

Loss Prevention Standards – Asset Classes

# Data Centres – Fire Detection and Protection

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



# Data Centres - Fire Detection and Protection



## Introduction

Aviva Loss Prevention Standard **Data Centres – General Overview and Design Considerations** provides an overview of the main activities, equipment, and guidance on design aspects, whilst **Data Centres – Hazards and Ongoing Care** discusses the commonly occurring hazards, and guidance to help manage such hazards.

This standard provides guidance on the recommended fire detection and protection systems for data centres, helping you select the most appropriate systems to reduce the risks of fire development and spread.



**Note:** This document relates to data centres. It is not for on-site data processing and storage facilities, typically provided within business premises to support other trading activities, however, refer to 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 catastrophic loss event, such as fire, could result in not only significant material damage, but also disproportionate business interruption losses. As such, ensuring the most appropriate fire detection and protection systems are installed can significantly help to reduce the risks of fire growth and spread. These risks include:

- **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 load.** A high fire load is presented by combustible materials in hardware e.g. plastics, rubber etc. Server equipment is typically in close proximity to maximise space efficiency.
- **Housekeeping.** Poor housekeeping such as stored goods and spares, filing, furniture etc.
- **Fire-stopping.** Inadequate fire stopping which may allow the fire to spread from stores, offices, data halls etc., potentially through the property.
- **Detection and Fire Protection.** Inadequate or faulty fire protection and automatic fire detection systems can lead to potential delays in responding to fires, leading to more extensive damage.

## Business Impact Assessment

Before designing fire detection and protection systems, an assessment of the anticipated/possible financial losses, for both the material damage and business interruption exposures, in the event of a significant or catastrophe loss event should be undertaken. This helps ensure any fire detection and protection systems are sufficient and reflective of the potential loss estimates.

## Automatic Fire Detection and Protection Systems

The effective performance of automatic fire detection and active fire protection to detect and suppress, or extinguish fires, relies on good design and management. Ensuring the most appropriate fire protections and automatic fire detection systems are installed helps reduce the potential for impaired performance when called upon.

### Automatic Fire Detection

The data centre premises should be covered by an automatic fire detection system, compliant with national standards, regulations, or codes.

- ✓ 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.

Given the critical dependencies on the data centre, the use of aspirating detection technology, which can provide very early warning of fire events 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.

A response strategy should be formalised, particularly where the automatic fire detection system is interlocked to a pre-action automatic fire sprinkler system.

- ✓ Speed of response is critical in helping to identify and resolve issues before fire can develop/spread and fire protection devices deploy.

Any plans to change the existing fire detection system or install a new fire detection system should be discussed with your Property Insurer and Broker.

### Automatic Fire Protection

Sprinkler systems are the most reliable means of suppressing fire at its seat and limiting the extent of fire damage and impacts to trading. 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. Consideration should be given to the most appropriate system design for the room.

- A high hazard 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.
  - ✓ With this system design the sprinkler pipework is normally charged with water, and as soon as the fire activates a sprinkler head in the room, water is immediately available to suppress the fire at its seat.
  - ✓ These systems are normally recommended for environments such as control rooms, UPS rooms, corridors etc.
- A high hazard pre-action system is likely to be the most appropriate system type for the data halls, given the criticality of data centres and the significant business interruption exposures.
  - ✓ With this design the sprinkler pipework is normally charged with a low pressure supervisory air supply.
  - ✓ The sprinkler pipework only charges with water when the automatic fire detection within the data hall goes into a confirmed alarm state. Ideally, this should be when an aspirating detection system operates, and which then opens the pre-action valve. The sprinkler system will then operate normally upon sprinkler head activation.

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.

Any plans to install or amend an existing fire protection systems should be discussed with your Property Insurer and Broker, who can provide guidance and advice.

### **Watermist**

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.

The systems are designed to suppress rather than fully extinguish a fire and additional firefighting action will need to be factored in to planning and contingency arrangements. Also of concern is the potential for water related damage to critical components which is likely to lead to system downtime. Systems should be in compliance with a recognised test standard, such as **FM 5560 Water Mist Systems**. Other related standards include:

- **BS 8489-1:2016 Fixed fire protection systems – Industrial and Commercial Watermist Systems Part 1: Code of practice for design and installation**
- **BS EN 14972-1:2020 Fixed firefighting systems – Water Mist Systems Part 1: Design, installation, inspection, and maintenance**
- **FM 5-32 Data Centres and Related Facilities**
- **FM 4-2 Water Mist systems**
- **NFPA 750 Standard on Watermist Fire Protections**

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

### **Other Fire Protection**

Other localised fire suppression systems should be considered for protecting peripheral areas such as UPS rooms, storerooms and electrical plant rooms.

### **Gaseous Fire Suppression Systems**

A blend of gases, typically argon, Co2 and nitrogen, are released upon detection of a fire, which deplete oxygen levels in the room and knock down the fire.

The gas is generally stored in 80 lt. cylinder manifolds, which can be located outside of the data environments and typically operate at 300 bar. Rooms featuring inert gas systems must have over pressure ventilation fitted to protect against over-pressurisation. The suppression system increases the overall gas volume within the room by around 40% within one minute of operation, and ventilation helps prevent damage to walls, ceilings, and doors.

The room must be capable of containing the inerting gas and all openings and gaps will need to be sealed as effectively as possible. The current version of **BS EN 15004 - Fixed firefighting systems. Gas extinguishing systems** stipulates the room must be capable of holding the inerting agent for a minimum of 10 minutes to suppress the fire, 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, depending on the gaseous system used, include:

- **BS EN 15004-1:2019. Fixed firefighting systems. Gas extinguishing systems. Design, installation, and maintenance.**
- **BS EN 15004-10:2017. 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.**
- **BS7273:2006 Electrical actuation of gaseous total flooding extinguishing systems.**

CO<sub>2</sub> based suppression systems may be potentially suitable for use in such environments, however present significant life safety hazards requiring careful management.

**Note:** Any rooms protected by a gaseous suppression system must consider the impact of the ventilation arrangements serving the room. Is this:

- Interlocked to shut down before the extinguishing agent discharges?
- 100% fresh air inlet and full exhaust?
- Recirculating with a percentage of exhaust and fresh air make-up?
- 100% recirculating only?

This will impact the system design and performance.

**Note:** One consistent failing of localised gaseous suppression systems is ‘panel’ key management. Fire suppression system panel keys should not be left in situ in the panel. 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 from automatic to manual status requires strict control.

## Hypoxic Air

Also known as oxygen reduction systems, these operate by maintaining oxygen levels within the facility below 15% by volume via 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 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.**

## Clean Chemical Agent Suppression Systems

A variety of agents have been used in these systems including the now restricted Halon and FM200 agents. Novec 1230 has been the most commonly used clean agent since 2004 however has been voluntarily removed by the manufacturer 3M due its classification as a ‘forever chemical’ and will not be supplied from 2025. Alternative suppliers of the agent will continue to supply a version of the agent however the system manufacturer would have to provide permission to use such agents and confirm compatibility with existing systems. No other clean chemical agents are currently available.

Relevant standards 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.**

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

**Note:** Other hybrid gaseous and watermist systems are available. Any plans to install such systems should be discussed with your Property Insurer and Broker.

### **Enabling Devices**

An enabling device may be installed to ‘hold off’ the discharge of a gaseous fire suppression system. If this is provided, this must be located within the protected area itself and not outside of the room.

### **Alarms**

Alarms associated from the above should raise a site fire alarm or monitoring alarm to ensure there is an immediate emergency response and escalation if needed. Appropriate training should be provided on safe isolation of equipment. If not already in place you may wish to consider connecting the alarm to a constantly attended location or an approved Alarm Receiving Centre. An accredited fire alarm installer can provide further guidance.

### **Interlocks**

The use of interlocks needs to be considered carefully and subject to risk assessment. Whilst suitable for some ancillary equipment, interlocks are not recommended in respect of:

- Server equipment.
- Cooling/environmental systems.
- UPS and generator systems.

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

### **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.
- Whilst dry powder type appliances may be suitable for such facilities, damage caused by residues to non-affected equipment can be extensive and are therefore 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.

## Maintenance and Testing

- Fire detection systems should be serviced and maintained in accordance with installer recommendations.
  - ✓ For data centres this should be undertaken at least every three months.
- Fire alarm systems should be checked daily and tested at least weekly to ensure there are no faults and the system is working correctly. Your fire alarm installer can provide guidance in this regard.
- Fire sprinkler systems and pumps should be serviced and maintained in accordance with installer recommendations, based on guidance within accepted international standards such as **BS EN 12845:2015+A1:2019 Fixed firefighting systems. Automatic sprinkler systems. Design, installation and maintenance** or **NFPA 13 Standard for the Installation of Sprinkler 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.
- The sprinkler system should be subject to an inspection and test programme which includes:
  - ✓ Weekly water motor alarm test.
  - ✓ Weekly automatic pump starting test.
  - ✓ Weekly Checks on:
    - Trace heating and other local heating systems.
    - Water and air pressure readings.
    - Valves left in correct operating condition.
    - Alarm signal connections.
  - ✓ Monthly battery charging and battery health checks.
  - ✓ Monthly suction tank checks.

**Note:** Your Property Insurer will typically provide test cards and guidance to support testing regimes.

- Other protection systems should be checked weekly, and the room protected also checked to ensure no material changes to the protected hazard and the room integrity has not been compromised e.g. damage to doors, seals, new openings for cables, removed ceiling panels etc., and be subject to a maintenance programme as per manufacturers or installers guidelines.

## Impairments

Ensure any impairments relating to fire detection and protection systems are reported to your Property Insurer and Broker. Temporary changes may be necessary to some arrangements whilst impairments are ongoing.

## Training

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

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

## Key Action Steps

- Ensure a business impact assessment has been undertaken before commissioning fire detection and protection designs.
- Fire protection and detection systems should be bespoke to reflect the sensitivity of the equipment and processes. Ensure your Property Insurer and Broker are engaged as soon as possible.
- Utilise the services of experienced, reputable, and accredited companies to design detection and protection systems.
- Once installed, complete weekly checks to ensure fire detection and protection systems are operating normally with no faults.
- Also undertake weekly and monthly testing as stipulated in design standards, codes or by your Property Insurer.
- Ensure all systems are serviced and maintained as per installer and Property Insurer recommendations/requirements, and in accordance with accepted standards or codes.
- Ensure system adequacy is assessed whenever a fundamental change is made to the layout of the premises or equipment is installed or removed.
- Provide appropriate training for relevant persons.

## 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, including:

- Fire risk assessment: [Cardinus Risk Management](#).
- Electrical/Lightning installation testing and explosion/DSEAR Risk Assessments: [Bureau Veritas](#).
- Thermographic imaging and PAT testing: [PASS](#)
- Automatic fire 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.](#)
- [I.S. 3218:2013+A1:2019 Fire detection and alarm systems for buildings - System design, installation, commissioning, servicing, and maintenance and amendment.](#)
- [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+A1:2020 Fixed 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.](#)
- [BS 8489-1:2016 Fixed fire protection systems – Industrial and commercial watermist systems Part 1: Code of practice for design and installation.](#)



- [BS EN 14972-1:2020 Fixed firefighting systems – Water mist systems Part 1: Design, installation, inspection, 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.](#)
- [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:

- **Gaseous Fire Extinguishing Systems**
- **Water Mist Fire Protection Systems**
- **Property and Business Impact Risk Assessment**
- **Fire Safety Legislation**
- **Sprinkler Systems - How they Operate**

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

**Email us at [riskadvice@aviva.com](mailto:riskadvice@aviva.com) or call 0345 366 6666.\***

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## LOSS PREVENTION STANDARDS