

A Guide to BS 9999:2008

Code of practice for fire safety
in the design, management and
use of buildings.

BS 9999, which has taken over ten years to develop, was published by the British Standards Institution in October 2008. The document builds on the existing government guidance to provide an enhanced design guide which is based on scientific analysis and research.

Previously, when designing a building, there was a raft of different guidance documents including the 12-part **BS 5588** series of documents. The **BS 5588** series was developed over a period of time, with different parts being published at different times to reflect industry requirements. This approach inevitably led to problems in coordinating the various parts of the series, with the result that some elements of the series were repetitive and contradictory. **BS 9999** consolidates much of the **BS 5588** guidance into one document, reducing the size from over 1000 pages down to around 450 and providing one source of reference. Except for **BS 5588-1**, which deals with residential buildings, **BS 9999** supersedes the **BS 5588** series and replaces the previous draft standard, **DD 9999**.

In addition to providing guidance for a range of specific building features that were previously addressed in the **BS 5588** series, e.g. atria and fire service access, **BS 9999** also provides guidance on general fire safety design using a more flexible risk-based approach. By taking into account the varying physical and human factors related to your building, **BS 9999** allows you to develop a bespoke solution which provides more flexibility than previously available under prescriptive guidance such as Approved Document B.

BS 9999 recognises the importance of a package of measures to ensure the fire safety provisions in a building work effectively. It encompasses all of the areas which should be taken into account when designing a building and advocates a solution for the life of the building, including the level of fire safety management, provision for means of escape and fire fighting and structural stability in the event of a fire.

With **BS 9999** there is an expected level of fire safety management by which the suitability of a solution can be assessed and there is a fundamental assumption that the building will remain managed throughout its lifetime. Approved Document B notes that the Building Regulations do not impose any requirements on the management of a building and that the proper management is assumed. **BS 9999** goes beyond this and recognises that having designed a building, it is imperative that management ensures that the building still functions as it should. The document provides guidance on the function of fire safety management and provides criteria against which that management function can be assessed.

So where does BS 9999 fit in as a guidance document?

BS 9999 goes further than providing technical design guidance; the standard introduces and promotes a new 3-tiered approach to fire safety design. For simple buildings, a design can be based on a **general approach**, following relatively simply guidance such as Approved Document B. One of the main limitations of this type of approach is that it is fairly generic and classifies all buildings as belonging in

Fire Safety Management BS 9999

What level is your fire safety management operating at?



BS 9999 details 3 levels of fire safety management performance.

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just one of the seven main purpose groups. This approach can therefore be unnecessarily onerous or limiting for some buildings.

If you require a more flexible solution, the use of an **advanced approach**, which takes into account the individual characteristics of the building and its occupants, should be used, based on **BS 9999**. Although based on extensive scientific analysis, no fire engineering expertise is needed to adopt this approach; the standard guides the reader logically through the design process using commentary, examples and tabular analysis. Some fire safety knowledge is, however, necessary to realise the full potential of the standard, such as determining if there is a clear benefit to be achieved from automatic fire detection.

For an ultimate optimised design, which might be the only solution for a complex or innovative building, the design should follow a **fire engineered approach**. **BS 9999** is not suitable for this approach; **BS 7974** should be utilised by those experienced and qualified in fire engineering design.

BS 9999 can be used for design of new buildings or as the basis for assessing existing buildings. It may be that fire authorities will use the guidance within **BS 9999** to assess a building, e.g. in relation to the level of management, or fire risk assessments are undertaken which adopt guidance contained within the document.

BS 9999 has greatly expanded on the detail relating to the evacuation of disabled people than was provided in the previous **DD 9999**, now reflecting the ethos of inclusive design. It advocates the use of evacuation lifts to allow all occupants, regardless of their level of mobility, to self-evacuate without reliance on others for their safe evacuation.

Risk profile

To establish the required fire safety provisions, a user of **BS 9999** must establish a Risk Profile for their building (or part of). If the user is equipped with sufficient fire safety knowledge they can determine the risk profile from

first principles, or alternatively refer to one of the many examples provided in the document.

Once the risk profile has been determined, **BS 9999** indicates what minimum package of measures is to be provided i.e. travel distance, stair and exit widths and level of fire alarm. The minimum package of measures is different to those contained in Approved Document B and may be more or less onerous, depending on the perceived risk. If this minimum package cannot be achieved, a fire engineered approach is probably required, which goes beyond the scope of the **BS 9999** guidance document.

If the minimum package of fire protection measures is achievable for your building design, then those measures can be further analysed to see if any flexibility can be achieved through the recognition of the enhancement to fire safety provided by any additional fire protection measures. If a clear benefit can be demonstrated then certain enhancements to the minimum levels can be applied.

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Fire Engineering BS 7974



- Fire Engineering aspects of building control approval
- Computer modelling of fire and evacuation behaviour

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So how are the risk profiles determined?

The first part of the risk profile is related to occupant characteristics. This is important because if someone is unfamiliar with the building, or perhaps asleep, then they will take longer to evacuate than an occupant who is awake and familiar with the escape routes and layout of the building. Risk categories D and E are not dealt with by BS 9999 and other appropriate guidance needs to be referenced for any project relating to these occupancies.

Occupancy Characteristic	Description	Examples
A	Occupants who are awake and familiar with the building	Office and industrial
B	Occupants who are awake and unfamiliar with the building	Shops & assembly
C	Occupants who are likely to be asleep	
Ci	Long-term individual occupancy	Individual flats
Cii	Long-term managed occupancy	Serviced flats
Ciii	Short-term occupancy	Hotels
D	Occupants receiving medical care	Hospitals
E	Occupants in transit	Railway stations, airports

(BS 9999 Table 1 – Occupant Characteristics)

The second part of the risk profile is related to fire growth. The table below is available in BS 9999 to help assess the fire growth, or alternatively somebody with a knowledge of fire safety may be able to determine the expected fire growth rate for your particular situation.

Category	Fire growth rate	Examples
1	Slow	Banking Hall - limited combustible materials
2	Medium	Wooden pallets, stacked cardboard boxes
3	Fast	Stacked plastic products, baled clothing
4	Ultra Fast	Flammable liquids, expanded cellular plastics

(BS 9999 Table 2 – Fire Growth Rates)

The occupancy characteristic and fire growth rate can then be combined to determine an overall risk profile.



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Category	Growth rate	Risk profile	Examples
A	1	Slow	Abattoir
	2	Medium	Office
	3	Fast	Filling room
	4	Ultra fast	Not allowable
B	1	Slow	Reception area
	2	Medium	Bar, gymnasium
	3	Fast	Shop
	4	Ultra fast	Not allowable
C	1	Slow	House conservatory
	2	Medium	Hotel bedroom
	3	Fast	Hotel store room
	4	Ultra fast	Not allowable

(BS 9999 Table 3 – Risk Profile Table)

Achieving the flexibility

The flexibility is realised by looking at additional measures which could be provided beyond what is determined as the minimum standard by the guide. For example, BS 9999 recognises the benefit to escape times that an enhanced fire detection system provides. Also, a high ceiling provides the occupants with a greater time to escape because the smoke will take longer to build down and impact upon the occupants escape route.

The enhanced detection/warning and high ceiling height allows for a number of options where flexibility can be achieved such as an extended travel distance or a smaller exit, stair or corridor width. The allowable options are clearly indicated within the guidance and are simple to use.

The provision of automatic sprinklers provides benefits by allowing the fire growth rate to be reduced. For example, an occupancy that was determined to be a fast fire growth category could, with the inclusion of sprinklers, be downgraded to a medium fire growth category. This reduction in fire growth rate then leads to a change in the fire safety provisions which are required.

Having recognised that flexibility is available using BS 9999,

it is important to understand that this is a whole-package approach and should not be used for part of a design where there is a single issue that you need to overcome. The guidance must be embraced in its entirety for the design to be effective.

After the Fire ...

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Fire resistance

Another important difference to the general approach using Approved Document B is the assessment of fire resistance performance. Approved Document B does not take into account heat from a fire which is lost from the building via ventilation openings. Based on the concept of 'time equivalence', BS 9999 enables the benefit of ventilation from the fire compartment to be realised, resulting in reduced periods of fire resistance if certain levels of ventilation can be achieved.

Worked example

This example shows how some of the fire safety provisions can be determined for a multi-storey shop with a maximum floor height of just under 18m, fitted with automatic sprinklers and an automatic fire detection & alarm system and with ceiling heights of 3.2m.

Step 1 - Risk profile

The combination of awake, but unfamiliar occupants, and a fast rate of fire growth results in a risk profile of B3. However, the presence of sprinklers means the fire growth rate can be reduced and the risk profile is thus B2.

Step 2 – Minimum level of fire detection & alarm system

For a B2 risk profile the minimum recommendation is for a manual fire alarm system.

Step 3 – Travel distances

For the initial B3 risk profile, the travel distance limits were 16m in a single direction and 40m if more than one direction of travel is possible. The reduction in risk profile to B2 (due

to sprinklers) now gives increased limits of 20m and 50m. These limits can be further increased by 15% because of the benefit afforded by the automatic fire detection & alarm system, and by a further 5% due to the ceiling height. The travel distance limits are therefore now 24m and 60m. (Approved Document B recommends limits of 18m and 45m.)

Step 4 – Exit widths

For the initial B3 risk profile, the exit width requirement was 6mm per person (i.e. a 1200mm wide door can accommodate 200 people). The reduction in risk profile to B2 (due to sprinklers) now gives a reduced requirement of 4.1mm per person which can be reduced by 15% because of the benefit afforded by the automatic fire detection & alarm system, and by a further 5% due to the ceiling height. The exit width requirement is now 3.3mm per person – a 1200mm wide door can now accommodate 363 people. (Approved Document B recommends a 1200m wide door can accommodate 240 people.)

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Summary

In summary, **BS 9999** is different to other guidance on fire safety because it:

- Is intended for the life cycle of the building applicable to both new and existing buildings
- Has an expectation relating to the fire safety management of the building
- Allows flexibility of design by taking into account the physical and human factors
- Takes into account a package of fire safety measures, one of the most important measures being management
- Sits between Approved Document B and Fire Engineering
- Is easy to use, logical prescriptive guidance
- Introduces the risk profile concept

This article was written to highlight some of the important differences between **BS 9999** and the other guidance available for fire safety design. For further information and support in using this document please contact **The Fire Strategy Company**.

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