FIRE SUPPRESSION SYSTEM

TUBE BASED TYPES AND APPLICATION

FIRE SUPPRESSION SYSTEM – TUBE-BASED TECHNOLOGY AND ITS USES

Tube-based fire suppression systems are innovative, self-activating fire suppression technologies that use a **flexible heat-sensitive detection tube** to both detect and suppress fires directly at their source. These systems are compact, cost-effective, and ideal for enclosed or sensitive environments where traditional systems may not be practical.

How Tube-Based Fire Suppression Works

Key Components:

Detection Tube: A polymer (usually nylon or polyamide) tube that is heat-sensitive and pressurized.

Agent Cylinder: Contains the extinguishing agent (e.g., clean agent, CO_2, dry chemical).

Discharge Nozzle or Tube End: Allows the agent to be released when the tube ruptures or via a separate nozzle.

Working Mechanism:

Fire Starts: Temperature rises near the protected equipment or space.

Tube Detects Heat: The detection tube softens and ruptures at the hottest point (typically around 150°C–180°C).

Agent Release: The rupture acts as a nozzle, releasing the extinguishing agent directly at the fire source.

In indirect systems, the rupture triggers a valve to release the agent through nozzles.

Types of Tube-Based Systems

Type	Description	Common Agents Used
Direct System	The detection tube acts as both detector and discharge line.	Clean agent, CO_2, dry chemical
Indirect System	The detection tube activates a valve to release agent via nozzles.	Clean agent, CO_2, foam

Advantages of Tube-Based Fire Suppression

- **Automatic and Self-Contained**: No power or electronics required
- **Fast Response**: Detects and suppresses fire at the ignition point
- **Compact and Lightweight**: Fits into tight or enclosed spaces
- **Low Maintenance**: Fewer moving parts and simple design
- **No False Alarms**: Activates only under real fire conditions
- **Minimal Downtime**: Quick suppression minimizes equipment damage

Common Applications and Uses

Application Area	Use of Tube-Based Systems
Electrical Cabinets	Protects control panels, PLCs, and distribution boxes
Server Racks / IT Equipment	Prevents damage to data and hardware
Vehicles (e.g., buses, mining trucks)	Suppresses engine and battery compartment fires
CNC Machines / Industrial Equipment	Stops fires caused by oil, coolant, or electrical faults
Kitchen Hoods / Small Cooking Stations	Extinguishes grease or oil fires (especially with wet chemical agents)
ATM Machines	Protects against arson or electrical shorts
Battery Energy Storage Systems (BESS)	Mitigates thermal runaway or electrical fires

Limitations

- Limited to **small to medium enclosures**
- May not be suitable for **large open spaces**
- Some systems may require **replacement of the entire tube** after discharge
- Not ideal where fire spreads rapidly outside the enclosure

Environmental Considerations

Tube-based fire suppression systems are an efficient, cost-effective solution for **localized fire protection** in enclosed or mission-critical areas. Their simplicity, speed, and self-activation make them particularly useful in industries where fire must be stopped immediately at the source, especially where access is limited.

Summary

Many tube-based systems use **clean agents** like **NOVEC 1230** or **FK-5-1-12**, which have:

- Zero ozone depletion potential
- Low global warming potential
- No residue, safe for electronics

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