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Heat release and smoke production according to ISO 5660-1

(3 appendices)

Introduction

RISE has by request of Finsa Dpto. De Idi + Calidad performed a fire test according to ISO 5660-1. The purpose of the test is to form a basis for technical fire classification.

Products

According to the client:

MDF board called "FIBRAPAN IGNIFUGO E-Z".

The product has a nominal area weight of 5.1 kg/m², density of 850 kg/m³ and a nominal thickness of 6 mm. The product has a red colour. The product has an organic content of 82 %.

The product is flame retardant treated with Ammonium salts, content per mass, 143 kg/m³ dry weight.

Manufacturer

Finsa Fibranor, Rabade (Lugo), Spain.

Sampling

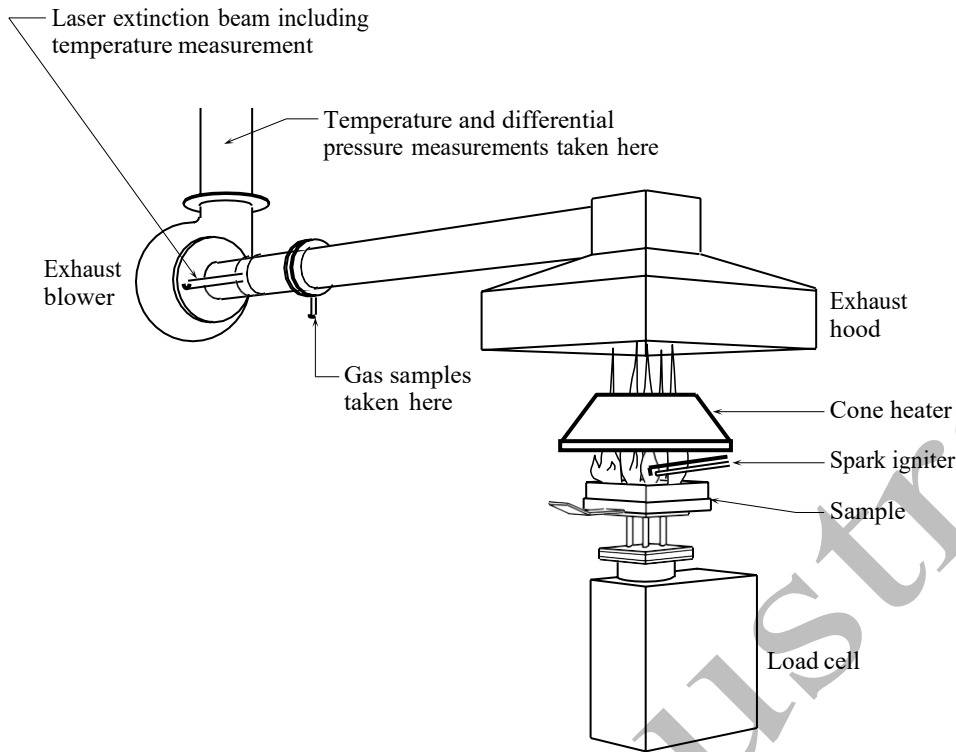
The sample was delivered by the client. It is not known to RISE Safety – Fire Research if the product received is representative of the mean production characteristics.

The sample was received July 13, 2021 at RISE Safety – Fire Research.

Test procedure

In the Cone Calorimeter, ISO 5660-1, specimens of 0.1 by 0.1 m are exposed to controlled levels of radiant heating. The specimen surface is therefore heated up and an external spark ignitor ignites the pyrolysis gases from the specimen. The gases are collected by a hood and extracted by an exhaust fan.

The heat release rate (HRR) is determined by measurements of the oxygen consumption derived from the oxygen concentration and the flow rate in the exhaust duct. The specimen is placed on a load cell during testing. A retainer frame covers the periphery of the specimen. Smoke production rate is measured with a laser system.



Schematic drawing of the Cone calorimeter, ISO 5660-1.

Test results

Detailed test results are given in appendix 1. The test parameter explanation is given in appendix 3.

Below a tabulated summary is given.

Product	Time to ignition (s)	THR (MJ/m ²)	q _{max} (kW/m ²)	q ₁₈₀ (kW/m ²)	SPR _{max} (m ² /m ² s)	TSP (m ² /m ²)
FIBRAPAN IGNIFUGO E-Z	206	64.9	252	106	3.8	359

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

New Zealand Building Code Verification

The following classification has been assessed in the accordance with the New Zealand Building Code Verification Method C/VM2 Appendix A. Establishing Group numbers for lining materials. Calculation were carried out according to section A1.3 for predicting a material's group number for each specimen tested.

Table 1 : FIBRAPAN IGNIFUGO E-Z, 6 mm.

	Sample 1	Sample 2	Sample 3	Classification
Group number Classification	1	1	1	1

The tested samples recorded a specific extinction area less than 250 m²/kg. In accordance with Verification Method C/VM2 Appendix A, samples achieving either a Group number classification 1 or 2, and with an average specific extinction area less than 250 m²/kg are identified with "S" post-script to the Group number.

The cone calorimeter testing was carried out on the single specimens. For the purpose of compliance with the NZBC Verification Method C/VM2 Appendix A, the following classification is indicated for the material "FIBRAPAN IGNIFUGO E-Z, 6 mm".

Table 2 : FIBRAPAN IGNIFUGO E-Z, 6 mm.

Building Code Document	Indicated Group Number Classification, product FIBRAPAN IGNIFUGO, 6 mm
NZBC Verification Method C/VM2 Appendix A	1-S

Table 3: Classification group number

Product	Classification group number
FIBRAPAN IGNIFUGO E-Z, 3 - 6 mm	1-S

Reports in support of this assessment

Table 4: Test reports

Name of laboratory	Name of sponsor	Test report reference no	Accredited test methods and date
RISE	FINSA Dpto. de IDi + Calidad	O100352-129410	ISO 5660-1:2015/AMD 1:2019
RISE	FINSA Dpto. de IDi + Calidad	O100352-144518-2	ISO 5660-1:2015/AMD 1:2019

Note

The accreditation referred to is valid for ISO 5660-1.

**RISE Research Institutes of Sweden AB
Department Fire Technology - Reaction to Fire Material Lab**

Performed by

Examined by



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Appendices

- 1 Test results
- 2 Photographs of the specimen
- 3 Test parameters explanation

Appendix 1

Test results ISO 5660-1:2015/AMD 1:2019**Product**

According to the client:

MDF board called "FIBRAPAN IGNIFUGO E-Z".

The product has a nominal area weight of 5.1 kg/m², density of 850 kg/m³ and a nominal thickness of 6 mm. The product has a red colour. The product has an organic content of 82 %.

The product is flame retardant treated with Ammonium salts, content per mass, 143 kg/m³ dry weight.

Test specification

Irradiance level:	50 kW/m ² .
Calibration constant (C):	0.04244 m ^{1/2} g ^{1/2} K ^{1/2} .
Orientation:	Horizontal.
The exposed surface area of test specimen	0.009 m ² . The retainer frame was used. The specimen had metal wires crossing the surface to avoid intumescences.
Backing:	No other than the non-combustible required in the standard.
Radiator cone location:	The radiator cone was located so that the lower rim of the radiator cone shade junction was 25 mm above the upper surface of the specimen when oriented in the horizontal position.

Appendix 1

Test results

Property	Name of variable	Test 1	Test 2	Test 3	Average value
Flashing (min:s)	t_{flash}	-	-	-	-
Ignition (min:s)	t_{ign}	03:26	03:26	03:25	03:26
All flaming ceased (min:s)	t_{ext}	35:56	35:26	35:25	35:36
Test time (min:s)	t_{test}	35:26	35:26	35:25	35:26
Heat release rate (kW/m ²)	q	See figure 1	See figure 1	See figure 1	
Peak heat release rate (kW/m ²)	q_{max}	248	233	277	252
Average heat release, 3 min (kW/m ²)	q_{180}	103	109	106	106
Average heat release, 5 min (kW/m ²)	q_{300}	77	82	78	79
Total heat produced (MJ/m ²)	THR	61.0	76.7	57.1	64.9
Smoke production rate (m ² /m ² s)	SPR	See figure 2	See figure 2	See figure 2	
Peak smoke production (m ² /m ² s)	SPR_{max}	3.4	4.5	3.5	3.8
Total smoke production before ignition (m ² /m ²)	$TSP_{\text{start-ign}}$	333.0	371.7	342.8	349.1
Total smoke production after ignition (m ² /m ²)	$TSP_{\text{ign-end}}$	13.9	3.9	12.6	10.1
Total smoke production (m ² /m ²)	TSP	347	376	355	359
Sample mass before test (g)	M_0	53.4	54.0	53.8	53.8
Sample mass at sustained flaming (g)	M_s	34.0	34.2	34.4	34.2
Sample mass after test (g)	M_f	6.9	8.3	8.6	7.9
Average mass loss rate (g/m ² s)	$MLR_{\text{ign-end}}$	1.8	1.7	1.7	1.7
Average mass loss rate (g/m ² s)	MLR_{10-90}	1.9	1.8	1.8	1.8
Total mass loss (g/m ²)	TML	3371	3240	3209	3274
Effective heat of combustion (MJ/kg)	ΔH_c	18.1	23.7	17.8	19.9
Max average rate of heat emission (kW/m ²)	MARHE	54.3	61.0	59.9	58.4
Volume flow in exhaust duct (l/s)	V	24	24	24	24

Appendix 1

Graphs of heat release rate and smoke production rate

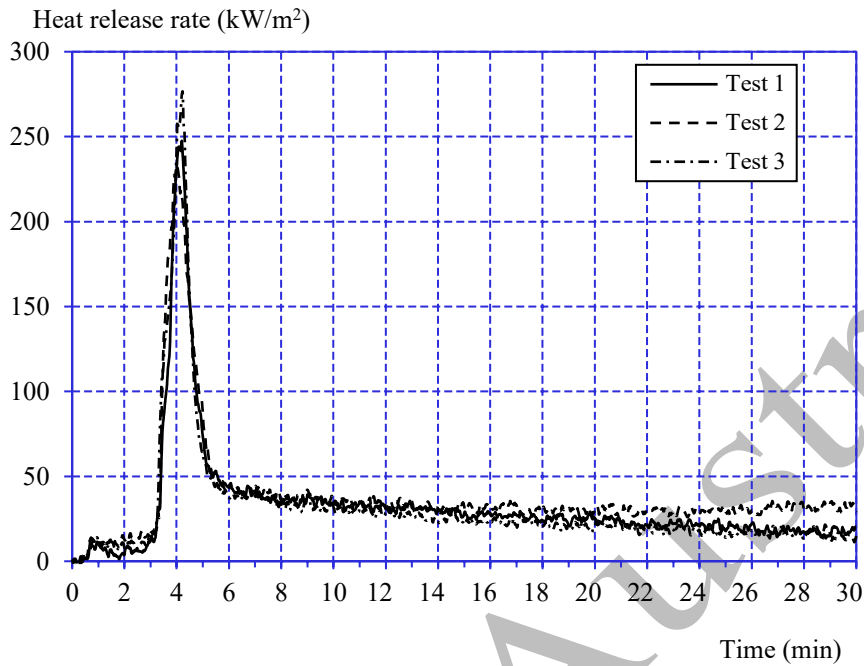


Figure 1 Heat release rate for FIBRAPAN IGNIFUGO E-Z 6 mm, triplicate tests at an irradiance of 50 kW/m².

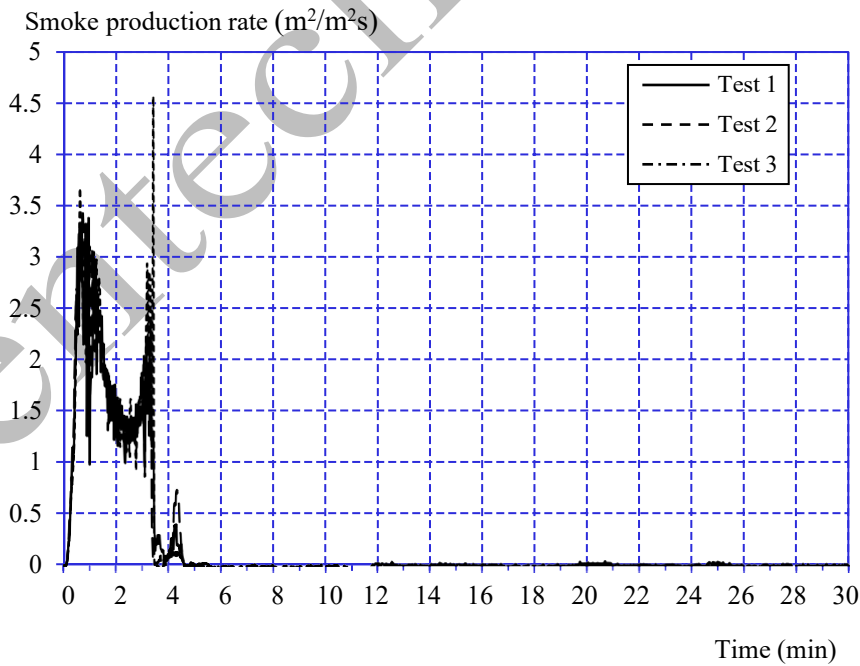


Figure 2 Smoke production rate FIBRAPAN IGNIFUGO E-Z 6 mm, triplicate tests at an irradiance of 50 kW/m².

Appendix 1

Measured data

Thickness 6.0 – 6.1 mm.
Area weight 5.4 – 5.6 kg/m².

Conditioning

According to ISO 5660-1.

Temperature (23 ± 2) °C.
Relative humidity (50 ± 5) %.

Operator

Patrik Nilsson.

Date of test

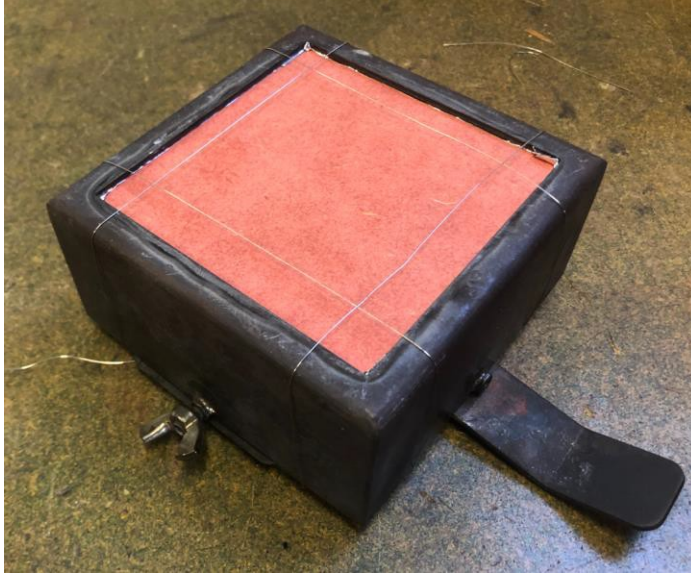
September 8, 2021.

Ventech Australia

Appendix 2

Photograph of a specimen of the tested product

Specimen dimensions are 100 x 100 [mm].



Appendix 3

Test results explanation – ISO 5660

Parameter	Explanation
Test start	The test specimen is subjected to the irradiance and the clock is started.
t_{flash}	Time from test start until flames with shorter duration than 1 s.
t_{ign}	Time from test start until sustained flaming with duration more than 10 s.
T_{ext}	Time from test start until the flames have died out.
End of test	Defined as the time when both, the product has been extinguished for 2 minutes, and the mass loss is less than 150 g/m ² during 1 minute. According to EN 45545-2, end of test is always at 20 min.
T_{test}	Test time. From test start until end of test.
q_{max}	Peak heat release rate during the entire test.
q_{180}	Average heat release rate during 3 minutes from ignition. If the test is terminated before, the heat release rate is taken as 0 from the end of test.
q_{300}	Average heat release rate during 5 minutes from ignition. If the test is terminated before, the heat release rate is taken as 0 from the end of test.
THR	Total Heat Released from test start until end of test.
SPR_{max}	Peak Smoke Production Rate from test start until end of test.
TSP	Total Smoke Produced from test start until end of test.
M_0	Mass of specimen.
M_s	Mass of specimen at sustained flaming.
M_f	Mass of specimen at the end of the test.
$\text{MLR}_{\text{ign-end}}$	Mass Loss Rate. Average mass loss rate from ignition until end of test.
MLR_{10-90}	Mass Loss Rate. Average mass loss rate between 10% and 90% of mass loss.
TML	Total mass loss from ignition until end of test.
ΔH_c	Effective heat of combustion calculated as the ratio between total energy released and total mass loss calculated from ignition until end of test.
MARHE	Maximum Average Rate of Heat Emission defined as the maximum of the function (cumulative heat release between $t = 0$ and time = t) divided by (time = t).
V	Volume flow rate in exhaust duct. Average during the test.