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TATA STEEL

TATA

Colorcoat® Technical Paper

Fire performance of pre-finished steel cladding systems

MINIMISING FIRE RISK

Tata Steel have a long history of product development and assessment of pre-finished steel performance in fire. The fire performance of all Colorcoat® products have been assessed and Tata Steel are able to provide performance data to National and European test standards.

Pre-finished steel cladding systems are designed to meet the needs of building regulations and insurance requirements. The actual fire requirements for a building will be specific to the location and end use. The guidance given here will help the building designer to understand the legislative and insurance requirements and identify the most appropriate construction for the application.

Working together to provide guidance

Over the past 40 years, Tata Steel have developed close strategic relationships with the leading roof and wall cladding system manufacturers.

In developing the guidance contained in this Colorcoat® Technical Paper, Tata Steel have worked closely with CA Group, Euroclad and Eurobond.

This close involvement with key leading suppliers of cladding systems ensures that the guidance given here represents the industry best practice. Any one of these supply chain partners are in a position to provide assistance in meeting specific project fire performance requirements for the building envelope.

Contents

Overview

The performance of a building in a potential fire situation must be seen as a fundamental requirement and it is essential that this be considered at the initial design stage.

Two major considerations for fire performance are:
- Compliance with the Building Regulations.
- Insurance requirements.

The focus of this technical document is specifically on the building envelope and understanding how to satisfy these requirements when using pre-finished steel cladding systems. Included is an assessment of the current regulations in England and Wales as well as an overview of the main UK insurance requirements. Guidance is also provided about what to specify in terms of pre-finished steel, insulation and cladding system as well as information about the main UK, European, and insurance fire tests used to ensure compliance. While the choice of building envelope materials is of key importance, it should be seen as part of an overall strategy of compliance and risk management. Where risks are high or difficult to control, more emphasis needs to be placed on the intrinsic performance of the building components.

Performance Requirements

Building regulations

Approved Document B1 is one of a series of approved documents which have been issued by the secretary of state. It provides practical guidance for compliance with the requirements of the Building Regulations of England and Wales. The basic concepts are similar in all parts or the UK.

Where to find the latest standards

For detailed information, please consult the relevant building regulations:

- Approved Document B (England & Wales).
- Building Standards Section 2 (Scotland).
- Technical Booklet E (Northern Ireland).
- Technical Guidance Document B (Ireland).

Links to the relevant websites can be found on www.colorcoat-online.com

Regulatory Approved Document B1

The purpose of this Approved Document is to provide guidance on the fire safety requirements for the completed building. It is intended to ensure that reasonable provisions have been made to minimize the risk to people in the building. The protection of property and the building itself may require additional measures and insurers will in general specify their own higher standards, before accepting the insurance risk.

It does not address the risk of fire during the building construction phase, which is covered by the 'Construction (Health, Safety and Welfare) Regulations 1996' The Health and Safety Executive has issued the following guidance on these regulations:

- Construction information sheet No 51.
- Constructional fire safety.
- HSG 168 – Fire safety in construction work, ISBN 0-7 176-1332-1.

The provisions set out in Approved Document B1 deal with different aspects of fire safety, with the following aims:

B1: To ensure satisfactory provision of means of giving an alarm of fire and a satisfactory standard of means of escape for persons in the event of fire in a building.

B2: That fire spread over the internal linings of buildings is inhibited.

B3: To ensure the stability of buildings in the event of fire; to ensure that there is a sufficient degree of fire separation within buildings and between adjoining buildings; and to inhibit the unseen spread of fire and smoke in concealed spaces in buildings.

B4: That external walls and roofs have adequate resistance to the spread of fire over the external envelope, and that spread of fire from one building to another is restricted.

B5: To ensure satisfactory access for fire appliances to buildings and the provision of facilities in buildings to assist firefighters in the saving of life of people in and around buildings.

Insurance requirements

The insurance requirements are specifically related to minimising the financial risk of fire to an acceptable level. In recent years a number of high profile fires have caught the attention of the media and the insurance companies, and has raised the level of interest in the choice of roof and wall cladding systems and insulation. The insurance companies no longer consider compliance with the Building Regulations as being sufficient. Insurance companies now often specify additional fire performance criteria that the building components must meet.

There are two main bodies each with their own set of approval tests and criteria. These are:

- The Association of British Insurers (ABI) who use the Loss Prevention Certification Board (LPCB) assessment.
- FM Global who have their own FM approvals.

In the UK, the LPCB is more widely used, however international companies sometimes favour FM Global, as it is more widely known outside the UK.

In 2003 the ABI published some technical guidelines with the following conclusions:

- The ABI believe that LPCB approved cladding systems, which have been tested and approved to LPS 11812, have a better fire performance and should be specified when the financial exposure is high or where high levels of risk management are not achievable.
- When well designed, neither built-up nor composite cladding systems contribute significantly to the fire load in the building.
- Panel joint detailing and support to prevent panel delamination are key factors in preventing building loss.

This report has recently been reviewed and a section redrafted as the ABI felt that a reference to non-combustible buildings was open to misinterpretation. The report now states that 'external composite panels must be suitable for the intended end use application and should have either a non-combustible core or be LPCB approved to the appropriate requirements of LPS 11812 and fully satisfy the insurers fire resistance requirements through appropriate testing.' All factory insulated foam filled composite panels have combustible cores and so will require LPCB approval.

The report also details the fundamental approach to risk management and minimisation as part of an overall strategy.

FM Global has a policy of only using products approved by FM Approvals to Class 1 of the relevant standard at all its insured locations, whenever these products are locally available.

Where financial exposure is high, there is high risk of ignition or general risk management and control is difficult. The specifier should consider a higher performing composite cladding panel or system.

Both the Building Regulation and insurance specific requirements are subject to a periodic review based on legislative changes. These may be European or National changes, introduction of new test standards and recent case history.

Compliance with Approved Document B[1] requirements

Most of the guidance given in Approved Document B[1] regarding the minimum performance requirements for products, materials and structures is given in relation to set standards or technical approvals.

Following a decision to harmonise standards in the construction sector across Europe, new European standards have been introduced into the regulations.

Currently, there is a period of co-existence of standards and either EN standards or BS 4763 can be used to demonstrate compliance.

The fire performance requirements are a function of:

- Building use
- Building storey area
- Building height
- Building location

Internal linings for walls and ceilings

The internal lining of the building must inhibit the spread of fire within the building and shall:

- Adequately resist the surface spread of flame.
- If ignited, have a rate of heat release or rate of fire growth, which is reasonable for the application.

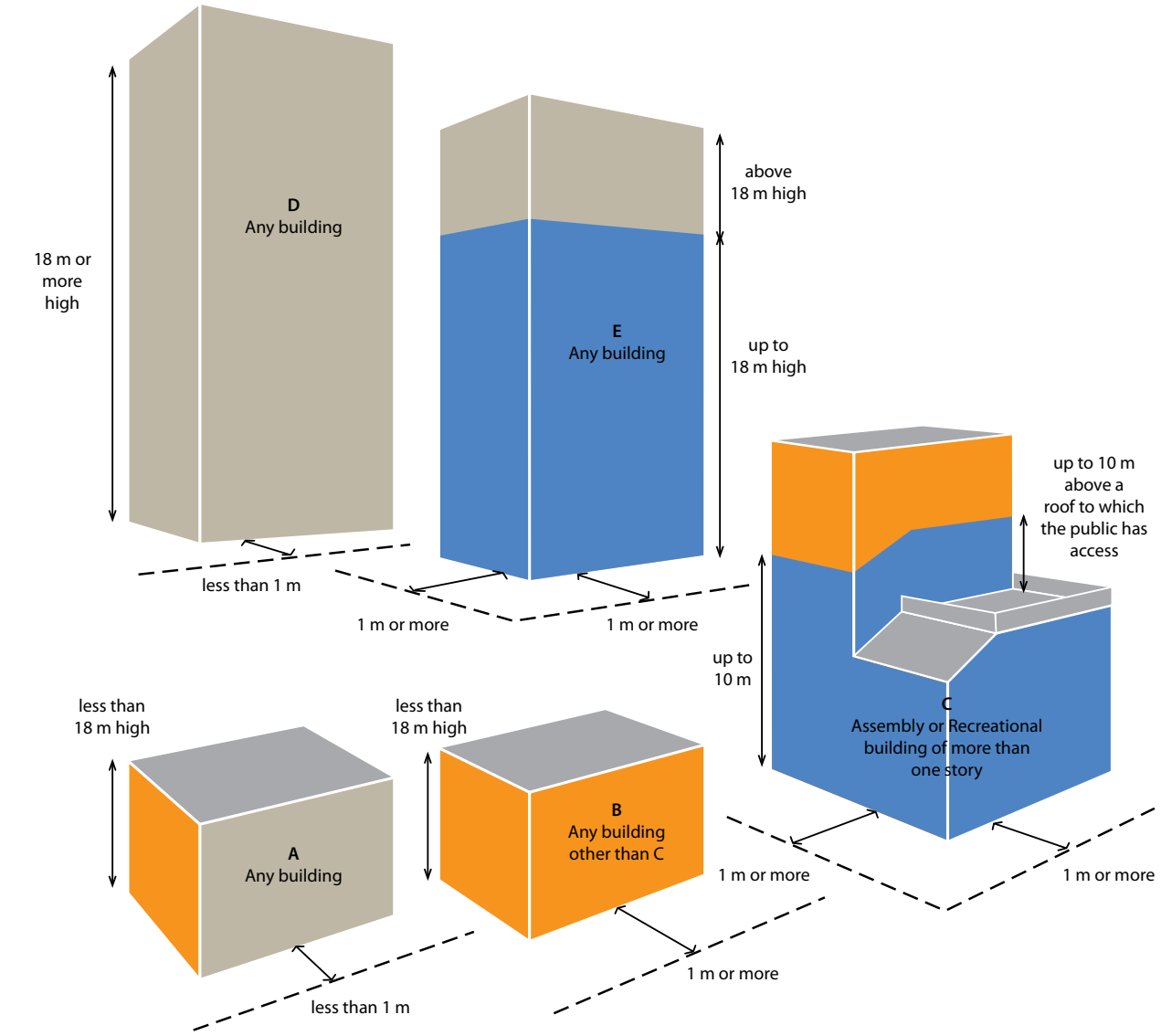
The choice of materials for walls and ceilings can significantly affect the spread of a fire and its rate of growth, even though they are not likely to be the materials first ignited. It is particularly important in circulation spaces where linings may offer the main means by which fire spreads, and where rapid spread is most likely to prevent occupants from escaping. Internal surfaces for large warehouses and rooms in buildings need to meet the requirements of Class 1. Circulation areas and general access and escape routes require a Class 0 surface.

Cladding systems using Colorcoat® pre-finished steel products including Colorcoat HPS200 Ultra®, Colorcoat Prisma® and Colorcoat® PE 15 can meet all the requirements for internal surfaces of walls and ceilings.

Provisions for external surfaces of walls

Approved Document B1 specifies the performance requirements for the external surface of walls according to building height and location. Figure 1 summarises these requirements for a range of building types and locations.

Figure 1. External surface requirements by height and location



Cladding systems using Colorcoat® pre-finished steel products including Colorcoat HPS200 Ultra® and Colorcoat Prisma® can meet all the requirements for external surfaces of walls.

Key

- No provision in respect of the boundaries indicated.
- Class 0 (National Class) or Class B-s3, d2 or better (European Class).

  Profiled or flat steel sheet at least 0.5 mm thick with an organic coating of no more than 0.2 mm thickness is also acceptable.
- Index (I) not more than 20 (National Class) or Class C-s3, d2 or better (European Class).

  (The index (I) relates to tests specified in BS 476: Part 6[4]).
- = Boundary

Notes

1 The National classifications do not automatically equate with the equivalent European classifications, therefore products cannot typically assume a European class unless they have been tested accordingly.

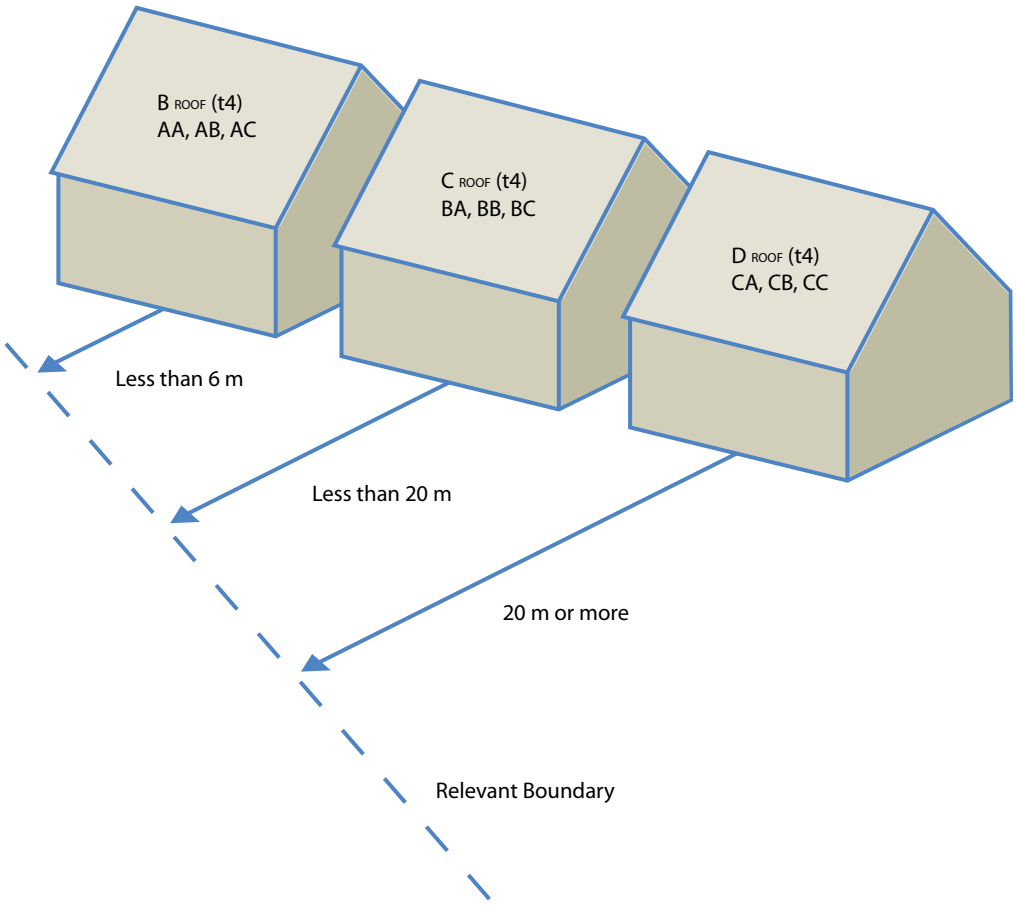
2 When a classification includes 's3, d2', this means that there is no limit set for smoke production and/or flaming droplets/particles.

External roof coverings

Approved Document B1 specifies the performance requirements for external roof coverings according to location in relation to the distance of the building from a relevant boundary.

Figure 2 sets out the minimum requirements that are stated according to European EN 11875 and National BS 476 – 33 standards for industrial buildings and warehouses.

Figure 2. Performance requirements for roof coverings



There are no restrictions on the use of roof coverings that are designated AA, AB or AC, National Class, or B ROOF (t4), European class. Roof products which meet the requirements stipulated in Commission Decision 2000/553/EC can be considered to satisfy the requirements without the need for testing.

Cladding systems using any Colorcoat® pre-finished steel products, including Colorcoat HPS200 Ultra® and Colorcoat Prisma®, can meet all the requirements for external roof coverings.

Fire resistance of external walls and internal compartmentation

The Building Regulations require that in certain conditions, wall construction must be of a fire resisting construction. This is dependant upon the building application and the fire load in the building, as well as the ease of personnel evacuation and the ability to tackle a fire. These are summarised below:

- External walls within a specified distance of a notional boundary.
- Where multiple occupiers use a building, the dividing walls must be of a fire-resisting standard, including the junction with the roof and external walls.
- If the area exceeds a maximum laid down in the regulations and has to be sub divided into 2 or more compartments.
- In a building where there is an area of high risk, the walls surrounding it should be fire resisting.

External walls

The performance requirements for external walls are dependant on the building location with respect to the site boundary:

- When a wall is less than 1 m from a boundary, it must be of fire resisting construction measured from both sides of the construction.
- If it is more than 1 m from the boundary, the specific requirements are dependant on the building application and distance from the boundary. In all cases, the fire resistance is only specified from the inside out of the building.
- The performance criteria for the wall will depend on whether the building has an automatic fire sprinkler system or not.

Compartment walls

For single storey buildings, there are no limits on the size of a compartment except for retail premises where the limit is 2000 m^2, unless a fully automated sprinkler system is fitted, in which case there is no limit on compartment size.

Where a compartment wall is required, the performance criteria for the wall will depend on whether the building has an automatic fire sprinkler system or not.

Places of special fire hazard

A space which is designated as a 'place of special fire hazard' must be enclosed with a fire resisting construction. These walls and floor/roof, are not considered to be compartment walls and have a different level of required fire resistance.

Places of 'special fire hazard' are detailed in Approved Document B[1] as oil filled transformer and switch gear rooms, boiler rooms, storage space for fuel or other highly flammable substances and rooms housing a fixed internal combustion engine.

The minimum fire resistance requirements for commercial, assembly, recreation, industrial and storage single storey buildings are summarised in the table below. The first figure relates to integrity and the second figure relates to insulation, both are expressed in minutes to failure.

Table 1. Fire resistance requirements for walls

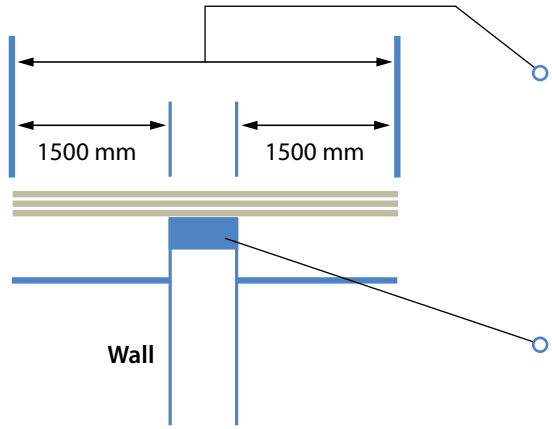
	External wall		Compartment wall between occupancies	Wall enclosing a place of special fire hazard
	Distance from boundary			
	<1 m	>1 m		
	Test from both sides	Test from both sides	Test from both sides	Test from both sides
Not sprinklered	60/60	60/30	60/60	30/30
Sprinklered	30/30	30/15	30/30	30/30

Cladding systems using any Colorcoat® pre-finished steel products, including Colorcoat HPS200 Ultra®, Colorcoat Prisma® and Colorcoat® PE 15, can be specified to meet the fire resistance requirements for external walls for all building locations and internal compartmentation requirements.

Junction of a compartment wall with the roof or external wall

Where an internal compartment wall meets the roof, the junction must be designed to minimise the risk of fire spread around the adjoining roof structure. These requirements are summarised in figure 3.

Figure 3. Compartment wall to roof junction details

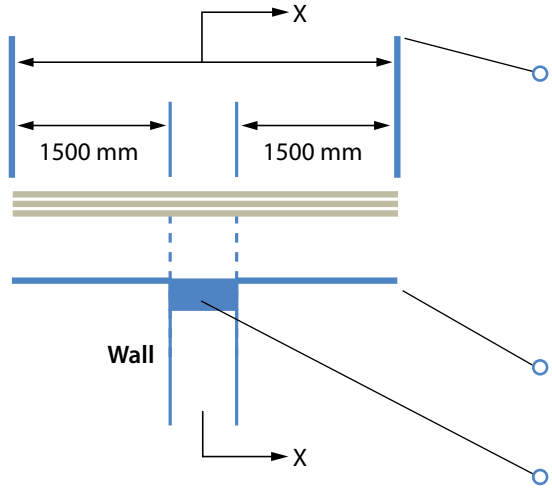


A. Any building or compartment

Roof covering over this distance to be designated AA, AB, AC or B ROOF (t4) on a deck of material of limited combustibility.

Twin-skinned insulated roof sheeting should incorporate a band of material of limited combustibility at least 300 mm wide centred over the wall. For built-up systems and mineral wool core composite panels this is integral to the construction. Factory insulated foam filled composite panel construction will need to include a separate piece of mineral wool at the wall/roof interface.

Resilient fire stopping to be carried up to the underside of the roof covering.



B. Residential (not institutional) office or assembly use and not more than 15 m high

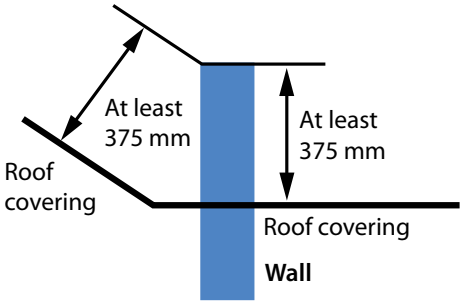
Roof covering to be designated AA, AB, AC or B ROOF (t4) for at least this distance.

Thermoplastic insulation material should not be carried over the wall.

Factory insulated foam filled composite panels should incorporate a band of material of limited combustibility at least 300 mm wide centred over the wall. Resilient fire stopping of the junction may be seen as an adequate alternative

If roof support members pass through the wall, fire protection to these members for a distance of 1500 mm on either side of the wall may be needed to delay distortion at the junction.

Resilient fire stopping to be carried up to the underside of the roof covering.



C. Any building or compartment

The wall should be extended up through the roof to a height of at least 375 mm above the top surface of the adjoining roof covering.

Where there is a height difference of at least 375 mm between the two roofs or where the roof coverings on either side of the wall are AA, AB, AC or B ROOF (t4), the height of the upstand/parapet wall above the highest roof may be reduced to 200 mm.

Built-up roof systems, bonded mineral wool and factory insulated foam filled composite panels using any Colorcoat® pre-finished steel product can be detailed to meet these requirements.

Approved Document B[1] does not specify how the junction between an internal compartment wall and an external wall should be detailed. Where the external wall has to be of fire resisting construction due to proximity to a boundary, the general requirements will be adequate.

Where the external wall has no general requirement for fire resistance or surface characteristics, it is sensible to apply similar principles to those specified for a roof/ compartment wall junction and ensure that:

- For a distance of 1500 mm either side of the junction the internal and external surfaces meet the requirements of Class 0 and the construction has a minimum of 15 minutes insulation.
- The junction between the compartment wall and the external wall is adequately detailed to ensure integrity of the joint similar to the overall performance of the compartment wall.
- There are no local hot spots that occur at the junction, which could cause excessive heat to be conducted around from one side of the compartment to the other.

National and European testing for classification for Approved Document B[1]

Most of the guidance given in Approved Document B[1] regarding the minimum performance requirements for products, materials and structures is given in relation to set standards or technical approvals.

The performance of a building element can be classified under two main criteria:

- Reaction to fire: The contribution that the building element material makes to the growth of a fire.
- Resistance to fire: The ability of a building element to resist the spread of fire.

National and European standards exist for testing and assessment of product fire performance.There is currently a period of co-existence of standards, which means that either National or European test methods and classification can be used to demonstrate compliance with building regulation requirements. It is expected that this period of co-existence will continue for some time until the European classification standards fully supercede the National Standards.

To demonstrate that a product complies with the requirements for a given application, the cladding system provider must demonstrate compliance with one of the following criteria:

- National or European testing and classification.
- Conformance without the need for further testing (CWFT):
  In some cases, CEN (Comité Européen de Normalisation) technical committees have undertaken a programme of work to demonstrate that certain products when used within limiting criteria such as gauge and profile have a generic fire performance and do not require individual system testing to demonstrate compliance.
- Notional classification:
  The notional performance of a number of widely used generic materials are stated within Approved Document B[1] and for these products, in the stated application, there is no need to carry out any additional testing.
- The Fire Regulator for England and Wales has recognised the 'track record of performance' and has stated that pre-finished steel within defined parameters is acceptable for certain applications, when used as part of a cladding system.

Internal linings and external surfaces of walls

The main tests used, assess the way the product contributes to the fire growth and the surface spread of the flame; both are detailed below. It should also be noted that the National standard tests are effectively material property tests, whereas the European tests, assess the performance of the material as part of a system.

National Standards

Test standard	
BS 476 part 4[6]	Measures the thermal contribution the product makes and whether it produces a flame.
BS 476 part 6[4]	Measures the fire propagation indices for a product. The overall performance index and sub-indices for each specimen are quoted. The lower the figure, the less the product contributes to fire propagation.
BS 476 part 7[7]	Measures the surface spread of flame for a product. Results are classified from 1, the best to 4 the worst.
BS 476 part 11[8]	Measures the heat emission from a product in a furnace at 750˚C.
The surface is classified from non-combustible to Class 4.	

European Standards

Test standard	
EN 11925[9]	A small-scale test which measures the ease with which the product ignites in two different flame application criteria.
EN 13823[10]	Often referred to as the single burning item test. This simulates a small fire in a room corner and measures the contribution that the product makes to the fire.
EN ISO 1182[11]	Non-Combustibility.
EN 1716[12]	Measures the calorific value of the product.
Classification is according to EN13501[13] from Class A1 to Class F	
EN 1716[12] and EN ISO 1182[11] are only required for the highest classifications within EN 13501[13]	

Correlation of National Classes and European Classes

When European standards were introduced into Approved Document B[1] a detailed correlation exercise between European and National classes was undertaken for the Office of the Deputy Prime Minister (ODPM) now Communities and Local Government (CLG).

The table below shows the correlation between the different standards, however it must be stressed that the test conditions and parameter are very different and that a product which may be a Class 0, National Class, may not necessarily give a Class B result according to European test and classification.

Correlation of National Classes and European Classes

National Class		European Class	
Class	Tests	Class	Tests
Non-Combustible	BS 476 part 4[6]	A1	EN ISO 1182[11] and EN 1716[12]
Limited Combustible	BS 476 part 11[8]	A2	EN ISO 1182[11] or 1716[12] and EN 13823[10]
Class 0	BS 476 part 6[4] & 7[7]	B	EN 13823[10] and EN 11925-2[9]
Class 1	BS 476 part 7[7]	C	EN 13823[10] and EN 11925-2[9]
Class 2	BS 476 part 7[7]	-	
Class 3	BS 476 part 7[7]	D	EN 13823[10] and EN 11925-2[9]
Class 4	BS 476 part 7[7]	E* and F	EN 11925-2[9]

* E does not meet the requirements of Class 3 but has a performance that is better than Class 4.
A Class 0 surface has a Class 1 surface spread of flame when tested in accordance with BS476 part 7[7] and has fire propagation indices I≤12 and i1≤6 when tested in accordance with BS476 part 6[4].

Colorcoat® pre-finished steel products including Colorcoat HPS200 Ultra® and Colorcoat Prisma® meet the requirements of Class 0.

External roof coverings

The main tests used to assess and classify product performance are detailed below. These tests are used to assess the ability of the roof structure to resist penetration of fire. The tests also incorporate an element of assessment of surface spread of flame.

National Standards

Test standard	
BS 476 part[3]	External fire performance for roofs/roof coverings.
	Resistance of the structure to fire penetration. Results are classified from A, the best, to D, the worst.
	Surface spread of flame. Results are classified from A, the best, to D, the worst.

National Standards

Test standard		
	External fire performance for roofs/roof coverings.	
EN 1187[5] (t1)	German test	Burning brand alone.
EN 1187[5] (t2)	Nordic test	Burning brand and wind.
EN 1187[5] (t3)	French test	Burning brand, wind and radiation.
EN 1187[5] (t4)	UK test	Gas flame, wind and radiation as per BS 476 part 3[3].

EN 1187[5]

The European test procedure used to assess the performance of roof materials has not been completely harmonised. The test procedure documents four different test regimes, t1 – t4, which can be used to assess materials/constructions. Only test method (t4) is applicable in the UK.

Correlation of National standards and European standards

The table below gives a correlation between results according to National standards and European standards.

Correlation of European standards and National standards

European Class	National Class
B ROOF (t4)	AA, AB, AC
C ROOF (t4)	BA, BB, BC
D ROOF (t4)	CA, CB, CC
E ROOF (t4)	AD, BD, CD
F ROOF (t4)	DA, DB, DC, DD

It should be noted that the National class AA is significantly tighter than the European class B ROOF (t4) due to the lower surface spread of flame allowance.

Cladding systems using Colorcoat® pre-finished steel products including Colorcoat HPS200 Ultra® and Colorcoat Prisma® can achieve a performance AA or B ROOF (t4).

Fire resistance of external walls and internal compartmentation

Where there is a specific requirement for resistance to fire and compartmentation, a wall with fire resisting properties is required. This is assessed using BS 476 part 22[14], 'Fire resistance of non-load bearing elements.'

The BS 476 Part 22[14] test measures the performance of a wall when exposed to heat on one face from a furnace with a defined temperature characteristic. There are two important criteria for the test; integrity and insulation.

- The wall integrity is the ability of a system to prevent the penetration of hot gases and flames.
- The insulation of the wall relates to the ability of the system to reduce the temperature rise on the unexposed side of the fire and therefore prevent fire spread through radiated heat.

The failure criteria for this test are specified in BS 476 Part 20[15]. A failure of the test construction to maintain integrity is deemed to have occurred when:

- Collapse or sustained flaming on the unexposed face occurs.
- Flames and/or hot gases cause flaming or glowing of a cotton fibre pad held on the external face of the system.
- A gap gauge of specific size, as defined in BS 470 Part 20[15], can be moved through a gap and into the furnace.

Insulation failure is deemed to have occurred when either:

- The mean unexposed face temperature increases by more than 140˚C above its initial value.
- The temperature recorded at any point on the unexposed face exceeds 180˚C above the initial mean temperature of the unexposed face.
- Any of the above listed integrity failures occur.

The performance is only valid for the direction tested. A wall may require fire resistance from either or both sides, dependant on the building situation, in which case it must be tested in both directions.

Cladding systems using Colorcoat® pre-finished steel products including Colorcoat HPS200 Ultra® and Colorcoat Prisma® can be specified to meet the building fire resistance requirements.

Demonstration of compliance with insurance requirements

When looking at the insurance risks a number of factors including the building fabric must be taken into account. These include:

- The intended application of the building.
- Safety management.
- Internal sprinkler systems.
- Compartmentation.
- Panel core material.
- Panel construction and joint design.

Insurance companies now often specify additional fire performance criteria/tests, which the building components must meet. Cladding systems, which meet the requirements of these tests, are generally seen as presenting a lower level of fire risk. Although these requirements were originally specific to factory insulated foam filled composite panels, they can also be applied to built-up systems and mineral wool insulated composite panels.

ABI and Loss Prevention Certification Board (LPCB)

The LPCB specifies 2 separate standards:
LPS 1181[16] Fire growth tests.
LPS 1208[17] Fire resistance requirements for compartmentation.

The LPS 1181[16] test involves a small room, 10 m x 4.5 m x 3 m, with three walls and an open end. A standard timber crib is positioned in the corner of the room and ignited. The test last for 30 minutes, after which time, the cladding system is assessed on the following basis:

- Distance of fire spread from the crib.
- Amount of damage sustained by the panel core material/insulation quilt.
- Break through of fire to the outside of the building.
- Average air temperature in the building, which must not exceed 600°C, which is the 'flashover' temperature.

There are a number of small scale, preliminary tests and criteria that indicate whether a full-scale room test is required.

Built-up systems and mineral wool insulated composite panels with pre-finished steel cladding can usually meet these requirements and a full-scale test is often not required.

Factory insulated foam filled composite panels are not able to meet these preliminary requirements due to the combustible nature of the core material and a full-scale test is required.

Where a level of fire resistance is required, the cladding system will need to be assessed according to BS 476 part 22[14] for non-load bearing walls/partitions/LPS 1208[17]. A cladding system that has passed the requirements of LPS 1181[16] can be classified as EXT B.

A cladding system which has passed the requirements of LPS 1181[16] and LPS 1208[17] is classified as EXT A, with the period of insulation quoted e.g. EXT A30, for 30 minutes of insulation when tested to LPS 1208[17].

The ABI believe that LPCB approved cladding systems, which have been tested and approved to LPS 1181[16] have a better fire performance and should be specified when the financial exposure is high or where high levels of risk management are not achievable.

The performance of all LPCB assessed cladding systems can be found on the 'red book live' website which lists the manufacturer, product description and performance rating. www.redbooklive.com

FM Global and FM Approvals

FM Global has a general policy of only using products approved by FM Approvals at all its insured locations, whenever these products are locally available. Approval can be gained on a project specific basis. This would be subject to an engineer assessment of the system and the cladding manufacturer demonstrating that their product met or exceeded the requirements of the FM Approvals standard.

FM Approvals is the testing and certification body for FM Global, it applies two separate standards for assessment of wall panels and panel roofs.

4881[18] Approval Standard for Class 1 Exterior Wall Systems

4471[19] Approval Standard for Class 1 Panel roofs

The standards cover a number of key performance criteria including fire, wind, traffic, hail and water-tightness. To satisfy Approval Standard 4881[18] for fire performance the requirements of Approval Standard 4880[20] must also be met. For all new build construction FM Global has a preferred policy that all roof and wall composite panels be approved to class 1 of the relevant standards.

In deciding whether to provide insurance for existing buildings, FM Global may elect to carry out a bespoke risk assessment and work with the insured over time to address any deficiencies identified, and to upgrade the facility to the levels of a new build construction.

Approval Standard 4880[20] relates to fire performance only. There are a number of preliminary tests and criteria, which indicate whether a large scale corner test, 25 ft or 50 ft, is required. This is a significantly larger scale test than required by LPS 1181[16]. The need for a 25 ft or 50 ft corner test is, dependant upon the results of initial flammability testing of the core material and the height to which the product is being assessed.

In all cases a room test will also be required. Mineral wool insulated composite panels with Colorcoat® pre-finished steel cladding can be specified to meet the stringent requirements for non-combustible core approval and therefore do not need to be subject to a corner test. All approved products can be searched for online at www.approvalguide.com.
In addition all approved roof panel assemblies can be searched for online at www.roofnav.com

Summary of Approval Standard 488020.

30 ft (9.1 metre) approval	50 ft (15.2 metre) approval	Unlimited height approval	Non-combustible core approval
Flammability test on core (FPA).	Satisfy 30 ft tests.	Satisfy 30 ft tests.	Room test - UCB 26-3 or ISO 9705.
Possible 25 ft corner test.	50 ft corner test required.	50 ft corner test required.	ASTM D 482 - ash content and E 2058 - core combustion.
Room test - UCB 26-3 or ISO 9705.		More stringent pass/fail criteria.	ISO 1716 - heat of combustion/ calorific value.
Small scale "code" tests e.g. ASTM E 84.			More stringent pass/fail criteria.

Independent assessment and attestation of conformity

Fire test laboratories

Official product fire testing should be undertaken at a United Kingdom Accreditation Service (UKAS) approved test laboratory, which also has UKAS accreditation for the test to be carried out and for the classification and reporting of the results. A test laboratory may also be a 'notified body' that can offer testing, certification and interpretation of results. The European group of organisations for fire testing (EGOLF) ensures a harmonised approach to testing and interpretation by notified bodies across Europe.

British Board of Agrément certification

The BBA provides an independent assessment and certification of a products performance. Fire performance is a key product parameter, which is assessed. The fire performance can be stated according to either National or European test standards for wall and roof applications.

It should be noted that fire test results quoted in the BBA certificate only relate to the actual colour of pre-finished steel which has been tested; unless stated otherwise. Specifying a BBA certified product ensures that all the performance claims made by the supplier have a sound technical base.

Example text from BBA certificate Tata Steel Colorcoat® pre-finished steel coil and sheet Colorcoat Prisma®

Properties in relation to fire

A Goosewing Grey sample of the product when tested to BS 476-3[3] had an EXT.F.AA rating.

When tested to BS 476-6[4]: 1989, a Goosewing Grey sample of the product had an index of performance (I) of 3.2 and a sub-index (I_1) of 2.0. When tested to BS 476-7[7]: 1997, a similar sample achieved a Class 1 result. The product, therefore, has a Class 0 / "low risk" surface as defined in the various National Building Regulations. This is valid for all colours in the product range.

The reverse side specifications are also Class 0 / "low risk" surfaces.

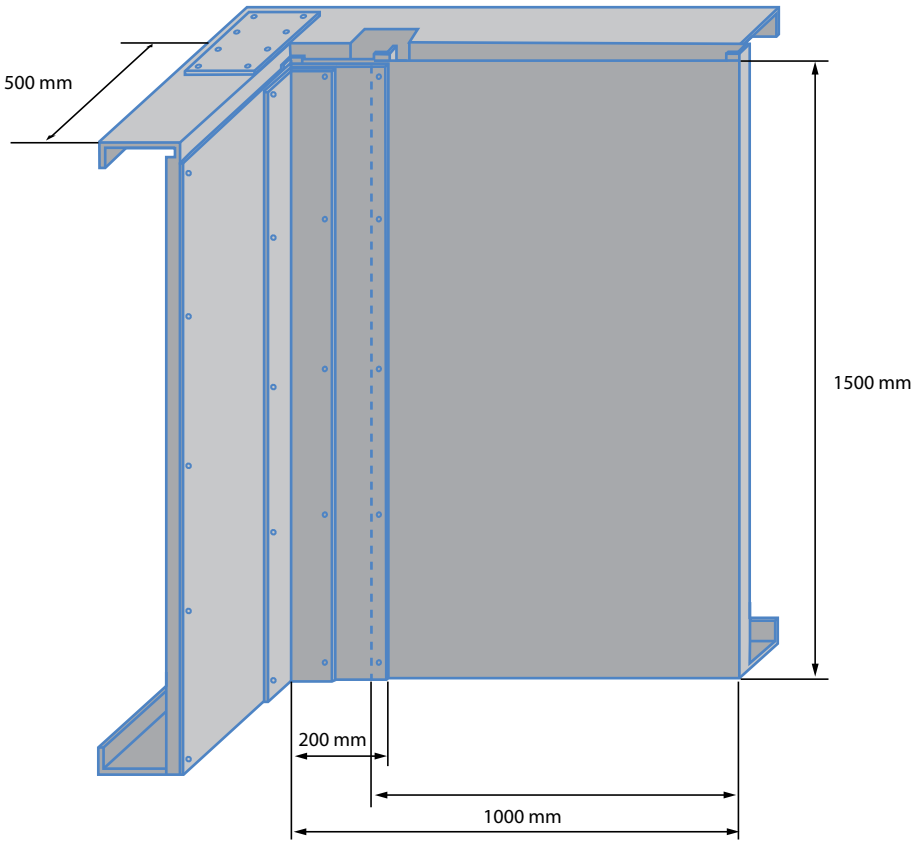
CE marking of profiled metal sheeting

The harmonised standard for profiled roofing and cladding products EN 14782[21] came into force across the EU on 1st November 2007. All EU countries, except the UK, Ireland and Sweden, must CE mark roof and wall cladding products. Products in the UK, Ireland and Sweden must comply with the Construction Products Directive (CPD) and the simplest way to do this is to CE mark.

The harmonised standard EN 14782[21], defines the test standards and configurations in which the pre-finished steel material must be tested and the way the product performance must be displayed. The defined configuration for reaction to fire testing test EN 13823[10] is shown in figure 4.

Note the CE mark and fire performance quoted only applies to the profiled metal sheeting not the built-up cladding system.

Figure 4. Configuration for testing to EN 13823[10]



Application of results

The fire performance figures, quoted on the CE mark label/product literature, have limitations to their application in end use.

External performance of roof covering products: The result are only applicable to the exact configuration which was tested or in the case of products classified according to CWFT, the application is limited to the criteria defined in the CWFT formal decision.

Reaction to fire: The results are only applicable to single-skin un-insulated wall constructions, which have a maximum profile depth of 165 mm, a substrate gauge heavier than or equal to that tested and a paint thickness less than or equal to that tested.

Fire performance data to European test standards is available for all Colorcoat® pre-finished steel products tested in accordance with CE marking requirements.

Tata Steel supply chain partners are able to CE mark all products and demonstrate compliance of their products with the Construction Products Directive.

Typical performance and considerations

Single-skin construction

Building Regulation requirements

Single-skin construction is often specified in agricultural buildings and for unheated warehousing.

All Colorcoat® pre-finished steel products meet the requirements of Class 0 and meet the performance requirements for the internal and external surfaces of walls. They are suitable for all single-skin construction applications.

All Colorcoat® pre-finished steel products can be used in single-skin roof systems and can meet the requirements of EN 1187[5] B ROOF (t4) or BS 476 part 3[3] Class AA.

A single-skin wall or roof construction cannot be regarded as providing any level of fire resistance, as it will not provide any thermal insulation. Single-skin construction cannot be used in boundary conditions. In practice they will provide some integrity and resistance to the spread of fire.

Insurance requirements

Single-skin construction will not meet the requirements of the insurance based tests, however all Colorcoat® pre-finished steels products have Class 0, low risk surfaces and a non-combustible substrate and so would not contribute significantly to any fire. For many applications where single-skin construction is specified, there would not be any issues with insurance.

Figure 5. Cross section of single skin construction

Built-up construction

Building Regulation requirements

All Colorcoat® pre-finished steel products meet the requirements of Class 0 and meet the performance requirements for internal and external surface of walls for all applications when used as part of a built-up cladding system.

All Colorcoat® pre-finished steel products can be used in a site assembled built-up roof system and meet the requirements of EN 1187[5] B ROOF (t4) or BS 476 part 3[3] Class AA.

Built-up systems can be designed to provide effective fire resistance for external walls and compartmentation within a building. Manufacturers can provide specific construction details that will provide a range of performance, which will have been assessed according to BS 476 part 22[14].

Typically performance will range from 15 to 60 minutes insulation and up to 240 minutes integrity, dependant on the construction details.

Key points to consider are:

- Is fire resistance required from one or both sides?
- Type of insulation used: In general, an air gap of ~40 mm should be incorporated between the exposed face and glass wool quilt insulation. This is not required for rock mineral wool insulation.
- Stitching of side lap joints will reduce the risk of any opening of the joint during exposure.
- Consideration must be given to spacer bars and brackets to ensure the risk of localised hot spots is minimised and also that the bar and bracket retain their integrity.
- Detailing of the wall to any adjoining structure e.g. wall, floor or roof.

When a built-up system is specified within 1 m of a boundary condition it will meet the requirements, provided an automated sprinkler system is installed in the building.

Insurance requirements

Built-up systems using pre-finished steel cladding and mineral wool quilt insulation can meet the requirements of the insurance based tests and are seen as not contributing significantly to the fire load in the building.

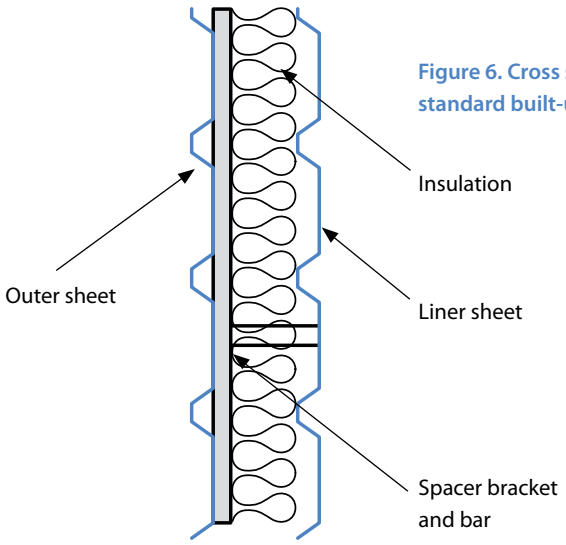


Figure 6. Cross section of a standard built-up system

General

Built-up systems allow the building designer to tailor the construction to meet the exact specifications. This is particularly important when there are a number of separate requirements such as fire, thermal and acoustic which have to be met. Built-up systems provide excellent fire performance, with only minimal changes required to enhance the level of resistance to fire performance.

They are suitable for virtually all applications where there may be a higher than normal fire risk or where risk control management may be difficult.

Mineral wool insulated composite panels

Building Regulation requirements

All Colorcoat® pre-finished steel products meet the requirements of Class 0 and meet the performance requirements for internal and external surface of walls for all applications when used as part of a mineral wool insulated composite panel cladding system.

All Colorcoat® pre-finished steel products can be used in mineral wool insulated composite roof panels and meet the requirements of EN 11875 B ROOF (t4) or BS 476 part 33 Class AA.

Mineral wool insulated composite panels using Colorcoat® pre-finished steel facing can be used to provide effective fire resistance for external walls and compartmentation within the building.

Manufacturers can provide specific performance data for panels, which will have been assessed according to BS 476 part 2214. These panels can generally achieve between 30 and 240 minutes of insulation and integrity. Detailing of the wall to any adjoining structure e.g. wall, floor or roof, is critical to maintain the integrity of the system.

Insurance requirements

Mineral wool insulated composite panels using pre-finished steel can meet the requirements of the insurance based tests and are seen as not contributing significantly to the fire load in the building.

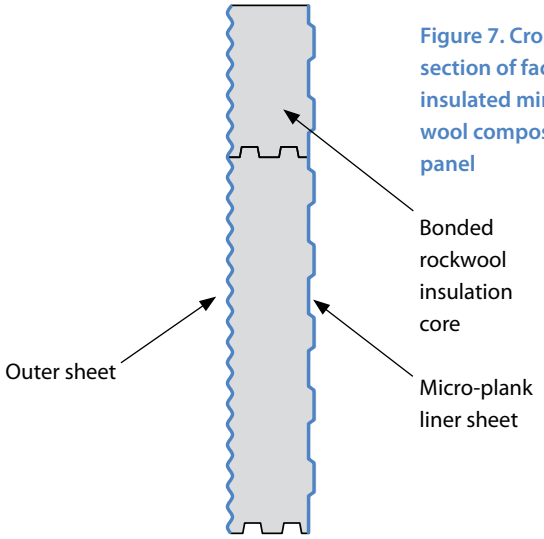


Figure 7. Cross section of factory insulated mineral wool composite panel

General

Mineral wool insulated composite panels provide an effective solution where the building designer wants to specify a composite panel and there is a higher fire risk for example in food processing plants. Mineral wool insulated composite panels will give the highest level of performance when a fire resisting construction is required for external walls in boundary conditions or for internal compartmentation. The mineral wool insulation is non-combustible and will not contribute to the growth of a fire, even if the core becomes exposed to flame. For a number of pre-finished steel mineral wool insulated composite panels, the overall performance of the panel when assessed against the criteria for classification to EN 13501 can be classed as A2, that is that the entire panel is of limited combustibility. This is occasionally required as part of the product specification.

Factory insulated foam filled composite panels

Building Regulation requirements

All Colorcoat® pre-finished steel products meet the requirements of Class 0 and meet the performance requirements for internal and external surface of walls for all applications when used as part of a factory insulated foam filled composite panel cladding system.

All Colorcoat® pre-finished steel products can be used in factory insulated foam filled composite roof panels and meet the requirements of EN 1187[5] B ROOF (t4) or BS 476 part 3[3] Class AA.

Most factory insulated foam filled composite panels only achieve 15 minutes insulation, although some can achieve 30 minutes, when assessed according to BS 476 part 22[14].

The integrity performance is very dependant on the panel system used and the joint details. Detailing of the wall to any adjoining structure e.g. wall, floor or roof, is critical to maintain the integrity of the system. Most factory insulated foam filled composite panels cannot be used for compartment walls requiring more than 30 minutes insulation performance or in locations where the external wall is within 1 m of a boundary unless the building is fitted with an automated sprinkler system. Cladding panel manufacturers can provide specific performance figures and installation guidelines for their products.

Insurance requirements

Factory insulated foam filled composite panels using pre-finished steel can meet the requirements of the insurance-based tests. The ABI believe that LPCB approved panels, which have been tested and approved to LPS 1181[2], have a better fire performance and should be specified when the financial exposure is high or where high levels of risk management are not achievable. Where a level of fire resistance is required the panel should be assessed according to LPS 1208[17]. Factory insulated foam filled composite panels are not able to achieve fire resistance rating greater than 30 minutes or Ext-A 30 rating. FM Global would generally specify panels that are approved to Class 1 by FM Approvals.

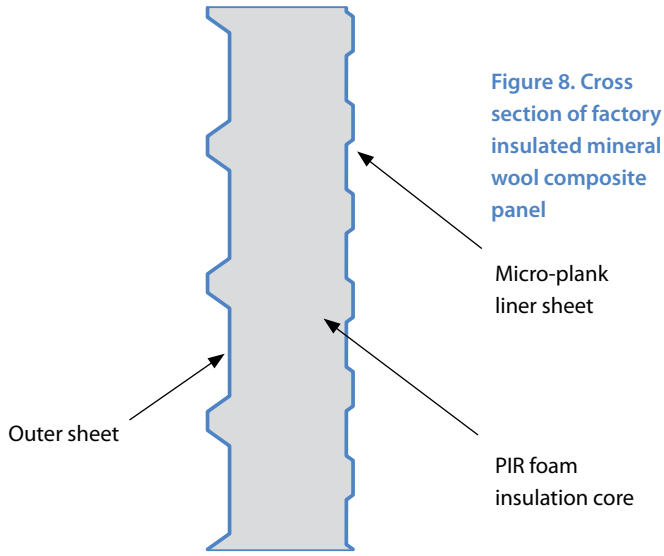


Figure 8. Cross section of factory insulated mineral wool composite panel

General

The performance of a factory insulated foam filled composite panel is extremely dependant upon the material used for the panel core. The following materials are used for panel cores:

- PIR
- PUR
- Polystyrene

The fire performance of the current formulation PIR factory insulated foam filled composite panels is significantly better than previous generation polyurethane and polystyrene core panels. Indeed many of the concerns around factory insulated foam filled composite panels relate to instances involving earlier generation foam panels. It must however be noted that all foam cores are combustible. Integrity of the panel joints and adequate fire stopping and sealing practices around penetrations through the construction are essential to prevent exposure of the core during a fire. Delamination of the panel skins or failure of the panel joints can lead to exposure of the panel core and rapid fire growth.

Where risks are high or risk management is difficult the specifier should consider the suitability of this type of construction.

Conclusions

When specifying the construction for wall and roof cladding, the specifier should consider:

- The material properties of the different elements of the construction.
- The regulatory requirements.
- Specific insurance requirements.

These are summarised below:

1. All Colorcoat® pre-finished steel products have a Class 1 surface spread of flame and fire propagation indices of $I<12$, $i_1<6$ and meet the requirements of class 0.

2. All Colorcoat® pre-finished steel products when used as part of a wall cladding system meet the Building Regulation requirements for external surfaces for all applications.

3. All Colorcoat® pre-finished steel products can be used in roofing systems to achieve a Class AA, National Class, or B ROOF (t4), European Class.

4. The surface spread of flame requirements for a National Class AA are much tighter than for a European Class B ROOF (t4).

5. All Colorcoat® pre-finished steel products when used as part of a roof cladding system meet the Building Regulation requirements for all applications.

6. Built-up systems using mineral wool insulation can meet most Building Regulation requirements for external envelope applications.

7. Mineral wool insulated composite panels can meet the Building Regulation requirements for all applications.

8. Factory insulated foam filled composite panels can meet most Building Regulation requirements for the external envelope applications.

9. Where Building Regulations or local building control require a higher level of fire resistance of a wall structure, a mineral wool core composite will provide the highest level of performance.

10. Only built-up systems and composite panels that have been assessed according to BS 476 part 22[14]/LP 1208[17], should be used where fire resistance performance is specified.

11. Cladding systems that have been assessed according to LPS 1181[2] are seen by the ABI as offering lower risk.

12. FM Global has a general policy of only using products approved by FM Approvals for new buildings.

13. All foam core materials are combustible.

14. It is essential that the core of factory insulated foam filled composite panels be adequately protected at penetrations to eliminate risk of direct flame contact with the core material.

15. Internal fire protection systems such as sprinklers can reduce the requirements on the building envelope and compartment wall performance.

It is important that the building envelope and cladding construction should be considered as part of an overall fire regulation compliance and risk management strategy.

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7. BS 476-7: Fire tests on building materials and structures – Part 7: 1997 Method for classification of the surface spread of flame of products.

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14. BS 476-22: Fire tests on building materials and structures – Part 22 1987. Methods for determination of the fire resistance of non-loadbearing elements of construction.

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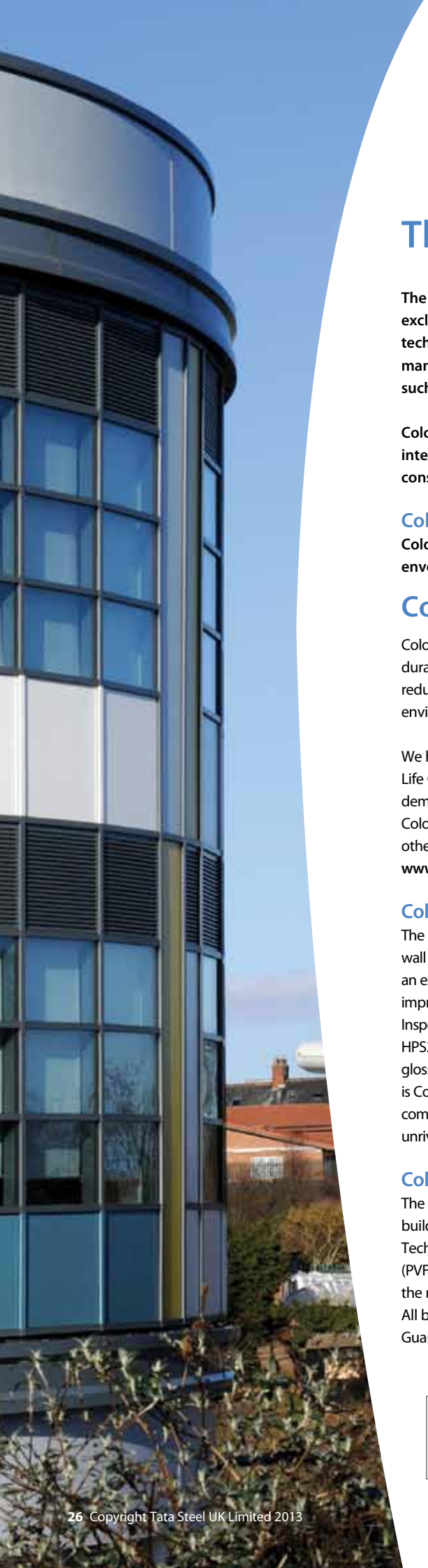

The Colorcoat® brand

The Colorcoat® brand provides the recognised mark of quality and metal envelope expertise exclusively from Tata Steel. For nearly 50 years Tata Steel has developed a range of technically leading Colorcoat® products which have been comprehensively tested and are manufactured to the highest quality standards. These are supported by a range of services such as comprehensive guarantees, colour consistency and technical support and guidance.

Colorcoat® products are manufactured in the UK and are certified to independently verified international management system, ISO 14001 and are 100% recyclable, unlike most other construction products.

Colorcoat® BES 6001 approved

Colorcoat® products are certified to BES 6001 Responsible Sourcing standard, the first steel envelope products in the world to achieve this.

Colorcoat® products and services

Colorcoat® products offer the ultimate in durability and guaranteed performance reducing building life cycle costs and environmental impact.

We have detailed Life Cycle Costing and Life Cycle Assessment information that demonstrates the positive performance of Colorcoat® products when compared with other alternatives. This is available from **www.colorcoat-online.com**

Colorcoat HPS200 Ultra®

The latest generation product for roof and wall cladding, Colorcoat HPS200 Ultra® offers an exciting colour range and dramatically improved colour and gloss performance. Inspection and maintenance free, Colorcoat HPS200 Ultra® delivers twice the colour and gloss retention of standard plastisols, and is Confidex® guaranteed for up to 40 years, combining outstanding performance with unrivalled reliability.

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The ideal choice to deliver eye-catching buildings that will stand the test of time. Technically and aesthetically superior to PVDF (PVF2), Colorcoat Prisma® is readily available in the most popular solid and metallic colours. All backed up by the comprehensive Confidex® Guarantee.

Confidex® Guarantee

Offers the most comprehensive guarantee for pre-finished steel products in Europe and provides peace of mind for up to 40 years. Unlike other guarantees, Confidex® covers cut edges for the entirety of the guarantee period and does not require mandatory annual inspections. Available only with Colorcoat HPS200 Ultra® and Colorcoat Prisma®.

Confidex Sustain®

Provides a combined guarantee which covers the durability of the Colorcoat® pre-finished steel product and makes the pre-finished steel building envelope CarbonNeutral® - the first in the world. Tata Steel and their Confidex Sustain® assessed supply chain partners endeavour to reduce the CO_2 emissions generated in the manufacture of pre-finished steel cladding systems but there will always be some unavoidable CO_2 emissions. These unavoidable CO_2 emissions are measured from cradle to cradle and the impact offset. Our aim is to encourage specification of the most sustainable pre-finished steel products and cladding systems. Available only with Colorcoat HPS200 Ultra® and Colorcoat Prisma®.

For further information on Colorcoat® products and services please contact the Colorcoat Connection® helpline on **+44 (0)1244 892434** or email **colorcoat.connection@tatasteel.com** Alternatively visit **www.colorcoat-online.com**

Colorcoat® Technical Support Team

Colorcoat® products are supported by a comprehensive range of services, technical advice and guidance. Our knowledge and expertise of the complete range of building envelope systems available with Colrocoat® products, means that the advice and support that we can offer you is truly objective.

We can help you to achieve the best technical solution for your building with the optimum in performance and environmental credentials. If you are building to specific sustainability credentials or performance criteria, we can work with you at the design phase of your project to help you integrate these requirements and deliver technically superior buildings that match your vision.

Whether you require information on the latest building regulations, calculations for a specific project or advice on integrating renewable technologies you can contact the Colorcoat Connection® helpline on +44 (0) 1244 892434 to request a visit from your regional representative

for impartial advice and support on a broad range of topics including:

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- Energy Efficiency, savings and paybacks.
- Building integrated renewable technologies.
- Responsible Sourcing.
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- Structural implications.
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- Fire performance.
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