

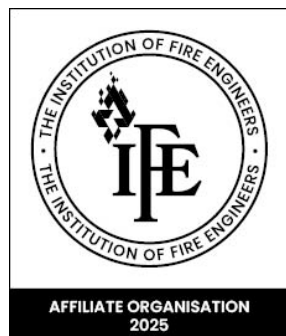


BS476-22 and EN 1364-1 testing

**Commentary and comparison
Kingspan Structural Products**

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Registered Office:

Strufire Ltd
Collingwood Buildings
38 Collingwood Street
Newcastle upon Tyne
NE1 1JF

Registered Number:

16016898 England

EXECUTIVE SUMMARY

This document provides a comparative analysis of two key fire resistance test standards for non-loadbearing wall elements: the British Standard BS 476-22:1987 and the European Harmonised Standard BS EN 1364-1:2015. The focus is on their application to fire-resistant cladding panels, such as those manufactured by Kingspan Structural Products, and the implications for compliance, certification, and market acceptance.

Scope and applicability

BS 476-22 is a UK-specific standard covering a broad range of non-loadbearing elements, including partitions, doorsets, shutters, ceiling membranes, and glazed elements.

EN 1364-1 is harmonised across Europe and applies specifically to non-loadbearing walls, with or without glazing. It is more prescriptive and aims to ensure consistency and comparability across different testing laboratories.

Key Differences

Test Equipment and Conditions:

Both standards use the nominal standard fire curve, but EN 1364-1 employs plate thermometers to monitor the temperature within the furnace. This results in more severe furnace conditions, particularly in the early stages of testing. EN 1364-1 imposes stricter tolerances and more demanding instrumentation requirements.

Specimen Requirements:

EN 1364-1 is more prescriptive regarding specimen configuration, joint placement, and thermocouple layout, while BS 476-22 allows greater flexibility to reflect real-world UK construction practices.

Performance Criteria:

Both standards assess the key performance criteria for *integrity* (preventing passage of flames and hot gases) and *insulation* (limiting temperature rise on the unexposed face).

EN 1364-1 introduces an additional radiation criterion for uninsulated walls and is stricter in its failure logic and classification system.

Reporting:

EN 1364-1 requires more detailed and structured reporting, including comprehensive specimen descriptions, material properties, conditioning, instrumentation, and explicit compliance statements. This supports broader acceptance and certification across European markets.

Regulatory Implications

The UK is transitioning towards the EN harmonised system. From 2 September 2029, the UK's Approved Document B will no longer accept product classifications based on BS 476 testing. This shift is driven by the need for greater consistency, comparability, and international acceptance of fire resistance test results.

Conclusion

EN 1364-1 is the more onerous and comprehensive standard. It imposes stricter requirements and more onerous conditions at every stage from specimen design to reporting.

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All citations to external documents and data sources are noted thus [1].

1 INTRODUCTION

Kingspan Structural Products manufacture fire-resistant cladding panels that have historically been tested to different test standards dependent on the geographical location of the projects being supplied to comply with regional fire safety regulations and statutory guidance.

This document focusses on two of those fire test standards:

BS 476-22:1987	Fire tests on building materials and structures - Methods for determination of the fire resistance of non-loadbearing elements of construction [1]
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BS EN 1364-1:2015	Fire resistance tests for non-loadbearing elements - Walls [2]
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The report documents the features and objectives of each standard with respect to the common areas in the fire resistance tests for non-loadbearing wall elements together with side-by-side comparison summaries for the key aspects where the test methods differ.

2 OVERVIEW

The two test standards can both be used to demonstrate the performance of construction products in fire within common considerations for testing whilst recognising the existence of key differences between the two documents.

Both standards are specific test methods that form part of a larger suite of fire test procedures referencing other fundamental standards for their respective general principles. Although these reference standards are identified in Section 3, there is no explicit comparison made in this report between the two reference documents.

The respective differences between the standards defining the general principles of the test standards shall be reflected as implicit commentary through their influence on the two test standards forming the focus of this report outlined above in Section 1. This approach simplifies the document to a comparison between two documents rather than four.

This document summarises the key aspects of each standard with respect to key section titles or equivalents. The references made to the 'European Norms' documents shall be abbreviated to 'EN' rather than 'BS EN' to provide greater distinction from their British Standards counterparts referred to as 'BS' for the purpose of the report.

3 REFERENCE STANDARDS

3.1 BS 476-22

The testing defined in the standard must be used in conjunction with the general principles outlined in:

BS 476-20:1987	Fire tests on building materials and structures - Method for determination of the fire resistance of elements of construction (general principles) [3]
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3.2 EN 1364-1

The testing defined in the standard must be used in conjunction with the general principles outlined in:

BS EN 1363-1:2020	Fire resistance tests - General requirements [4]
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4 GENERAL FEATURES

The two test standards can both be applied to testing of non-loadbearing walls and have differences in their overall scope and regional application. An overview of the general features and scope of the two standards is shown below in Table 1.

The suite of test standards in the BS 476 series is specific to the UK with a focus on representative testing with a degree of flexibility in the specimen design and installation to reflect actual construction where possible.

The BS 476-22 [1] standard covers testing for non-loadbearing wall elements and also extends to a wider range of testing other non-loadbearing construction elements such as doors, shutters and horizontal membranes and ceilings.

The EN series of standards harmonised across Europe and are more prescriptive than the UK documents with respect to rules governing specimen design, application and extension of results.

The EN 1364-1 [2] standard is specific to non-loadbearing wall only.

Table 1 - Comparison of the general features

Feature	BS 476-22:1987	BS EN 1364-1:2015
Standard type	British Standard	European Harmonised Standard
Region	UK	Europe
Scope	Fire resistance of non-loadbearing elements: partitions, doorsets, shutters, ceiling membranes, glazed elements	Fire resistance of non-loadbearing walls (internal/external), with or without glazing
Referenced standards	BS 476-20	EN 1363-1

5 TEST EQUIPMENT AND TEST CONDITIONS

An overview of the key features for the test equipment types and tolerances required by both standards is shown below in Table 2 together with a view on which of the two standards presents the more onerous requirements for compliance where quantitative comparison can be made.

One of the key differences between the BS tests and their EN counterparts lies within the instrumentation used to monitor the furnace temperature. Whilst both tests adopt the same temperature-time curve for the furnace temperature development of the period of the test, the instrumentation used to monitor that development differs.

The furnace temperature in the BS 476 tests is monitored using wire thermocouples which are more responsive to temperature change due to their lower thermal mass compared to the plate thermometers used in the EN tests. This results in more thermal energy being delivered into the furnace during and EN test to ensure the plate thermometers still record a temperature within the allowable tolerances for their respective test compared to the BS tests.

The difference in thermal energy input between the two tests is most significant in the early stages of the test up to around 10 minutes, after which the energy input required for the two tests tends to converge as the instrumentation types reach thermal saturation.

Table 2 - Comparison of the test equipment and test conditions

Feature	BS 476-22:1987	BS EN 1364-1:2015	More Onerous
Furnace temperature-time curve	Standard fire	Standard fire	Equivalent
Furnace temperature tolerance	<15% (0–10 min) <10% (10–30 min) <5% (>30 min)	15% (5–10 min) decreasing to 2.5% (>60 min) area-under-curve	EN 1364-1
Furnace pressure control	Positive pressure > 5 min Gradient 8.5 Pa/m Neutral axis at 1000 mm Tolerance ± 2 Pa	Positive pressure > 5 min Gradient 8.5 Pa/m Neutral axis at 500 mm Tolerance ± 3 Pa > 10 min	EN 1364-1
Ambient temperature conditions	5–35°C max rise +5°C	10–40°C max rise +20 K max drop –10 K	BS 476-22
Instrumentation: Furnace	Wire thermocouples	Plate thermometers	EN 1364-1
Instrumentation: Specimen	Copper disc + Insulation pad	Copper disc + Insulation pad	Equivalent
Instrumentation: Pressure	Steel pipe probe Resolution ± 0.5 Pa	Specified sensor design ± 2.0 Pa accuracy	EN 1364-1
Test termination	At failure Sponsor request Monitor all criteria	At failure Sponsor request Monitor all criteria	Equivalent

6 SPECIMENS

The two test standards focus on representative specimen sizes and construction requirements with an overview for each test standard is shown below in Table 3.

The BS test allows more flexibility than the EN test which has specific specimen sizes and configurations to achieve consistency across testing facilities.

The thermocouple arrangements for the EN test are also more prescriptive than the BS test, with defined layouts specified to ensure consistency and comparative benchmarking across testing facilities.

This prescriptive approach to the thermocouple approaches is viewed as providing greater consistency and comparability for manufacturers to facilitate the subsequent certification process to demonstrate product performance for cross-border market acceptance.

Table 3 - Comparison of the specimen requirements

Feature	BS 476-22:1987	BS EN 1364-1:2015
Specimen size	Minimum 3 m × 3 m	Minimum 3 m × 3 m or 2.8 m × 2.8 m with supporting construction
Number of specimens	Two specimens unless symmetry or exposure direction is clear	Two specimens unless symmetry or exposure direction is clear
Joints	Must include representative joints used in practice	Requires vertical and horizontal joints with specific placement rules
Edge restraint	1 vertical edge may be free Sealed with mineral fibre gasket	1 vertical edge may be free Seal with non-combustible material
Construction details	Must reflect in-use construction including deflection heads and service penetrations.	Must be representative or designed for widest applicability Includes rules for glazing and framing
Glazing	If >50% glazed, test as glazed element Otherwise as partition	Glazing treated as discrete areas Detailed rules in Annex A
Instrumentation	Thermocouples on unexposed face Additional for glazing	Specific thermocouple layouts with diagrams
Supporting construction	Must have greater fire resistance than specimen	Defined as rigid or flexible Rules for standard vs. non-standard types.

7 PERFORMANCE CRITERIA

An overview of the key features for the performance requirements of both standards is shown below in Table 4 together with a view on which of the two standards presents the more onerous requirements for compliance where a qualitative comparison can be made.

Whilst both tests specify requirements to demonstrate performance for *integrity* to prevent the passage of hot gases and flames from one compartment to another and for *insulation* to prevent the non-exposed side of the partition exceeding specific temperature limits, it is the EN tests and their subsequent classification that provide greater acceptance across construction projects.

This is of particular relevance to construction projects adopting the Eurocode structural design standards where compliance to performance criteria is only demonstrated via testing to the EN standards and the BS standards for the UK are given no explicit reference.

Table 4 - Comparison of performance criteria

Criteria	BS 476-22:1987	BS EN 1364-1:2015	Commentary
Integrity	Defined as the ability to prevent passage of flames and hot gases Failure occurs with sustained flaming (≥ 10 s), cotton pad ignition, or gap gauge penetration	Defined as the ability to prevent passage of flames and hot gases Failure occurs with sustained flaming, cotton pad ignition, or 6 mm/25 mm gap gauge penetration	EN 1364-1 is more prescriptive and detailed in failure conditions
Insulation	Limits temperature rise on unexposed face: mean $\leq 140^{\circ}\text{C}$ any point $\leq 180^{\circ}\text{C}$ above initial Failure occurs when limits are exceeded	Limits temperature rise on unexposed face: mean $\leq 140^{\circ}\text{C}$ any point $\leq 180^{\circ}\text{C}$ above initial Failure occurs when limits are exceeded Includes detailed thermocouple placement and rules for disregarding edge failures under certain conditions	EN 1364-1 is more detailed in instrumentation and edge failure treatment.
Radiation	Not explicitly addressed	Included for uninsulated walls Radiation failure occurs when heat flux exceeds 15 kW/m^2 at 1 m distance	EN 1364-1 includes an additional radiation criterion, making it more onerous
Loadbearing capacity	Not applicable	Not applicable	Equivalent
Failure criteria	Integrity and insulation assessed independently No automatic cross-failure	Explicitly states that failure of integrity implies insulation failure and vice versa in some cases.	EN 1364-1 is stricter in failure logic
Classification	Resistance period dependent e.g. FD30, FD60, etc.	Resistant period dependent e.g. EI30, EI60, etc.	EN classifications have greater cross-border acceptance

8 REPORTING

An overview of the key features for the reporting requirements of both standards is shown below in Table 5 together with a view on which of the two standards presents the more onerous requirements for compliance where a qualitative comparison can be made.

The EN test reports are viewed as more uniform in their structure and contain more prescriptive content requirements which provides greater comparability across test laboratories from different countries.

Table 5 - Comparison of test report requirements

Feature	BS 476-22:1987	BS EN 1364-1:2015	More Onerous
Report structure	Structured but less prescriptive Focuses on tested specimen and test conditions	Highly structured with detailed sections and mandatory inclusions	EN 1364-1
Specimen description	Requires description and drawings Less emphasis on full reconstruction	Requires comprehensive details including drawings, photos, and full reconstruction capability	EN 1364-1
Material properties	Requests for key physical properties and sources	Requires full list of components, properties, and identification marks	EN 1364-1
Pre-test conditioning	Reports moisture content and general state of materials	Specifies conditioning periods and environmental conditions Must be reported	EN 1364-1
Instrumentation layout	Requires thermocouple positions and measurement methods	Requires detailed diagrams and precise placement of all sensors	EN 1364-1
Deviations	Requires justification for deviations	Requires explicit reporting and validation of all deviations	EN 1364-1
Field of application	Limited guidance Results apply to tested specimen only	Mandatory statement of direct and extended application with references to other standards	EN 1364-1
Data presentation	Example format provided Less emphasis on graphical data.	Requires tabular and graphical presentation of all relevant data	EN 1364-1
Compliance statements	Includes disclaimer on applicability to real fires	Requires statements on methods, limitations, and uncertainty of measurement	EN 1364-1

9 SUMMARY

Based on the comparisons made between BS 476-22 [1] and EN 1364-1 [2], along with their respective reference standards BS 476-20 [3] and EN 1363-1 [4], it is evident that EN 1364-1 is the more onerous standard for fire resistance testing of non-loadbearing walls.

This conclusion is driven by several key features that collectively impose stricter, more prescriptive, and more comprehensive requirements across all phases of the test procedures from specimen design and conditioning to the test execution, performance evaluation, and reporting.

The test equipment considerations covered in Section 5 highlighted one of the key differences between the tests with respect to the severity of the test conditions. Test specimens subjected to the EN tests undergo more onerous exposure conditions during the early stages of the test than the BS counterpart due to the instrumentation used to monitor the furnace temperatures. This results in a greater amount of thermal energy being introduced into the furnace during the early period until the instrumentation and test specimens begin to converge to more balanced thermal saturation levels as the test progresses.

The test specimen instrumentation is also more prescriptive and consistent in the EN test with less flexibility and therefore greater comparability across test reports conducted by different testing laboratories. This subsequently provides a means of obtaining product certifications that have greater acceptance across a wider range of market territories than the BS tests.

The above considerations are key drivers behind the decision for the UK to transition from their current dual system of accepting BS and EN certification and move towards the EN harmonised system.

The UK's *Approved Document B* [5] will no longer accept product classifications obtained from BS 476 testing after 2nd September 2029.

10 REFERENCES

- [1] British Standards Institute, “BS 476-22:1987 Fire tests on building materials and structures - Part 22: Methods for determination of the fire resistance of non-loadbearing elements of construction,” BSI, London, 1987.
- [2] British Standards Institute, “BS EN 1364-1:2015 Fire resistance tests for non-loadbearing elements - Walls,” BSI, London, 2015.
- [3] British Standards Institute, BS 476-20:1987 Fire tests on building materials and structures - Part 20: Method for determination of the fire resistance of elements of construction (general principles), London: British Standards Institute, 1987.
- [4] British Standards Institute, BS EN 1363-1:2020 Fire resistance tests - Part 1: General requirements, London: BSI, 2020.
- [5] H M Government, The Building Regulations 2010: Fire Safety - Approved Document B Volume 2, 2019 edition, London: Crown Copyright, 2025.