

# Fire Protection

Data centers face many challenges from managing complexity to improving energy efficiency and meeting fire safety, security and business regulatory requirements. Human failure (e.g. non-observance of fire protection regulation) or technical reasons can lead to a fire incident.

It is important to have a fire-suppression system which is specifically designed for Datacenter to maintain the high uptime and maximum availability and get maximum protection. A comprehensive fire safety system is mandatory to ensure business continuity. High availability can only be achieved if all relevant influencing factors are planned, implemented and put into effect in the company in a coordinated and consistent way.

Appropriate incident response would also prevent or contain the risk due to the fire and assist to avail the system.

So the data centers have to be designed, implemented and operated in such a way that a high level of availability can be guaranteed in case of a fire.

The goals of fire protection are to efficiently protect people, assets, data and the environment from the dangers and effects of fire, and to minimize material damages, loss of data, operational interruptions and the consequent loss of business.

Fire risks result basically from the probability of occurrence and the effect caused by fire.

There are four major reasons why there is a potential risk of fire in a data center:

- Heavy power load:  
Heavy power loads or a defective piece of equipment can very quickly lead to a short circuit or overheating.
- Electrical fire risk:  
Constant ignition source (electricity); and combustible materials such as plastics in printed circuit boards.
- Infrastructure:  
Extensive cabling; particularly below raised floors.
- Ventilation:  
Comprehensive air -cooling, resulting in a higher air exchange, increases risk of spreading the fire.

The objective of fire prevention in data centers is to minimize or eliminate the use of combustible materials.

The basic design elements of fire protection are:

- Fire detection  
Smoke, heat, and early warning detectors connected to an alarm and monitoring panel.

- Fire alarm system

A system, including the fire detection systems, with a means to automatically send an alarm to

the supervisor and trouble signals to a central station, security center, fire department, or other approved, constantly attended location, and warn occupants of the presence of smoke, heat, or fire using audible or visual alarms.

- Fire suppression

Extinguishing systems to protect the data processing equipment.

## Fire detection

Fire detection system detect and alert early and guarantee the protection of the datacenter from fire and relevant fire safety controls and measures helps to take necessary precautions and avoid any incident.

The fire detection system should include an early warning smoke detection system and a water leak protection system.

The sprinkler system should have an alternate water source to prevent a single point of failure and to allow maintenance.

Local codes may sometimes require that the suppression agent used below the access floor must be identical to the method used above the floor for the rest of the space or building.

If the entire facility is not protected with a gaseous clean agent system, it is a best practice to protect space under access floors with a dedicated inert gas clean agent system or a carbon dioxide total flooding system when the under-floor space contains combustible material.

Carbon dioxide should normally not be used above the access floor in computer rooms.

Data center personnel should be trained on the use and function of the fire detection and extinguishing systems of the computer room.

Paper should be stored outside the computer room with a fire suppression system separate from the one used by the computer room.

Penetrations through the walls and floor of the room shall be sealed with a fire-resistant material that provides a fire rating at least equal to the rating of the wall and floor.

Air ducts shall be provided with automatic fire and smoke dampers where the ducts pass through fire-rated structure.

All pass-through or windows are provided in the fire-rated walls should be provided with a fire-rated shutter or fire-rated window of rating equal to the wall.

Some clean agents such as the inert gas agents will require vents in the enclosure that open during the discharge of clean agent to prevent excessive pressure build up as a result of the influx of gas in the room.

Containment aisles or “hot collars” (e.g., equipment cabinet chimneys, vertical exhaust ducts) shall not be considered as being plenums.

Materials used to construct containment structures or barriers shall meet the requirements of the local authority. For locations where the local authority does not have requirements, materials used shall have a maximum flame spread index of 50 and a maximum smoke development index of 450 as measured by UL 723(Standard for surface burning characteristics of building materials)

Hinged doors used in hot aisles shall open in the direction of egress.

Sliding doors and hinged doors shall meet the requirements of the local authority and be operable from the inside without the use of hands (e.g., “panic hardware”) as allowed by the local authority.

## **Fire suppression**

Fire Suppression systems used within a contained aisle shall meet or exceed the minimum requirements for suppression systems used in the surrounding space and shall comply with local regulations.

Where containment is introduced into existing data centers, fire suppression systems shall be modified when necessary to meet prevailing codes and standards.

Sprinkler head placement shall meet local code requirement for clearances to walls or other obstructions to dispersal.

The system may have to be retested to verify compliance.

Sprinkler or clean agent system dispersal modification requirements may be waived if:

- Obstructions are removable prior to an emergency dispersal event, Obstruction can be removed without compromising means of egress, and removal is initiated by an automatic means of smoke detection.
- Fusible links, shrinking panels or other heat-responsive triggers shall not be used as a means for triggering removal of barriers to code-required clearances for suppression systems.
- Automatic barrier removal, if used, shall remove all obstructions for the entire suppression zone.

For gaseous fire suppression systems:

- Any additional volumetric space constructed for contained closed loop return air shall be added to the calculated total volume requirement for gaseous agent.
- The concentration of the gaseous agent, when released, shall not be less inside a contained space than it is in the area outside the contained space.

Sprinkler piping should be centered at ceiling level within the contained aisle (not above cabinets). Sprinkler heads should be high enough that spray can reach the top of the cabinets on either side

of the aisle.

Clean agent nozzles that are too close to a wall or other obstruction can result in “frosting”, thereby reducing the effectiveness of the agent, before the agent has a chance to atomize. Placement of 1.2 – 1.8 m (4 – 6 ft.) from the nearest obstruction is recommended.

Fire suppression sprinkler pipes on eight-foot centers grids can be arrayed to meet clearance requirements of most local codes for hot aisle containment and cabinet hot collar containment.

Rows will fall on an eight-tile pitch from the center of cold aisle to the center of the adjacent cold aisle. Fire extinguishers shall be clearly visible. Each fire extinguisher shall be labeled to describe clearly the type of fire on which it should be used.

Hand-held clean agent fire extinguishers are recommended and may be required by Rwanda Standard Board . Extinguishers that use dry chemical agents are not recommended because they can damage electronic equipment.

Switchgear rooms should have clean agent handheld fire extinguishers like those used in the computer room.

#### Recommended Sprinkler Systems for Data Center Spaces

Area	Sprinkler system
Computer Room	Pre-action sprinkler system
Network Operations Center	Pre-action sprinkler system
Entrance Room	Pre-action sprinkler system
Office	Wet sprinkler system
Electrical Switch Gear	Pre-action sprinkler system
Battery and UPS Room	Pre-action sprinkler system
Generator Room	Pre-action sprinkler system
Chiller Room	Wet sprinkler system
Other space not listed above	Wet sprinkler system

Labeling and signage practices for the fire protection system should include the following:

- Emergency procedures should be posted on all fire alarm control panels and annunciator panels.
- Fire alarm manual stations should be clearly labeled to avoid any confusion.
- Install a cover over these manual stations to avoid accidental triggering.

Pre-action sprinkler systems should be trip tested at least once every three years.

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