6 October 2017

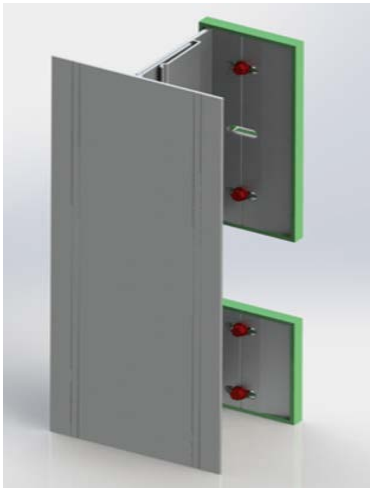
Summary of the large-scale fire testing carried out by DCLG during August 2017

Upon completion of the recent BS 8414-1:2015+A1:2017 testing commissioned by the Department of Communities and Local Government (DCLG), BRUFMA has analysed the test results published and outlined its findings below. BRUFMA fully approves the DCLG 8414-1 test programme and support the need for the publication of the actual (named) component materials used in the tests along with the Declaration of Performance (DOP). It is of critical importance not to rely on 'generic' labels to illustrate a material performance. Our comments below are based on the data published.

The BS 8414-1 Test (Fire performance of external cladding systems. Test method for non-loadbearing external cladding systems applied to the masonry face of a building)

The tests were carried out in accordance with BS 8414-1:2015+A1:2017. The fundamentals of this test are outlined below.

For the BS 8414-1 test, this is carried out on a masonry backed structure. Helping hand brackets are fixed to the structure and insulation is fitted back to the main structure around these brackets. Rails are then placed on the brackets and the cladding tile is fixed to these rails. Cavity barriers are placed in vertical and horizontal positions representative of current regulations. It is important to note that the BS 8414 test is a full system test and the result achieved is only relevant to the actual system tested.



The BS 8414-1 test is used to assess compliance with BR 135 (Fire performance of external thermal insulation for walls of multistorey buildings). The pass-fail criteria are as follows.

- The temperature at the level 2 thermocouples must not exceed 600°C + ambient starting temperature (for a period of 30 seconds or more) in the first 15 minutes after the test is deemed to have started.

Level 2 is 6.3mtrs high and has 3 different measurement points, external, within the ventilated cavity and within the insulation.

- The test must run to completion (maximum 60 minutes) without sustained flaming over the top of the test rig which is 8.0mtrs high.

DCLG Tests

In the recent tests carried out in the BRE there were two variables, the type of insulation, i.e. PIR and Stonewool and the type of cladding tile used. The tiles used were of the ACM (aluminium composite material) type and had 3 different generic fire performance level. Test 1-2 were non-fire rated, Test 3-4 were fire retarded and Test 5-6 were of limited combustibility.

Table 1 Combination on insulation and cladding used in each test

Test No.	Insulation Type		ACM Cladding Type			Result
	PIR	MW	PE Core	FR Core	A2 Core	
Test 1	x		x			Fail (8 mins)
Test 2		x	x			Fail (7 mins)
Test 3	x			x		Fail (25 mins)
Test 4		x		x		Pass
Test 5	x				X	Pass
Test 6		x			X	Pass

Analysis of Results

Table 2 Summary of measurements taken during the tests

	DCLG	DCLG	DCLG	DCLG	DCLG	DCLG
	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
Insulation	100mm PIR and PE ACM	180mm Dual Density Stone Wool & PE ACM	100mm PIR & FR ACM	180mm Dual Density Stone Wool & FR ACM	100mm PIR & A2 ACM	180mm Dual Density Stone Wool & A2 ACM
t_x (sec)	130	115	110	85	105	105
L2 EXT Peak Temp (C)	814	675	877	810	565	508
L2 EXT Peak time (S)	390	310	1395	1290	1380	1325
Rate C/sec	2.09	2.18	0.63	0.63	0.41	0.38
L2 CAV Peak Temp (C)	410	334	225	269	215	370
L2 CAV Peak time (s)	380	310	1395	1725	1055	1530
Rate C/sec	1.08	1.08	0.16	0.16	0.20	0.24
L2 Insul Peak Temp (C)	218	46	102	88	141	298
L2 Insul Peak time (s)	380	225	590	775	890	1605
Rate C/sec	0.57	0.20	0.17	0.11	0.16	0.19
Crib inpinging on cladding	100	100	100	75	80	79
Flame tips mid first panel (s)	120	105	105	110		
Flame tips top first panel (s)	165	120	110	140	130	150
Flame tips mid second panel (s)	225	150	135	180	455	
Flame tips top second panel (s)	405	180	195	250	660	208
Burning droplets (5sec)			360	300	500	
Burning droplets (20sec)	300	310	480	420	540	
Calorific value (cladding)	46.3	46.3	13.86	13.58	2.47	2.47
Crib Extinguished	525	429	1512	1800	1800	1800
Max Ext L2 temp at 15mins	814	675	420	410	420	435
Max Cav L2 temp at 15mins	410	334	150	175	195	200
Max Insul L2 temp at 15mins	218	46	50	65	140	50
Max Ext L1 temp	875	950	1000	920	900	890
Max Ext L1 time	375	300	1275	1350	1350	1475
Rate C/sec	2.3	3.2	0.8	0.7	0.7	0.6
L2 Ext Temp at 7mins	360	675	410	405	320	315
L2 Cav Temp at 7mins	175	334	145	150	145	150
L2 Insul Temp at 7mins		50	75	53	110	25
Gaps Measured between Panels	18-25mm	18-21mm	18-20mm	20-23mm	18-25mm	20-25mm

Table 2 summarises various measurements taken during the tests. The critical rows to focus on are:

- L2 Ext Peak Temp (C) – if greater than 600°C + ambient within 900secs then a failure occurs.
- L2 Cav Peak Temp (C) if greater than 600°C + ambient within 900secs then a failure occurs.
- Max Ext L2 temp at 15mins
- Yellow rows – these indicate the “rate of temperature rise”, i.e. °C/sec. It can be clearly seen that the rate of temperature increase for the non-FR ACMs (first yellow row) is much higher than that for the A2 rated ACM. An average of 2.135°C/sec versus 0.395°C/sec.

Grouping the test by the type of ACM used allows for a direct comparison between the insulant type.

Tests 1 & 2:
The result clearly shows that the insulation did not play a significant part in how the build-up performed. Both tests failed due to uncontrolled burning on the face of the façade and the crib fire had to be extinguished after 7-8mins rather than 30mins. This indicates that the insulation did not have time to truly contribute to the fire growth and that the performance of the ACM was the contributory factor. On analysis of the test data both tests failed in a similar time frame, had similar temperature data and rate of temperature increase. It is clearly demonstrated that the ACM for this particular build up is the critical component that leads to the failure.

Tests 3 & 4:
Test 3 and Test 4 both were below the targeted temperature rise in the first 900sec. The PIR/FR ACM test failed at 25mins due to fire spread over the top of the rig. The Stonewool option reached the 30mins at which point the crib fire was extinguished and fire load significantly reduced. It would be a fair assessment to say that the temperature profiles and rate of heat release would indicate that the contribution from the different types of insulation performed similarly.

Tests 5 & 6:
Both the A2 ACM tests passed. Temperature data was comparable between the tests and no clear trend emerged which differentiate the insulations choices from each other.

Conclusion
It is important to note that within each report issued by the BRE it clearly states that only the system tested can be deemed to satisfy the criteria of BR 135. As stated previously, quoting results for generic material is unhelpful since individual cladding materials, whether designated FR or A2 will perform quite differently, as will insulation types. Rainscreen components cannot be treated generically as each will individually affect the performance.

For these reports to have any relevance for designers and installers to put in place compliant specifications, then a full list of materials used in the DCLG tests must be published to allow absolute replication of specification.

However, with this series of tests now completed, all those responsible in specifying and installing external cladding systems can be confident that, when used with the approved mixture of materials, PIR insulation can remain as the first choice of insulation material on our buildings. As shown in test 5, PIR has passed the full BS 8414-1 fire test, and it also provides a number of other beneficial characteristics, including high thermal efficiency to help buildings meet energy efficiency levels that enhance people's living conditions and reduce their energy consumption.

For the full list of approved rainscreen cladding systems please visit the BRE website.