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CAHILL DESIGN CONSULTANTS

TECHNICAL NOTE

THE DIFFERENCE BETWEEN REACTION TO FIRE AND FIRE RESISTANCE

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1. Introduction

1.1 This technical note provides a clear overview of the difference between reaction to fire and fire resistance; two terms commonly confused across the construction industry. Each describes a distinct fire performance property, governed by separate standards and applied in different design contexts.

1.2 Misuse of these terms often leads to inaccurate specification, regulatory setbacks, and gaps in fire strategy development. By setting out precise definitions and practical examples, this document aims to support better-informed decisions and encourage consistent terminology use across project teams.

1.3 All references used are relevant and drawn from recognised industry guidance. The note is intended to contribute to clearer communication and strengthened fire safety knowledge across the sector.

2. What does "Fire Resistance" mean?

2.1 Fire resistance refers to the capacity of a building component—such as a wall, floor, or door—to inhibit the passage of fire, heat, or smoke for a specified duration. It must meet specific test criteria to show it can perform under fire conditions.

Fire Resistance Classification

2.2 Depending on the type of component or building element, specific fire resistance tests are required to assess performance against relevant criteria.

2.3 The relevant EN 13501 series standard is BS EN 13501-2:2016. It covers the fire resistance classification of construction products and building elements, excluding ventilation systems. This standard is the current method used to classify products based on fire resistance and smoke leakage test results, within the scope of the relevant test method.

2.4 The performance of a building component to inhibit the passage of fire, heat, or smoke for a set period is classified using the REI system, as set out in BS EN 13501-2:2016. This rating is expressed in time periods (such as 30, 60, 90 or 120 minutes), depending on how long the component meets required performance criteria.

2.5 REI is three performance criteria defined as:

- R = Loadbearing capacity.
- E = Integrity.
- I = Thermal insulation.

2.6 Other optional fire resistance performance parameters are listed below:

- W = Thermal radiation.
- S = Smoke permeability.

2.7 An example of classification of fire resistance is if a fire protected ceiling remains stable for up to 60 minutes, it can be designated according to BS EN 13501-2:2016 with the abbreviation R60 (load-bearing capacity for 60 minutes).

2.8 Each fire resistance performance criteria is considered individually and can be assessed separately.

2.9 Alternatively, further guidance on previous tests regarding fire performance of construction products can be found in **BS 476-20 to BS 476-24**:

- BS 476-20 for general principles.
- BS 476-21 for loadbearing elements.
- BS 476-22 for non-loadbearing elements.
- BS 476-23 for fire-protecting suspended ceilings.
- BS 476-24 for ventilation ducts.

Note: the **BS 476** series of standards tests is currently being phased out of use.

3. What does "Reaction to Fire" mean?

3.1 Reaction to fire is defined as the degree to which a product or building element will react, by its own decomposition, to a fire under specified conditions. Products are specifically classified accordingly based on their performance.

Reaction to Fire Classification

3.2 Classes of reaction to fire performance A1, A2, B, C, D, E and F (with class A1 representing the highest level of performance and class F the lowest) are applied to products other than floorings in accordance with BS EN 13501-1.

- A1 - rated products are considered non-combustible.
- A2 - rated products are classified as having limited combustibility.
- B to F ratings indicate increasing levels of combustibility.

3.3 Classifications A2, B, C, D and E have additional smoke classifications in relation to the production of smoke (s1, s2, s3). Also, the "d" element refers to the presence of flaming droplet classification (d0, d1, d2).

3.4 BS EN 13501-1 provides further guidance on the classes with their corresponding fire performance:

- Table 1: Construction products excluding floorings and linear pipe thermal insulation products.
- Table 2: Floorings.
- Table 3: Linear pipe thermal insulation products.

3.5 Fire performance classification must be established through testing or an approved extended application. It cannot be used across different product types or classification systems.

3.6 For example, flooring classified as $A1_{fl}$ must be tested using EN ISO-1182 and EN ISO-1716 methods, in accordance with Table 2 of BS EN 13501-1.

4. Practical Implications and Specification Guidance:

4.1 Fire resistance and reaction to fire serve different purposes and must not be confused, as this can lead to non-compliance and poor fire protection.

4.2 Product data sheets must be checked to ensure classification aligns with intended use and tested application.

Table 1 - Practical Use of Fire Performance Classifications

Aspect	Fire Resistance (REI)	Reaction to Fire
Purpose	Prevents fire, heat, and smoke from passing between spaces for a set duration.	Indicates how materials behave when exposed to fire and contribute to fire growth.
Common Applications	Walls, floors, fire doors, structural elements.	Wall linings, insulation, floor finishes.
Typical Misuse	Applying REI ratings to non-loadbearing items	Failure to consider required smoke and flaming droplet ratings when specifying A2–E classified products.

4.3 Responsible parties should verify that a product's classification is an REI rating for structural elements and confirm its relevance to the product's intended application and building location.

4.4 Fire performance classifications should reflect the full tested construction, including substrate, fixings and finishes, as results may not be valid for different installations.

5. Summary and Recommendations:

5.1 Reaction to fire and fire resistance refer to different fire performance characteristics and must be clearly distinguished in design, specification, and compliance processes.

5.2 Fire resistance relates to how long building elements can hold back fire, heat or smoke and is measured using time-based REI classifications set out in standards such as BS EN 13501-2 and BS 476 series.

5.3 Reaction to fire assesses how materials respond when exposed to fire, including their contribution to fire spread, smoke production, and flaming droplets. Classification follows BS EN 13501-1.

Table 2 – Fire Safety Verification Resources and Actions

Key Resources	Recommended Actions
Product Data Sheets.	Check product classifications align with fire performance goals.
Regulatory Guidance Documents.	Integrate fire performance requirements early in project planning.
Installation Records & Certificates.	Confirm that implemented materials match approved specifications.

5.4 Misuse of terminology or incorrect classification may lead to poor design decisions, non-compliance, and compromised fire protection measures.

5.5 Design teams, specifiers and clients should always consult product data sheets, test evidence, and relevant standards to ensure correct classification and intended performance.

5.6 This note encourages careful distinction between the two terms and promotes accurate use of fire safety terminology to support effective design strategies and regulatory compliance.