 + A1:2015) Hazard Level HL1, HL2 and HL3.

Requirement set R21 should be conducted on the composite as used in practice.

Validity of opinion

This opinion is based on the requirements of BS EN 45545-2:2013+A1:2015 at the date of this report. If BS EN 45545-2:2013+A1:2015 is revised or amended in any way subsequent to that date, care must be taken to ensure that this opinion is not invalidated by those revisions or amendments.

The opinion has been formulated on the assumption that the specimens are representative of the product in practice. [Warringtonfire](#) was not involved in any sampling or selection procedures which would confirm this or in any audit testing which would provide confidence in the consistency of the product in the tests.

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Revision History

Issue No : 1	Re - Issue Date: 21 st August 2019
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