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Heat release and smoke production according to ISO 5660-1

(2 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 8.3 kg/m², density of 830 kg/m³ and a nominal thickness of 10 mm. The product has a brown colour with a red core. The product has an organic content of 83 %.

The product is flame retardant treated with Ammonium salts, content per mass, 121 kg/m³ dry weight.

Manufacturer

Finsa Padron. Padron (A Coruna), 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 April 14, 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.

RISE Research Institutes of Sweden AB

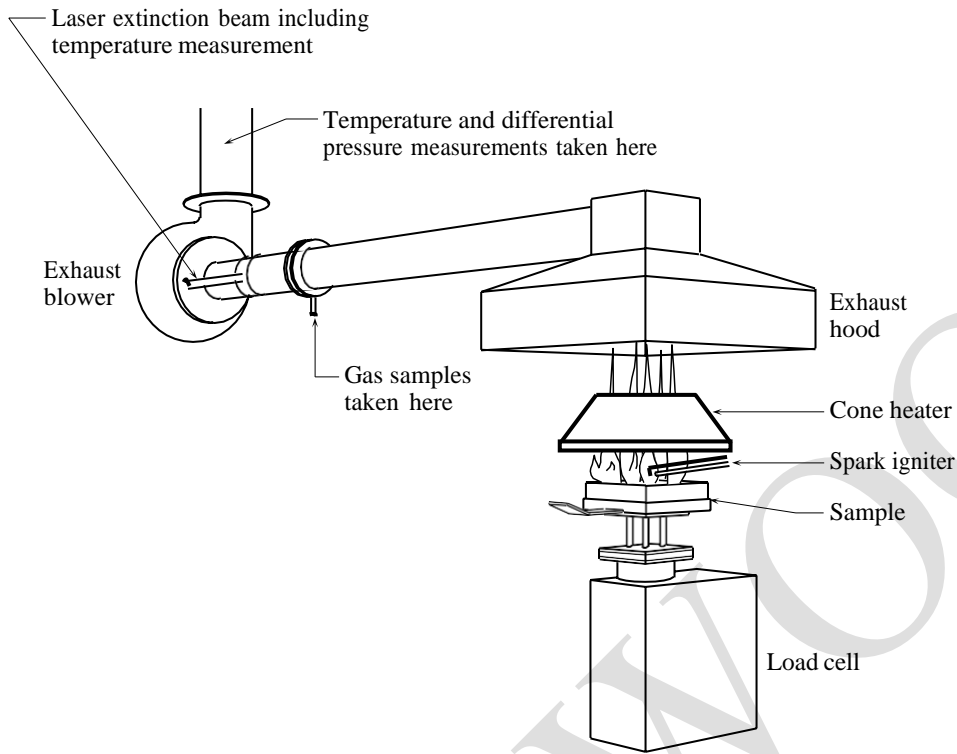
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Schematic drawing of the Cone calorimeter, ISO 5660-1.

Test results

Detailed test results are given in appendix 1. The test parameter explanation is given in appendix 2.

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, 10 mm	39	72.4	154	22	3.2	336

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.

Assessment according to AS 5637.1:2015 Determination of fire hazard properties

The following classification has been assessed in the accordance with the AS 5637.1:2015 Determination of fire hazard properties. Establishing Group numbers for wall and ceiling linings. Calculation were carried out according to section 8, Determining group numbers by prediction, for predicting a material's group number for each specimen tested.

Table 1 : FIBRAPAN IGNIFUGO E-Z, 25 mm.

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

Table 2 : FIBRAPAN IGNIFUGO E-Z, 10 mm.

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

Table 3 : The tested samples recorded a specific extinction area, ASEA, AS 3837:1998:

	Sample 1	Sample 2	Sample 3	Average ASEA
ASEA, (m ² /kg)	37.5	45.5	34.5	39.2

The cone calorimeter testing was carried out on the single specimens. For the purpose of compliance with the AS 5637.1:2015, section 8, the following classification is indicated for the material "FIBRAPAN IGNIFUGO E-Z".

Table 4: Classification group number

Product	Classification group number
FIBRAPAN IGNIFUGO E-Z, 10 - 25 mm	1

Reports in support of this assessment

Table 5: Test reports

Name of laboratory	Name of sponsor	Test report reference no	Accredited test methods and date
RISE	FINSA Dpto. de IDi + Calidad	O100352-144518-1	ISO 5660-1:2015/AMD 1:2019
RISE	FINSA Dpto. de IDi + Calidad	O100352-129410-1	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 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 8.3 kg/m², density of 830 kg/m³ and a nominal thickness of 10 mm. The product has a brown colour with a red core. The product has an organic content of 83 %.

The product is flame retardant treated with Ammonium salts, content per mass, 121 kg/m³ dry weight.

Test specification

Irradiance level: 50 kW/m².

Calibration constant (C): 0.04126 m^{1/2} g^{1/2} K^{1/2}.

Orientation: Horizontal.

The exposed surface area of test specimen 0.009 m². The retainer frame was used.

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}	00:36	00:33	00:34	-
Ignition (min:s)	t_{ign}	00:41	00:37	00:38	00:39
All flaming ceased (min:s)	t_{ext}	01:21	01:08	01:17	01:15
Test time (min:s)	t_{test}	32:41	32:37	32:38	32:39
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}	151	142	168	154
Average heat release, 3 min (kW/m ²)	q_{180}	19	23	24	22
Average heat release, 5 min (kW/m ²)	q_{300}	18	18	18	18
Total heat produced (MJ/m ²)	THR	72.4	71.1	73.6	72.4
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	2.8	3.4	3.2
Total smoke production before ignition (m ² /m ²)	TSP _{start-ign}	38.0	31.6	35.4	35.0
Total smoke production after ignition (m ² /m ²)	TSP _{ign-end}	278.3	328.4	294.9	300.5
Total smoke production (m ² /m ²)	TSP	316	360	330	336
Sample mass before test (g)	M_0	84.8	85.2	89.7	86.6
Sample mass at sustained flaming (g)	M_s	82.5	83.7	87.9	84.7
Sample mass after test (g)	M_f	22.0	22.6	23.4	22.7
Average mass loss rate (g/m ² s)	MLR _{ign-end}	3.7	3.7	3.9	3.8
Average mass loss rate (g/m ² s)	MLR ₁₀₋₉₀	5.3	5.3	5.7	5.4
Total mass loss (g/m ²)	TML	7071	7165	7488	7241
Effective heat of combustion (MJ/kg)	ΔH_c	10.2	9.9	9.8	10.0
Max average rate of heat emission	MARHE	56.0	52.5	53.5	54.0
Volume flow in exhaust duct (l/s)	V	24	24	24	24

Appendix 1

Graphs of heat release rate and smoke production rate

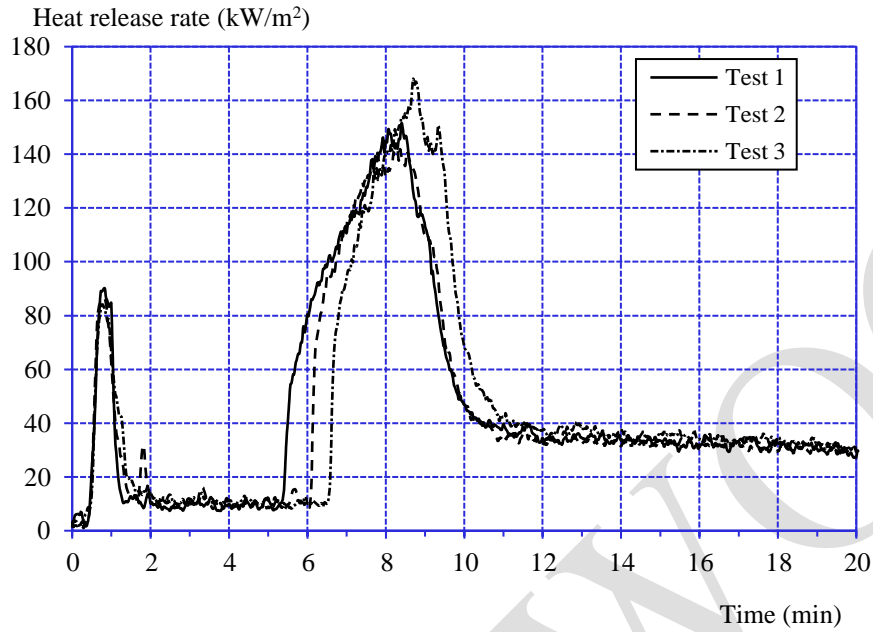


Figure 1 Heat release rate, triplicate tests at an irradiance of 50 kW/m².

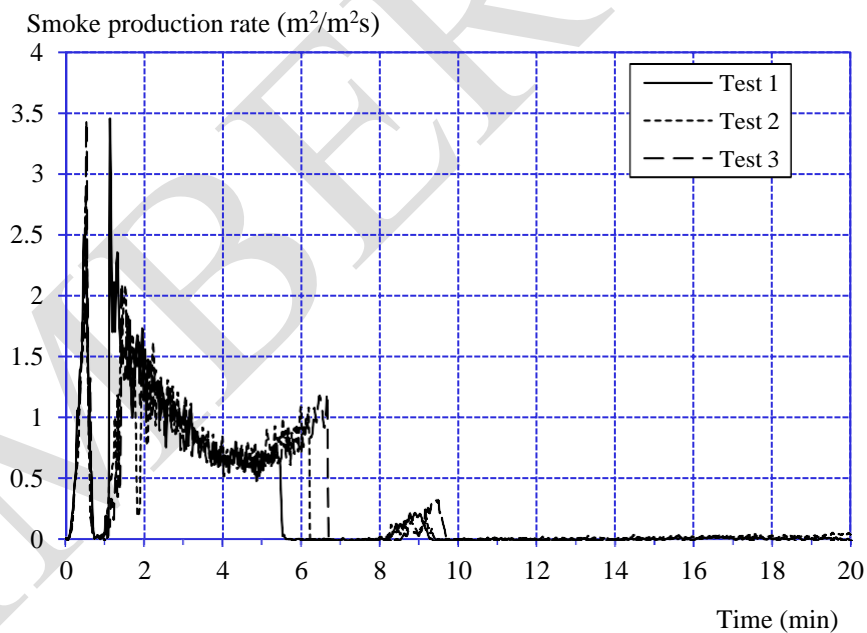


Figure 2 Smoke production rate, triplicate tests at an irradiance of 50 kW/m².

Appendix 1

Measured data

Thickness 9.9 – 10.1 mm.

Area weight 8.5 kg/m².

Density 840 kg/m³.

Conditioning

According to ISO 5660-1.

Temperature (23 ± 2) °C.

Relative humidity (50 ± 5) %.

Operator

Sven Karlsson.

Date of test

May 21, 2021.

Appendix 2

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.