UK & Ireland

Guidance Note - No.6

Powder Coating and the Facts About Fire Resistance

May 2023

Scope

At the time of issue of this guidance note there remain a number of insurance companies attempting to reduce the risk of building fire by requesting that all external finishes achieve an 'A1' classification as per BS EN 13501-1:2007+A1:2009 "Fire classification of construction products and building elements. Classification using test data from reaction to fire tests."

Approved Document B (2019 Edition incorporating 2020 and 2022 amendments) and the recommendations for use of an 'A1' or 'A2-s1,d0' classification material is applicable for buildings above 11m in height and include apartment blocks, student accommodation, hospitals, care homes and residential schools.

Purpose

This document has been written by QUALICOAT UK & Ireland in order to present the facts borne out by testing which confirms the suitability of an 'A2-s1,d0' classification in building construction.

These recommendations are intended to assist architects, contractors, owners and building managers who are involved with the specification of powder coated architectural aluminium.

General

QUALICOAT UK & Ireland believe that the 'perceived' reduction in risk is not necessarily mitigated by moving from 'A2-s1,d0' classification to 'A1'.

Amended Approved Document B requires that all materials that form part of an external wall on relevant buildings (residential dwelling, student accommodation, hospital etc) over 11m in height should achieve either an 'A2-s1,d0' or 'A1' classification in accordance to BS EN 13501-1. So the choice of 'A1' rated material is entirely optional.

When applied at standard industry thicknesses, architectural polyester powder coating (PPC) achieves an 'A2-s1,d0' classification and so is permissible under Approved Document B for the following reasons.

PPC does not promote combustibility or fire spread when tested to BS EN 13501-1. This is further supported by the testing required for London Underground approval, often lauded as a barometer of fire safety. This requires compliance to EN 45545, where spread of flame is measured objectively (ISO 5658-2) unlike EN 13501-1 which involves visual assessment only.

Furthermore, smoke production is extremely low or non-existent with PPC, and no flaming droplets are created by its combustion.

It is important to assess the cladding system holistically and not just the performance of the constituent parts under EN 13501-1.

The predominant fire test for the whole external cladding system is BS 8414. This provides a route to compliance for buildings over 18m that are outside the scope of Part B regulations. This requires materials to meet the performance criteria given in BRE report BR 135 which measures whether the cladding build up is deemed safe for buildings at elevated height. The test itself involves a 9m high wall with a complete cladding installation, including the fixing of panels and insulation. It is therefore a through-the-wall test.

There are a number of BS 8414 tests which highlight negligible differences between a cladding system using PPC and one which applied an A1 rated finish such as anodising and pre-coat aluminium: These tests consistently and tangibly demonstrate the PPC does not escalate fire spread and the cladding membrane and plasterboard remain uncompromised.

PPC cladding yields a lower temperature increase within an apartment block 2 floors above the source of the fire as measured by strategically placed thermocouples. The peak temperature measured on the respective plasterboards (which sit right at the back of the cladding system at the closest point to the building face) were consistently lower for the PPC system. Therefore, if we look at the differential between the recorded start temperature vs plasterboard peak temp, we essentially get the worst case scenario of temperature increase that would be felt in that apartment block. See comparative examples below:

Temperature recordings - PPC

Parameter	Result (whole test)	Result (t_s+15mins)
T_s Start Temperature	7°C	n/a
T_s Start time	02:10 after ignition of crib	n/a
Peak temperature/ time at Level 2. External	393°C (t_s+20:30)	391°C (t_s+15:00)
Peak temperature/ time at Level 2. Cavity	296°C (t_s+24:30)	270°C (t_s+15:00)
Peak temperature/ time at Level 2. Insulation	161°C (t_s+29:20)	99°C (t_s+12:20)
Peak temperature/ time at Level 2. SFS	32°C (t_s+38:40)	27°C (t_s+11:40)
Peak temperature/ time at Level 2. Plasterboard	14°C (t_s+45:20)	9°C (t_s+12:40)

Temperature recordings - Anodised

Parameter	Result
Ts start temperature	27°C
t_s start time	93 seconds after ignition of the crib (thermocouple 3)
Peak temperature & time at level 2 (External)	421°C at 819 seconds from t_s (thermocouple 11)
Peak temperature & time at level 2 (Mid-depth of Cavity)	329°C at 831 seconds from t_s (thermocouple 27)
Peak temperature & time at level 2 (Mid-depth of 125mm Rockwool Duo Slab Insulation)	159°C at 1143 seconds from t_s (thermocouple 27)
Peak temperature / time at level 2 (Mid-depth of 12mm RCM Y-wall Calcium Silicate Board)	65°C at 765 seconds from t_s (thermocouple 37)
Peak temperature / time at level 2 (Mid-depth of 150mm SFS with Rockwool Flexi Slab Insulation)	38°C at 3114 seconds from t_s (thermocouple 48)
Peak temperature & time at level 2 (Mid-depth of 2 layers of 12.5mm British Gypsum Gyproc Fineline Boards)	40°C at 8129 seconds from t_s (thermocouple 55)

Temperature recordings - Pre-Coat

Parameter	Result
T_s Start Tepreture	8°C
t_s Start time	1 minute 55 seconds after ignition of crib
Peak temperature / time at Level 2. External	493°C at 17 minutes 5 seconds after t_s
Peak temperature / time at Level 2. Front Cavity	242°C at 20 minutes 40 seconds after t_s
Peak temperature / time at Level 2. Insulation	131°C at 21 minutes 0 seconds after t_s
Peak temperature / time at Level 2. Steel framing	36°C at 19 minutes 25 seconds after t_s
Peak temperature / time at Level 2. Plasterboard	18°C at 24 minutes 25 seconds after t_s

Fundamentally, as the BS 8414 testing demonstrates, once the coating starts to carbonise, the residual organic content is so low that there is no calorific mass for the fire to propagate any further. Equally, the comparative maximum external peak temperatures recorded at level 2 further highlights that PPC cladding doesn't promote greater intensity in the event of a fire breaking out.

A1 classification rated cladding can restrict the scope of façade design and often carries added practical challenges for subcontractors. This inevitably leads to significant uplift in cost.

Irrespective of whether aluminium cladding is 'A1' or 'A2-s1,d0' classified, the critical aspect is to ensure the full system is specified, configured and installed correctly.

Ultimately, correct installation of cavity barriers and positioning of fire breaks will serve to mitigate fire escalation if the aforementioned is adhered to. This would enable safe evacuation of residents providing other measures are in place

Whether it's the public or private sector, the need to protect people and safeguard against any potential financial burden of remediation can be realised with PPC cladding.

It is incumbent upon the supply chain to challenge and educate building owners, councils, insurers alike.

If there is any doubt on the correct specification of PPC any licenced member of QUALICOAT would be able to assist.

QUALICOAT UK & Ireland believe it is helpful to provide a guide to the classes in BS EN 13501 and to put things into a visual perspective in order to show the best to worst fire resistance performance. Visualised in this way 'A2-s1,d0' demonstrates it's high performance.

Classification	
A1	No contribution to fire. Permissible under Part B Regulations for relevant buildings over 11m.
A2-s1,d0	
A2-s1,d1	Very Limited contribution to fire. Non-compliant for relevant buildings over 11m but permissible for non-relevant buildings over/under 11m.
A2-s1,d2	
A2-s2,d0	
A2-s2,d1	
A2-s2,d2	
A2-s3,d0	
A2-s3,d1	
A2-s3,d2	
B-s1,d0	Combustible. Non-compliant for relevant buildings over 11m but permissible for non-relevant buildings under/over 11m.
B-s1,d1	
B-s1,d2	
B-s2,d0	
B-s2,d1	
B-s2,d2	
B-s3,d0	
B-s3,d1	
B-s3,d2	
C	Combustible. Non-compliant for relevant buildings over 11m and non-relevant buildings over/under 11m.
D	
E	
F	

References

QUALICOAT Specifications
Specifications for a quality label for liquid and powder coatings on aluminium for architectural applications.

BS EN 13501-1:2007+A1:2009
Fire classification of construction products and building elements. Classification using test data from reaction to fire tests.

Approved Document B (fire safety) volume 1
Dwellings, 2019 edition incorporating 2020 & 2022 amendments.

BS EN 45545-2:2013+A1:2015
Railway applications. Fire protection on railway vehicles. Requirements for fire behaviour of materials and components.

BRE Global
BR 135 classified external cladding systems.

ISO 5658-2:2006
Reaction to fire tests — Spread of flame — Part 2: Lateral spread on building and transport products in vertical configuration.

BS 8414-2:2020
Fire performance of external cladding systems. Test method for non-loadbearing external cladding systems

Note

The BS 8414 PPC results are representative of the following build up: Steel stud frame, Non-combustible rock mineral wool slab (10mm), Non-combustible sheathing panel (9mm); Flame retardant membrane, Wall Cavity Fire Barrier (275mm deep x100mm wide), Mineral Wool Insulation (180mm thick), Grade 1050 Aluminium Panel (3mm), Polyester Powder Coating to standard industry thicknesses.

Disclaimer

The information provided in this document is for guidance only and is not intended to replace any manufacturers recommended procedures. Qualicoat UK & Ireland strongly recommend that a qualified member of the association is contacted and underwrites any procedures which apply to powder coated finishes.

More Information

Current approved powder coaters can be found at:
www.qualicoatuki.org

Current Qualicoat standards and updates from the European website are at:
www.qualicoat.net

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