

Fire Compartmentation

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The spread of heat, smoke and fire through a building can increase the damage and impact of a fire on a business. Effective fire compartmentation can help slow down this spread to prevent or reduce losses.



Introduction

Fire compartmentation, or passive fire protection, is used to prevent a building collapse and/or to contain the spread of fire, heat and smoke for a set period of time. As such, it's an essential part of an effective fire safety design of a building. It requires careful design, installation and management to ensure it is up to the right standard and effectiveness.

Effective Fire Compartmentation

Compartmentation is achieved by the provision of a fire-resistant building frame, and the subdivision of the building into fire compartments using fire-resisting materials and assemblies, specifically designed and tested for their resilience against fire. The benefits of compartmentation include:

- Reduction in risk to the building occupants, and providing adequate means of escape, by slowing the spread of fire, heat and smoke, protecting the building structure and hopefully preventing early building collapse
- Subdivision of the building into manageable areas of risk
- Containing the fire size and spread, which will help to assist firefighting operations
- Minimising the heat, smoke, acid gases and water damage to the building and contents, together with the resultant disruption caused to the business

Designing and Specifying Fire Compartmentation

Compartmentation principles depend on whether compartmentation is between:

- Common walls of different adjoining buildings/areas
- Walls and floors within an individual building divided into separate parts and/or occupancies
- Construction around places of special hazard or operational areas which are critical to the organisation
- Other considerations, including:
 - The fire load/occupancy and size of the building
 - Insured values of the building/contents
 - Sensitive nature of the occupancy
 - Importance and value of the business
 - Height of the building (top storey)
 - Provision of automatic sprinkler systems, etc., which could control a fire or slow its spread

In the UK, the Building Regulations detail the legal requirements covering the construction and extension of buildings, although this focuses primarily on life safety and means of escape. This should always be the absolute minimum standard provided, although it is not discussed within this document.

It is important to recognise that these regulations can be inadequate in protecting assets – neither satisfying property owners, businesses and insurers, nor ensuring business resilience. So, additional measures should be considered, including:

- Increasing the fire resistance rating of a compartment
- Reducing fire compartment size or increasing the number of fire compartments
- Providing additional fire compartmentation specifically for high-value or sensitive assets, or for key production equipment or processes
- Providing additional fire compartmentation specifically for equipment or stock susceptible to the effects of fire or its by-products, e.g. smoke damage to a multi-storey building, food or pharmaceutical risk
- Providing automatic sprinkler or automatic fire suppression protection
- Providing appropriate heat and smoke venting systems

Fire resistance

Fire resistance is the ability of the materials of construction such as walls, beams and columns, floors and doors, etc., to resist the effects of fire in one or more ways, for a period of time. There are three primary elements, with each dependent on the purpose of the compartment within the building:

- Structural resistance - the ability of the material to resist structural collapse
- Integrity – the ability to resist the passage of fire, hot gases and smoke, etc.
- Insulation – the ability to resist conduction of heat

It may be that a combination of elements, including all three, are necessary, for example, a:

- Structural floor may require all three elements
- Steel frame may require structural resistance
- Compartment wall within a building may require integrity and insulation

Ensuring compartmentation

When designing a new building, making alterations to an existing building, or changing the occupancy or operations, full consideration should be given to the effects of fire, heat and smoke spread. Each fire compartment must be treated as a fire-resistant sealed box with no gaps or openings through which heat or smoke can traverse.

Effectively installed fire compartmentation will:

- Increase the fire resistance of a structure
- Provide physical resistance against flames
- Provide insulation against heat conduction to adjacent areas
- Limit the effects of smoke/acid gas/fire/water/condensation contamination to other areas of the building

Elements of fire compartmentation

The main elements for consideration to provide adequate compartmentation include:

- Fire protection of structural framework
- Fire-resistant walls
- Fire-resistant floors
- Fire and smoke doors, shutters, dampers
- Fire-resistant glazing
- Provision of fire stopping to penetrating services, both around and within the penetrations
- The protected zone
- Smoke/draft curtains

Fire resistance can be significantly compromised by any weaknesses or omissions of the above elements. Particular care needs to be taken where items such as mechanical and electrical services breach compartments, and where there are junctions within fire-resisting compartments and openings.

Openings and service penetrations through fire compartment walls and floors should be kept to a minimum. This includes ventilation systems; ductwork; utilities; cables; piping systems; drains/waste; service risers; conducting solid elements (e.g. metal beam) traversing a compartment wall or floor, etc.

Note: Special attention should be paid to any floor or ceiling voids directly adjacent to a fire compartment wall.

Structural framework

This typically can be steel but may also be other materials such as reinforced concrete or timber. As steel buckles at relatively low temperatures (loses mechanical integrity at around 565°C) resulting in the possibility of early building collapse, it may be essential to protect a steel frame with suitable fire-resistant coatings or materials.

Walls

These may:

- Separate different adjoining buildings
- Divide an individual building into separate parts and/or occupancies
- Be around a special or specific hazard

A compartment wall may be loadbearing, non-loadbearing or could be considered free standing, and it must maintain the fire integrity and insulation for a specified duration. They should be constructed of materials which are sufficiently robust to resist damage. Depending on the exposure, the wall may need to be parapetted vertically extending above a roof, or horizontally extending beyond or within a perpendicular wall.

Floors

These may separate different horizontal areas within an individual building divided into separate parts and/or occupancies or around a special hazard. A compartment floor must maintain the structural fire resistance, fire integrity and insulation of the floor for a specified duration.

Fire doors and shutters

Doors, shutters and dampers installed within fire compartment walls must have a fire resistance rating for both insulation and integrity commensurate with the rating of the fire compartment wall.

Note: All devices kept normally open should automatically close based on activation of automatic fire detection. This actuation device and mechanism should be based on the risk and appropriate fire signature. Ideally this should be by the site's automatic fire alarm and also from actuation manually by the manual break glass alarm system. See the Aviva Loss Prevention Standard: Fire Doors, Fire Shutters and Fire Dampers for further guidance.

Fire-resistant glazing

Just like fire doors and shutters, fire-resistant glazing and framing installed within fire compartment walls must have a fire resistance rating for both insulation and integrity commensurate with the rating of the fire compartment wall.

Provision of fire stopping to penetrating services

Services may include such items as ducting, electrical cabling, gas and water pipes, etc. Again, the fire-stopping fire resistance should be consistent with the fire compartment wall, which may be achieved by the use of fire dampers, fire-resistant ductwork and fire-resistant enclosures.

Where there are openings or gaps created externally or internally to the penetration, it's more common to use approved fire-stopping products such as mineral fibre batts, intumescent pillows, fire-resistant sealants, mortars, plugs, pipe closures, etc. Fire-rated, certified/approved foam products forming part of a fire barrier should only be used in small linear gaps and are not suitable for larger openings in fire compartment walls.

The protected zone

The purpose of the protected zone is to prevent fire from bypassing the compartment wall at a junction with the **building's external wall, roof, and/or compartment floor in multi-storey buildings**. The objective is to provide, at a junction of a compartment wall, structural frame and wall/roof, the same level of fire resistance as the compartment wall or roof, and typically applies where there are lightweight roof, wall or window claddings. Fitting of mineral board or other fire-resistant materials helps prevent fire leaping from one compartment to another.

Smoke or draft curtains

These are designed to help prevent heat and smoke spreading at high level from one area to another. They may be rigid barriers or a heat resistant fabric, fixed to the ceiling or roof deck. They can be located permanently in position or be manually or automatically operated. **Typically, a smoke curtain has a 'drop' from a ceiling or roof of one metre or two but doesn't reach the floor.**

Installation and Maintenance

When planning new buildings, alterations or changes, it is vital that:

- The materials used for fire compartmentation are suitable for the stated purpose
- Reference is made as appropriate to the Building Regulations and/or fire test reports
- All passive fire protection systems, products and installers selected are approved or listed by internationally recognised certification schemes

It is also advisable to consult with your insurers and other interested parties.

When a building is constructed or completed, details of the building and fire compartmentation, including plan layouts, etc., should be retained for future reference and maintenance purposes. The fire compartmentation should be formally recorded, as should any subsequent alterations, including doors, glazing, services, etc.

It is essential to have a documented maintenance programme for all elements of fire compartmentation, and this may take the form of regular visual examinations through to more formal inspection and testing. Inspections should be undertaken by a competent person, i.e. someone who has the necessary level of knowledge, experience and training to carry out the required duties. A thorough audit and test, where appropriate, should also be completed formally at least annually, and more regularly where there are issues, damage or changes taking place.

Damage or deterioration can occur to any elements of the fire compartmentation, due to:

- Accidental damage
- Wear and tear
- Through the actions of own maintenance or third-party contractors during alteration works or installation of new services, etc.

Any damage should be considered as a fire protection system impairment and such defects should be repaired as a matter of urgency.

Aviva Recommended Fire Resistance Ratings

For property insurance purposes Aviva doesn't recognise 30-minute fire-rated barriers between occupancies as these are designed to assist with safe personnel evacuation. By the time the public fire brigade are contacted, respond to the fire, complete their risk assessments, set up and start actually fighting the fire, 30-minutes could have easily passed. Even if everyone is evacuated from the building, usually manual firefighting efforts will be undertaken largely from outside the property and concentrated on exposure management.

Doors, shutters and dampers installed within fire compartment walls must have a fire resistance rating for both insulation and integrity commensurate with the rating of the fire compartment wall.

IT, server, control room to surrounding areas	At least 1 hour, depending on risk up to 2 hours
Kitchen/cooking facilities to surrounding areas	At least 1 hour, depending on risk up to 2 hours
Utility and plant rooms to surrounding areas	At least 1 hour, depending on risk up to 2 hours
Offices to warehouse	At least 2 hours, depending on risk up to 4 hours
Offices to production	At least 2 hours, depending on risk up to 4 hours
Production to warehouse	At least 2 hours, depending on risk up to 4 hours

The fire resistance rating within a particular occupancy to subdivide (for example, a multi-storey office, a large manufacturing area, multiple production lines, or a large warehouse) should be based on the exposure but not less than the minimum recommended above.

For food processing risks, refer to Table 10 – *Fire resistance durations (in minutes) for compartment walls in food factories* – within the following publication:

[Design Guide for the Fire Protection of Buildings FOOD PROCESSING FACTORIES 1: DESIGN PRINCIPLES](#) - Fire Protection Association

Summary

Based on formal fire risk assessments for property and business needs, a properly designed and joined-up fire compartmentation strategy, consistent with the building occupancy and installed fire protections, and at a minimum meeting any building regulatory requirements, will help prevent or minimise the loss due to the effects of fire, heat and smoke. Appropriately installed and maintained fire compartmentation forms an essential part of the fire risk management strategy and will add immense value to any site.

Checklist

A generic Fire Compartmentation Checklist is presented in Appendix 1, which can be tailored to your own organisation.

Specialist Partner Solutions

Aviva Risk Management Solutions can offer access to a wide range of risk management products and services via our network of Specialist Partners who are reputable companies offering agreed discounted rates for Aviva customers.

For more information please visit:

[Aviva Risk Management Solutions – Specialist Partners](#)

Sources and Useful Links

- Fire Protection Association Shop: [Approved Document B: Fire Safety \(Volume 2 - Buildings other than dwelling houses\) Incorporating Insurer's Requirements for Property Protection](#)
- Fire Protection Association: [BDM2 Design Guide for the Fire Protection of Buildings – Core Document Compartmentation](#)
- Fire Protection Association: [BDM6 Design Guide The Fire Protection of Buildings – Core Document – Protection of Openings and Service Penetrations from Fire](#)
- Fire Protection Association: [BDM7 Design Guide for the Fire Protection of Buildings – Protected Zone](#)
- Fire Protection Association Shop: [Passive Fire Protection Handbook](#)
- RedBookLive: [LPCB Approved Installers and Products](#)

Additional Information

Relevant Loss Prevention Standards include:

- Arson Prevention
- Fire Safety Inspections
- Housekeeping – Fire Prevention
- Smoking and the Workplace
- External and Internal Third Party Exposures – Property Protection
- Fire Doors, Fire Shutters and Fire Dampers
- Smoke Contamination
- Data Cabling

To find out more, please visit [Aviva Risk Management Solutions](#) or speak to one of our advisors.

Email us at riskadvice@aviva.com or call 0345 366 6666.*

*Calls may be recorded and/or monitored for our joint protection.

Appendix 1: Fire Compartmentation Checklist



Location	
Date	
Completed by (name and signature)	

	Fire Compartmentation	Y/N	Comments
1.	Has a formal fire risk assessment been completed that considers property damage and business impact?		
2.	Is the fire compartmentation and use of fire doors consistent with the needs of the site, in particular: <ul style="list-style-type: none"> • Life safety? • Property values? • Business impact/interruption? • Smoke sensitivity? 		
3.	Are there accurate fire compartmentation wall/floor drawings for the site, including: <ul style="list-style-type: none"> • Materials of construction? • Fire resistance in minutes? • Structural resistance – ability of the material to resist structural collapse? • Integrity - ability to resist the passage of fire, hot gases and smoke? • Insulation – ability to resist conduction of heat? 		

	Fire Compartmentation Contd.	Y/N	Comments
4.	<p>Are all the following identified on the fire compartmentation drawings:</p> <ul style="list-style-type: none"> • Ventilation systems? • Extraction systems? • Service risers? • Cable tray runs? • Utility runs? • Pipe runs? • Drainage and waste systems? • Floor and ceiling voids? • Fire/smoke doors? • Fire/smoke dampers? • Fire/smoke shutters? • Intumescent devices? • Draft/smoke curtains? • Heat and smoke vents? 		
5.	<p>Are all fire and smoke doors, shutters and dampers formally listed with a unique identifier?</p>		
6.	<p>Are all penetrations through fire compartments sealed with appropriately approved/listed fire stopping materials?</p>		
7.	<p>How often are formal and documented fire compartment inspections and checks completed by a competent individual:</p> <ul style="list-style-type: none"> • Weekly? • Monthly? • Quarterly? <p>Are issues raised tracked through to completion?</p> <p>Is the return frequency of these inspections based on issues found?</p>		

	Fire Compartmentation Contd.	Y/N	Comments
8.	Are formal annual fire compartment audits completed by a competent individual?		
9.	Is a formal fire compartment audit completed by a competent person following any changes/projects?		
10.	Are ceiling and floor voids included in the fire compartment inspections and audits?		
11.	Are any of the fire walls parapetted? If so, are these areas considered as part of the annual fire compartment audits?		
12.	Is there any damage, deterioration, wear and tear or breaches to the fire protection of the structural framework? If so, what remedial works are planned?		
13.	Is there any intumescent paint on any structural steelwork? If so, <ul style="list-style-type: none"> • Is this included in the fire compartmentation audits? • Does this need reapplication? • Is this near to the end of its effective life? 		
14.	Is there damage, deterioration, wear and tear or breaches to the fire-resistant walls? If so, what remedial works are planned?		
15.	Is there damage, deterioration, wear and tear or breaches to fire-resistant floors? If so, what remedial works are planned?		
16.	Is there damage, deterioration, wear and tear or breaches to fire doors and shutters, including fixings and framework? If so, what remedial works are planned?		

	Fire Compartmentation Contd.	Y/N	Comments
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17.	Are all normally open fire doors, shutters and dampers reviewed by a competent person to check they automatically close with an appropriate interlock to an automatic fire detection system?		
18.	Are all normally open fire doors, shutters and dampers closed when the premises are vacated/at the end of the working day?		
19.	Are all fire door, damper and shutter closure devices visually and formally checked periodically by a competent person?		
20.	Are the automatic closure actuation elements of every normally open fire door, damper and shutter trip tested on an annual basis?		
21.	Are any fire doors propped open at any time, e.g. using wedges, etc.?		
22.	Is there damage, deterioration, wear and tear or breaches to the fire-resistant glazing, including fixings and framework? If so, what remedial works are planned?		
23.	Is there damage, deterioration, wear and tear or breaches to the fire stopping to penetrating services such as air handling equipment, electrical services, piping breaches, etc.? If so, what remedial works are planned?		
24.	Are there any fire dampers within ducting? If so, are they securely fixed, inspected, maintained and tested?		
25.	Is there damage, deterioration, wear and tear or breaches to the protected zone? If so, what remedial works are planned?		
26.	Is there damage, deterioration, wear and tear or breaches to any smoke/draft curtains? If so, what remedial works are planned?		

	Fire Compartmentation Contd.	Y/N	Comments
27.	Are any smoke/draft curtains automatically operated and if so, are they maintained and tested by competent individuals?		
28.	Are there any heat and smoke vents? Are these automatically actuated? Are these in sprinkler- protected areas ? If 'yes', do they only open via manual actuation? Are they maintained and tested?		
29.	As part of any regular fire alarm test, are all automatically interlocked operating devices, e.g. doors, dampers, vents, etc., verified as operating as intended?		
30.	After any regular fire alarm test are all devices verified as being returned to their 'normal' position , e.g. heat and smoke vents not left open, etc.?		
31.	Is the building ventilation interlocked to immediately shut down upon actuation of the fire alarm system? <i>Smoke contamination can be exacerbated if the ventilation is allowed to continue. See Aviva Loss Prevention Standard on Smoke Contamination.</i>		
32.	Are any flammable or combustible liquids used in buildings that if released could pass beneath a closed fire door? If 'yes', are appropriate measures taken to prevent this and maintain the fire compartmentation strategy?		
33.	Is fire compartmentation considered as part of the Management of Change process?		
34.	Are method statements obtained for own staff and contractors who undertake work which could damage or breach the fire compartmentation?		
35.	Where work has damaged or breached the fire compartmentation, is the repair work and its timeframe clearly specified?		

	Fire Compartmentation Contd.	Y/N	Comments
36.	Are only approved and accredited contractors and products used for any new compartmentation projects or repairs to compartmentation?		
37.	After any change or work on site is the fire compartmentation integrity formally signed-off as being consistent with the fire compartmentation drawings or risk assessments?		
38.	Additional comments:		

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