Material vs façade system performance – Example Ventilated Facades

European Fire Safety Week, November 19, 2019

Adam Heath,
Regulatory Affairs Manager Fire at Kingspan Insulation

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Ventilated Facades - What is ACM Cladding?

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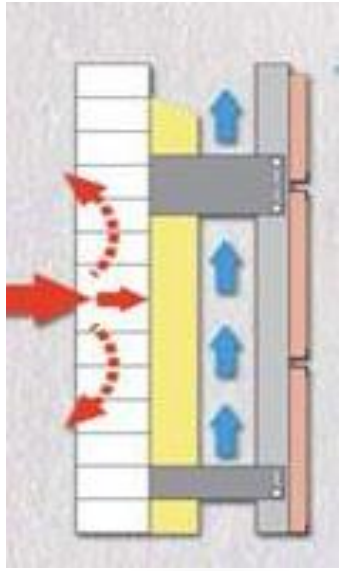
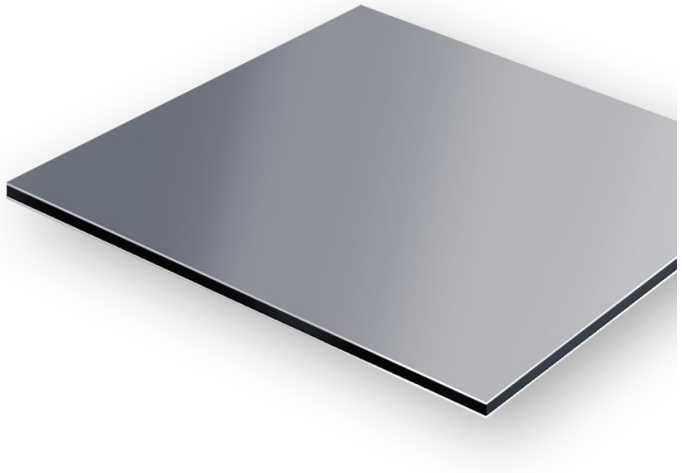
Ventilated Façade:
- Insulation
- Cavity
- Cavity Barriers
- External Cladding



ACM External Cladding:
- Aluminium Composite Material
- 3 common core types PE/FR/A2
- No insulation properties



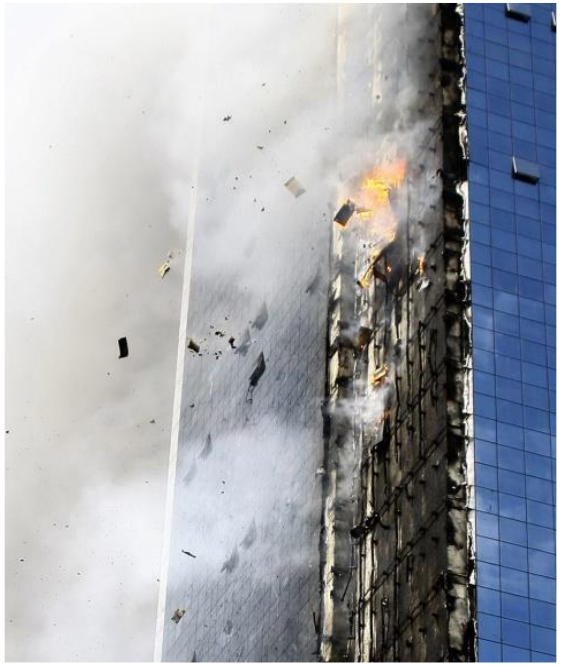
Façade Fires with ACM PE claddings, New?

Lacrosse Tower Melbourne 2014

Hotel Grozny 2013

Address hotel Dubai 2016

The Torch tower Dubai 2015



Polat tower Istanbul 2012

Façade Fires Fires with ACM claddings, New?

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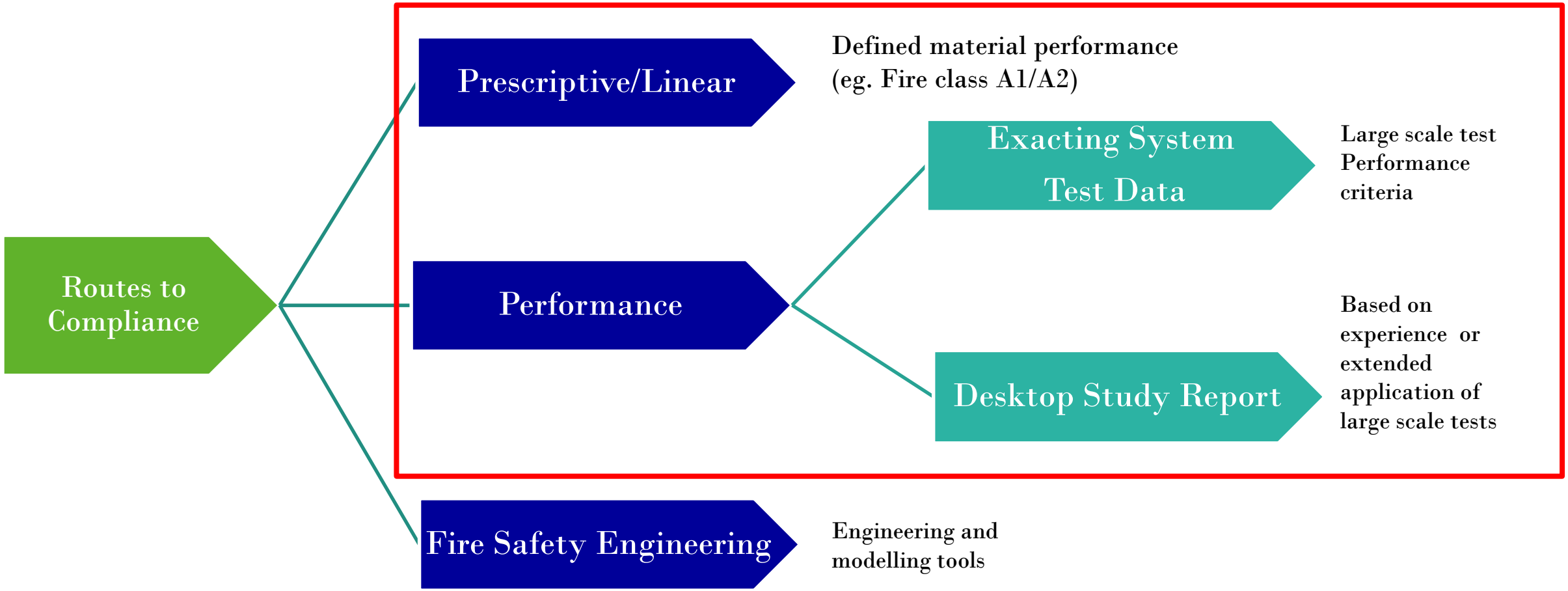
Tamweel tow

Address hotel Dubai 2016

The Torch tower Dubai 2017

Polat tower Istanbul 2012

Routes to compliance of façade systems*



*Example UK before Dec. 2018

Linear Route – Setting the scene

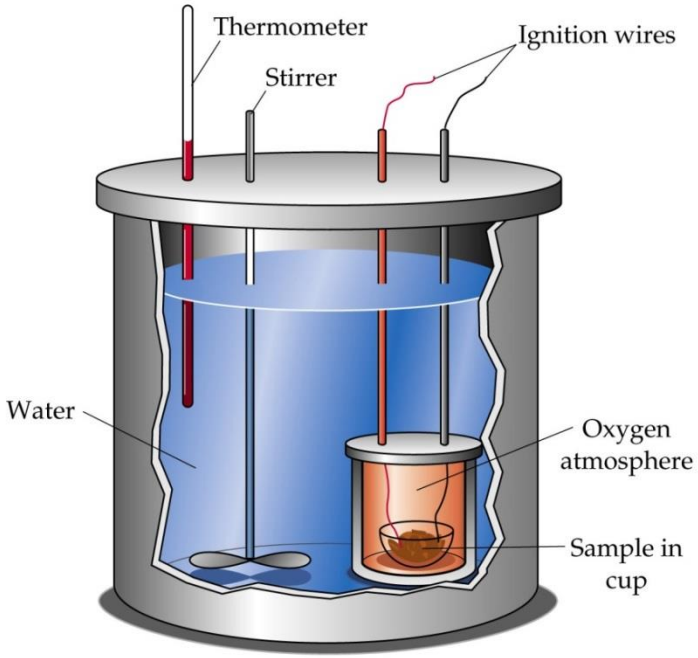
The European Reaction to Fire classification system (Euroclasses) is the EU common standard for assessing the qualities of building materials in the event of fire.

How is A1/A2 determined? One of the necessary tests:

- Via the potential energy released by a material
- Considering full combustion
- Limits
  - *≤ 3 MJ/kg to be classified Euroclass A2*
  - *≤ 2 MJ/kg to be classified Euroclass A1*

A sample of 10 to 50 gram is ground to a powder and 0.5 grams is eventually used in the calorimetric bomb using pure oxygen under 3 MPa

Gross calorific potential EN-ISO 1716



Linear Route - A1/A2 material level

- Tick-box solution
- Accuracy and scalability of small tests questionable
- ‘Silo’ approach to design

→ A material performance
→ not a system approach

European harmonized classification tests

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Façade classification based on materials

A1 + A2 = “deemed to satisfy” but is it the same as large scale test (eg. BS8414/BR135) compliant?

A1 + B = large scale test compliant?

B + A2 = large scale test compliant?

B + B ≠ large scale test compliant?

European harmonized classification tests

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SBI test EN 13823 for classes B, C and D

Fire in corner

30 KW burner output

Intended to be a product test

Fire scenario:

- Starting room fire
- Contribution in early stage of fire

European harmonized classification tests

Façade classification based on materials

What does this tell you about the façade performance???

A1 + A2 = deemed to satisfy but is it the same as large scale test (eg. BS8414/BR135) compliant?

A1 + B = large scale test compliant?

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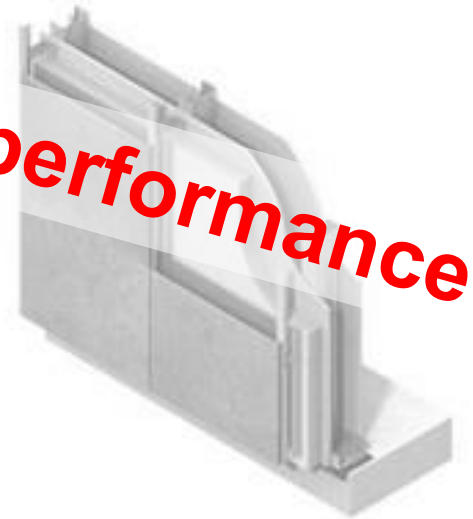
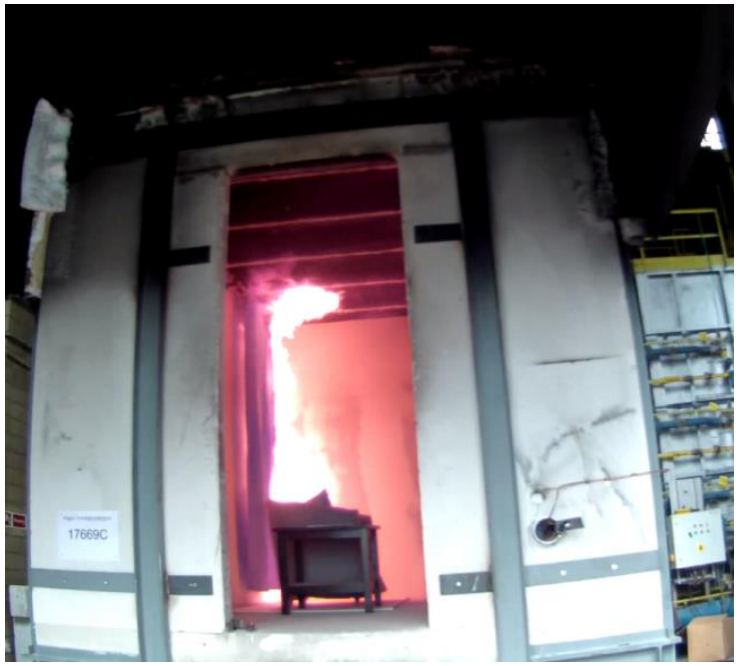
B + B ≠ large scale test compliant?

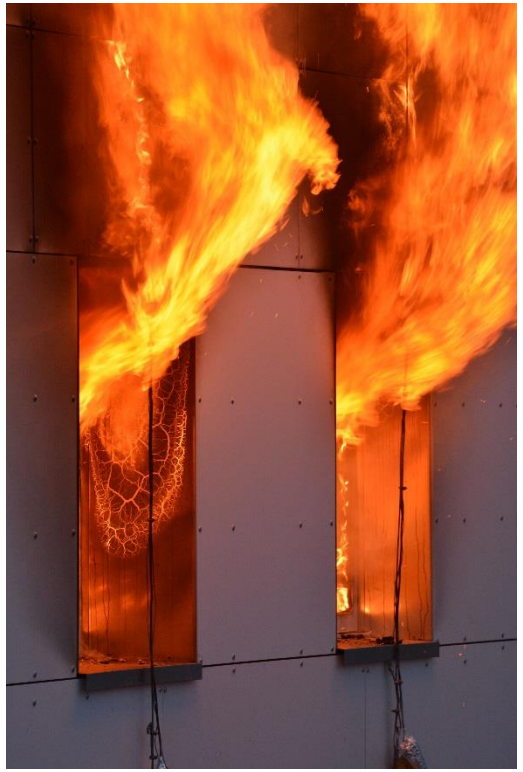


Façade fire vs European product classifications



SBI / Room Corner scenario

≠

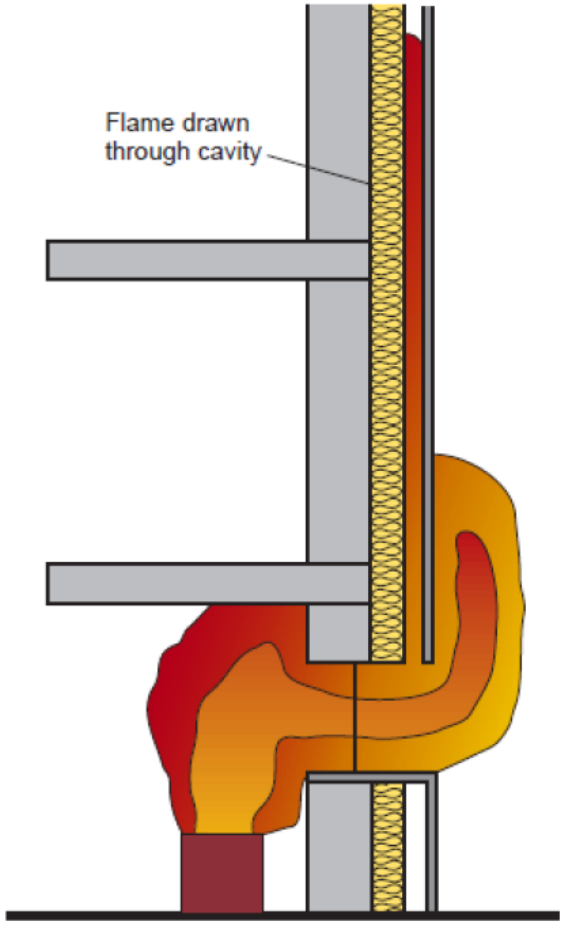


Flashover fire impacting Facades…

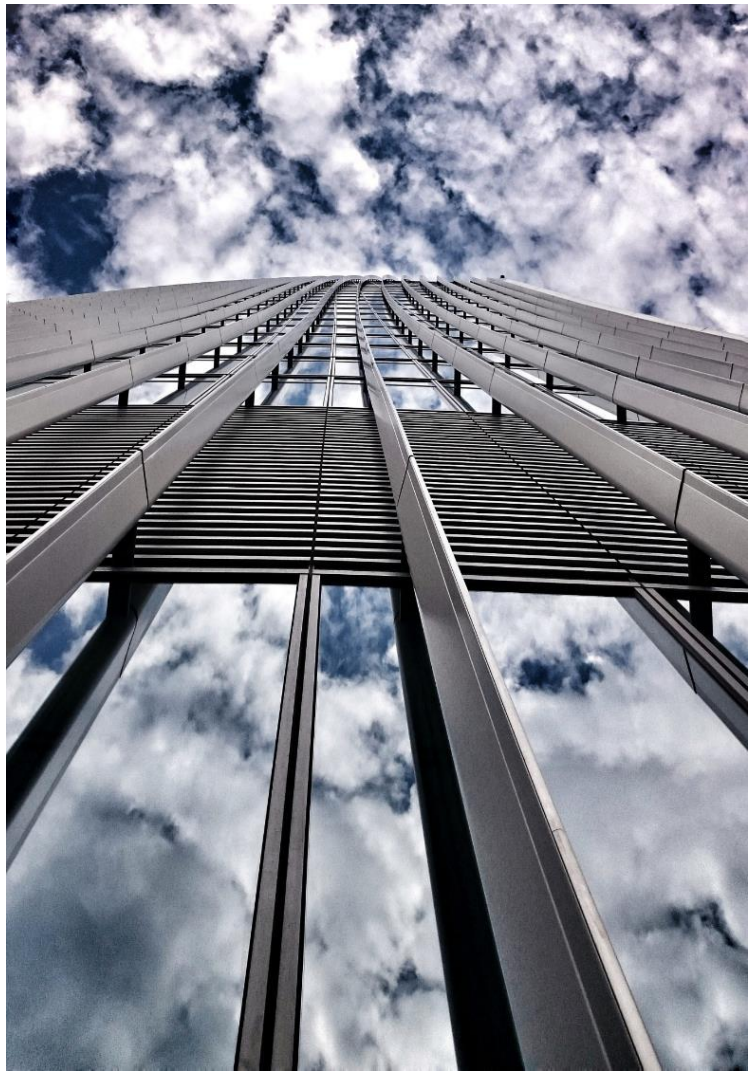
System testing?

Small Scale Testing ignores the chimney Effect

"If flames become confined or restricted by entering cavities within the external cladding system, they will become elongated as they seek oxygen and fuel to support the combustion process. This process can lead to flame extension of five to ten times that of the original flame lengths regardless of the materials used to line the cavities." BR 135



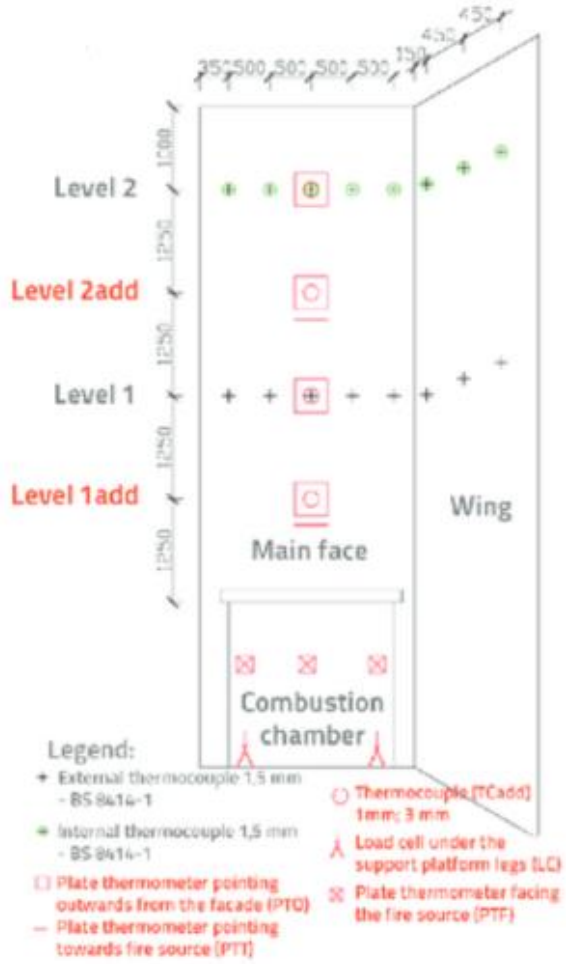
Performance based route



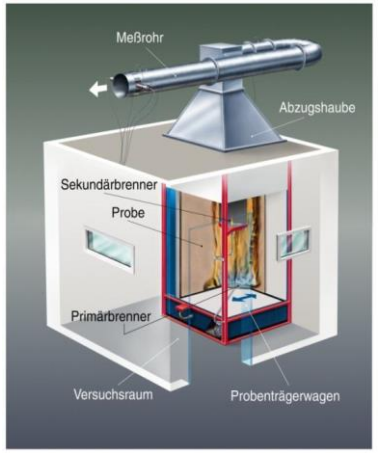
System testing philosophy as used in several European countries

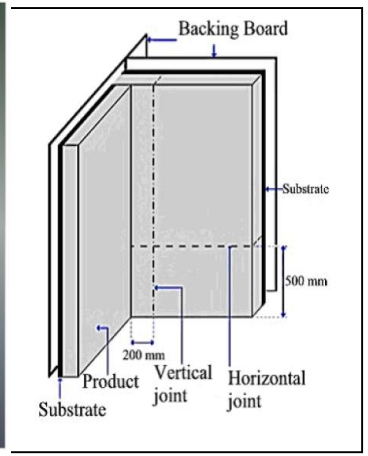
- Large scale testing of entire system
- Directly applicable only to the precise system tested

Example of UK : BR 135 to BS 8414



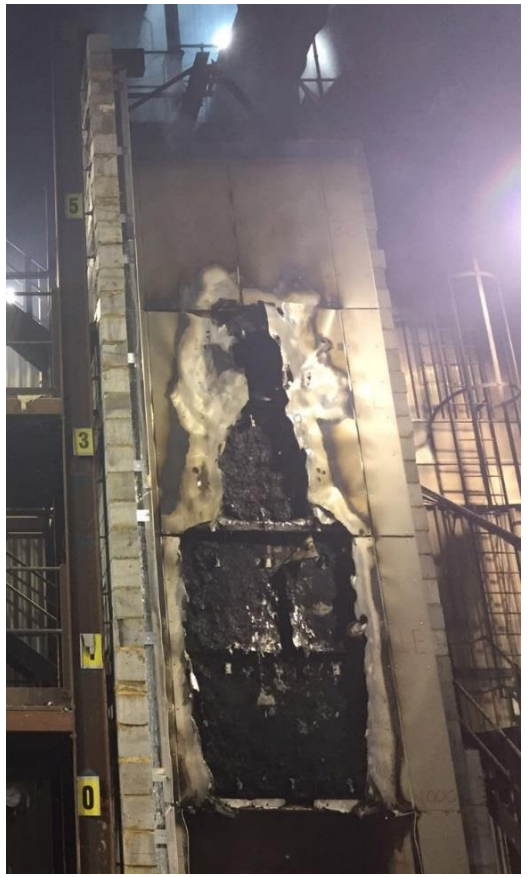
Tested at system level?





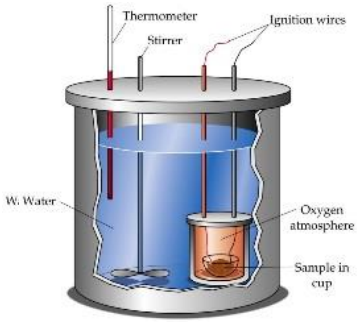
EN-13823

✓ C + B



✓Passed

A1/A2 tested at system level?



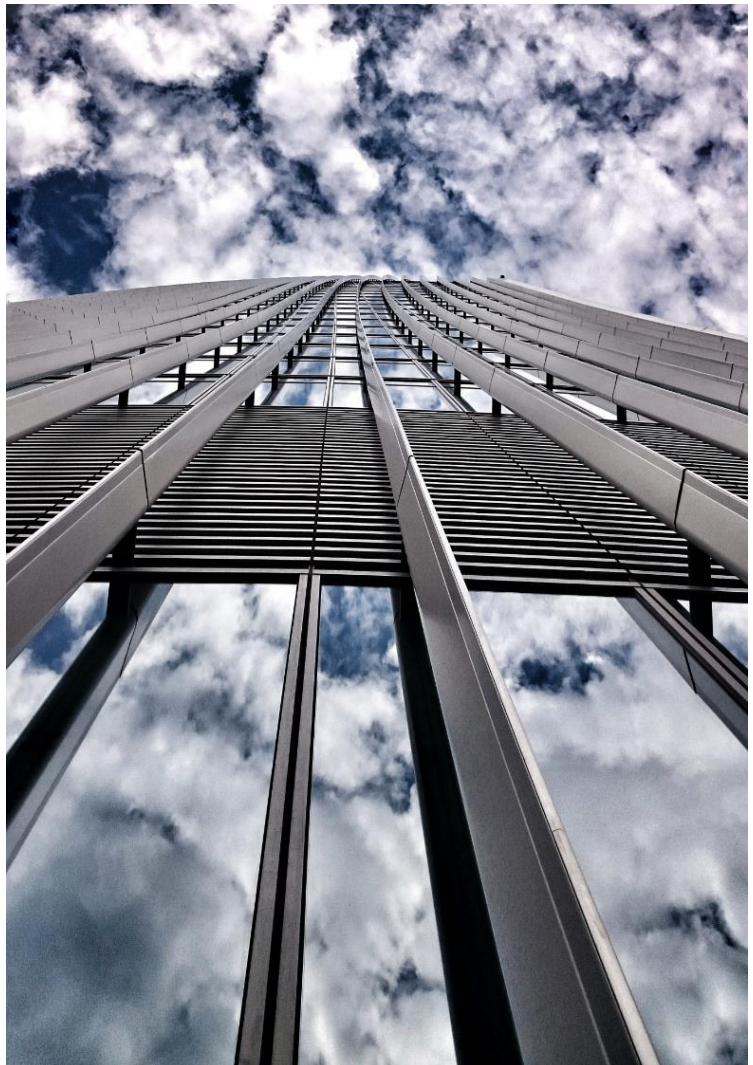
EN-ISO 1716 & EN-ISO 1182

✓A1 + A2

BS 8414-1

✗ Failed

Performance based route



System testing philosophy as used in several European countries

- Large scale testing of entire system
- Directly applicable only to the precise system tested

But how about changes to the tested system? Can we do assessments with existing test data?

Post Grenfell Testing according to BS 8414-1

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Official DCLG testing programme https://www.gov.uk/guidance/aluminium-composite-material-cladding

Test	Build up	Result
Test 1	100 mm PIR – PE core ACM	Fail - 8,45 mins
Test 2	180 mm MF – PE Core ACM	Fail - 7,09 mins
Test 3	100 mm PIR – FR core ACM	Fail - 25.12 mins
Test 4	180 mm MF – FR Core ACM	Pass
Test 5	100 mm PIR – A2 core ACM	Pass
Test 6	180 mm MF – A2 Core ACM	Pass
Test 7	100 mm PF – FR core ACM	Fail – 28,14 mins

PIR :Polyisocyanurate insulation
MF : Mineral fibre insulation
PF : Phenolic foam insulation

PE core ACM : Aluminum Composite Material with polyethylene core
FR core ACM : Aluminum Composite Material with Fire Retardant core
A2 core ACM : Aluminum Composite Material with limited combustibility core

Post Grenfell Testing according to BS 8414-1

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PIR :Polyisocyanurate insulation
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Post Grenfell Testing according to BS 8414-1

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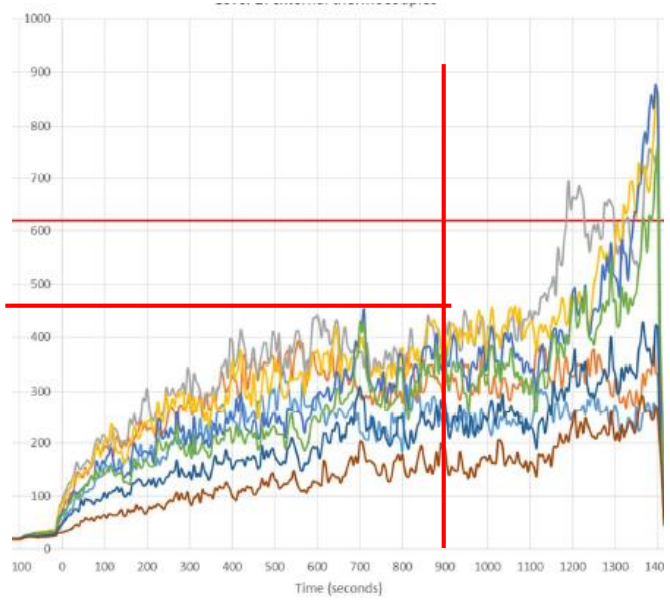
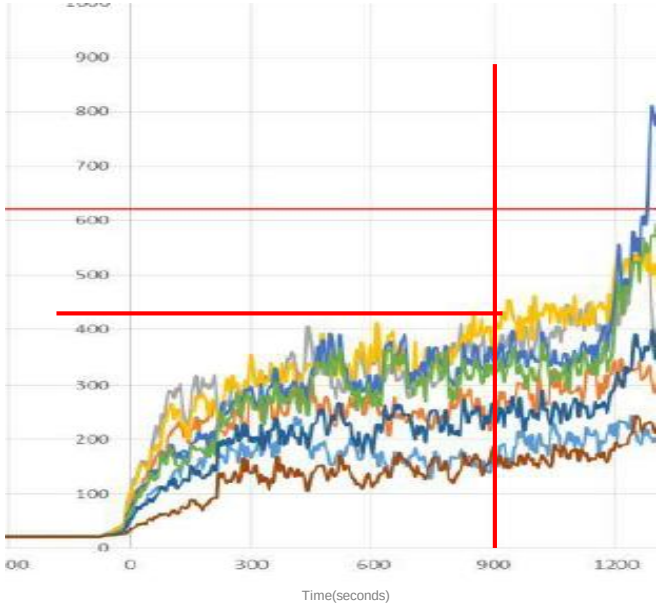
Official DCLG testing programme

± 470°C



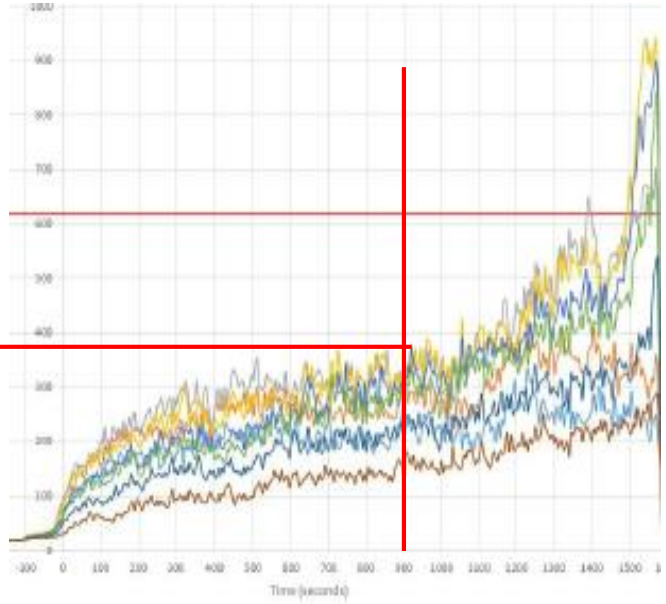
PIR – FR ACM [Test 4]

± 430 °C



Mineral Fibre – FR ACM [Test 5]

± 380 °C



Phenolic – FR ACM [Test 7]

Post Grenfell Testing according to BS 8414-1

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Official DCLG testing programme

PIR – FR ACM

Phenolic – FR ACM

Mineral Fibre – FR ACM

Post Grenfell Testing according to BS 8414-1

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Official DCLG testing programme

PIR – FR ACM

eight photograph of cladding system following removal of ACM panels

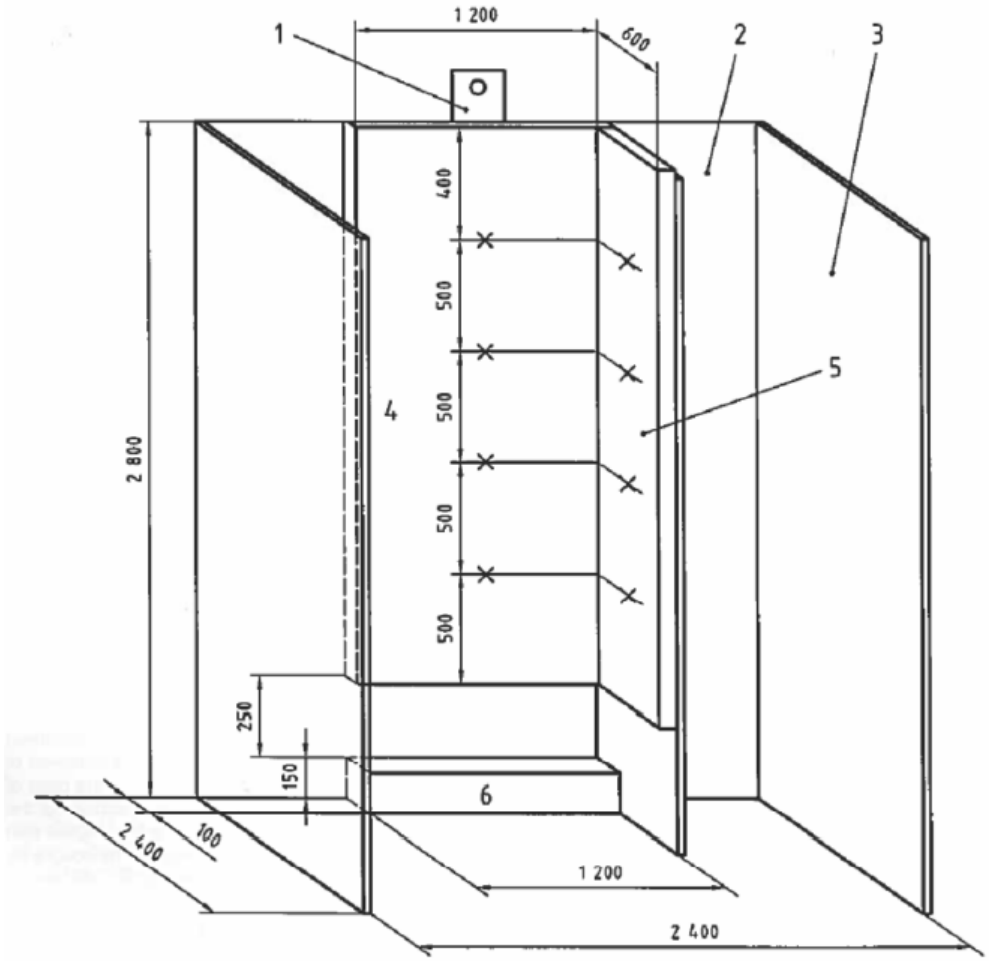
Mineral Fibre – FR ACM

Phenolic – FR ACM

Medium scale test ISO 13785-1

- Comparative tests
- Same test set-up as DCLG test
- 3 insulants / 3 ACM types
- 30 minutes / 100 KW
- 3 fire stages (development, fully developed fire, decay)

Medium scale test ISO 13785-1



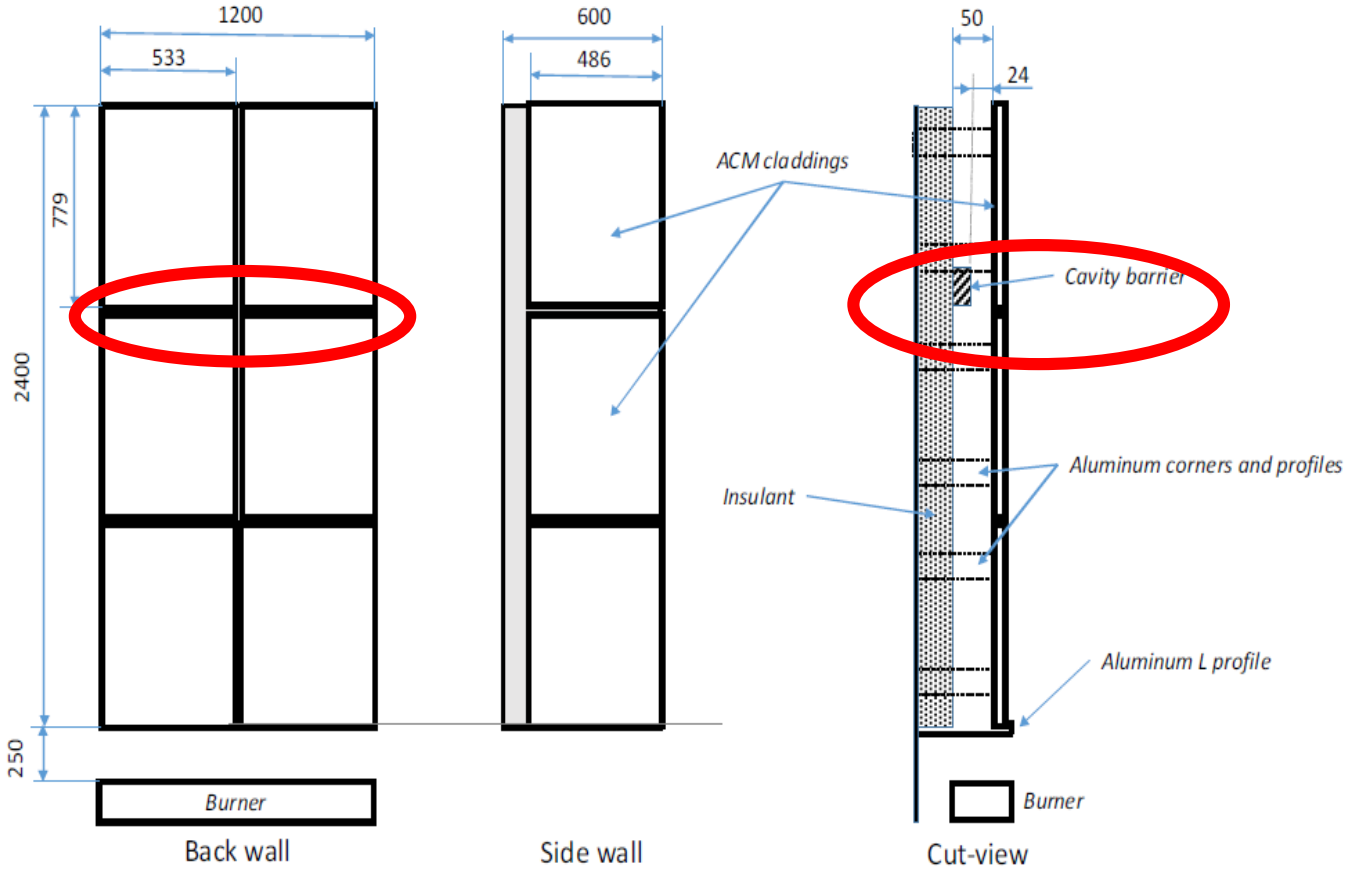
Build-up

Insulation Types

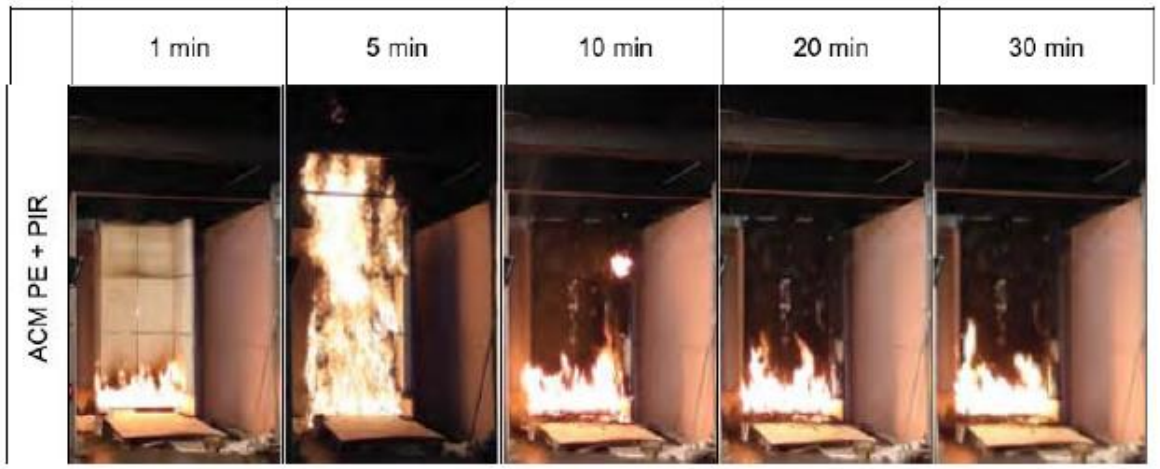
- PIR (50 mm)
- Phenolic foam (50 mm)
- Mineral Fibre (100 mm)

Cladding Types

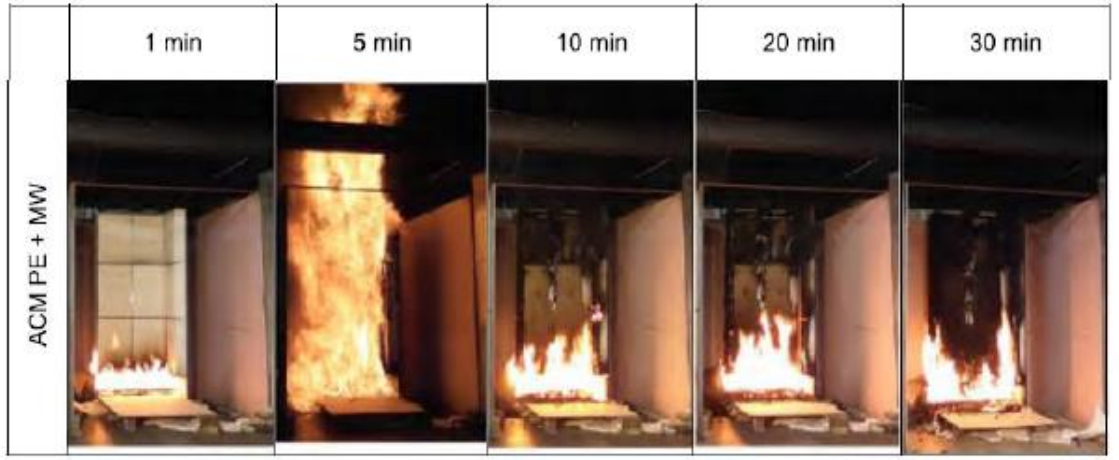
- PE core ACM
- FR core ACM
- A2 core ACM



Polyethylene cored ACM

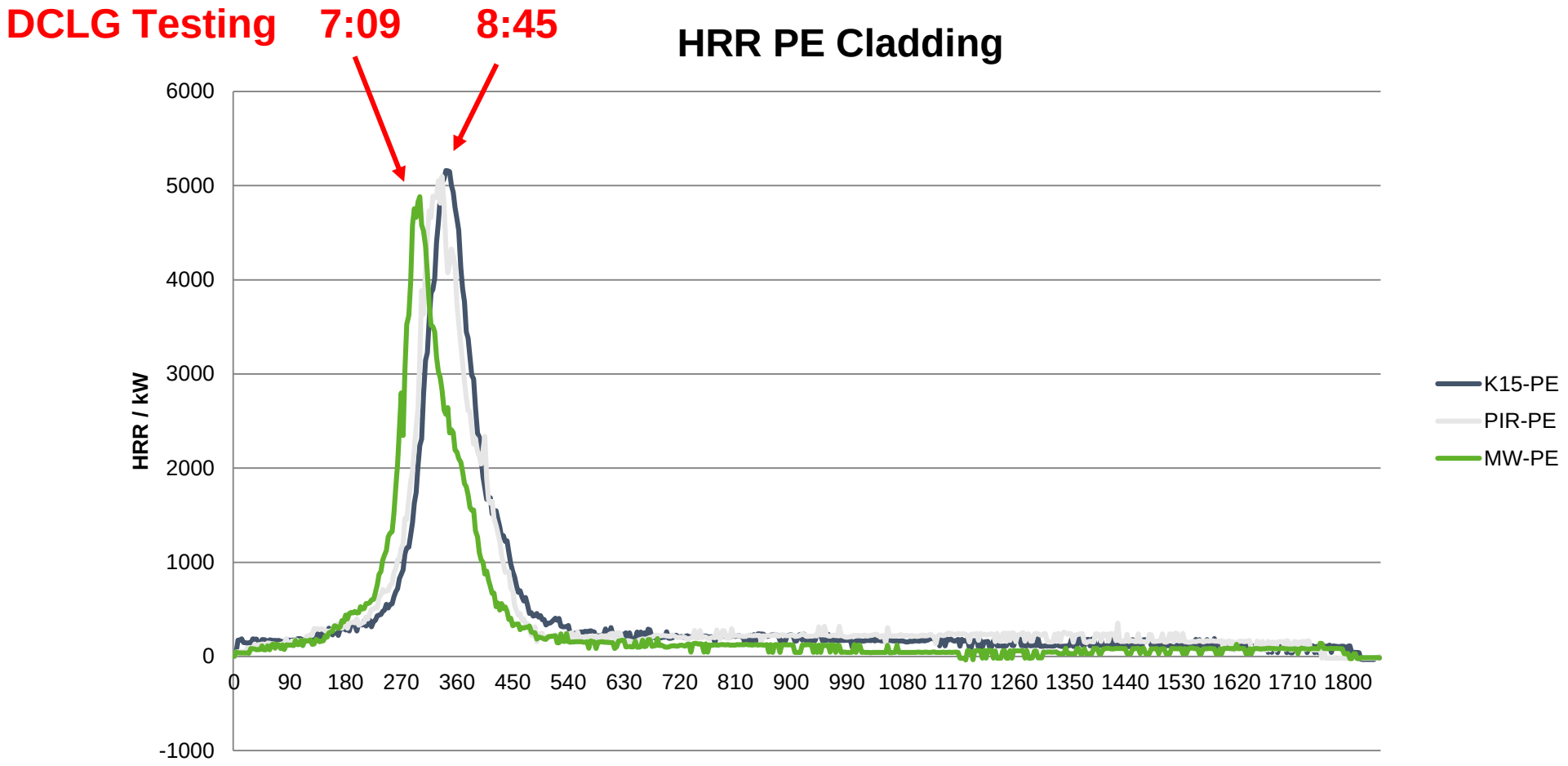


PIR



Stonewool

Polyethylene core ACM

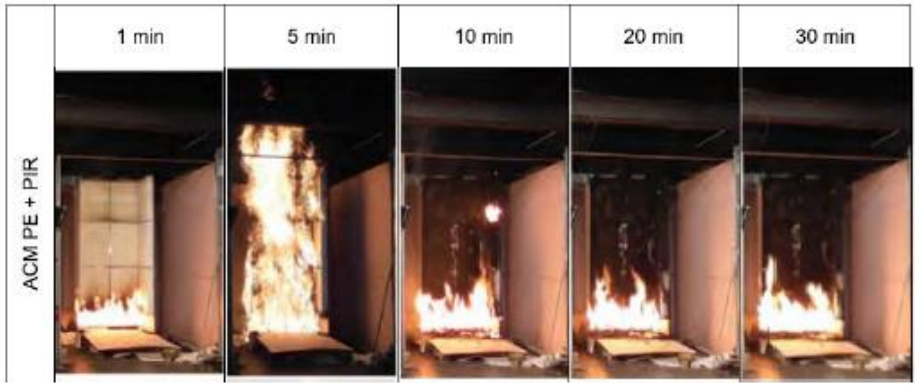


Polyethylene core ACM

PIR

Mineral Fibre

PIR with ACM Claddings



PE

A2

FR

PIR with different ACM Claddings

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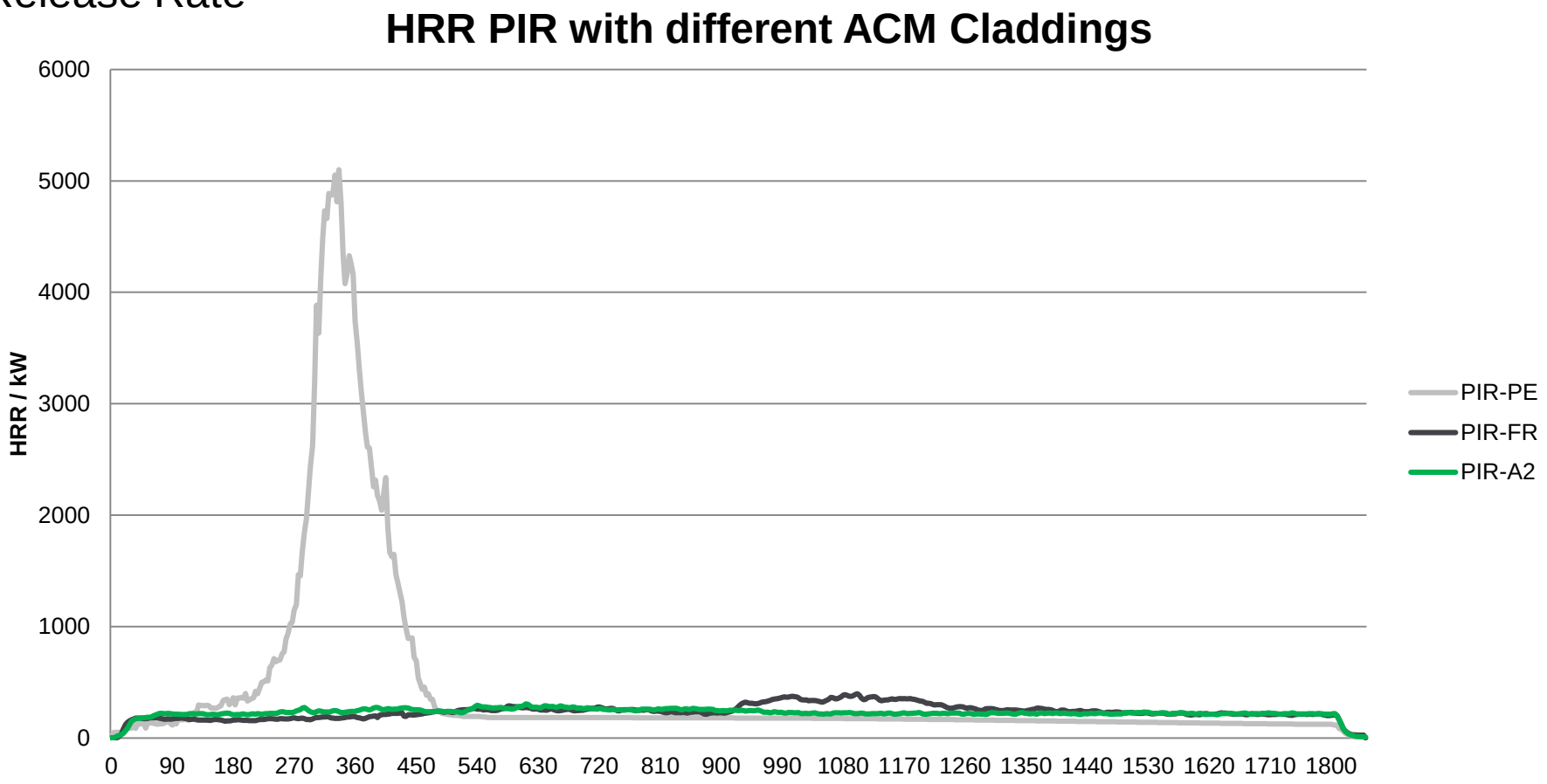
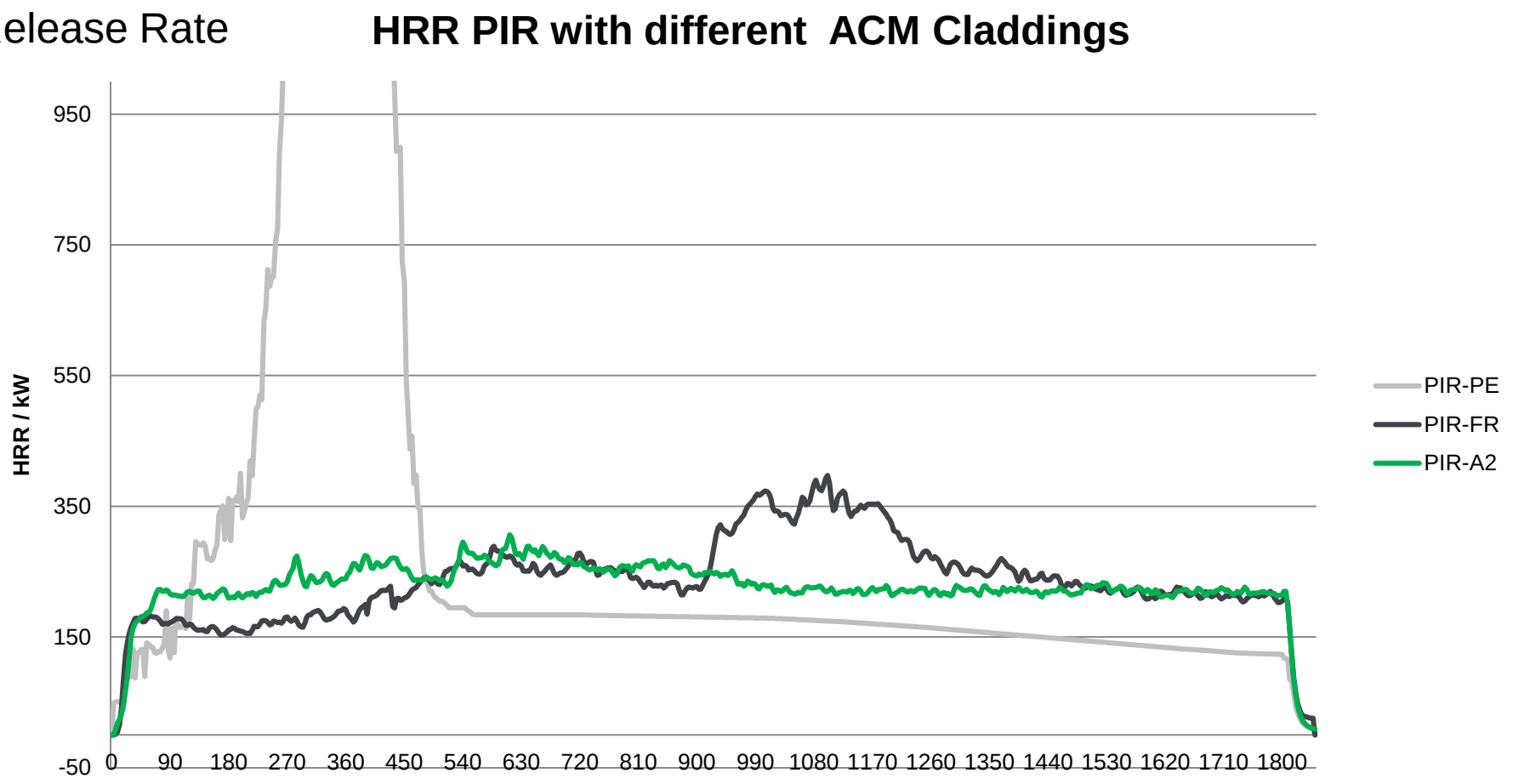
HRR : Heat Release Rate



PIR with different ACM Claddings

HRR : Heat Release Rate



HRR curves of the 3 Insulants with ACM A2

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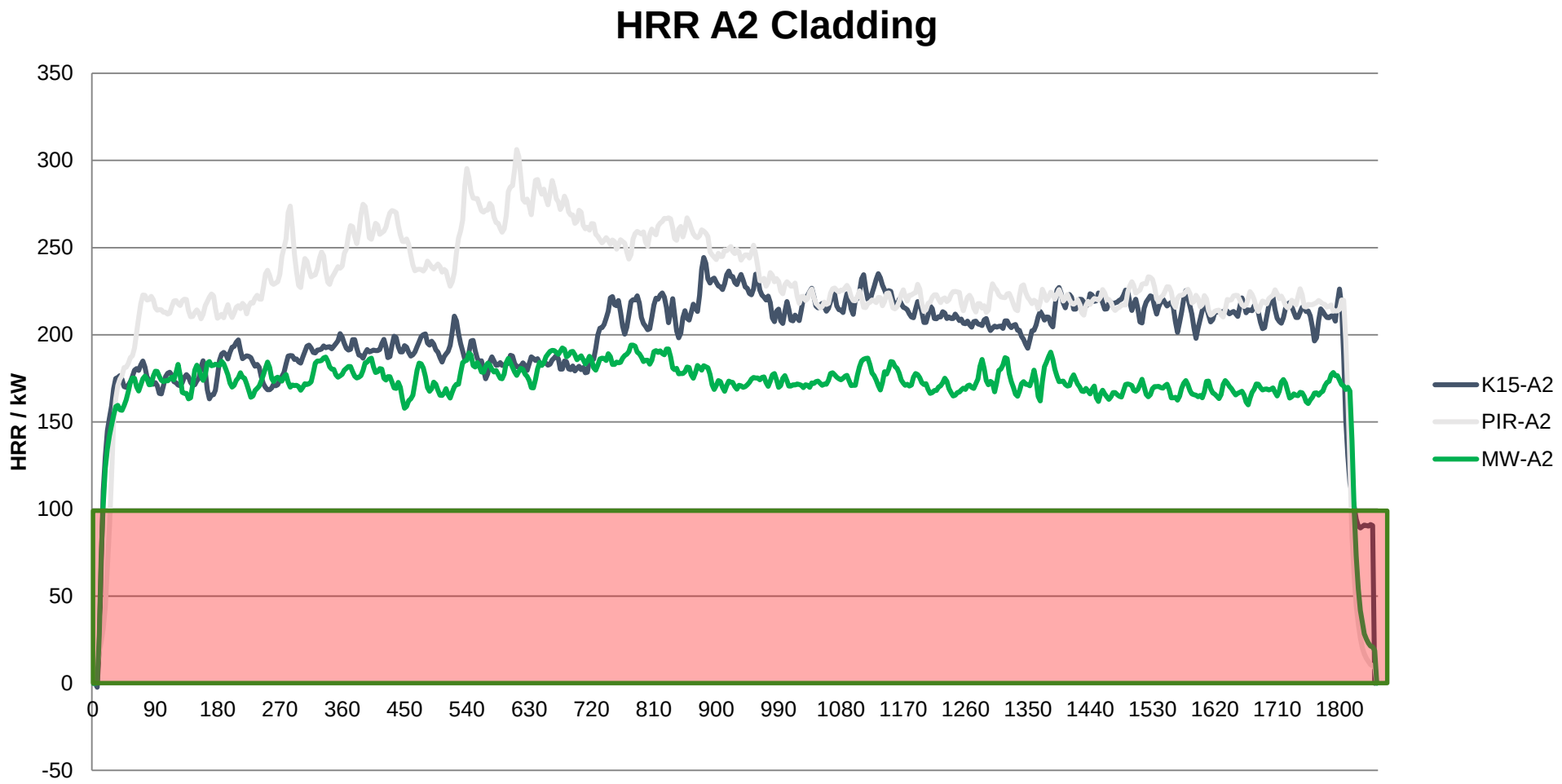
HRR : Heat Release Rate



Full paper available in ‘Fire and Materials’

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Study of fire behaviour of facade mock-ups equipped with aluminium composite material-based claddings, using intermediate-scale test method

Eric Guillaume[1] | Talal Fateh [2,3] | Renaud Schillinger[1] | Roman Chiva[1] |Sebastian Ukleja[2]

Efectis

Link to Full Report

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Correspondence
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Email: eric.guillaume@efectis.com

Fire and Materials. 2018;42:561–577

Maximum HRR of the 9 tests

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HRR : Heat Release Rate

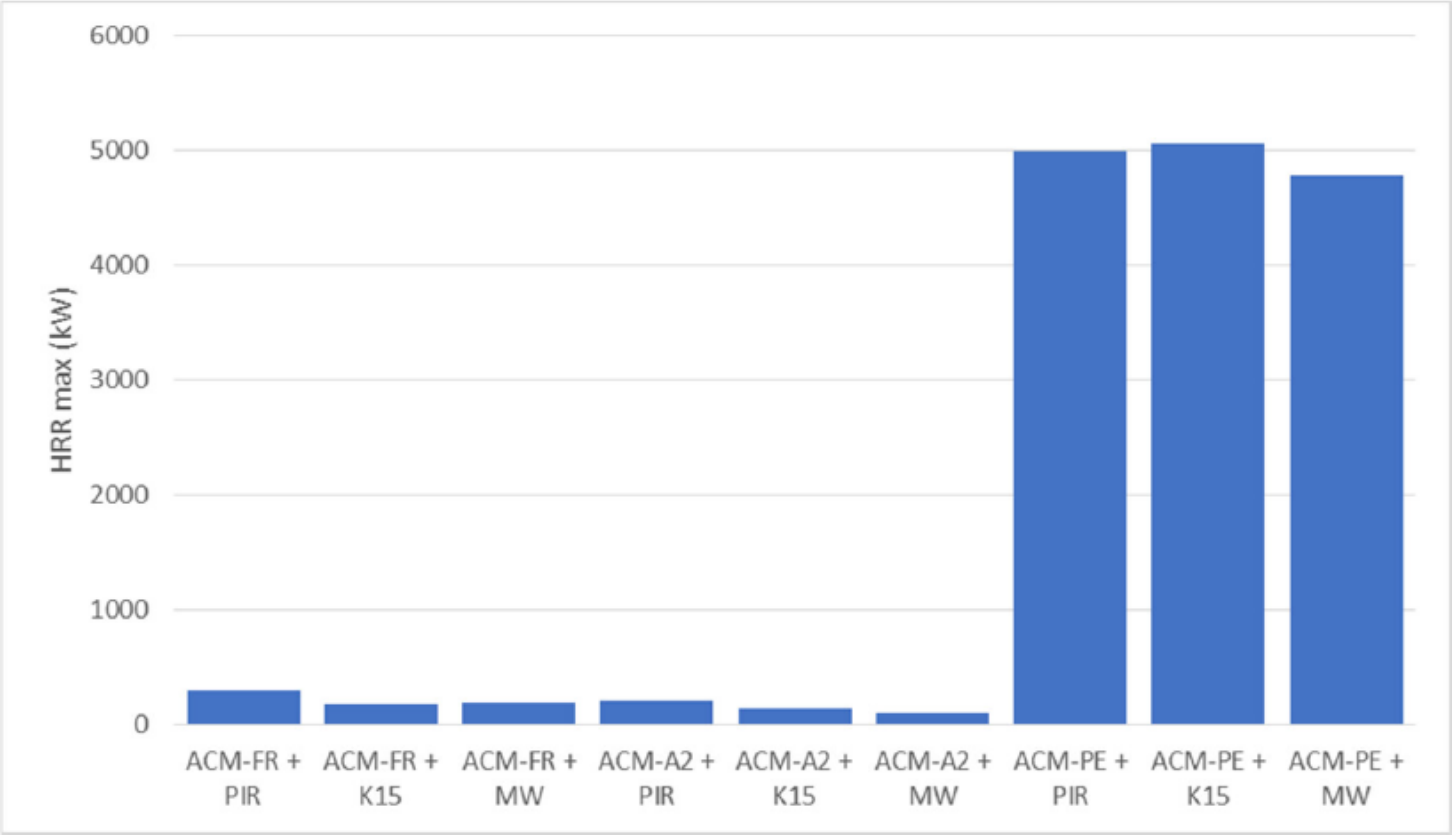

Figure 7 - Maximum heat release rate (contribution of burner removed)

Fire safety requirements for façades of taller buildings

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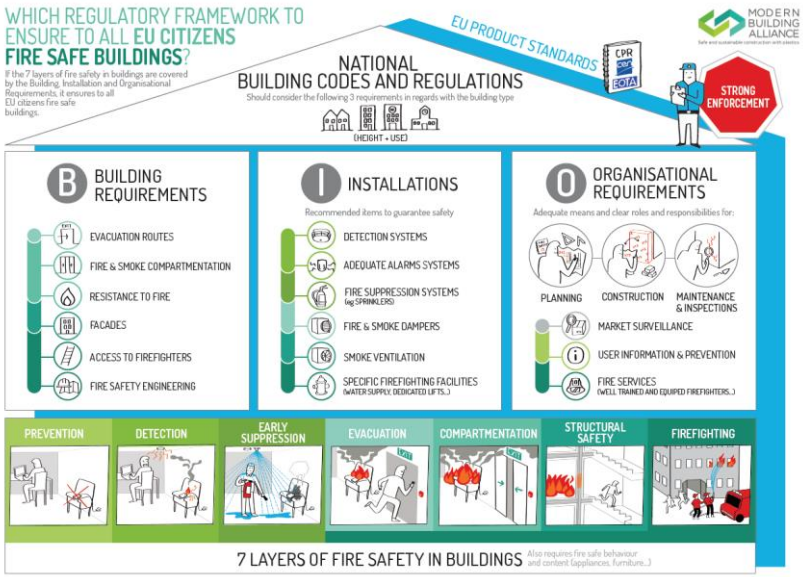
Our suggestion



FACADES

aim : limit fire spread

- Use **large scale system testing** as basis for all systems
  (regardless of combustibility of components)
- Consider **all elements of the system**.
  Fire barriers in cavities are for example essential for ventilated facades
- Ensure **unambiguous description** of system components via harmonized specifications
- Define the **extended application** of large scale test results
  (allowed variations in the systems, eg. thickness)

Thank you! Engage with us:

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