

Welcome

Presenting today

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Head of Regulatory Affairs - Fire

Kingspan

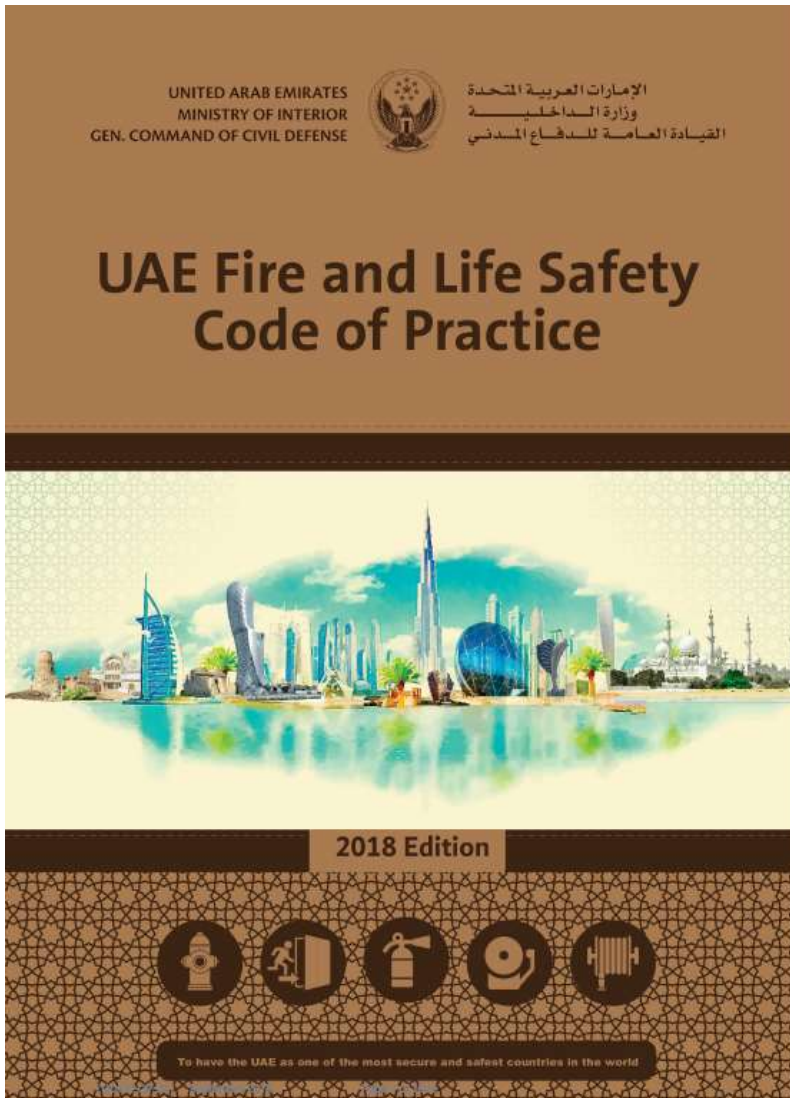




FIRE SAFETY & FACADES

What are the challenges?

The Legislation



4. Façade and Exterior Wall Covering Systems

- 4.1. Applicability
- 4.2. Material Tests
- 4.3. Flame Spread on Exterior Façade
- 4.4. Façade Approval from Civil Defence
- 4.5. General Requirements for Exterior Façade Systems
- 4.6. Metal Composite Materials and Panels (MCM, ACP)
- 4.7. Exterior Insulation and Finish Systems (EIFS) and External Thermal Insulation Composite System (ETICS)
- 4.8. Polycarbonate External Wall and Façade System (PEWFS)
- 4.9. Sandwich Panels
- 4.10. GRC/GRFC and GRP Systems

The Legislation

4.6. Metal Composite Materials and Panels (MCM, ACP)

Table 1.14.a.: MCM and

Table 1.14.a.: MCM and	OCCUPANCY AND TYPE OF BUILDING	on-Load bearing Exterior wall
<p>OCCUPANCY AND TYPE OF BUILDING</p> <ol style="list-style-type: none">1. SUPER HIGHRISE BUILDING2. HIGHRISE BUILDING3. MALLS4. THEME PARKS5. SCHOOLS6. HOSPITALS7. ASSEMBLY	<p>OCCUPANCY AND TYPE OF BUILDING</p> <ol style="list-style-type: none">1. SUPER HIGHRISE BUILDING2. HIGHRISE BUILDING3. MALLS4. THEME PARKS5. SCHOOLS6. HOSPITALS7. ASSEMBLY	
<ol style="list-style-type: none">8. LOWRISE BUILDING9. MIDRISE BUILDING10. WAREHOUSE11. INDUSTRIAL		

The Legislation

OCCUPANCY AND TYPE OF BUILDING	TEST 1 MCM/ ACP CORE AND PANEL AS PRODUCT	TEST 2 MCM/ ACP PANELS WITH WALL ASSEMBLY
1. SUPER HIGHRISE BUILDING 2. HIGHRISE BUILDING 3. MALLS 4. THEME PARKS 5. SCHOOLS 6. HOSPITALS 7. ASSEMBLY	i. Core shall be tested to the criteria iii and iv. ii. Panel shall be tested with the thickness intended to the criteria iii and iv. iii. EN 13501-1 With pass criteria A1 OR A2-s1-d0 AND iv. ASTM D1929 MCM/ACP shall have self ignition temperature of not less than 343°C.	v. BS 8414 -1 Or 2 With pass criteria as per BRE 135 OR vi. NFPA 285 With pass criteria "Pass" OR vii. FM 4881 With pass criteria "Pass" OR viii. ISO 13785-2 With pass criteria "Pass"

Table 1.14a

UAE has no linear route like the UK



4.4.2.1. Approval of “product” or “panel” or component is manufacturer’s responsibility. Manufacturer or supplier shall test the individual product or component as part of the assembly (TEST 1, as per Tables 1.14., 1.15., 1.16., 1.17., as applicable) to evaluate flame spread characteristics, droplets and smoke emission of the core, the skin, adhesive, panel and the product, and obtain approval and product registration from Civil Defence. The Civil Defence certificate shall only be for the product and permission to be installed “only on low rise buildings”.

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		Euro Klasse	
Standaard		A1	A2
Test apparatuur			
EN ISO 1716 Heat of combustion		kern materiaal PCS ≤ 2 MJ/kg	kern materiaal PCS ≤ 3 MJ/kg
EN ISO 1182 Non-Combustibility		$\Delta T \leq 30^\circ$ $\Delta m \leq 50 \%$ $t_f \leq 0 \text{ s.}$	i.p.v. EN ISO 1716 $\Delta T \leq 60^\circ$ $\Delta m \leq 50 \%$ $t_f \leq 20 \text{ s.}$



Table 1.14a

European harmonized classification tests

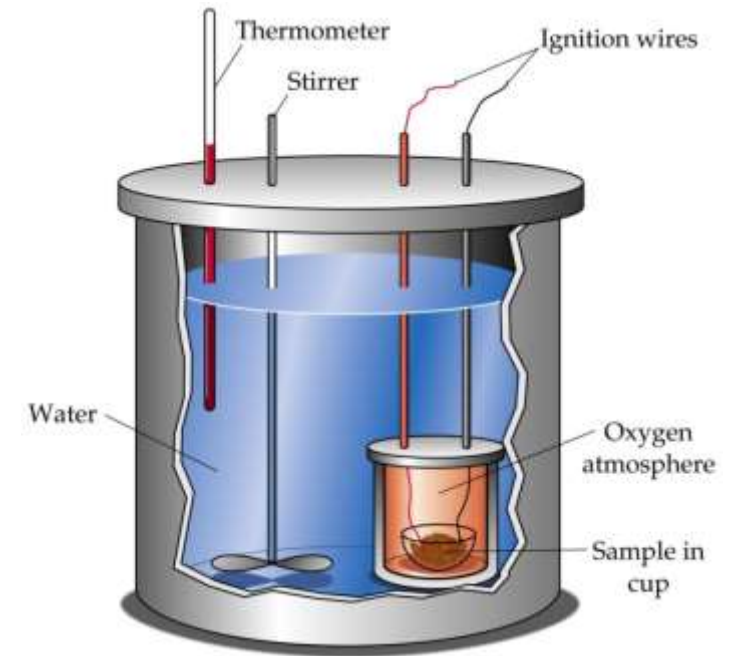
- Façade classification based on Euroclasses?
- A1 + A2 = OK?
- B + A2 = OK?
- C + B = Not OK?



Deemed to satisfy – Setting the scene

- Determine the potential energy released by a material
- Considers full combustion
- Limits
 - $\leq 3 \text{ MJ/kg}$ to be classified A2
 - $\leq 2 \text{ MJ/kg}$ to be classified A1
- *Sample 10 to 50 gram*
- *grinded 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



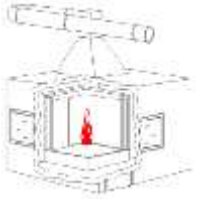





A1/A2 material level

- Tick-box solution
- Accuracy and scalability of small scale tests questionable
- ❖ A Material performance not even a product performance..

European harmonized classification tests

Euro Reaction to Fire classes		A1	A2	B	C	D	E	F
Standard	Test apparatus							
EN ISO 1716 Heat of combustion (caloric bomb)		Core material PCS ≤ 2 MJ/kg	Core material PCS ≤ 3 MJ/kg					
EN ISO 1182 Non-Combustibility		$\Delta T \leq 30^\circ$ $\Delta m \leq 50\%$ $t_f \leq 0$ s.	or EN ISO 1716 $\Delta T \leq 60^\circ$ $\Delta m \leq 50\%$ $t_f \leq 20$ s.					
EN 13823 Single Burning Item (SBI)-test			$Figra_{0,2} \leq 120$ W/s $THR_{600} \leq 7,5$ MJ no LFS to edge		$Figra_{0,4} \leq 250$ W/s $THR_{600} \leq 15$ MJ no LFS to edge	$Figra_{0,4} \leq 720$ W/s		
EN 11925 Small Flame					30 sec. flame impingement, after 60 sec. flamespread ≤ 150 mm		15 sec. flame impingement, after 20 sec. flamespread ≤ 150 mm	

European harmonized classification tests

Single Burning Item

- Fire in corner
- 30 KW burner output
- Intended to be a product test

- Fire scenario:
 - Starting room fire
 - Contribution in early stage



European harmonized classification tests

- Façade classification based on Euroclasses?

- A1 + A2 = OK?

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



Façade fire vs European classifications



SBI scenario



≠



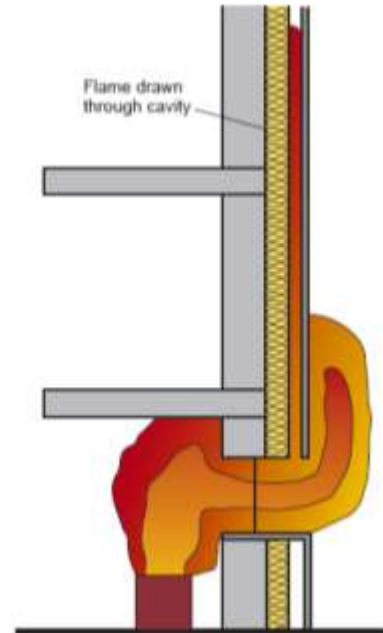
Flashover fire for Facades...

why system testing?

UK regulation BR135

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*



UAE Fire and life safety, code of practice - 2018

4.3.6. Cavity can be part of the façade system by design or cavity can be created by combustible materials on façade system or poor integrity of the façade panels or poor performance of perimeter joint systems and fire topping systems or combinations of these factors. As flame propagates and enters this cavity behind façade system, it can elongate ten times its length in its search for oxygen in the confined space of such cavity, thus burning behind the façade system unnoticed from outside for many floors above the fire origin.



LEARNING ABOUT FAÇADE PERFORMANCE

Facade mock-ups fire tests equipped with Aluminium-
Composite-Material based claddings

FIRE TESTS WITH ACM BY DCLG

post Grenfell

BR 135 to BS8414



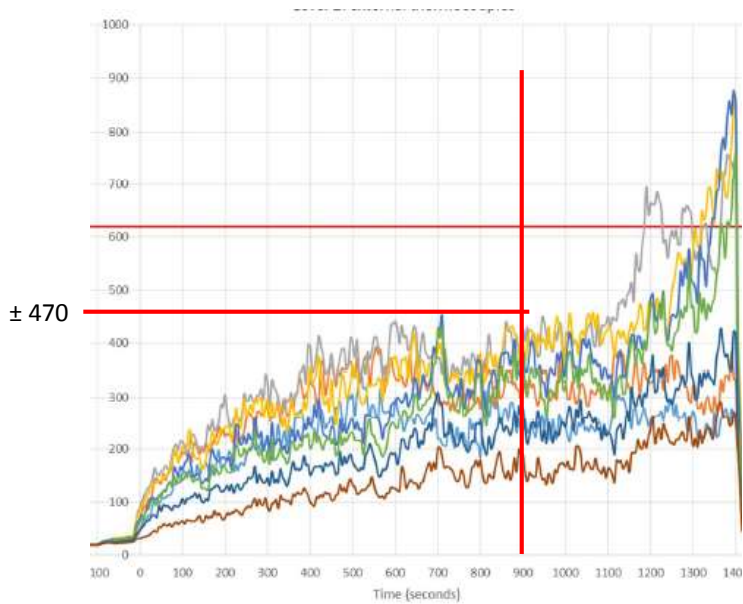
DCLG Testing according to BS8414-1

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

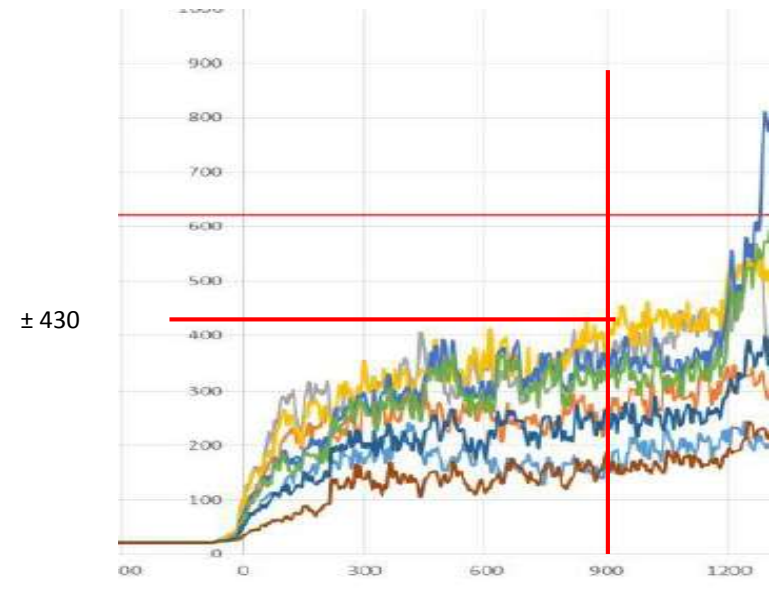
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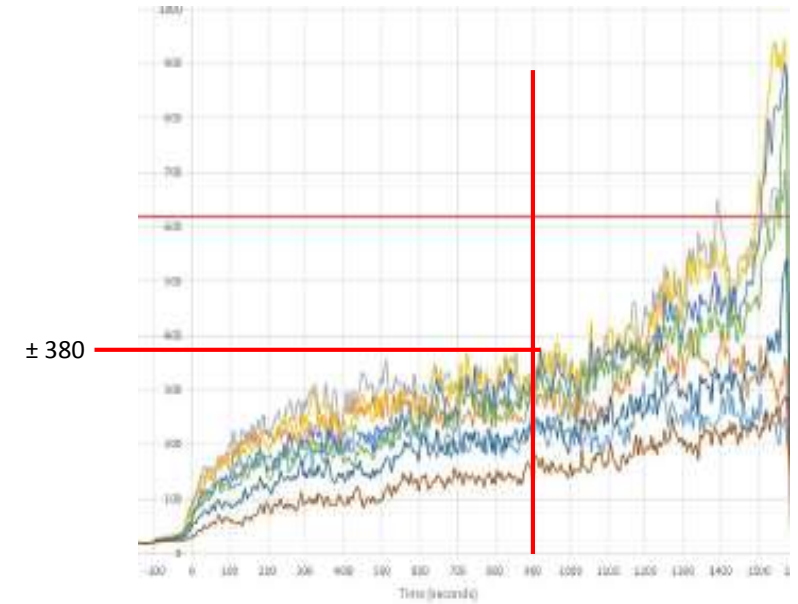
DCLG Testing according to BS8414-1



PIR – FR ACM [Test 4]



RockFibre – FR ACM [Test 5]



Phenolic – FR ACM [Test 7]

DCLG Testing according to BS8414-1



PIR – FR ACM



RockFibre – FR ACM



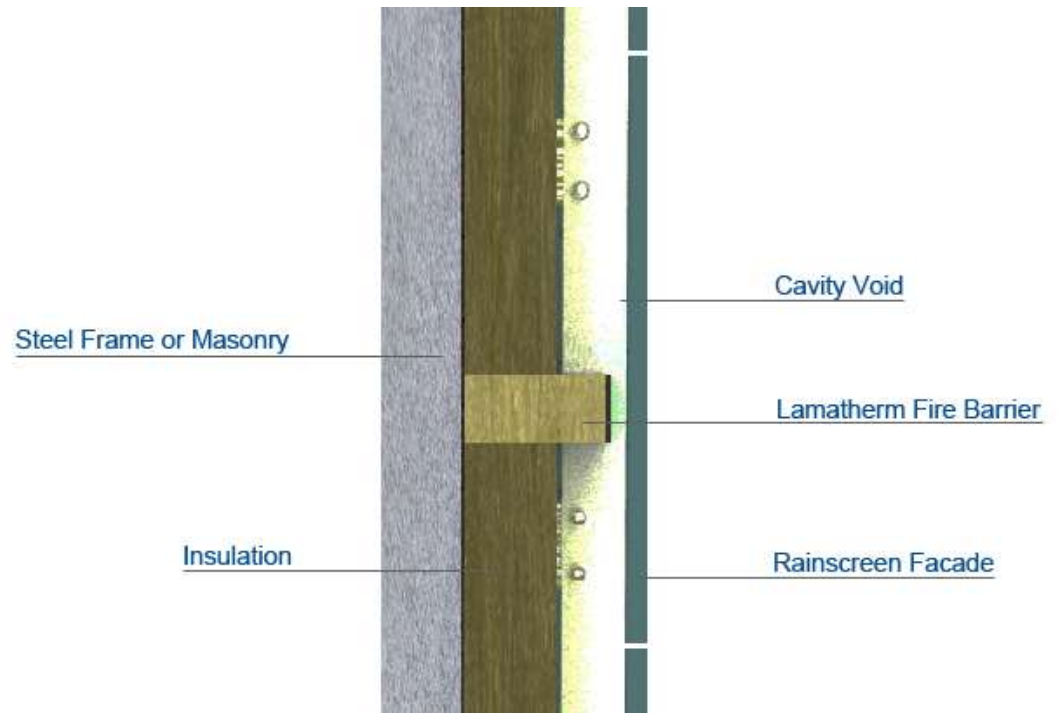
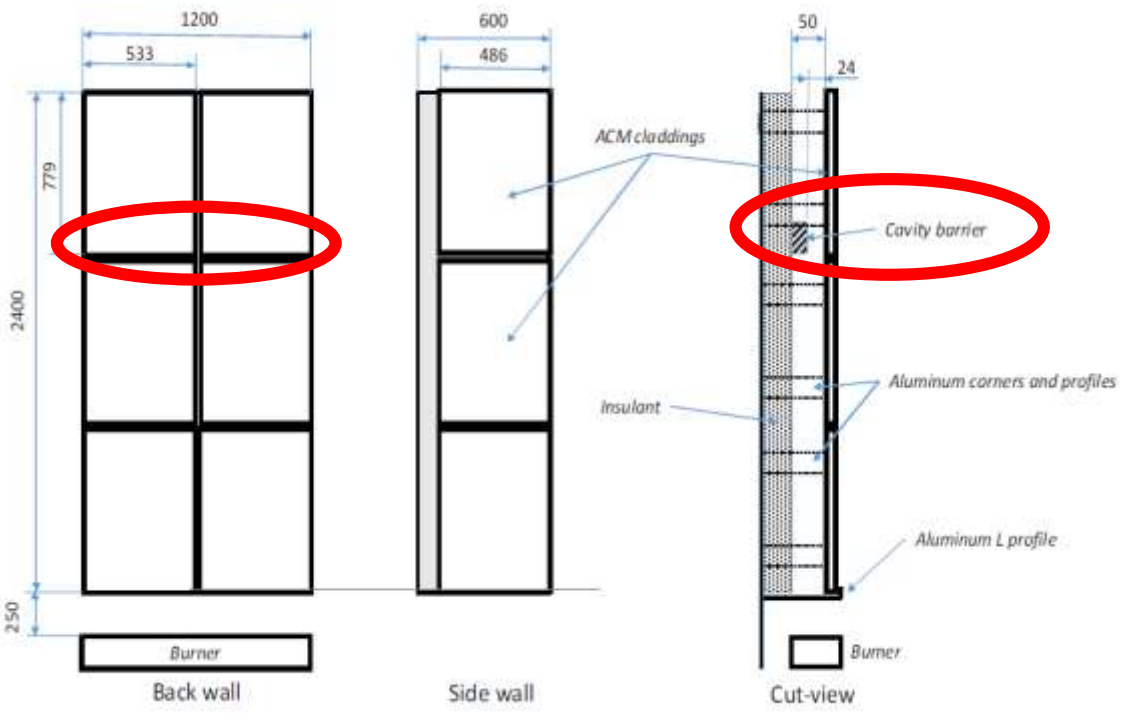
Phenolic – FR ACM



MEDIUM SCALE TEST ISO13785-1

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

Build-up



Lamatherm by Siderise

Polyethylene cored ACM



PIR



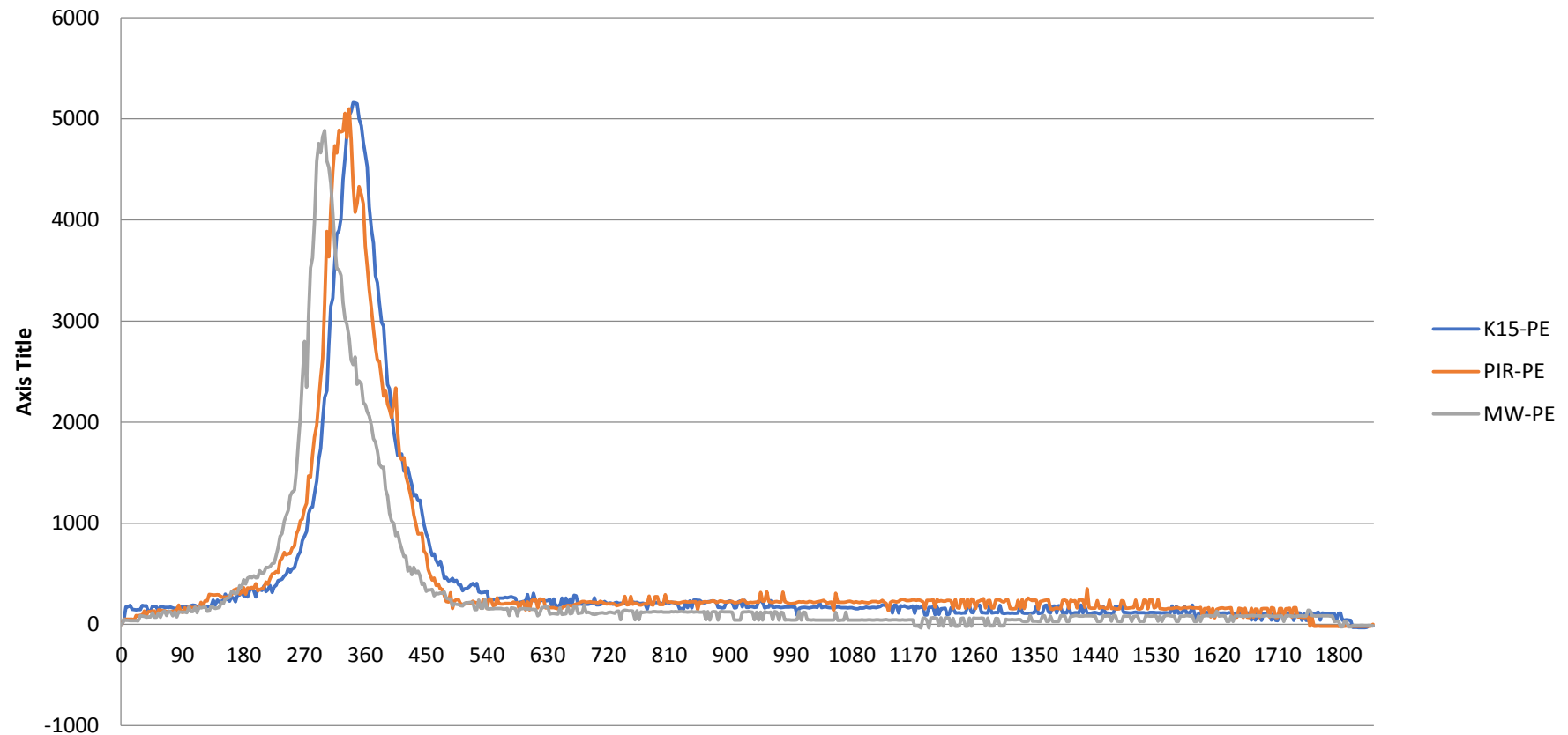
K15



Stonewool

Polyethylene cored ACM

HRR PE Cladding



Polyethylene cored ACM



PIR



Phenolic



Stonewool

Phenolic with ACM Claddings



PE



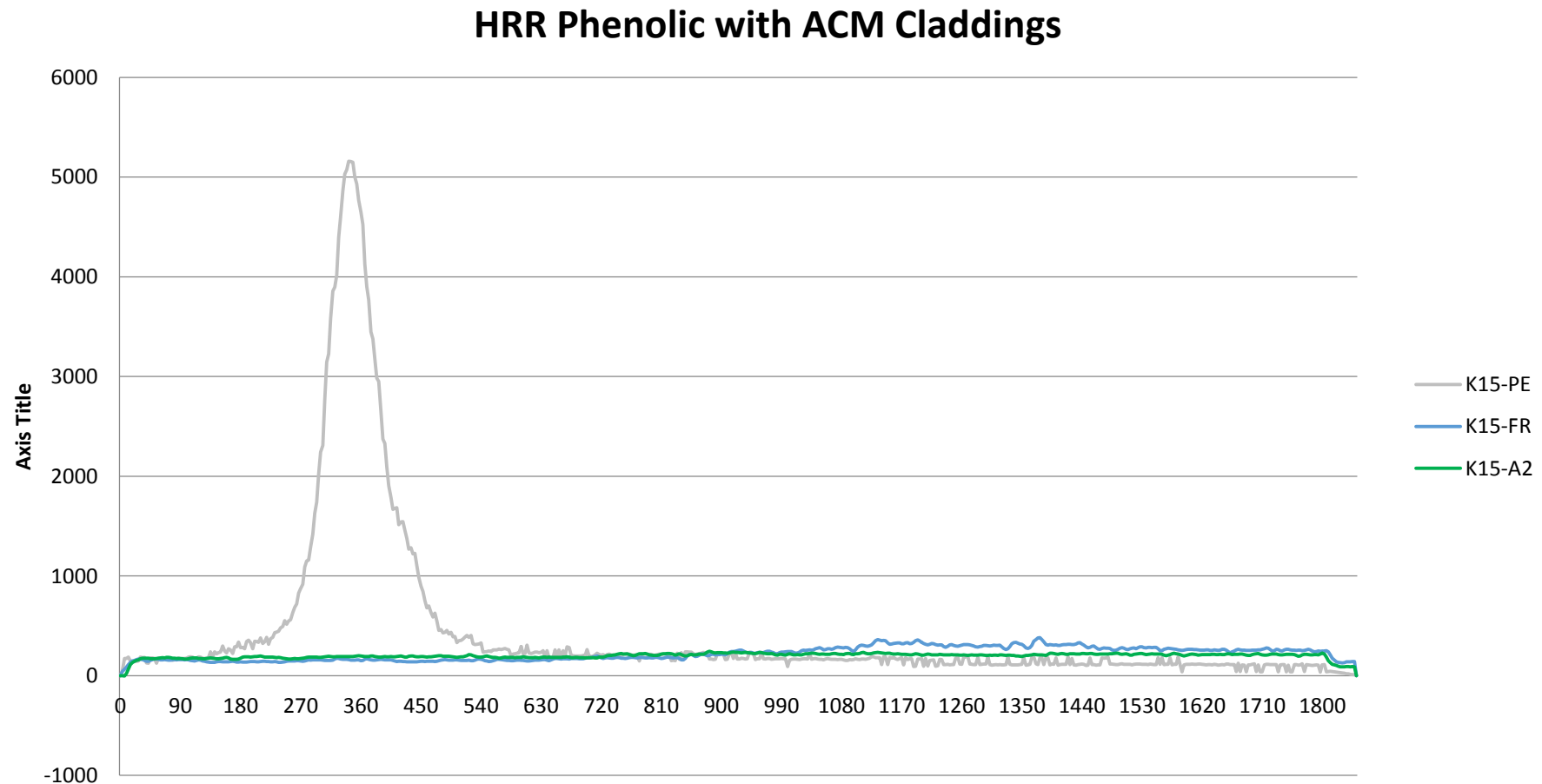
FR



A2

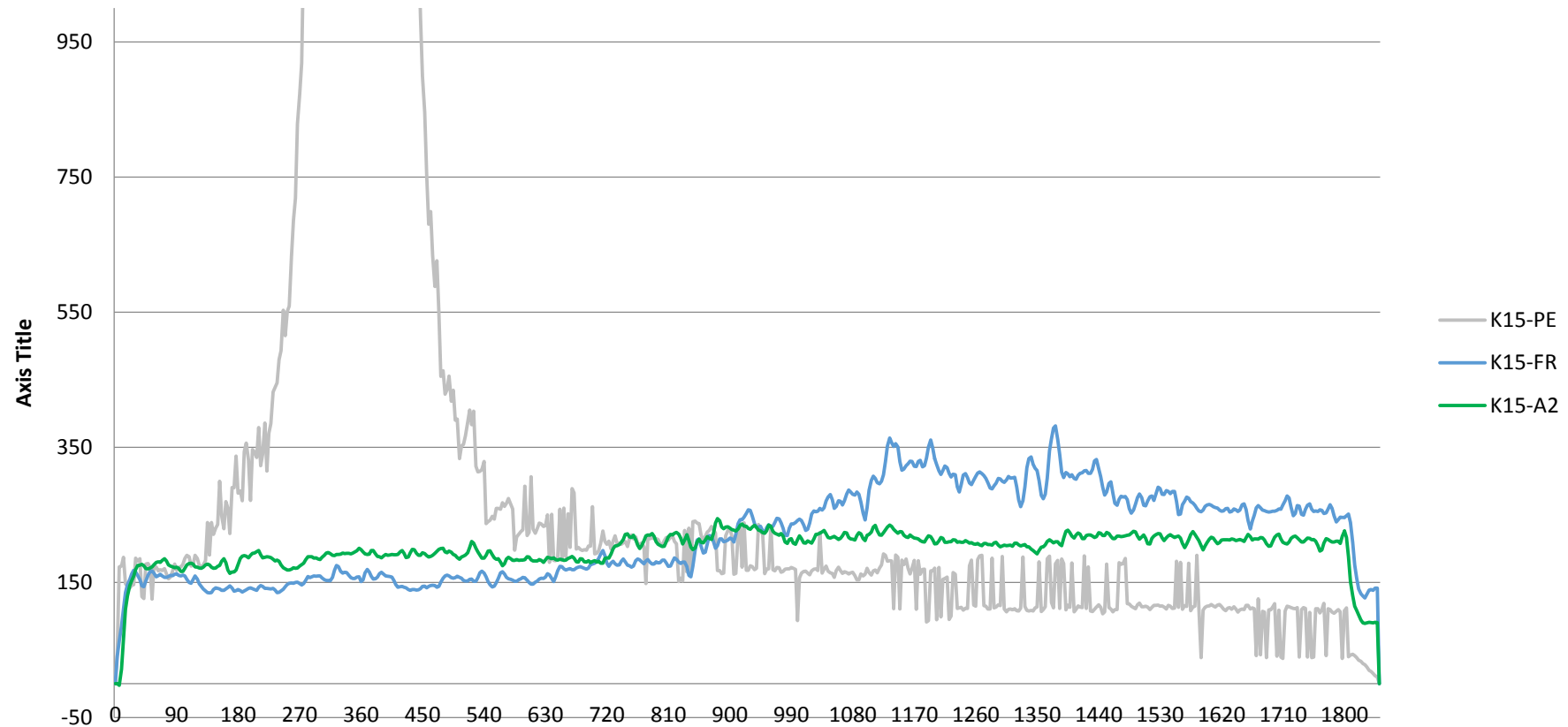
<https://www.youtube.com/watch?v=K7XVt42C-V0&app=desktop>

Phenolic with ACM Claddings

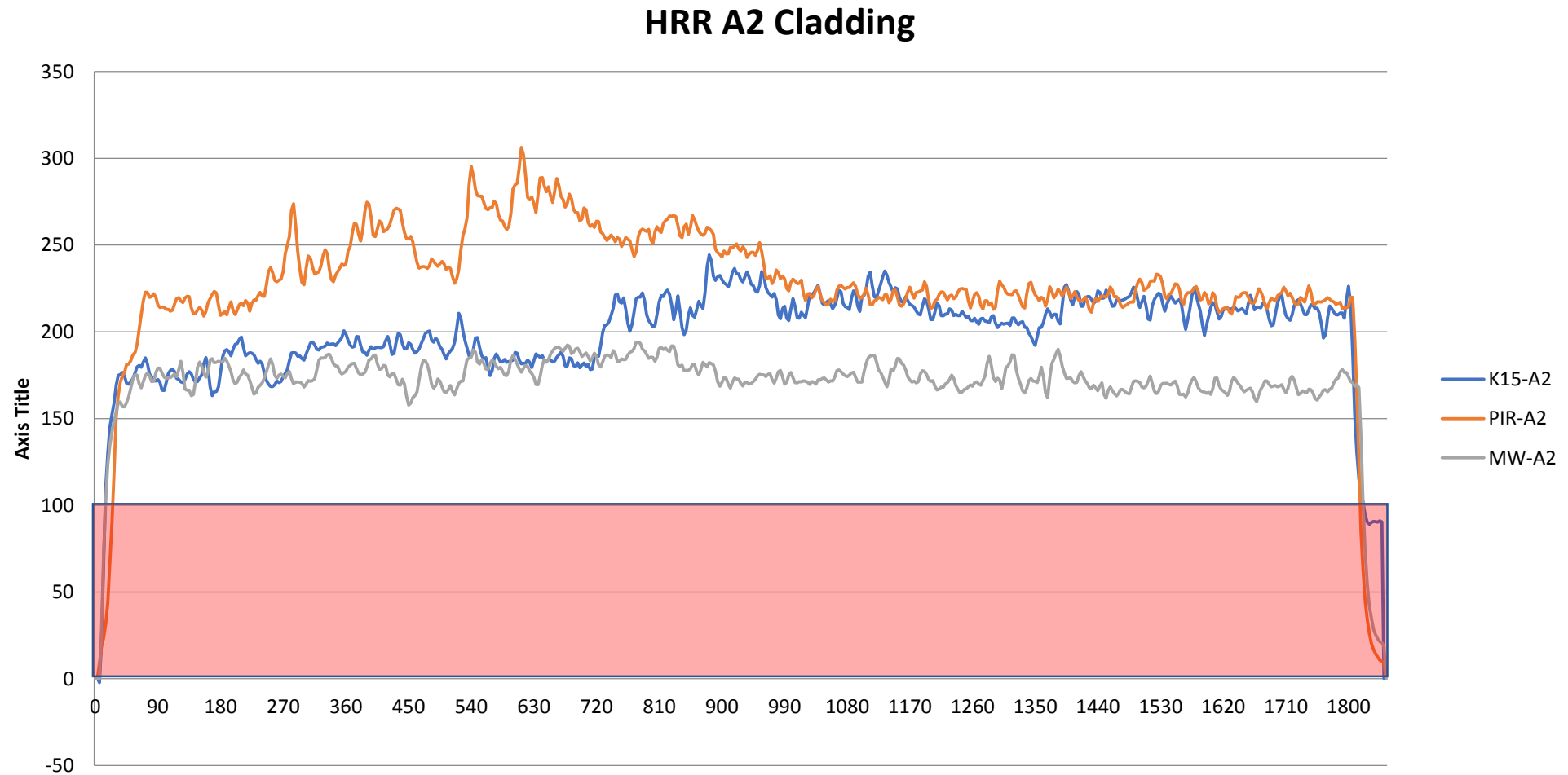


Phenolic with ACM Claddings

HRR Phenolic with ACM Claddings



HRR curves of the 3 Insulants with ACM A2



Full paper available in Fire and Materials

Efectis



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SPECIAL ISSUE PAPER WILEY

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

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Summary
The fire behaviour of a building facade is dependent on the overall system's performance, rather than the performance of the individual components. A facade system includes the cladding and the substrate, but also the system, cavity barriers, insulation and fire stops, substrate and any regulations, such as window frames. This publication presents facade fire propagation test according to the ISO 12101-2 standard with additional heat release rate and peak analysis using FIM. Tests have been performed on 9 different compositions of aluminium composite panels (ACP) with several insulators. For several compositions, the cladding is the most important parameter driving global fire behaviour of facade mock-ups. ACP-PI-based cladding systems gave very different results from the other tested facades. This was especially visible in heat release rates, where fire intensity was very high, whatever the insulator used in the system. The contribution of the insulator was only remarkable in these tests during the decay phase. The cavity barrier was largely affected in the 2 tests with ACP-PI cladding, as the integrity of the cavity was not insured.

1 | INTRODUCTION
Aluminium composite material (ACM) are increasingly commonly used in cladding when designing building facade materials, but different types of cladding can behave very differently in terms of performance. Assessment of a particular facade system fire performance can be undertaken using large-scale testing in accordance with BS8112-1, but there is currently no standard accepted method of assessing the scope of a large-scale test system to account for a system from the configurations that have been tested. It is therefore proposed that intermediate testing could offer a route for assessing the significance of different system configurations and components to reduce the scope of large-scale testing.

The test protocol proposed for such intermediate level testing tests facade fire propagation test according to the ISO 12101-2 standard with additional heat release rate and peak analysis using FIM. These results have been compared with available data available to estimate maximum heat release rate of each intermediate-scale test.

In order to assess the variability of different system configurations, as well as the effect of different interaction between panels and insulators, a fire propagation test of facade systems was performed using intermediate level testing. This involved 9 different ACM-based cladding systems in combination with 3 different insulators within each system.

The global market for facade insulation and especially ventilated facades is growing quickly and likely to reach in size to 2024 in the growing market, the penetration of ACM is currently estimated at



Fire Safety Engineering Research and Technology Centre (FireSERT)

Special thanks to the authors of the Fire and Material paper:

Eric Guillaume, Talal Fateh, Renaud Schillinger, Roman Chiva, Sebastian Ukleja

Contractor Training



- Fire-safety mandatory in façade contractor training
- Create accreditation system

Better Control of Specification



- Specification must be robustly protected
 - Architects
 - Building Control

European harmonized classification tests

- Façade classification based on Euroclasses?

- A1 + A2 = OK?

- B + A2 = OK?

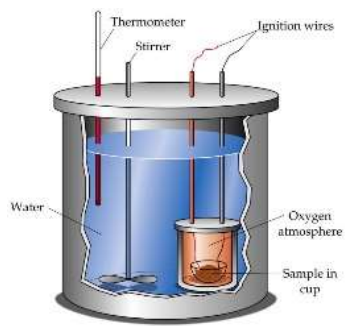
- C + B = Not OK?

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



tested at system level?

BS 8414-1



EN-ISO 1716 & EN-ISO 1182

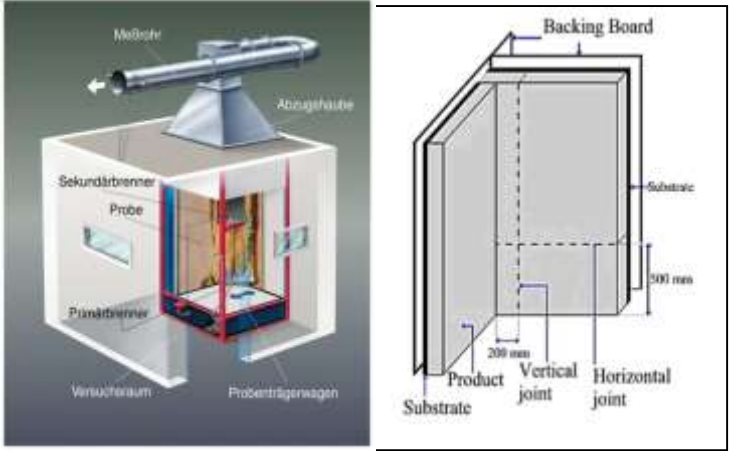
✓ A1 + A2



✗ Failed

tested at system level?

BS 8414-1



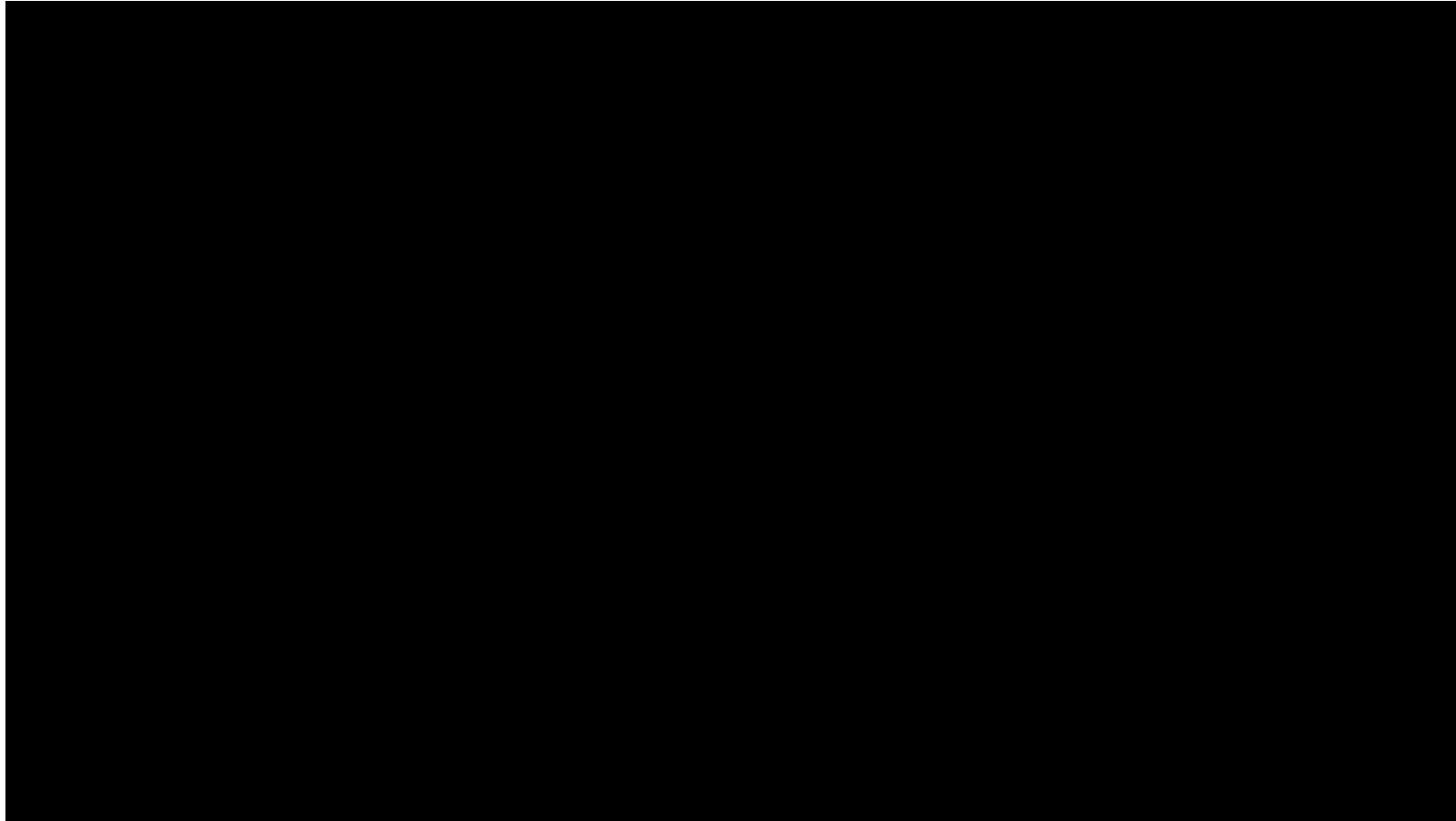
EN-13823

✓ C + B



✓ Passed

Stonewool A1 vs Kingspan K15 with ACM A2



<https://www.youtube.com/watch?v=BoO9KRucUbs>

Thank-you

question time

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