

European approach to assess the fire performance of facades

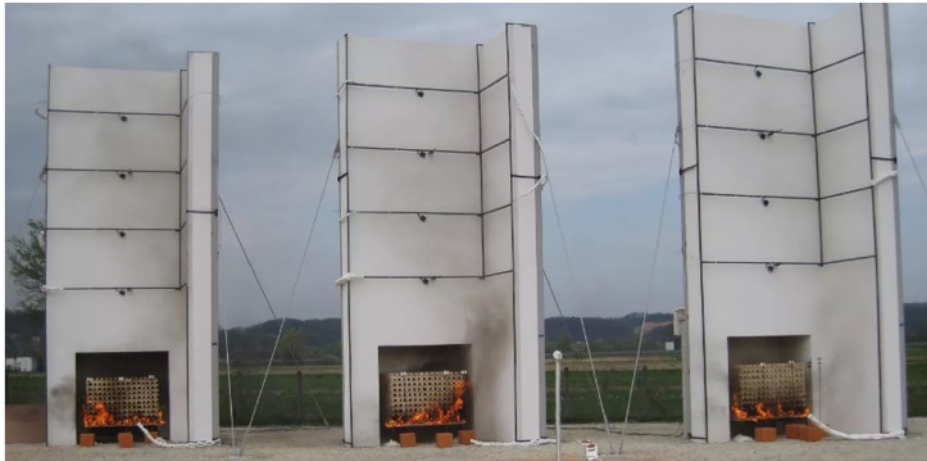
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BRE Global

2023



Part of the BRE Trust

Project history



European approach to assess the fire performance of facades

Summary

PROJECT NAME

New European fire test for facades

STATUS

Active

RISE ROLE IN PROJECT

Coordinator

PROJECT START

2020-03-12

DURATION

45 months

TOTAL BUDGET

720 000 Euro

PARTNER

BAM, Germany, Efectis, France, EMI, Hungary, University of Liege, Belgium

FUNDERS

European Commission

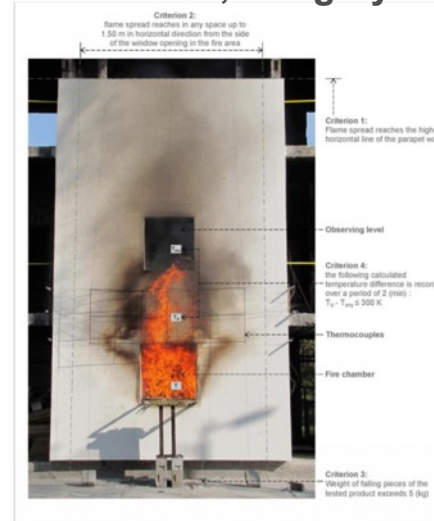
Large scale fire tests methods

BS 8414, UK

ISO 13785-2, International

MSZ 14800-6, Hungary

SP FIRE 105, Sweden



LEPIR II, France

DIN 4102-20, Germany

Draft test method, Romania

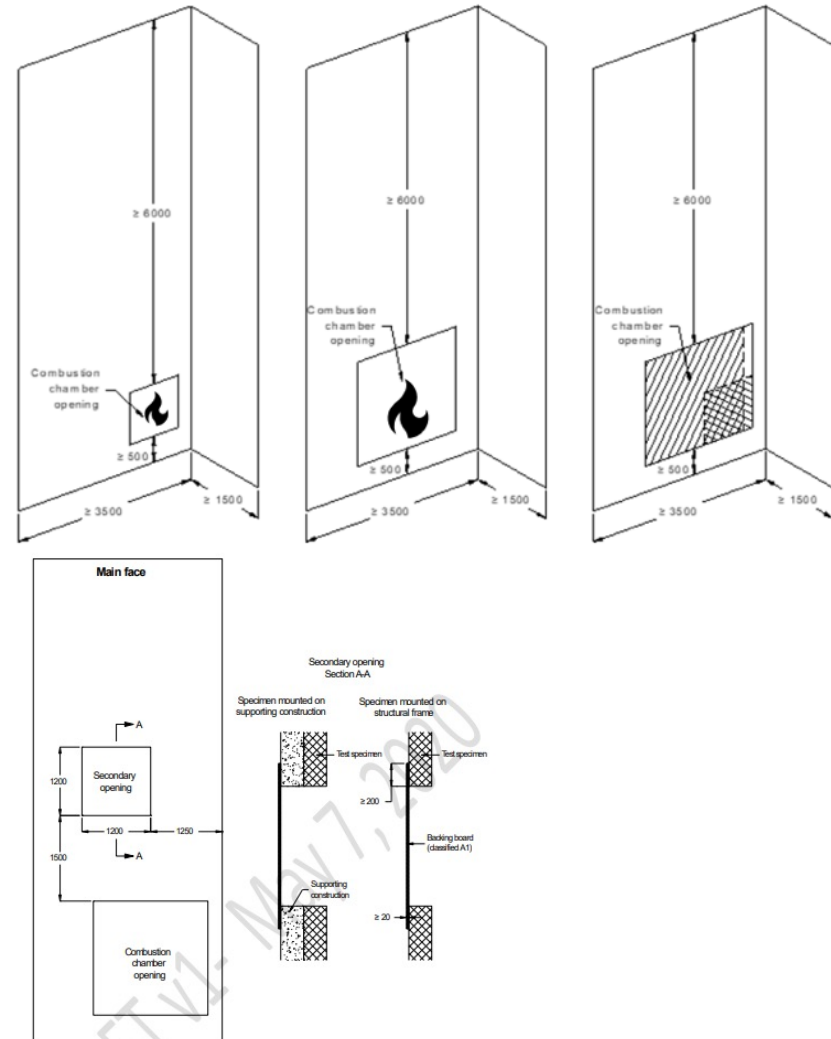
GOST 31251, Russia



Harmonisation of the test procedure

Elements addressed by the façade tests in use:

- Flame spread - vertical and horizontal, surface and within the system
- Fire spread from one room to another (above)
- Junction between façade and floors
- Windows
- Detailing around window openings
- Smouldering
- Falling parts
- Smoke
- Heat
- Fire from inside
- Fire from outside
- Permanent changes to the system (assessed after the test)



Main tasks of the project

Theoretical round robin

- Theoretical assessment of a series of virtual tests
- Perform the exercise with EGOLF Members
- Analyse the response
- Rewrite the assessment method

Initial testing activities

- Parametric studies on wood species, density, geometrical tolerances, moisture content
- Analysis of mass loss rate, heat release rate, heat flux and temperature
- Influence of a secondary opening
- Measurement of falling parts

Experimental round robin

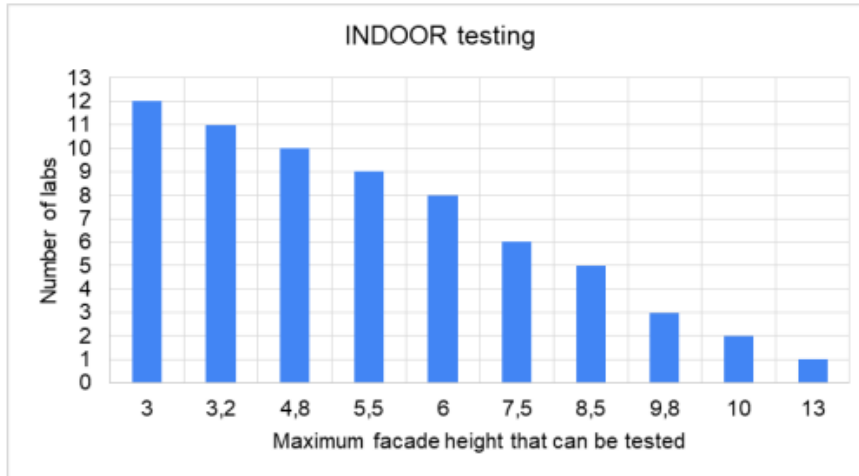
- Definition of façade systems to be incorporated in the programme
- Procurement, design and installation of the façade system from sponsors
- Round robin testing and data analysis

Analysis

- Update of the assessment method after each task
- Comparison with other methods
- European approach to assess the fire performance of facades

Theoretical
round robin

Presence of fire testing labs



Hong Kong

Israel

UAE

USA



Outdoor testing ?

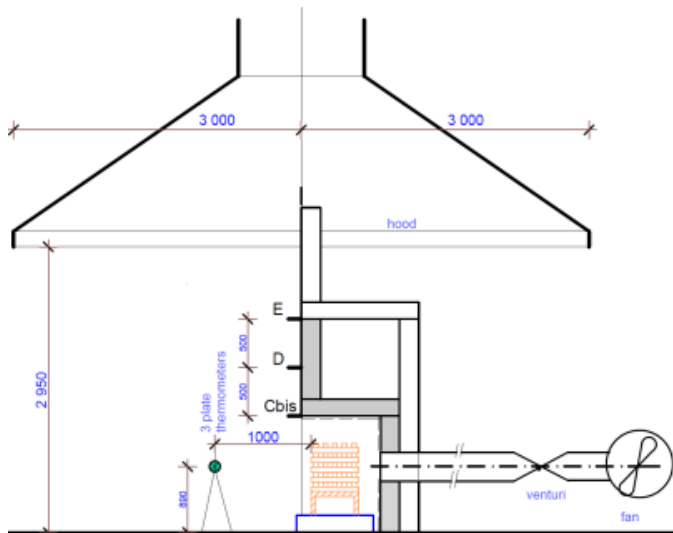
- 12 labs are able to test facades up to 3m high
- 6 labs are able to test facades up to 7.5m high
- 1 lab is able to test facades up to 13m high

Parametric study on timber cribs

Test reference	Fire exposure	Wood species	Surface finish	Wood density [kg/m ³]	Moisture content [%]
L1	Large	Spruce	Planed	Average	Average
L2	Large	Spruce	Planed	Low	Average
L3	Large	Spruce	Planed	High	Average
L4	Large	Pine	Planed	Low	High
L5	Large	Spruce	Planed	Low	Low
L6	Large	Spruce	Planed	Average	High
L7	Large	Spruce	Planed	Low	Average
L8	Large	Spruce	Sawn	Average	Average
M1	Medium	Spruce	Planed	High	Average
M2	Medium	Spruce	Planed	Low	Average
M3	Medium	Spruce	Sawn	Low	Average

Initial testing
activities

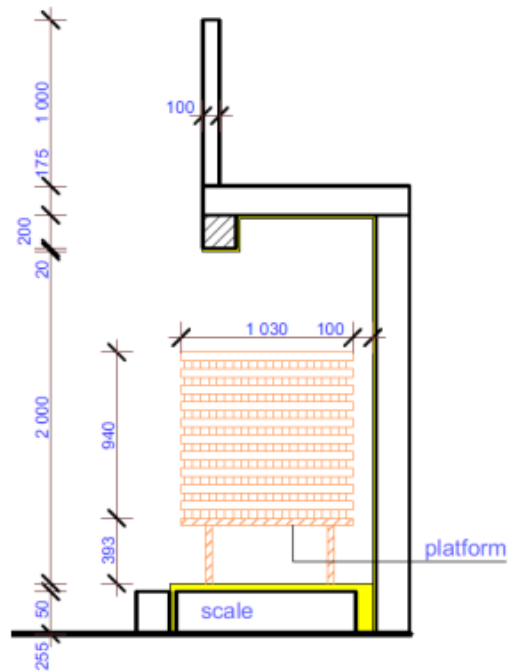
Medium fire exposure



- Set limits for density, moisture content, and total mass to ensure repeatability of the fire source

Initial testing activities

Large fire exposure



Initial testing
activities

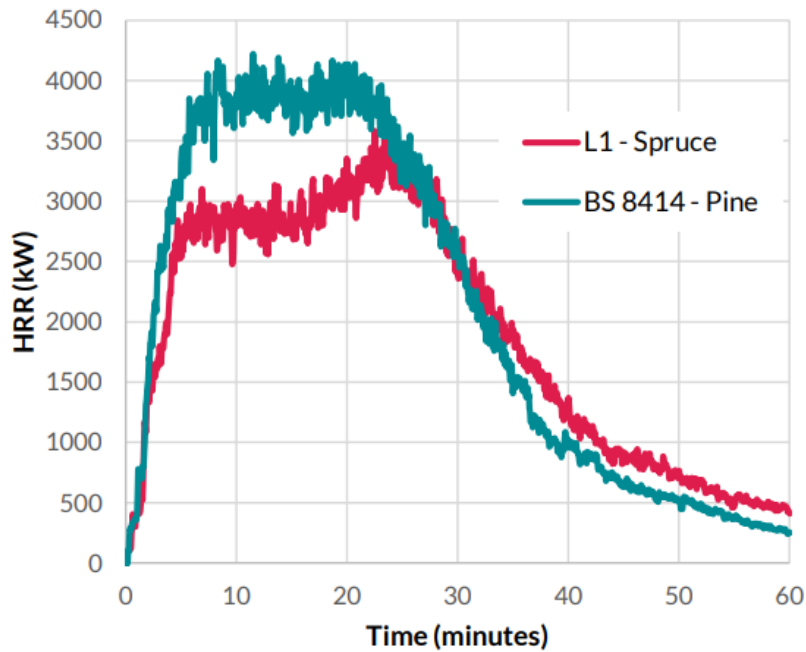
Large fire exposure

Test example

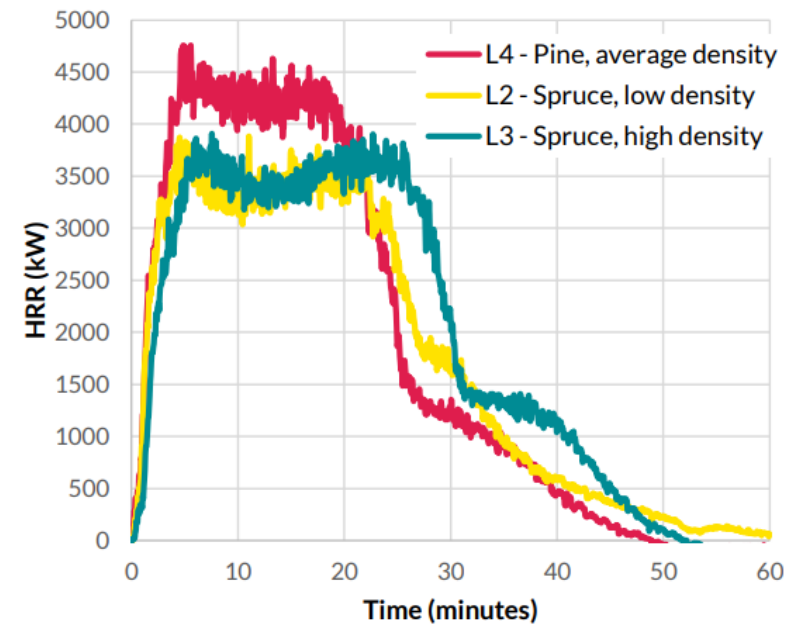


Large fire exposure

Effect of species

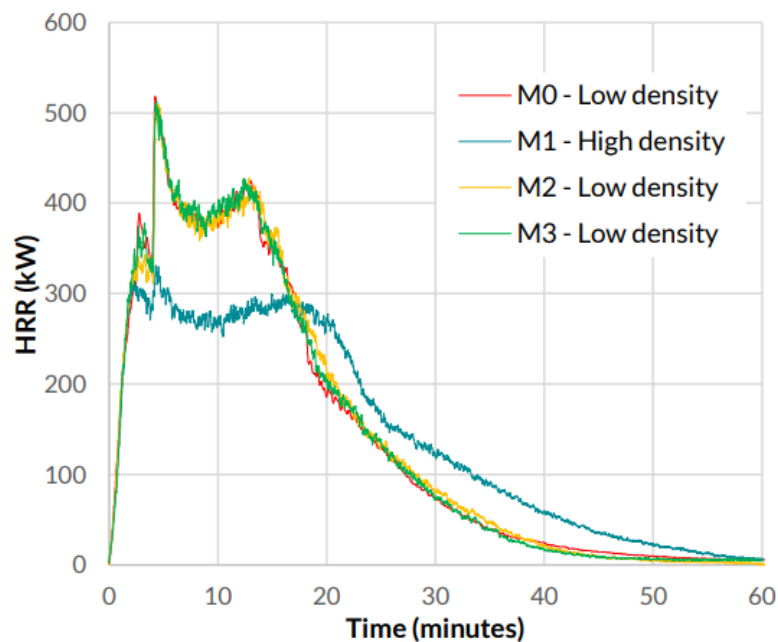


Effect of species

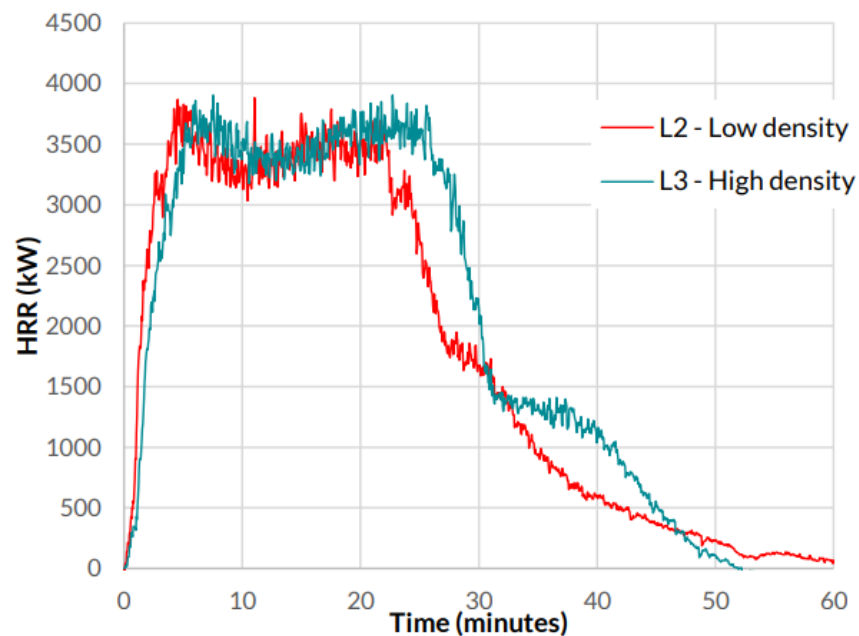


Large fire exposure

Effect of density – medium crib

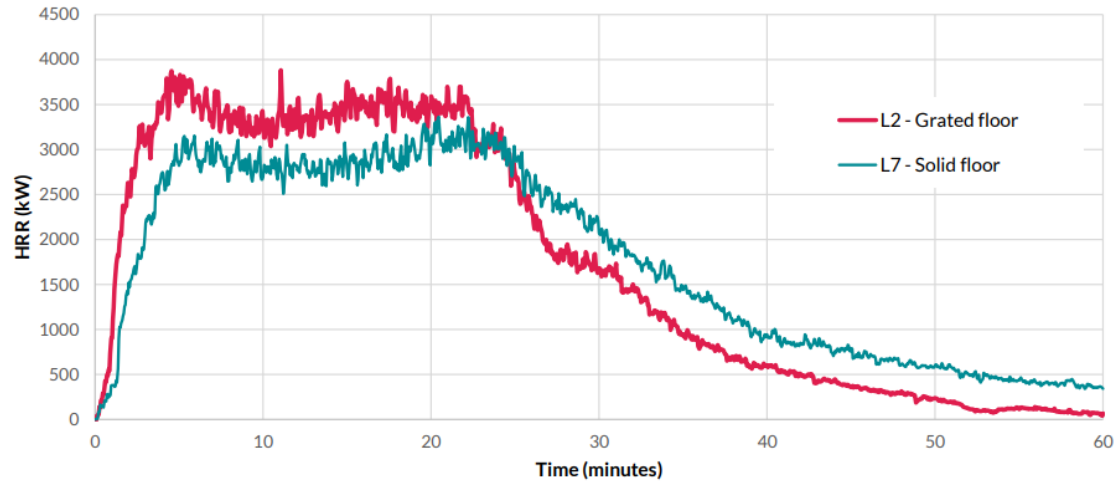


Effect of density – large crib

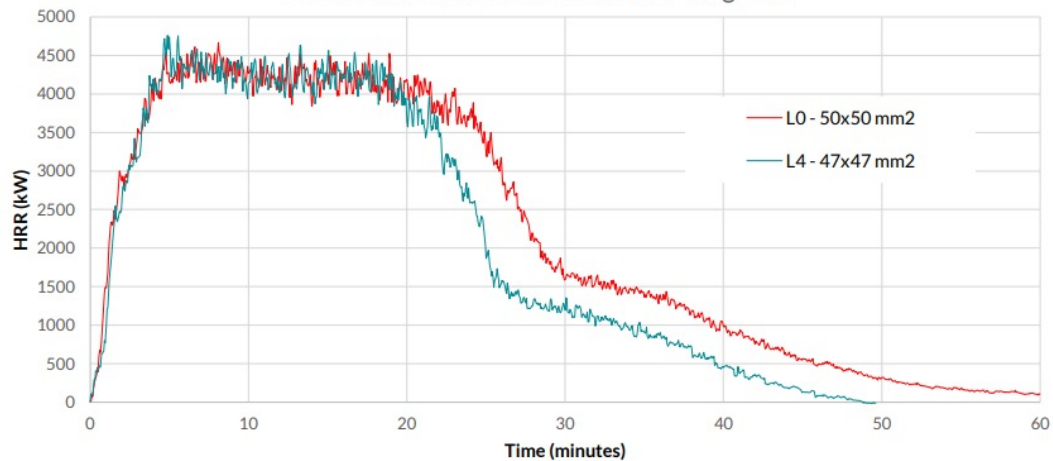


Large fire exposure

Effect of floor design – large crib



Effect of cross-section dimensions – large crib



Initial testing
activities

Further testing

Still missing
information?

- Test with full size rigs
- Average tests – repetition three times
- Effect of wind speed
- Uplift of rig
- Position of secondary opening

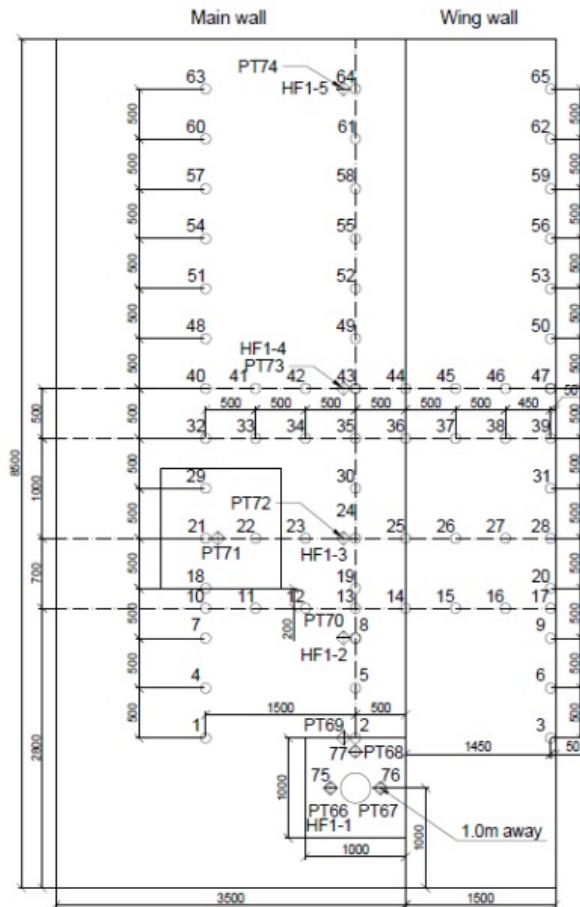
Further testing – medium scale

Calibration exercise

Test ref.	Wood crib parameters	Fire exposure	Air flow (m ³ /h)	Wind speed (m ³ /s)	Uplift (m)	Secondary opening location	Test specimen	
D1	Average density and moisture content	Medium	400	0.5	0.5	Eccentrically	Inert	Completed
D2		Medium	400	0.5	0.5	Eccentrically	Inert	
D3		Medium	400	0.5	0.5	Eccentrically	Inert	
E1		Medium	360	0.5	0.5	Eccentrically	Inert	
E2		Medium	440	0.5	0.5	Eccentrically	Inert	
F1 (4)		Medium	400	0.5	1	Eccentrically	Inert	Completed
F2 (4)		Medium	400	0.5	2	Eccentrically	Inert	
K1		Medium	400	0.5	0.5	Without	Inert	
K2		Medium	400	0.5	0.5	Symmetrically	TBC	
K3		Medium	400	0.5	0.5	Without	TBC	

Further testing – medium scale

Instrumentation



Further testing – medium scale

Test results for K

K1



K2



K3



Further testing – medium scale

Test results for K

K1



K2



K3



- **Flame spread min 2-3**

Further testing – medium scale

Test results for K

K1



K2



K3



- **Flame spread min 4-5**

Initial testing
activities

Further testing – large scale



Initial testing
activities

Further testing – large scale

Testing a real façade system would give results that are applicable to that system only.

We therefore used a homogeneous insulation material (C-s2, d0 - EN 13501-1) and 35 kg/m³.
Not complying to instalation recommendations

One test without opening

One with asymmetric opening

One symmetric above the combustion chamber



Initial testing
activities

Further testing – large scale

Gas test 2.2 MW



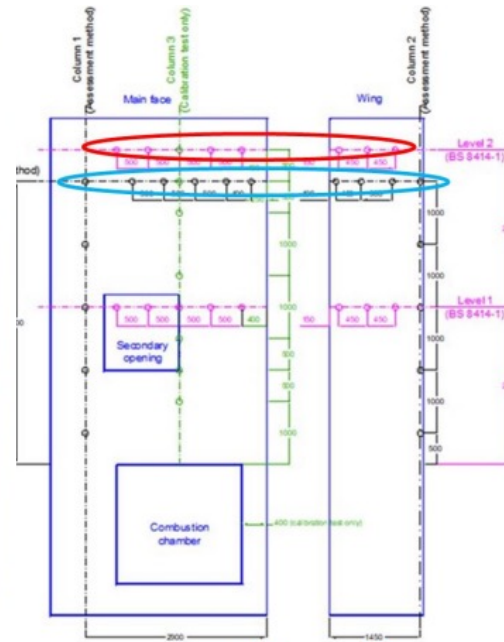
Round Robin tests

Test program

Type of test	Number	Exposure	Location	Remark
Tests in lab 1	4	Large	BRE	Indoor
Tests in lab 2	4	Medium	RISE	Indoor
Tests in lab 3	4	Large	RISE FRN	Indoor
Tests in lab 3	3	Medium	RISE FRN	Indoor
Tests in lab 4	4	Large	EMI	Outdoor
Tests in lab 5	4	Medium	Efectis France	Outdoor
Tests in lab 6	1	Medium	MFPA Leipzig	Indoor

Experimental
round robin

Timber cladding system



TC positions

TC1,4,10,13,16,19,22
External BS8414-L2

TC25,28,31,34,37,40,43,46,49,
52 External Assessment M L1

TC26,29,32,35,41,44,47,50,
53 Panel Assessment M L1

TC27,30,33,36,39,42,45,48,51
,54 Cavity Assessment M L1

Timber cladding system



2:30 min



5:00 min



6:30 min

Timber cladding system



6:50 min



7:10 min



7:30 min

Timber cladding system



13:40 min



20:00 min



40:00 min

Timber cladding system



48:00 min



51:00 min



64:00 min

Timber cladding system



Test terminated



Post test



Reignition after 2h

Next steps



- Experimental Round Robin
 - Analysis of results and reports
 - Planning for the other tests
- Review of the performance criteria for classification
- Review of the assessment method



Questions ?