Rockpanel®

Part of the ROCKWOOL Group

# Fireproof the future

## Build safer with rock solid fire resilience

# Building a safer future together
# One facade at a time

At Rockpanel, we feel everyone deserves to be in a safe environment. No matter where you live, work, play or learn: safety comes first.

When it comes to protecting people's lives, you can never be too sure. Making the right choices is therefore essential.

Fire regulations differ from country to country as do building habits. Some countries have prescriptive measures in their codes, others have performance criteria. In addition, fire regulations are often based on the most recent disaster happening in a country. It is common practice to adapt the regulations after a fatal fire.

To really know what different fire classifications mean, it is important to know more about the various types of facade materials and their reaction to fire, and to gain insight in to how building materials are tested.

This brochure will provide you with the latest information on fire safety and fire regulations in your country.

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# When or where does fire regulation begin?

Complying to fire regulations can be quite a challenge. The fire and building regulations are different for every single country. In a growing number of countries, fire safety has become a top priority and the regulations have changed accordingly. However, in others the fire regulations are still somewhat outdated. No matter what the regulations are: it is vital to opt for a fire safety solution that is futureproof and offers people a safe environment.

## Make fire safety a central topic in building engineering

Within total building engineering, fire safety is a central topic, regardless of the type or height of a building. Although there are rules and regulations for what a high-rise building is, you need to be aware of the fire risks for any building. Keeping inhabitants safe should be your number one priority, no matter what.

Fire regulation and thinking about fire safety starts the moment you consider a building, whether this is a new building or a refurbished one. Risk management and risk assessment are important aspects to cover because of the impact a fire can have on a building, its inhabitants or users and the owner. These aspects are not just something one person involved with the process of designing and constructing a building should take into account, but they are important for anyone involved with this process (architects, contractors, installers, building owners etc.).

It is best to think about fire safety in a broad perspective. This includes not only facade cladding or insulation materials, but many more technical aspects such as the application of fire compartments within the building, fire-resistant materials, an escape and emergency plan etc.

## The starting point to consider fire safety is in the design phase of a project.

Ask yourself if you want to comply with national building regulations, that are often the bare minimum needed on fire safety, or if you want to do more and ensure a building will be fire safe for many years to come and thus keep its economic value. If the latter is the case, the choice for non-combustible materials should be an easy one to make.

In this way, you design out the risks involved with combustible materials and you contribute to a more fire safe and sustainable building.

*New-build residential high-rise, Lokeren, Belgium*

## If I comply with national building regulations, isn't that enough?

National building regulations are sometimes outdated, having been implemented years ago and not updated since. They therefore do not always consider modern developments, such as the increased fire load (consumer electronics, more furniture, new building materials and modern methods of construction) present in buildings nowadays.

Regulations in many European countries do not always require the use of non-combustible materials. To be completely firesafe, there is sometimes more needed than to just comply with these regulations, which are often just the bare minimum. The use of non-combustible materials for facade cladding ensure maximum safety in case a fire starts either within a building or via an external source such as a rubbish bin or vehicle fire.

Furthermore, it is extremely important to realise that when a building material (for example facade cladding) with a certain fire classification (such as A2 or B) is used, that this classification is valid for the end use conditions for a so-called tested kit.

This means that if a product was tested with mineral wool insulation, for example, the classification is not valid for other types of insulation. Next to that, it is equally important that the real construction matches the tested construction.

# How does rainscreen cladding work?

# What is a ventilated facade?

A ventilated facade is a facade construction with an air cavity between the insulation and the facade cladding. This cavity is open at the top and bottom and the cladding has small open joints. This creates a way for **natural ventilation** of the facade.

A ventilated facade can be viewed as a raincoat: it protects a building against the weather, while at the same time creating a healthy indoor climate. This is why the building technique of ventilated facades is often referred to as **rainscreen cladding.**

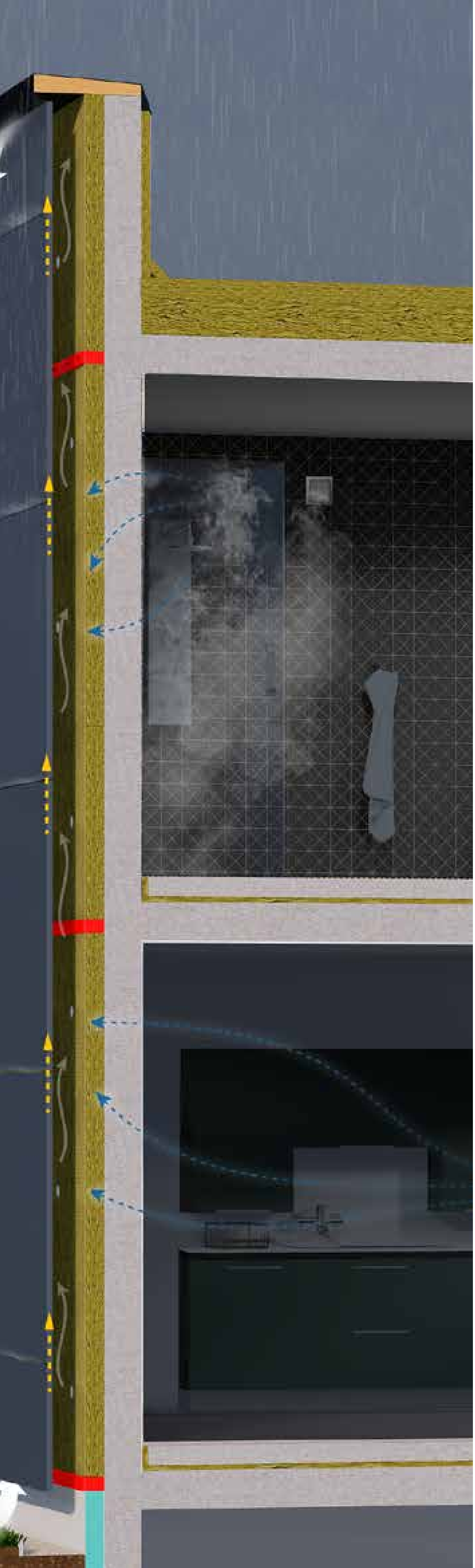
A ventilated facade has multiple benefits compared to other building techniques:

## Natural ventilation

A ventilated facade protects the building against weather influences and has natural ventilation. Most of the rainwater will run down the outer surface of the cladding boards. Small rain drops which enter the cavity or any condensed water will drain off. Vapour will escape quickly thanks to the ventilation flow within the cavity.

## 'Self-breathing' facade

Algae and moisture problems do not occur and mould cannot grow because the facade is 'self-breathing'. With a well-designed and well-constructed ventilated facade, the negative effects of condensation can be prevented, because a good balance in moisture transfer is created.



## Healthy indoor climate

Using a ventilated facade construction helps in creating a healthy indoor climate. A ventilated facade reduces the direct solar impact on the building. Walls do not heat up as much during Summer, thanks to the constant air flow in the cavity which is constantly cooling the construction.

## Insulating effect

Ventilated facades provide great insulation and contribute to energy efficiency and cutting down exterior noise.

## Lower construction costs

Compared to a brick cavity wall, a ventilated facade is lighter, which can lower construction costs.

## Easy access

With a ventilated facade, it is relatively easy to access the facade and the construction behind it when necessary. This comes in handy when any maintenance or refurbishment is required.

## Easy demounting

All parts of a ventilated facade construction can be demounted individually, which enables them to be reused or recycled. As Rockpanel boards are fully recyclable and sustainable, they are the best choice for exterior cladding in your ventilated facade when it comes to circularity.

## Design freedom

Architects are afforded flexibility in their design choices, with a wide range of colours and designs available for exterior cladding. It's also easy to replace the cladding at any point, providing even more flexibility in aesthetics.

Rockpanel facade boards are available in over 200 colours and designs – and customisation is possible too.

## Firesafe

Rockpanel exterior cladding also stands out because of its excellent fire resilient qualities. The core material basalt can withstand extremely high temperatures naturally.

Rockpanel cladding is available in Euroclass A2.

*Apartment building renovation project,*
*Haarlem, The Netherlands*

# Rainscreen cladding in renovation and refurbishment

In the future, a huge amount of buildings will be retrofitted or refurbished. Main drivers for renovation are often energy savings but also improvement of the indoor climate, fire safety and last but not least, the aesthetics of the building. Improvement in all these aspects increases the quality of life of the people occupying these buildings, and their surroundings.

## Limit the inconvenience for occupants during renovation with a ventilated facade

When we talk about renovation and refurbishment, adding a ventilated facade construction to an existing building can be an excellent way to achieve the desired goals. As it is a light-weight construction, the insulation can be maximised without affecting the structural performance of the building, which means foundations do not need to be adapted.
A ventilated facade construction can be installed while keeping the inconvenience for inhabitants limited. And when it's made from the right materials, it can also easily be dismantled and re-used or recycled at the end of life.

## Improve the fire safety of your building

When constructing a ventilated facade with the right materials, the fire safety of the facade and building can be significantly improved. Special attention is needed when, for example, buildings with existing brick walls are renovated. These brick walls are non-combustible so when the renovation is carried out with combustible materials, the fire safety of a building can be compromised . With the wide availability of non-combustible insulation like ROCKWOOL and non-combustible facade cladding like Rockpanel A2 there is no need to compromise on design or fire safety.

Resillient, fire safe, energy-efficient and healthy buildings: a non-combustible ventilated facade makes it possible.

*Prospect & Hicks Renovation Project, London, United Kingdom*

# Sub-constructions for a ventilated facade

A ventilated façade is always applied onto a sub-construction.
This sub-construction can be made of timber, aluminium or steel. In each type of build-up the fire classification of the facade boards can vary.
The minimum requirements to mount Rockpanel boards are the following:

## Timber sub-construction

When opting for a timber sub construction, it's important that it fulfils certain requirements:

- Timber stud walls and timber battens fixed to masonry walls should be constructed in accordance with BS EN 1995-1-1 and preservative treated in accordance with BS EN 335 and BS 8417. Studding and framing should be adequately supported by noggings to ensure rigidity.
- Where timber stud walls or battens are treated with cuprous preservatives, care must be taken to ensure that sufficient time is allowed for the preservative to properly condition before the cladding is fixed.

TIMBER SUB-CONSTRUCTION

## Metal sub-construction

Metal sub-constructions are the best option if a building requires optimum fire safety.

When Rockpanel boards are applied to an aluminium or a steel sub-construction, there are also certain requirements for the materials.

Sub-construction suppliers can provide the required details.

For **aluminium sub-constructions** the following requirements should be met:

- The aluminium alloy is AW-6060 according to:
  - BS EN 755-2
  - $R_m/R_{p0,2}$ value is 170/140 for profile T6
  - $R_m/R_{p0,2}$ value is 195/150 for profile T66
- The minimum thickness of the profile is 1.5mm.

For **steel sub-constructions**, the requirements are the following.

- The minimum thickness of the vertical steel profiles is either 1.0mm (steel quality is S320GD +Z BS EN 10346 number 1.0250, or equivalent for cold forming), or 1.5mm (steel quality BS EN 10025-2:2004 S235JR number 1.0038).
- The minimum coating thickness (Z or ZA) is determined by the corrosion rate (amount of corrosion loss in thickness per year) which depends on the specific outdoor atmospheric environment.
- The coating designation (classification which determines the coating mass) shall be agreed between the contractor and the building owner. Alternatively, a hot dip galvanized coating according to BS EN ISO 1461 can be used.

## More information

More detailed information can be found on our website, including the European Technical Assessments (ETAs) of Rockpanel products, fixing distances, BIM and CAD details.

# What are the fire risks of facade cladding?

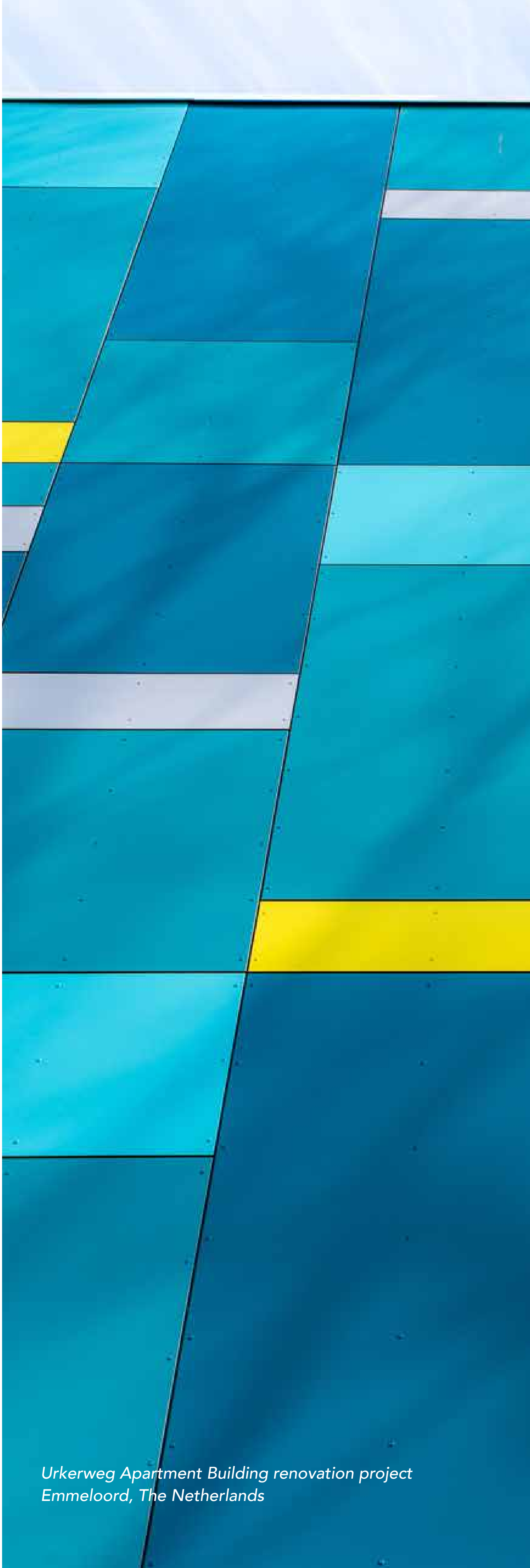
Facade cladding and fire safety: much has been written and said about this combination. When combustible materials are used for cladding or when materials are applied in the wrong way, there are increased risks regarding fire safety. But luckily, when you make the right choices, facade cladding is a completely safe option.

Knowing the facts will help you make the right decisions.

## The risks of using combustible materials in facade cladding

If combustible materials are used in either the facade cladding or insulation, the impact can be very serious when a fire occurs in a high-rise or high-risk building.

Combustible materials can add to the spread of smoke during a fire and increase the risk of spreading to another floor or room. Thus, the fire can spread and escape routes become impassable, trapping inhabitants in the building.



*Urkerweg Apartment Building renovation project Emmeloord, The Netherlands*

Today, fires develop 5 to 10 times faster than they did in the 1950s. The performance of a building during fire therefore has a major influence on the safety of building occupants and first-responders. Combustible materials can contribute to the spread of a fire and can produce toxic smoke, causing enormous risks for people inside a building.

## Combustible materials and smoke formation

Smoke inhalation causes more fire-related deaths than the fires themselves. All combustible materials produce some amount of smoke when they burn. How much toxic smoke will be emitted depends on the material, the amount of oxygen available and how long it burns.

In the early stages of a fire, before flashover, smoke will come from the first items ignited, often furniture, electrical devices and other contents of the room. As the fire grows and hits the flashover point, the volume and toxicity of the smoke it produces increases greatly.

The fire then continues to consume the room contents as well as combustible building materials. This includes the building exterior if the fire breaks through windows. This feeds the fire further and expands the amount of smoke. Fire and smoke spreading through the building and up the facade will threaten occupants even if they are not near the starting point of the fire.

## How does Rockpanel facade cladding perform during a fire?

The core material of Rockpanel boards is basalt, a volcanic rock that does not burn. It melts only at extremely high temperatures (1.000 degrees Celsius and higher). Rockpanel facade boards therefore have only a very low amount of calorific content. This calorific content comes from the small amount of binder which will decompose in case of fire. But it will not burn thanks to the stone wool fibre in the panels. The low calorific value indicates the panels have a very limited contribution to a fire.

## Fire safety: looking at the complete picture

It must be noted that Rockpanel boards, as with any other facade cladding panels, are always part of a kit which contains panels, insulation material, sub frames and a substrate. There are all kinds of insulation materials and subframes which each have their own fire behaviour and contribution to smoke formation. When it comes to smoke formation, you can design out the risk by using non-combustible materials exclusively.

## Safe facade cladding

To be compliant with the highest standards of fire safety, non-combustible materials for facade cladding (and insulation) are always the best choice. Always install them in the correct way, in line with manufacturer guidelines.

The best way to prevent risks is to 'design them out' completely. Therefore, only include non-combustible facade cladding materials in all phases of a construction project, from the creation of blueprints to the final construction of the building.

# What is a high-rise or high-risk building?

When it comes to fire safety, two types of buildings need some extra attention: high-rise and high-risk. What do these terms exactly mean? And what should you bear in mind to ensure optimum safety?

## What is a high-rise building?

Height is an important factor in fire safety. The definition of what constitutes a high-rise building differs between European countries. In Germany, the limit for high-rise buildings is 22 metres and above, in the UK it's 18 metres and above, in Belgium it's 25 metres and above and so on. No matter what the exact limit is, it remains indisputable that risks increase when the building reaches a certain height.

## Fire safety risks in high-rise buildings

Escaping from tall buildings is more complicated and takes more time compared to a single-family house with only one floor. Not only do high-rises have more inhabitants or people that work in them, normal houses also have more escape routes (windows, doors) and are therefore easier to escape when a fire occurs.

Using combustible materials on a building that is, for instance, 15 metres tall and thus not generally recognised as a high-rise, greatly increases the risks in the event of a fire and can have a catastrophic outcome.

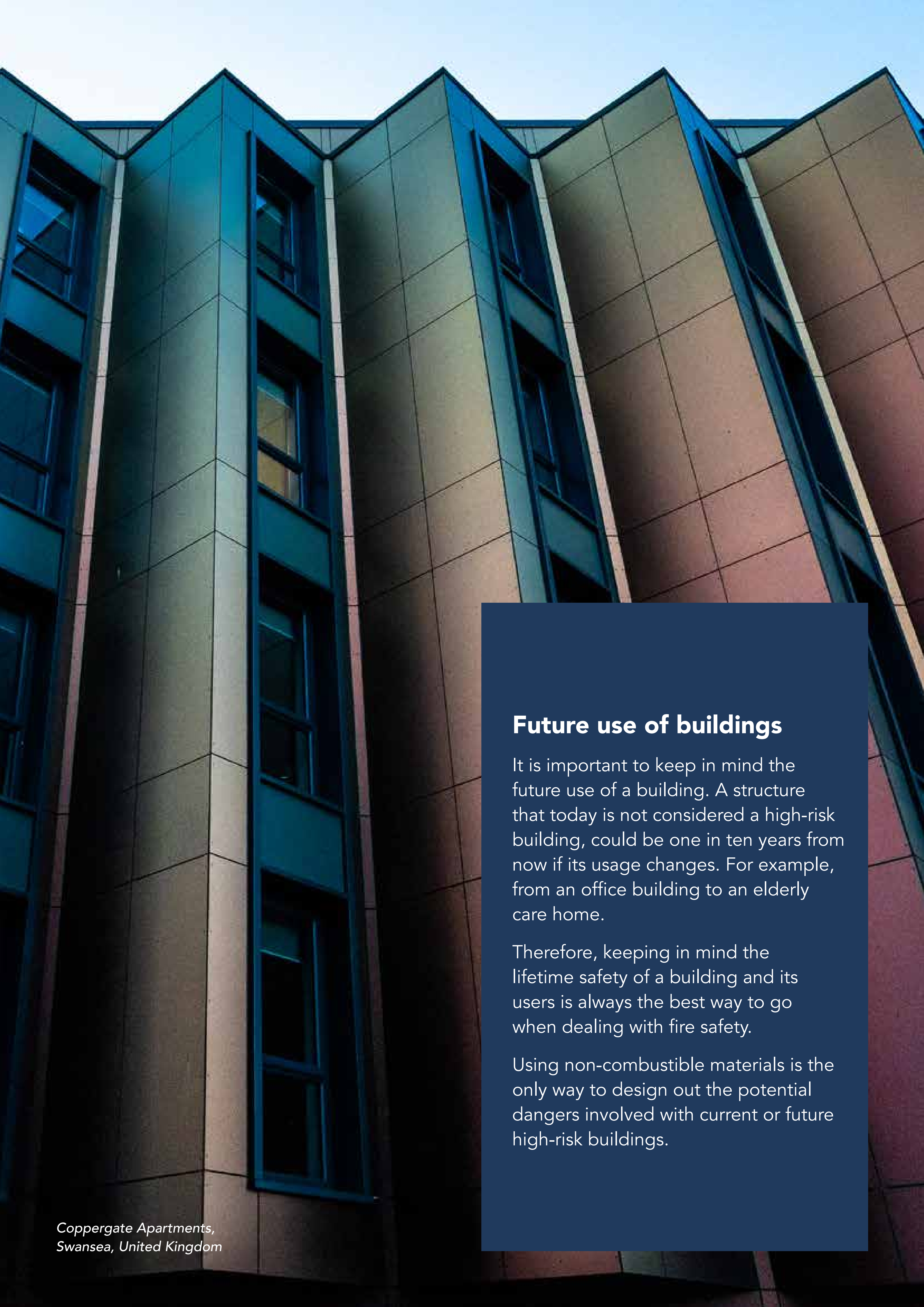
## New regulations for fire safety

Often high-rise limits are based on the possibility for fire fighters to reach the fire via ladders or other equipment. With the rapid changes in the building environment, these methods cannot always be applied.
These limitations form part of the debate in defining new regulations for fire safety.

## What is a high-risk building?

A high-risk building is a building where the impact of a fire can be catastrophic. Hospitals, nursing homes, schools, hotels, student housing: all of these and similar buildings fall under the definition of high-risk. They are buildings where a lot of people live, sleep, are in need of care and/or cannot escape quickly or easily in case of a fire emergency. The risk of losing lives due to a fire are high within this category of buildings.

The loss of property and the decreasing economic value of a high-risk building are also aspects of attention here.



*Coppergate Apartments, Swansea, United Kingdom*

## Future use of buildings

It is important to keep in mind the future use of a building. A structure that today is not considered a high-risk building, could be one in ten years from now if its usage changes. For example, from an office building to an elderly care home.

Therefore, keeping in mind the lifetime safety of a building and its users is always the best way to go when dealing with fire safety.

Using non-combustible materials is the only way to design out the potential dangers involved with current or future high-risk buildings.

# The Euroclass system; one standard on fire safety

The Euroclass system is the leading standard in Europe for fire safety classification of building materials. It's mandatory to use this standardised system with consistent quality levels. However, there are still often referrals to old standards. This leads to confusion and incorrectness, as they can be based on completely different test methods.

## What is the Euroclass system?

The Euroclass system classifies the reaction to fire and by this the behaviour and contribution of construction materials in a fire. The method of SBI-testing is leading here for determining class B to D. A1 and A2 classifications can be given on the basis of a successful non-combustibility test. Certification by the Euroclass system is mandatory.

## The Euroclass classifications: what does a certain classification mean?

In the Euroclass system, each classification means that for a product tested within a certain end-use application, there are specific parameters tested and achieved. In the lowest class, F, nothing is tested. Class E only tests with a small flame for a short period of time.

D does more testing and also takes into account smoke propagation (s) and the amount of flaming droplets and particles in the first ten minutes of the test (d). At level D, we basically see the first SBI-test in which a total kit is tested. Classes C and B are more strict.

In Class A2, all of the tests for previous classification levels are done, and there is also a test for the calorific content of the product. A1 only tests the calorific content, which should be of a very low value. Classes A1 and A2 are defined as non-combustible: materials from these classes do not contribute significantly to a fire. Basically, this method is based on a stacked level of testing: with every class there are stricter rules to comply with.

## What do the additions s1, s2, s3, d0, d1 and d2 mean?

Whereas the A-F determines the class of a product, there are also two subclasses involved with a classification. The 's' indicates the amount of smoke generated by the product during a fire, and can be s1 (little or no smoke), s2 (visible smoke) or s3 (substantial smoke). The 'd' indicates the flaming droplets and particles during the initial ten minutes of the fire and can be d0 (none), d1 (some) or d2 (quite a lot).

## Why was the Euroclass system introduced?

The Euroclass system was introduced by the European Union (EU) in 2000 to remove trade barriers between individual member states. Before the introduction, manufacturers of building products had to test building products in individual countries. All of them had their own unique testing methods to define the fire performance of a product. In order to enter the market in another country, companies had to obtain approval in every single country. This was not only time-consuming, but it also led to inconsistencies in quality levels. The EU solved this situation by introducing a classification system that applied to all member states.

The benefit of the Euroclass system is that it tests the performance in the so-called End Use Application. It also evaluates multiple aspects like ignitability, flame spread, heat emission and so on. Often national test methods cover only flame spread over the product surface, for example.

## What does this mean for old national classifications? Is it possible to compare national classes to the international standard?

All over Europe, the Euroclass system is recognised as the standard on fire safety. This means that, in principle, it is no longer allowed to use older (national) classifications. The Euroclass system is integrated into the national building regulations and codes (mandatory), but often the reference to the old standards is kept in this adaptation. This leads to confusion and incorrectness.

**National classifications are not the same as those of the Euroclass, because the test methods are totally different.**

It can look like there are tables that 'translate' the older classifications or regulations into Euroclass, but these are tables for legislation purposes and do not say anything about the performance of materials in case of fire. It is not possible to use a national classification to claim a Euroclass.

**It is therefore strongly advised to always use the Euroclass system and to be suspicious and question referrals to older classifications**.

# Understanding reaction to fire

An important aspect in evaluating the fire safety of a facade is an understanding of the reaction to fire classification. In all national building regulations throughout Europe, this is a corner stone with respect to material selection.

## The importance of fire tests

Reaction to fire of a product and a construction is a way to evaluate the contribution a material can have on fire growth and development, which is particularly important in the early stages of a fire.

The reaction to fire classification of building materials is determined through a series of tests which measure performance against several key characteristics. In principle the better the reaction to fire classification of a product is, the better it will limit the possibility for the fire to spread further over the facade and the more time people will have to escape.

The reaction to fire classification of materials is done in accordance with the BS EN 13501-1 standard. This standard determines the tests to be done for classification, the criteria and the reporting of the tests and classification.

The classification system differentiates between products classified A1 or A2-s1, d0 are considered non-combustible and those classified B – F are considered combustible.

## Reaction to fire tests

In order to classify the reaction to fire of a product the standard contains several tests, each covering an important part of the reaction to fire. The standard also contains a set of criteria for each test, to determine the classification.

There are three main aspects covered:

1. The first symbol (A1, A2, B, C, D, E or F) covers the class. A1 and A2 class are considered non-combustible were B – F are combustible.
2. The second symbol (s1, s2, s3) covers the smoke growth rate with s1 being the lowest and s3 the highest growth rate.
3. The third symbol (d0, d1, d2) covers the flaming droplets. With d0, there are no flaming droplets within the first 10 minutes, d1 means limited flaming droplets and d2 for anything else (worst score).

For determining these three aspects, a series of tests are included in the standard. These tests represent an evaluation of the material in the different phases as identified in the figure below.

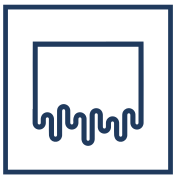
## Key characteristics

### Flame spread

The rate fire spreads across a surface

### Ignitability

Does the product catch fire?

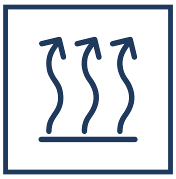


### Character changes

Does the product melt, drip or char?

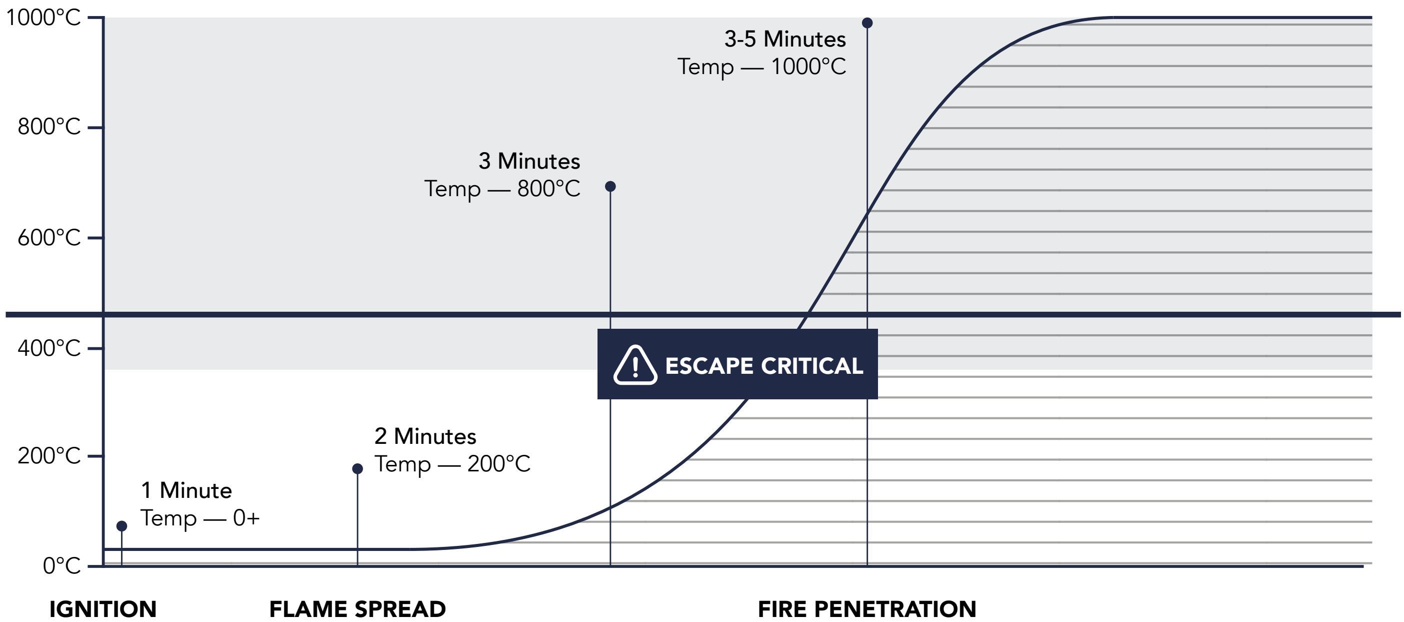
### Smoke emission

The level of smoke produced when burning



### Heat release

Heat energy released during combustion



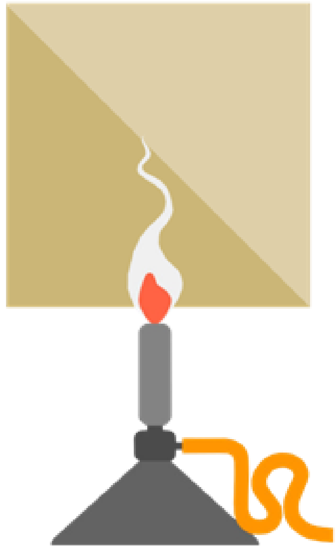
# Ignition

The test as described in ISO 11925-2, is in principle a test which evaluates the ignitability of products.

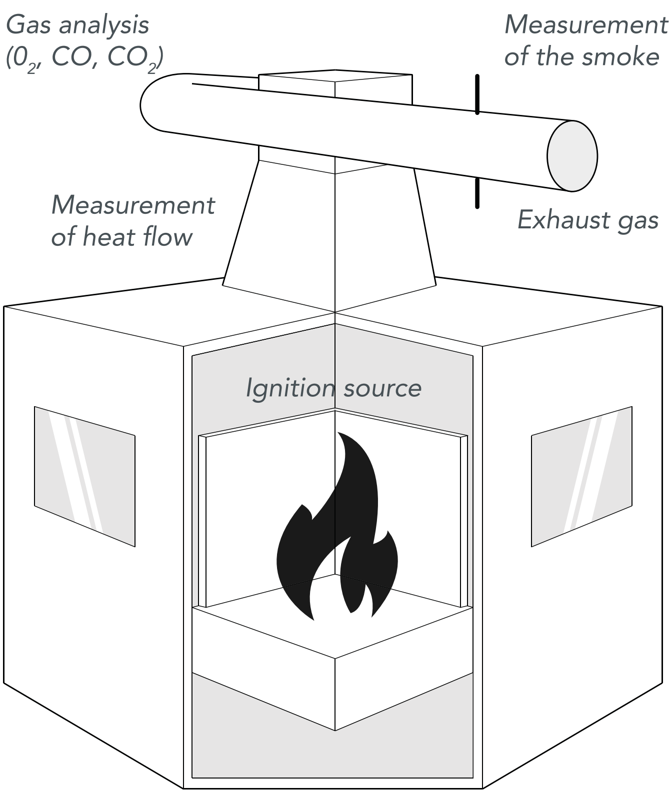
In this test a specimen is exposed from the edge to a flame with a temperature of 180 °C. Flame spread is measured every 2cm till a height of 15cm from the touchpoint of the flame.

This 15cm is also the limit for flame spread. In this test the falling droplets are measured by detecting if a paper underneath the sample is ignited.

This test is used for the classifications E to B.



*Ignitability test*




*SBI test*

# Development of a fire (flame spread)

The Single Burning Item (SBI) test is described in BS EN 13823 and is the test which determines the potential contribution of a product to the development of a fire.

The SBI test simulates a starting fire, for example a burning waste bin. During 20 minutes the construction including the specimen is exposed to a flame of 30 kW. During this test several parameters are measured like heat flow, oxygen consumption (indicator for the energy release during fire) and smoke production.

Based on these measurements, the classification is determined. It is important to realise that due to the suction of gasses for analyses, the combustible gasses which under normal conditions can contribute to the development of a fire are not evaluated in this test.

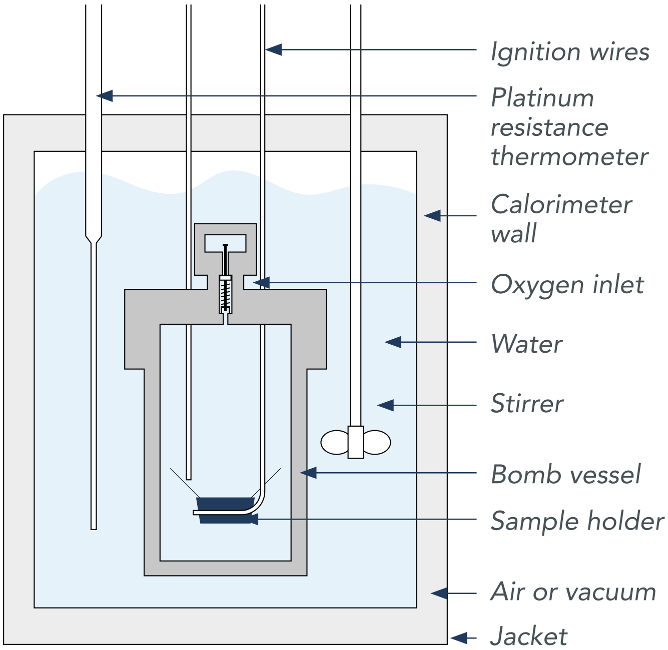
This test is used for the classifications D to A2.

## Growth of the fire

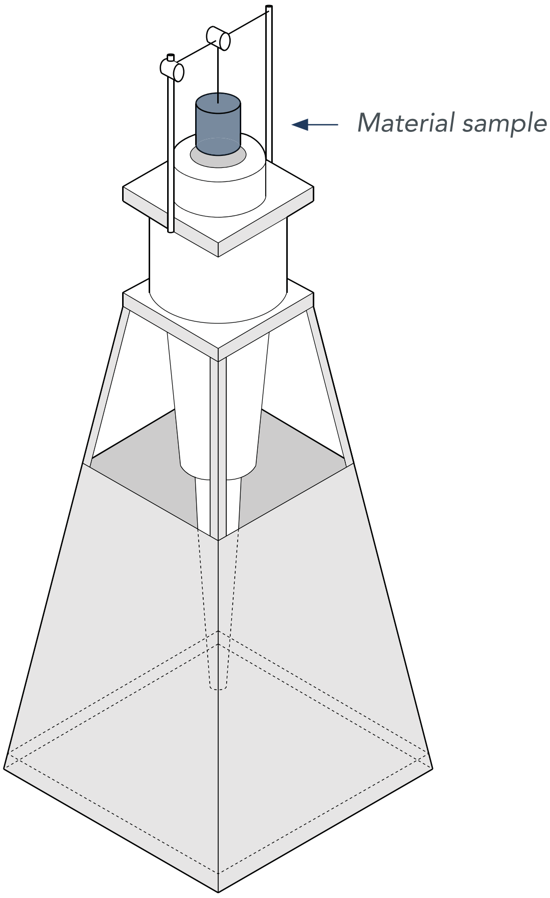
In order to evaluate the non-combustibility of products, two tests are relevant: the non-combustibility test BS EN ISO 1182 and the heat of combustion test BS EN ISO 1716.

The non-combustibility test BS EN ISO 1182 identifies products that will not, or not significantly, contribute to a fire, regardless of their end use. In this test a sample of the material is exposed for 60 minutes in an oven to a temperature of 750 °C. During the exposure the temperature rise is measured and after the test weight loss is measured. Both are measures for combustion of material.

This test is used for A1 and can be used for A2. This test can be used for A2 instead of BS EN ISO 1716.




***Oxygen Bomb Calorimeter***




***Non-combustibility tester***

The heat of combustion test BS EN ISO 1716 determines the potential maximum total heat release of a product when completely burned, regardless of its end use.

The test equipment is also called an Oxygen Bomb Calorimeter. In this test an exact amount of a product is placed in an hermetic sealed container and is burned with pure oxygen under 30 Bar.

By measuring the temperature rise of the water surrounding the container, the gross heat of combustion (PCS, abbreviation of the French term 'Pouvoir Calorifique Supérieur') can be determined.

This test is used for A1 classification and can be used for A2 classification. This test can be used for A2 instead of BS EN ISO 1182.

# Classification of reaction to fire

In the standard EN 13501-1 the classification criteria are described. The classification is done based on the test results of the different tests mentioned above.

First of all the reaction to fire classification F till A1 is determined. In the table below a summary is given where A1 and A2 are non-combustible and B to F are combustible. When the product isn't tested or doesn't meet the requirements of Class E or above it is determined as Class F.

| | BS EN 11925 (Ignitability test) | BS EN 13823 (SBI-test) | | | BS EN ISO 1716 (Gross calorific test) | BS EN ISO 1182 | | |
|---|---|---|---|---|---|---|---|---|
| **Class** | **$F_s$** | **FIGRA** | **LFS** | **$THR_{600s}$** | **PCS** | **ΔT** | **Δm** | **tf** |
| A1 | | | | | ≤ 2.0 MJ/kg | ≤ 30° | ≤ 50% | 0s |
| A2 | | ≤ 120 W/s | < edge | ≤ 7.5 MJ | ≤ 3.0 MJ/kg or | ≤ 50° | ≤ 50% | 20s |
| B | ≤ 150mm 60s | ≤ 120 W/s | < edge | ≤ 7.5 MJ | | | - | |
| C | ≤ 150mm 60s | ≤ 250 W/s | < edge | ≤ 15 MJ | | | - | |
| D | ≤ 150mm 60s | ≤ 750 W/s | | | | | - | |
| E | ≤ 150mm 20s | | | | | | | |

The second parameter covers the smoke production and is determined by the SBI test, the third parameter covers the flaming droplets and is determined by the ignitability test.

| | BS EN 13823 (SBI-test) | BS EN 11925-2 |
|---|---|---|
| s1 | SMOGRA ≤ $30m^2/s^2$ and $TSP_{600}$ ≤ $50m^2$ | |
| s2 | SMOGRA ≤ $180m^2/s^2$ and $TSP_{600}$ ≤ $200m^2$ | |
| s3 | Not s1 or s2 | |
| | | |
| d0 | No flaming droplets/particles occur within 600 s | |
| d1 | No flaming droplets/particles, persisting longer than 10 s within 600 s | |
| d2 | Does not comply with the d0 and d1 classification criteria given above | Ignites the paper in the ignitability test (EN ISO 11925-2) |

## Validity of the classification

The classification rules in EN 13501-1 cover two extremely important aspects:

- **End use application:** real application of a product, in relation to all aspects that influence the behaviour of that product under different fire situations.
- **Field of application** (direct and extended): outcome of a process (involving the application of defined rules) whereby a test result is deemed to be equally valid for variations in one or more of the product properties and/or intended end use applications.
- The extended field of application is the outcome of a process that predicts a test result on the basis of one or more test results to the same test standard.
  The process applies defined rules that may incorporate calculation procedures.
  The prediction of the test result includes a variation of a product property and/or its intended end us application(s).

In simple terms, this means that a classification is **only valid for the construction build-up used in the test.** Although a reaction to fire classification is a product property, it is only determined in relation with the application (End use application) as this can influence the behaviour when exposed to fire.

With the direct and extended field of application rules it is **possible to cover more products** (different thicknesses) **in different applications** (a test on wooden sub construction is also valid for aluminium sub construction but not vice versa).
But these are based on defined rules, either in the harmonised product standards or in the test standard itself.

# Large scale testing and cladding performance in the event of fire

How does facade cladding behave during a fire? The calorific value of building materials is an important measurement tool to see how it reacts to fire. Compare the calorific values of the most commonly used solutions for facade cladding and find out what they mean for the fire safety of your building.

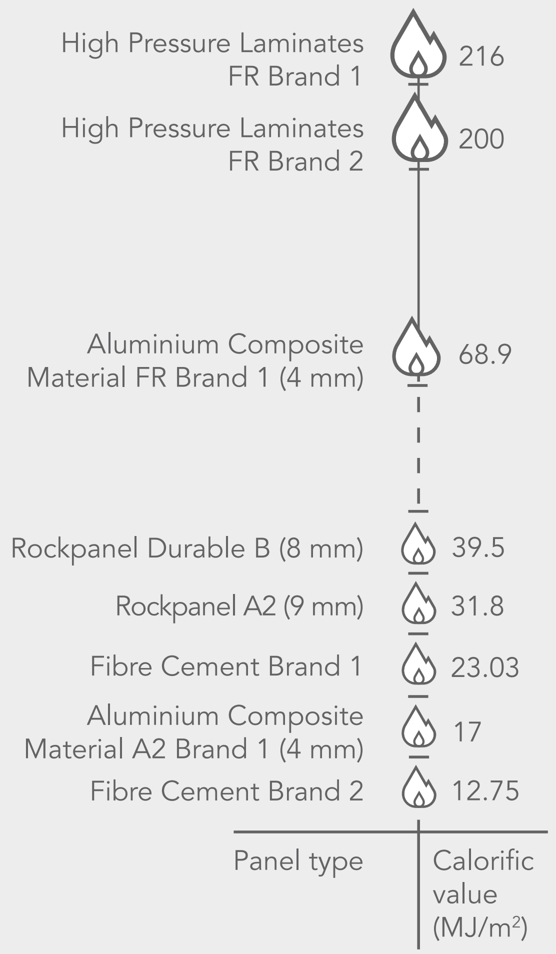
## Why is the calorific value of cladding materials important?

Calorific value is the amount of energy that is produced by the complete combustion of a material. This amount of energy determines how much heat a certain material contributes to a fire. More heat simply means a faster spreading of the fire. The calorific content of a panel is indicated by its PCS (abbreviation of the French term 'Pouvoir Calorifique Supérieur') value. The higher a PCS value is, the more calorific content a panel has. Non-combustible facade material (Euroclass A1 & A2) has a very low calorific value and thus a very low contribution to the fire. The classification of these non-combustible materials has an upper limit on the PCS values.

## Comparing calorific values of facade cladding

In general, the lower the calorific value of a product, the better it is when it comes to fire safety. But what does this imply? When it comes to PCS value, two panels distinct themselves: fibre cement and stone wool (Rockpanel). They both have a very low calorific content. Stone wool, for example, is made from natural volcanic basalt, which can withstand extremely high temperatures naturally .

What we also see when comparing the PCS values of different materials is that some materials come in two versions: a standard version and an FR version (for example some HPL or ACM). The FR version has a similar PCS value, so a similar energy content as the standard version. These products all use fire retardants to achieve a higher classification. These fire retardants do indeed slow down the ignition and burning of the product, nevertheless they are consumed during a fire, so release their energy content at a later time during the fire.




With a low calorific value, Rockpanel A2 board material sets the benchmark for very low combustion heat.

Products in the graph are 8 mm thick unless otherwise indicated.

FR: Fire Retardant

## Large scale testing: introduction

Where reaction to fire is a product property and (except for A1 material) is evaluated for the product in the end use application and by that dependant on the construction, it is not an evaluation of the real behaviour of a construction under realistic fire loads.

In different countries so-called medium scale or large scale test standards were defined to evaluate the behaviour of constructions on a more or less realistic scale. In contrast to the harmonised reaction to fire tests and classification, these large scale tests are not harmonised. The European Commission is working on a harmonised large scale test – the expectation is that this test will be available sometime in the coming years.

## Is large scale testing realistic?

Large scale tests often create the impression they are a realistic simulation of the construction when exposed to fire. Research and experience over the years have shown that this is not the case. Not only are large scale tests a simplification of the real facade build-up under ideal situations (i.e. no windows, no details), the results are also sensitive to the construction build-up. In real life, even the smallest details can influence the final fire behaviour – not just the materials used, but also the amount and position of fire barriers which determine the final behaviour.

Next to these limitations, large scale tests and their assessment are in all standards limited to the construction build up as tested, which means there is no or a very limited extension of results possible. Most standards do not foresee this. When one realises that on a typical large building often multiple construction build-ups are used, it is easy to see that large scale tests have their limits.

The fact that these limits exist, is reflected in recent legislation changes in, for example, United Kingdom where large scale tests are not seen anymore as a route to compliance for certain high-rise buildings (above 18 m).

## Test standards

There are several large scale tests, which differ in fire loads, test set-up, assessment criteria and their place in the national regulation. The best-known examples are:

- BS 8414-1 and BS8414-2: these tests are used in the UK but also abroad as they are also part of the Belgium regulations. The assessment is done in accordance with BR135.
- LPS 1581: this test is used in the UK and has more extended and strict assessment criteria, as the BS8414 series.
- DIN 4102-20: this test is used in Germany and is a medium scale test. It is also part of the Belgium regulation.
- Lepir2: this test is used in France and is also part of the Belgium regulation.
- SP105: this test is used in Sweden.

Not all countries have these large scale tests incorporated in their regulations.

# Rockpanel’s view on the fire safety of facades

As part of the ROCKWOOL Group, Rockpanel shares its position on fire safety of facades. In this position we differentiate between high-rise and high-risk buildings, medium-rise buildings and low-rise buildings.

## High-rise buildings

In high-rise buildings, it is difficult or even impossible for fire services to fight a facade fire. Safe evacuation of occupants is difficult in high-rise buildings and takes time, especially if there is only one escape route or if the escape routes have been compromised by smoke. For high-rise buildings it is thus essential to secure the slowest possible spread of fire and limitation of (toxic) smoke.

This can only be achieved by prescribing the use of non-combustible components and products for the entire facade.

Large scale facade fire tests can never fully reflect the complexity of a facade system, or reflect possible risks due to incorrect installation of the system or damage to it.

The height threshold differs for each country and is (or better, should be) based upon the height the fire service can fight the fire, often determined by the height of the ladders and the access to the building.

## High-risk buildings

For High-risk buildings where evacuation is slow or difficult in the event of a fire, either due to occupants who cannot escape by their own means (e.g. hospitals, care homes, kindergartens, prisons etc.), or due to a high occupancy level (e.g. schools, cinemas, stadiums, shopping malls).

In high-risk buildings, it takes a long time to secure safe evacuation. It is therefore essential to secure the slowest possible spread of fire and limitation of toxic smoke

This can only be achieved by prescribing the use of non-combustible components and products.

Large scale facade fire tests can never fully reflect the full complexity of a facade system, or reflect possible risks due to incorrect installation of the system or damage to it.

## Medium and low rise buildings

For medium and low-rise buildings, fire regulations are less strict. However, the ROCKWOOL Group recommends the use of non-combustible materials as the low-risk option, to our customers.

The advantage of choosing non-combustible materials for any facade is that they will help make a building futureproof, as the function of a building can change.

# Local legislation

Fire safety regulations vary from country to country. They are part of the building regulations or building codes. For ventilated facades, most countries have specific regulations with respect to materials and their application. These specific regulations often include demands on reaction to fire classification of the materials used in a ventilated facade.
In addition, the regulations also incorporate measures to minimize further propagation of the fire to other compartments of the building, like fire barriers and distances between windows and openings.

In the following section you will find a general orientation on the relevant regulations for ventilated facades for your country. This information is based on the regulations as they are at the time this brochure was made.

Please be aware that this is just a general guide, as a material manufacturer, Rockpanel cannot judge the compliance of certain constructions or solutions. For a proper evaluation on compliance please contact a certified fire safety engineer or consultant.

Last but not least, the regulations cover far more topics than the ones highlighted here.

## Understanding fire regulations

There are different regulatory frameworks covering different phases of construction of a building. They are primarily concerned with life safety. Fire safety of buildings is covered by the following:

- During Construction – The Construction (Design and Management) Regulations 2015
- Performance of the Building – Approved Document B
- Management during occupation and use – Regulatory Reform (Fire Safety) Order
- Materials and workmanship – Approved Document 7 2013

Approved Documents and Technical Guidance Documents offer guidance on how to comply with the Building Regulations across the UK and Ireland.

## Technical guidance –
### Approved Document B (fire safety) Volume 1: Dwelling houses and Volume 2: Buildings other than dwelling houses

This practical guidance considers various aspects of fire safety in the construction of buildings:

- Requires safe means of escape from the building
- Requires the stability of a building to be maintained in a fire, both internally and externally
- Fire and smoke will be prohibited from spreading to concealed spaces in a building's structure
- Externally – the external walls and roof will resist spread of fire to walls and roofs of other buildings
- The building will be easily accessible for firefighters and their equipment.

The Regulatory Reform Fire Safety Order now requires a developer or architect to hand over "sufficient" fire safety information to the building's future "responsible person", so they may commission an appropriate "Fire Risk Assessment", for the new building and its occupiers and/or users.

## Scotland

The standards and guidance in the fire safety section of the Technical Handbook (domestic) and Technical Handbook (nondomestic) are designed to work together to provide a balanced approach to fire safety. The purpose of the guidance in Section 2 is to achieve the following objectives in the case of an outbreak of fire within the building:

- To protect life
- To assist the fire and rescue services
- To further the achievement of sustainable development.

Areas covered include compartmentation, structural protection, cavities, internal linings and more.

## Northern Ireland

Technical Booklet E (Fire Safety) is one of a series that has been prepared by the Department of Finance and Personnel (the Department) for the purpose of providing practical guidance with respect to the technical requirements of the Building Regulations (Northern Ireland) 2012 (the Building Regulations) and covers the following:

- Means of escape
- Internal fire spread (linings)
- Internal fire spread (structure)
- External fire spread
- Facilities and access for the Fire and Rescue Service

## Republic of Ireland (ROI)

The provisions set out in Sections B1 to B5 of the Technical Guidance Document B, deal with different aspects of fire safety. The five sections are:

- Means of escape in case of fire
- Internal fire spread (linings)
- Internal fire spread (structure)
- External fire spread
- Access and facilities for the fire service

## Wales

Approved Document B gives guidance for fire safety compliance with the Building Regulations for building work carried out in Wales. It has been published in two volumes. Volume 1 deals solely with dwelling houses, while Volume 2 deals with all other types of building covered by the Building Regulations.

## England

Approved Document B addresses fire safety and has been split into two volumes. Volume 1 deals with dwelling houses and Volume 2 deals with buildings other than dwelling houses. It covers the following:

- Means of warning and escape
- Internal fire spread (linings)
- Internal fire spread (structure)
- External fire spread
- Access and facilities for the fire service

# Building with ROCKWOOL

In order to secure fire safety in your building, all materials used in a facade construction should have a good reaction to fire.
For example, think of the sub-construction and the insulation.

For insulation, ROCKWOOL products, are an excellent choice when it comes to fire safety. Just like Rockpanel facade cladding, they are made from the volcanic rock basalt.

ROCKWOOL fire resilient solutions can slow the spread of flames, contain fires locally and stop them from spreading further. Robust stone wool insulation is a key component in fire-resilient buildings, as its fibres are non-combustible and can resist temperatures above 1,000°C.

The fire protection qualities of these products help increase the safety of occupants – and protect nearby buildings too.

ROCKWOOL™

## Ban on combustible materials in the external walls of buildings over 18m

On the 29th of November 2018, the Government announced a ban on the use of combustible materials in the walls of certain buildings over 18m, effective from 21st December 2018.

The ban is implemented by changes to Regulation 7 of the Building Regulations ('Materials and workmanship') and the guidance in Approved Document B.

> *Regulation 7(2)*
>
> *Subject to paragraph (3), building work shall be carried out so that materials which become part of an external wall, or specified attachment, of a relevant building are of European Classification A2-s1, d0 or A1, classified in accordance with BS EN 13501-1:2007+A1:2009 entitled "Fire classification of construction products and building elements. Classification using test data from reaction to fire tests" (ISBN 978 0 580 598616) published by the British Standards Institution on 30th March 2007 and amended in November 2009.*

Since the ban also covers any 'specified attachment' to the external wall, careful consideration is required when specifying ancillary materials such as insulation fixed to upstands and parapet walls.

The ban applies to any building with a storey over 18m above ground level which:

i. Contains one or more dwellings

ii. Contains an institution (e.g. hospitals, care homes, residential schools, sheltered accommodation, student halls of residence)

iii. Contains a room for residential purposes (excluding hostels, hotels and boarding houses)

It is important to note that the ban applies not just to new-build, but covers 'material change-of-use' as well – so if a tall building may be subject to multiple usage types over its lifetime, building owners and developers should bear this in mind at the outset to avoid having to replace non-compliant materials later. Further information can be found in Section B4 of Approved Document B Volumes 1 and 2.

## Excluded building types

For buildings over 18m that are not covered by the ban on combustible materials contained in Regulation 7(2), there are two principal ways to comply with the guidance provided in Approved Document B.

Beyond the advice given in the current version of Approved Document B, there is a growing recognition that combustible materials in the external walls of buildings can pose a risk to safety – regardless of a building's height.

In July 2019, MHCLG issued a Circular to Building Control Bodies in which they advise "While the use of combustible materials within or attached to the external walls of buildings below 18m are not expressly prohibited, it is necessary to consider the risk from fire spread to health and safety in relation to any height".

*Further, in a January 2020 consolidated MHCLG Advice Note for Building Owners, the Independent Expert Advisory Panel wrote that they "strongly advise that building owners should already be actively ensuring the safety of residents, and not wait for the regulatory system to be reformed". This was followed by a review of the combustible material ban in which MHCLG proposes lowering the height threshold of the ban to 11 metres.*

ROCKWOOL recommends that non-combustible materials (including insulation and cladding panels) be used in the external walls of all high-risk buildings, including:

- All buildings taller than 11m
- All buildings having more than three storeys
- Vulnerable occupancy buildings of any height, including hospitals, schools, sheltered housing, care homes and entertainment venues

For more information about the ROCKWOOL insulation products, please see **www.rockwool.co.uk**, or contact ROCKWOOL on **info@rockwool.co.uk**.

# Other types of facade cladding

The calorific value of building materials has a major effect on their performance during fire. Compare the PCS values of the most commonly used solutions for facade cladding and find out what this means for the fire safety of your building.

## ACP and ACM: what are the risks in fire safety?

**ACP (Aluminium Composite Panels) or ACM (Aluminium Composite Materials)** are flat panels consisting of two thin coil-coated aluminium sheets bonded to a non-aluminium core. The most common ACP core nowadays for facade application is a mineral filled polymer core with fire retardants.

These materials are combustible and have a reasonable reaction to fire performance. ACMs with the highly flammable polyethylene core or polyurethane core without fire retardants have a very poor reaction to fire performance. In the aftermath of the Grenfell fire, they have been withdrawn or even forbidden for ventilated façade application in many countries.

However, this composition is still available on the market. In case of fire, this type of panel can delaminate and expose its core, with attendant consequences. The issue with an exposed core is even becoming bigger when profiled into so-called cassettes (a common application of ACPs). This type of ACM should be avoided at all times for ventilated facade application.

Next to the combustible mineral filled polymer core with fire retardants, most major manufacturers of ACMs also offer products with a mineral filled non-combustible core which results in a lower calorific value.

## How is High Pressure Laminate (HPL) made?

**HPL (High Pressure Laminate)** panels are made of resin impregnated cellulose layers that are cured under heat and high pressure. Among these various layers are those with overlay paper, decorative paper and Kraft paper. HPL panels consist of about 60-70% paper and about 30-40% thermosetting resins. All these materials are combustible by nature and therefore have a poor reaction to fire performance. This performance can be improved by adding flame retardants, but the calorific content of these materials remains high. High Pressure Laminate (HPL) panels contain lots of organic material that will ignite when heated. This makes them combustible and explains why the manufacturers choose to use fire retardants in these products. These are needed in order to pass an SBI test.

However, to be sure of a totally fire safe solution, it is strongly advised to use non-combustible panels and do not risk the somewhat dodgy performance of panels that include fire retardants to 'mask' their high calorific value.

## Fibre cement and fire safety

**Fibre cement** is a composite material, made of cement reinforced with cellulose fibres. Fibre cement boards can be pre-painted or pre-stained or this can be done after installation. The fire behaviour of fibre cement boards is very good, because of their low calorific content.

# Terminology

Fire terminology can be quite confusing. What does fire resistant or fire retardant mean? And what does it mean when building materials are called non-combustible, combustible or flammable?

## What does non-combustible or combustible mean?

**Non-combustible** simply means that a material does not contribute to a fire.
The gradation of non-combustibility is determined by the Euroclass system, where classes A1 and A2 are non-combustible and B-F combustible. Combustible materials have a higher calorific value than non-combustible materials and can therefore contribute to the spread of a fire.

## What does fire retardant mean?

**Fire retardants** are additives that are mostly used with combustible materials, to slow down the ignition of these materials.

## What are flammable materials?

**Flammable materials** ignite more easily than other materials (such as combustibles).
For example, it can burn rapidly with a flame or has a flash point below an arbitrary temperature limit of 50°C.

## What does fire resistance mean?

When a fire does ignite and sets fire to a room, it brings us to the field of **fire resistance**.
This focuses on how long we can keep the fire from spreading between separate rooms or floors (compartments) of a building. Fire resistance is therefore determined by the total engineering, construction and condition of a building. The fire resistance classification is mostly given as a time limit in minutes in which people should be able to safely escape out of a building in case of fire.

## What are fire barriers or cavity barriers?

**Fire barriers or cavity barriers** are elements placed in the cavity of a facade to prevent the spread of fire within the cavity. One can argue that when non-combustible insulation and cladding (Euroclass A1-A2) is used, the risk of fire spread via the cavity is limited. However, the use of cavity barriers is often prescribed in national building regulations or codes. In general, fire barriers can be divided into two categories: vertical and horizontal.

## What is the difference between horizontal and vertical fire barriers?

For rainscreen cladding, often **vertical fire barriers** are used, which are also referred to as **cavity closers**. Their function is to close the cavity at the corners to avoid accumulation of wind load.

**Horizontal cavity barriers** are often designed in such a way that they allow the airflow behind a ventilated façade in normal use and block the cavity when exposed to fire.
For this, either intumescent barriers or metal elements are used.

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