Data Centres – Detection and Fire Protection

This Loss Prevention Standard is one of a series of documents covering data centres and specifically discusses the recommended detection and fire protection measures.

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Introduction

The equipment in data centres is highly sensitive and particularly vulnerable to fire and smoke contaminants. Installing the most appropriate detection and fire protection systems is critical in helping to reduce the potential for loss, damage and business interruption.

This standard outlines recommended detection and fire protection systems for data centres, enabling the selection and application of suitable solutions to reduce the likelihood of fire development and mitigate potential spread.

Note: This document relates to data centre detection and fire protection systems. It is not for on-site data processing and storage facilities, typically provided within business premises to support other trading activities. Please refer to the Aviva Loss Prevention Standard Server/Comms Rooms for further guidance on such facilities. This document focusses on Property loss prevention and related risk management guidance and is not intended to address Business Interruption or Liability exposures. The presumption is that all regulatory requirements, such as Fire Risk Assessments, have been met.

Understanding the Risks

Data centres are large and connected structures relying on multiple systems, e.g., cooling, ventilation, power/back up power, dust controls, etc., to function efficiently. A loss event, such as a fire, could result in not only significant material damage, but also disproportionate business interruption losses. As such, ensuring the most appropriate detection and fire protection systems are installed can significantly help to reduce the risks of fire growth and spread. These risks include but not limited to:

- **Concealed Voids**. Data centres feature a number of voids for services and cabling, ceiling ventilation and suspended floors. These can support uncontrolled fire spread.
- **Fire-stopping**. Inadequate fire stopping may allow the fire to spread through fire compartment walls from non-business critical areas, such as stores and offices, to the data halls or from one business critical area to another. In addition, inadequate fire compartmentation and penetration sealing can significantly compromise fire detection and fire protection systems.
- **Fire Load**. The fire load present is from combustible materials in the server hardware and associated cabling, e.g., plastics, rubber, etc. These materials have the potential to generate significant heat and smoke, even from a small fire. Redundant equipment and cabling should be removed to reduce the overall fire load. In addition, server equipment is typically housed closely to maximise space efficiency.
- **Housekeeping**. Housekeeping should be maintained to the highest standards. Critical business areas should be maintained free from ordinary combustible materials and stored goods, spares, filing, furniture, etc., should be segregated from exposing the operational equipment.

- **Lithium-ion Batteries**. Battery backup systems (BBUs) and Uninterrupted Power Supplies (UPS) commonly use lithium-ion batteries, which when damaged, faulty or otherwise compromised can lead to thermal runaway, off gassing, fire and/or explosion.
- **Ventilation.** Ventilation system design and configuration can severely impact the ability of detection and fire protection systems to actuate as designed and installed. Air velocities and air movement present challenges to both.
- **Detection and Fire Protection**. Inappropriately designed and/or installed detection and fire protection systems, or those that are not inspected, tested and maintained as required, can lead to larger than expected fires and associated damage.

Management Programmes

Material Damage Risk Assessment

Before installing any detection and fire protection systems, an assessment of the anticipated or potential financial losses, for both material damage and business interruption exposures, should also be undertaken.

This helps ensure the detection and fire protection systems are sufficient and reflective of the potential property loss estimates.

Refer to the Aviva Loss Prevention Standards **Material Damage Risk Assessment** and **Business Impact Analysis** for further guidance.

Detection and Fire Protection Systems

The effective performance of detection and active fire protection to detect gas or fire events and suppress, or extinguish fires, relies on good design, installation and ongoing management.

Automatic Gas Detection

Automatic gas detection systems, designed for the detection of lithium-ion battery off gassing, should be considered within UPS rooms and server racks housing BBU systems. The gases released by these batteries during a fault event are both heavier and lighter than air and as a result, detection may need to be installed at floor and ceiling level.

Automatic Fire Detection

Data centre buildings should be covered by an automatic fire detection system that is compliant with national standards, regulations, or codes., but also is designed to consider the Property Damage and Business Interruption risk.

- In the United Kingdom such systems should be compliant with Category L1 or P1 of **BS 5839-1:2017 - Fire detection and fire alarm systems for buildings - Code of practice for design, installation, commissioning, and maintenance of systems in non-domestic premises**.
- Systems in Ireland should be compliant with Category L1 under **I.S. 3218:2013+A1:2019 Fire detection and alarm systems for buildings - System design, installation, commissioning, servicing, and maintenance and Amendment.** This is vital for life safety and early notification to the Fire and Rescue Service.

Based on the arrangements of the data hall, the nature and type of automatic fire detection needs to be carefully selected. This includes the nature of the detection device and the associated spacing. This must be based on the following:

- Business criticality of the data hall.
- Size and combustible loading of any floor voids.
- Size and combustible loading of any ceiling voids.
- Fire compartmentation strategy.
- Nature of the ventilation systems:
  - ✓ Air velocities – excessive velocities and air stratification prevent smoke from reaching detection devices at ceiling level.
  - ✓ Stagnant air pockets can be created within the equipment stacks, at the corners of the room or within any voids. In the early stages of a fire scenario any detection devices in these areas may not actuate as required.
  - ✓ Air circulation versus fresh air make-up and extraction. Provide fire detection on the inlet to the air recirculation and in any air exhaust lines.
  - ✓ Ventilation provision within any voids, etc.
- Safety interlocks provided that actuate upon alarm activation.
- Expected emergency response from on-site officials.

Given the criticality of the data centre, the use of high sensitivity normally aspirating detection technology, which can provide very early warning of fire events, over more standard point detection, is recommended.

The detection should extend to floor or ceiling voids as appropriate, and guidance should be obtained from an accredited fire alarm installer.

A means of manually raising the fire alarm should also be provided within the data hall in multiple locations, but especially at exit points to the hall. A means of manually raising the alarm should also be provided in the areas outside of the hall.

Speed of response is critical in helping to identify and resolve issues before fire can develop and spread and fire protection systems deploy. As such a response strategy should be formalised, particularly where the automatic fire detection system is interlocked to a pre-action automatic fire sprinkler system (see below).

Finally, when it comes to an automatic fire detection being used as an actuation mechanism for a fire suppression system or other purpose, one needs to consider the arrangement of the detection from a 'logic' perspective. Is the system:

- A single knock system (i.e., one detector or detection zone alarms).
- A double knock system (i.e., two detectors or detection zones alarm).

This is critical when considering how a system will operate to ensure maximum reliability, including when there is a system impairment.

For reliability purposes the detection system should be designed so that fire protection system actuation is based on:

- Single knock ideally, or
- Double knock – based on any 2 detection devices in the protected zone actuating. This should include the detection devices within any voids.

Where automatic fire protection systems are interlocked to operate upon actuation of the fire detection system, always consider there to be an impairment to a detection device or zone, as appropriate. In many instances the entire fire protection system can be compromised by the impairment of one fire detection device. This should be considered within the design.

Note: Please refer to the Aviva Loss Prevention Standard **Data Centres - Cooling and Ventilation** to understand the implications of these systems on the fire detection strategy.

Video Surveillance Systems

Whilst this may be considered as part of an overall security strategy, the use of appropriate (intelligent) video surveillance cameras located in advantageous positions that are also monitored or interlocked to other actions, may support any detection and protection strategy. These should be considered as part of an overall joined up approach.

Automatic Fire Protection

Automatic sprinkler systems are widely recognised as the most reliable means of suppressing fire at its seat and limiting the extent of fire damage and water damage. As such, automatic sprinkler protection should be installed throughout the entire data centre building including all data halls, control rooms, UPS rooms, ancillary stores and floor and ceiling voids where appropriate.

The type of automatic sprinkler system selected for each area of the data centre will have an impact on the speed of response in a fire situation.

- **Wet Pipe System**. A wet pipe sprinkler system is the most reliable sprinkler system and has the least amount of delay before water can suppress a fire at its seat. In normal circumstances, sprinkler systems designed and installed to an agreed standard will suppress a fire by the action of 2-6 sprinkler heads actuating.
- **Pre-action System**. With this design the sprinkler pipework is normally charged with a low-pressure supervisory air supply. The supervisory air is provided to help establish if there are any 'leaks' in the sprinkler system.
  - ✓ **Single Interlock or Type B Pre-action System (EN 12845: Fixed firefighting systems. Automatic sprinkler systems. Design, installation and maintenance)** The sprinkler pipework only charges with water when the automatic fire detection within the protected room alarms. The sprinkler system will then operate as a wet pipe system upon sprinkler head activation.
- **Dry Pipe Sprinkler System**. With this design, the sprinkler pipework is normally charged with air that is higher pressure than a pre-action system. The higher air pressure is not supervisory but holds the sprinkler system alarm check valve closed.
  - ✓ In a fire scenario, the sprinkler head activates and the air is released from the sprinkler system pipework. The air pressure drops and the alarm check valve is released allowing water to flow into the sprinkler system and to the activated sprinkler head, so putting water on the fire at its seat.
  - ✓ Because of the air pressure and the time to exhaust the air, a dry pipe sprinkler system is normally slower to suppress a fire than both wet pipe and pre-action system.
  - ✓ Because the air pressure in a dry pipe system physically holds back the water, any air leak in the system causes the air pressure to drop and can cause the unwanted system trips.

A suitably accredited sprinkler maintenance company, such as one approved to LPCB Loss Prevention Standard **LPS 1048: Requirements for the approval of sprinkler system contractors in the UK and Ireland,** should be used to design and install the sprinkler system.

Sprinkler System Hydraulic Design

The design of the automatic sprinkler system in each area of the data centre needs careful consideration based on the proposed occupancy. For a full specification and a design accepted by an insurer, please engage with your insurer and broker as soon as possible. Design densities and associated dedicated fire water supplies and their duration need to be agreed and confirmed by all parties. As a guide:

- Data hall – High Hazard - 7.5mm/min over 260m² for wet and single interlocked systems with a maximum sprinkler spacing of 9m².
- Where BBU / UPS systems installed within server racks - 12.5mm/min over 260².
  - ✓ Localised battery BBU systems are increasingly common within data halls and typically located within server racks. Where localised BBU systems are planned ensure the number within server racks is minimised as far as achievable and positioned to enhance ventilation and maintain full coverage by detection and fire protection systems.
- Office areas – depending on the physical arrangements but these are normally ordinary hazard.
- Storage rooms – the design would be based on the proposed physical arrangements and storage arrangements.
- Utility rooms - High Hazard - 7.5mm/min over 260m².
- UPS or similar rooms – 12.5mm/min over the entire room.

Type of Sprinkler Head

Based on the exposure of the data hall, the type of the sprinkler head to be used in the majority of areas in a data centre are recommended to be quick response sprinkler heads with a lower response time index. These sprinkler heads react quicker in a fire than standard heads.

Important: If sprinkler systems are proposed to be installed within any data centre building the proposed design including hydraulic densities must be reviewed and accepted by your Property Insurer.

Other Fire Protection

Important: If other fire protection systems, such as those presented below, are proposed to be installed within any data centre building this must first be reviewed and accepted by your property insurer.

In some instances where the exposure created by the data centre and particularly the data hall is high, in addition to automatic fire detection and automatic sprinkler protection, additional fire protection systems such as a gaseous extinguishing system may be recommended in the data hall. This is to provide layers of protection in the protected space based on different fire signatures and associated business impacts, for example:

- Smoke detection alarms.
- Actuates gaseous fire extinguishing – this extinguishes the fire when it is small (before the sprinklers actuate); it is a clean agent, requiring limited clean up.

However, if the fire compartment has been compromised by a cable penetration in the floor void, or the ventilation does not shut down, or the power is not isolated and the extinguishing gas concentration is not held and the fire grows, or the fire reflashes, the sprinkler system will eventually actuate and suppress the fire at its seat.

Panel. One consistent failing of localised fire protection systems is panel key management. Panel keys should not be left in situ in the panel itself. Panel keys should be kept in a secure area and there should be a formal key management process for authorised individuals who need to access the panel key. The management of suppression systems when switching from automatic to manual status requires strict control.

Gaseous Fire Suppression Systems

Any gaseous fire suppression system should be designed, installed, and maintained by a competent, and where applicable, a suitably accredited company. Companies specifying gaseous suppression systems in the UK should by certificated to **LPS 1204 - 3.1 Requirements for firms engaged in the design installation, commissioning, and servicing of gas extinguishing systems**.

Gas Selection. There are a number of different gases available and the type of gas selected and the system design should be discussed, reviewed and accepted with your property insurer.

Over Pressure Protection. Rooms featuring some gas systems (inert gases) must have over-pressure ventilation fitted to protect against over-pressurisation. The suppression system in some cases can increase the overall gas volume within the data hall by around 40% within one minute of operation, and ventilation helps prevent damage to walls, ceilings, and doors.

System Design. Regardless of the gas proposed to be used, the system design needs to be fully understood and aligned to an appropriate standard. Prior to the gas discharging will the:

- Ventilation within the data hall remain on?
  - ✓ Will it exhaust?
  - ✓ Will it remain recirculating or will it shut down?
  - ✓ This will impact the volume of gas required, the gas settling rate and concentration profile of the gas in the Hall.
- Power to the data hall shut down or remain operating? This may impact the need for a connected reserve (see below) or not. If the power is not shut down, the potential for fire reflash once it is extinguished exists but the gas concentration reduces below the extinguishing concentration.

System Actuation. The actuation of any gaseous suppression system must be reliable. As a result, having the appropriate automatic fire detection provided and actuation logic is essential. This should include having manual activation devices located outside the data hall adjacent to exit doors. The gas can therefore be released either automatically or manually upon detection of a fire.

Enabling Device. If required, a system enabling device can be provided within the data hall adjacent to the exit door(s). This should not be provided outside of the data hall. When this button is depressed, the gas is not discharged. However, once released, the gas release cycle re-commences and gas would be discharged a short time after. The time delay setting is based on the time required for personnel to exit the protected space e.g. 60 seconds. This was formerly known as a ‘dead man button’.

Connected Reserve. Once a gas has been discharged, the space is unprotected. In some instances, where the exposure warrants, insurers may prescribe a connected reserve of gas cylinders able to provide additional suppression gas. If this is provided, the

mechanism to switch from the primary bank of cylinders to the secondary bank of cylinders will need to be prescribed. This being either manually or automatically.

Room Integrity. The protected data hall must be capable of containing the gas for the design concentration for the recommended 'hold time'. The hold time is prescribed within the relevant design standard. As a result, all openings and gaps will need to be sealed as effectively as possible and the room will need to pass a 'room integrity test'. This is a non-destructive test that is simple to complete and will help establish the hold time of the protected data hall. If the hold time is less than that as prescribed in the design standard the data hall will not be considered as protected.

Important: Room integrity tests should be repeated after every change to the room and at least annually.

As an example, the current version of **BS EN 15004 - Fixed firefighting systems. Gas extinguishing systems** stipulates the room must be capable of holding the agent for a minimum of 10 minutes, and a room integrity test must be undertaken at the commissioning stage, and as part of ongoing routine maintenance, or following changes to the infrastructure to ensure compliance.

Relevant standards in the United Kingdom, depending on the gaseous system used, include:

- **BS EN 15004-1: Fixed firefighting systems. Gas extinguishing systems. Design, installation, and maintenance**.
- **BS EN 15004-10: Fixed firefighting systems. Gas extinguishing systems. Physical properties and system design of gas extinguishing systems for IG-541**.
- **LPS 1230 - 1.2 Requirements for fire testing of fixed gaseous fire extinguishing systems**.
- **BS ISO 14520-1 Gaseous fire-extinguishing systems - Physical properties and system design - Part 1: General requirements**.
- **BS7273: Electrical actuation of gaseous total flooding extinguishing systems**.

Note: Carbon Dioxide based systems may be potentially suitable for use in such environments. However, they present significant life safety hazards requiring careful management especially in relation to 'sneak paths' outside of a protected space.

Note: Hybrid gaseous and water mist systems are available. Any plans to install such systems should be discussed with your property insurer and broker.

Refer to the Aviva Loss Prevention Standard **Gaseous Fire Extinguishing Systems** for further guidance.

Water Mist

Important: If water mist systems are proposed to be installed within any data centre building this must be reviewed and accepted by your property insurer.

These systems emit finely divided water droplets under high pressure through small orifice nozzles to produce a mist. This mist thermodynamically cools the fire via evaporation of the water particles and reduces the oxygen within the compartment by steam displacement. The system requires less space than other fixed protection systems, typically comprising a small water tank and pumps but is bespoke to every installation and will be designed to meet the requirements of the data hall e.g., size and volume, fire load, fire behaviour, room sealing, etc.

Systems should comply with a recognised test standard, such as **FM 5560 Water Mist Systems**. Other related standards include:

- **FM 5-32 Data Centres and Related Facilities**
- **FM 4-2 Water Mist systems**
- **NFPA 750 Standard on Water Mist Fire Protections**

Refer to the Aviva Loss Prevention Standard **Water Mist Fire Protection Systems** for further guidance.

Hypoxic Air

Also known as oxygen reduction systems. These operate by maintaining oxygen levels within the 'protected space' below 15% by volume. This is completed by the separation of oxygen from the atmosphere, thereby increasing the volume of nitrogen gas and reducing the probability of ignition.

Caution should be applied when permitting new materials into the environment which contain an air supply or chemicals that oxidise in the absence of air. The protected environments are generally safe to access by humans for limited periods; however access should be based on risk assessment, which considers time limitations and any health issues or concerns of authorised persons.

Any such system should be compliant with a recognised test standard such as **BS EN 16750:2017+A1:2020 Fixed firefighting systems. Oxygen reduction systems. Design, installation, planning and maintenance** in the United Kingdom.

Important: The integrity of the protected space is critical in these applications. Otherwise, 'fresh air' will be drawn into the protected space.
Important: Having appropriate oxygen gas concentration detectors located throughout the space is critical in these applications.
Important: The arrangement and reliability of the equipment used to create the oxygen depleted environment is critical in these applications. E.g. reliability of power supplies, arrangements of cables etc.

Relevant standards in the United Kingdom include:
- **BS EN 15004-1:2019. Fixed firefighting systems. Gas extinguishing systems. Design, installation, and maintenance.**
- **LPS 1230 – 1.2 Requirements for fire testing of fixed gaseous fire extinguishing systems.**
- **BS ISO 14520-1 Gaseous fire-extinguishing systems – Physical properties and system design – Part 1: General requirements.**
- **NFPA 2001 – Standard on Clean Agent Fire Extinguishing Systems**

Note: Hypoxic air systems are not normally recommended for data halls. Any plans to install a Hypoxic System systems should be discussed with your property insurer and broker.

Alarms

All alarms associated with detection and fire protection systems should be connected to a constantly attended location or an approved Alarm Receiving Centre. This includes all fault, trouble, isolation etc, alarms as well as activation, fire and discharge alarms. Where needed, 'fire' alarms should raise a site fire alarm.

Important: Any alarm raised should result in an immediate response and escalation as needed.

Note: An accredited fire alarm installer can provide further guidance.

Interlocks

When considering the detection and fire protection strategy of a data centre, and the data hall in particular, careful attention must be given to the interlocks and the associated cause-and-effect philosophy. If these interactions are not fully understood, designed, and coordinated, the detection and fire protection systems may fail to operate or may not perform in accordance with their design requirements.

Interlocks therefore need to be considered, documented, and managed carefully, supported by a fully integrated risk assessment.

Key interlocked systems to evaluate include, but are not limited to:

- Gas detection provided for UPS rooms.
- Fire alarm activation:
  - ✓ First-stage/first-knock alarm.
  - ✓ Second-stage/second-knock alarm.
- Fire suppression system agent discharge.
- Sprinkler system waterflow signals.

Areas requiring detailed consideration include, but are not limited to:

- Fire door closure.
- Ventilation and environmental control systems:
  - ✓ Recirculation.
  - ✓ Shutdown.
  - ✓ Speed reduction.
- Power supply shutdown to the affected area
- UPS and generator system isolation or actuation
- Activation or shutdown of critical equipment
- Gas supplies and related services

Where installed, any interlocks should be tested at least annually and restored and verified following any impairment to the detection and fire protection systems.

Inspection, Testing and Maintenance

- **Acceptance Tests.** Any new or revised detection or fire protection system will need to be fully reviewed by your property insurer and full field acceptance test witnessed to confirm the systems are installed and operate as designed. This may include actuation and discharge tests.
- Automatic sprinkler systems and associated fire water supplies (including fire pumps) should be serviced and maintained in accordance with installer recommendations, based on guidance within accepted international standards such as **BS EN 12845+A1: Fixed firefighting systems. Automatic sprinkler systems. Design, installation and maintenance** or **NFPA 25 Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.**
  - ✓ A suitably accredited sprinkler maintenance company, such as one approved to LPCB Loss Prevention Standard **LPS 1048: Requirements for the approval of sprinkler system contractors in the UK and Ireland**, should be used to maintain the sprinkler system.
- Any other fire protection systems should be visually checked at least weekly to assure they are in good working order.
  - ✓ They will need to be serviced and maintained in accordance with installer recommendations.

- ✓ Any alarms and interlocks associated with the systems will need to be tested at least annually.

- Detection systems will need to be serviced and maintained in accordance with installer recommendations.
  - ✓ Whilst BS 5839-1 states fire detection systems should be inspected and serviced by a competent person at least every six months, three monthly is recommended for data centre premises.
- Detection and alarm systems should be checked in accordance with installer guidelines to ensure there are no faults and the system is working correctly. In the United Kingdom this is usually:
- Daily - Check the fire alarm panel for faults.
- Weekly - A weekly fire alarm test, activating one manual call point on a rotating basis.
- Monthly - Systems with standby batteries or generators require monthly checks to confirm power supply reliability.

  Your fire alarm installer can provide guidance in this regard.
- The integrity of the data hall or any protected space will need to be visually checked regularly and a fire compartment wall audit will need to be completed at least annually, to ensure the room integrity has not been compromised, e.g., damage to doors, seals, new openings for cables, removed ceiling panels, etc.

Impairments

Ensure any impairments relating to detection and fire protection systems are reported to your property insurer and broker. Temporary changes may be necessary to some arrangements whilst impairments are ongoing.

Important: With the values exposed at some data centres impairment management is considered critical and may be a condition of the insurance policy.

Refer to the Aviva Loss Prevention Standard **Impairment Management** for further guidance.

Manual Fire Extinguishers

Ensure appropriate numbers of fire extinguishers are present within the facility suited for use on electrical fires and other classes of fire within the facility.

In the data halls, the fire extinguishers should only be clean agent extinguishers.

Important: Whilst dry powder type appliances may be suitable for such facilities, damage caused by residues to non-affected equipment can be extensive and therefore are not recommended.

The Aviva Loss Prevention Standard **Fire Extinguishers** provides guidance on the number, type, location of appliances along with guidance on selecting a competent installer.

Training

Ensure appropriate training on detection and fire protection systems is provided to relevant stakeholders to reflect their level of responsibility. This should include investigation of alarm activations and escalation procedures.

- Fire systems maintenance companies will be able to provide training on the routine checks and the weekly/monthly testing requirements.

- This to include fire extinguisher training.
- Ensure this training is documented and reviewed routinely.
  - ✓ New starters should receive training before commencement of fire checks/testing duties.
- Dry-run exercises are recommended to test emergency response procedures.

Specialist Partner Solutions

Aviva Risk Management Solutions can offer access to a wide range of risk management products and services at preferential rates via our network of Specialist Partners.

- Fire risk assessment **Cardinus Risk Management.**
- Electrical/Lightning installation testing and explosion/DSEAR Risk Assessments **Bureau Veritas.**
- Thermographic imaging and PAT testing **PASS**
- Automatic detection and portable extinguishers **SECOM**
- Business continuity **Horizonscan**

For more information please visit: Aviva Risk Management Solutions – Specialist Partners

Sources and Useful Links

- BS 5839-1:2017 - Fire detection and fire alarm systems for buildings - Code of practice for design, installation, commissioning, and maintenance of systems in non-domestic premises.
- LPS 1204 : Issue 3.2 Requirements for Firms Engaged in the Design, Installation, Commissioning and Servicing of Gas Extinguishing and Condensed Aerosol Systems.
- British Standard BS5306 – Fire Extinguishing Installations and Equipment on Premises.
- BS EN 16750:2017+A1:2020Fixed firefighting systems. Oxygen reduction systems. Design, installation, planning and maintenance.
- BS EN 15004 - Fixed firefighting systems. Gas extinguishing systems.
- BAFE Scheme SP101 Competency of Portable Fire Extinguisher Organisations and Technicians.
- British Standard BS5306 – Fire Extinguishing Installations and Equipment on Premises.
- LPS 1230 – 1.2 Requirements for fire testing of fixed gaseous fire extinguishing systems.
- BS ISO 14520-1 Gaseous fire-extinguishing systems – Physical properties and system design – Part 1: General requirements.
- BS EN 16750:2017+A1:2020 Fixed firefighting systems. Oxygen reduction systems. Design, installation, planning and maintenance.
- BS7273:2006 Electrical actuation of gaseous total flooding extinguishing systems.
- NFPA Codes and Standards
- BS EN 12845:2015+A1:2019 Fixed firefighting systems. Automatic sprinkler systems. Design, installation and maintenance

Note: Whilst UK standards and legislation are referenced in this document, other international standards and legislation should be referenced where applicable.

Additional Information

Relevant Aviva Loss Prevention Standards include:

- **Data Centres - Planning and Design**
- **Data Centres - Construction**
- **Data Centres - Escape of Water and Other Fluids**
- **Data Centres - Cooling and Ventilation**
- **Data Centres - 15 Top Tips**
- **Data Centres - Fire and Smoke Resilience**
- **Gaseous Fire Extinguishing Systems**
- **Property and Business Impact Risk Assessment**
- **Sprinkler Systems - How they Operate**
- **Impairment Management**
- **Fire Extinguishers**

To find out more, please visit Aviva Risk Management Solutions **or speak to one of our advisors.**
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