CONDENSED AEROSOL EXTINGUISHING SYSTEMS

This document has been produced by the RISCAuthority Active Suppression & Detection working group to provide information and outline guidance on the application of Condensed Aerosol Extinguishing Systems (CAFES).

Summary

Refer to AFPG-01 Overarching Active Fire Protection Guide – All Technologies.

What is a Condensed Aerosol Extinguishing System (CAFES)?

CAFES is an extinguishing technology in which standard potassium firefighting salts are combined with other materials to form a highly combustible ceramic solid which, on activation is ignited to provide a smoke-like emission of salts that may chemically inhibit fire.

Housed in a metal cannister with burst disk at the delivery end, the hot gaseous discharge is usually cooled by chemical or mechanical means. CAFES is commonly used in the protection of small spaces such as cabinets; engine bays; for local application; and in the protection of larger compartments subject to appropriate testing.

These are 'extinguishing' systems and should be designed on the basis of having no 'suppression' capability, and that there is no requirement for follow on actions such as the attendance of Fire and Rescue Services to assure a proper conclusion to the fire event. Where used in occupiable spaces, alarms and interlocks must ensure that human exposure to the discharge is avoided.

Particular emphasis should be given to ensuring selected systems are certificated, tested and installed to recognised standards as this influences greatly its safety in use, likelihood to perform, and suitability for use in more demanding environments.

How it works

CAFES are designed to be installed within the protected space. They may be actuated electronically by the compartment's detection system via the squib embedded within the ceramic, or by a fuse which may hang from the unit.

For flooding applications, the units will be installed at ceiling level, with the system designed to achieve an aerosol loading (g/m^3) appropriate to the risk. The design may use a number of units to achieve this and, similar to gaseous systems, there is a need to hold an extinguishing concentration of agent for a defined period of time.

The system can be automatically or manually activated and should be designed to shut down any air conditioning systems, openings, and doors, prior to discharge, as well as isolating all sources of fuel, oxygen, heat, and conveyancing, to prevent reignition. For 'local' and 'cabinet' protection, the systems will be designed as for a 'streaming agent' with the key design factor being the discharge stream duration and concentration.

Challenges and considerations

The discharge from a CAFES unit is hot, but properly designed should not eject flame. The accidental discharge of CAFES units has been the cause of some historic fires and of life loss from the toxicity of the emission. Accidental discharge may be incorrectly interpreted by other detection systems as a fire and this needs consideration in the overall design to avoid unnecessary actions being taken.

Controls on use, and development of the technology, has reduced the likelihood of these unfortunate events. With the phase change, and ability to heat the protected space, there is a need to consider a means of venting pressure from the protected space, without undue loss of agent.

Early versions of the technology produced a very hot emission, that was expelled very quickly and was highly buoyant, making even distribution impossible (very poor extinguishing capability at low level), with high agent loss from the compartment during discharge, even causing damage to the enclosure.

Modern versions of the technology seek to ameliorate these changes by slowing the discharge rate, and cooling the gas emission. In flooding applications, compartment height remains a key design consideration.

Specification of design quantities required for 'streaming' (small cabinets and local application), and 'flooding' (compartment protection) applications is not as simple as for i.e. gaseous systems where the amount required may be related to a fundamental physical property of the fuel, such as its oxygen index, and must therefore be backed up by realistic experimental test confirmation.

Best practice dictates that a pressure relief device, installed to protect the structural integrity of the compartment, should direct gas and fire products on discharge to the outside via a route that will not lead to exposure of people to the emitted gases.

Consideration must be given to the impact that the released agent might have on the contents of the protected space in terms of corrosion and contamination of electrical components where problems have been reported.

Applicable standards

BS EN 15276-1 *Fixed firefighting systems - Condensed aerosol extinguishing systems Part 1: Requirements and test methods for components*

BS EN 15276-2 *Fixed firefighting systems - Condensed aerosol extinguishing systems Part 2: Design, installation and maintenance*

ISO 15779 *Condensed aerosol fire extinguishing systems — Requirements and test methods for components and system design, installation and maintenance — General requirements*

NFPA 2010 *Standard for Fixed Aerosol Fire-Extinguishing Systems*

UL 2775 *Standard for Fixed Condensed Aerosol Extinguishing System Units*

LPS 1204 *Requirements for firms engaged in the design installation, commissioning and servicing of gas extinguishing & condensed aerosol systems*

LPS 1656 Requirements and test methods for the LPCB approval of Condensed Aerosol Extinguishing Generators

Effective for use with:

- electrical cabinets
- engine bays
- flammable storage (not requiring classified electrical equipment)
- turbine enclosures
- storage vaults
- marine engine rooms
- CNC machines.

Has limitations in relation to:

- occupied spaces (subject to approvals)
- high ceiling heights
- deep seated Class A fires
- chemicals that are capable of rapid oxidation in the absence of air
- metal hydrides
- chemicals capable of undergoing autothermal decomposition
- combustible metals (Sodium, Potassium, Magnesium etc.)
- compartments whose openings cannot be controlled
- where air conditioning and openings cannot be closed/shut down on detection
- where sustained sources of ignition cannot be isolated or controlled within the agent hold time (flooding) or discharge time (streaming)
- pressure relief required during discharge
- corrosion of electrical components.

Approvals

LPCB, UL Solutions, BSI Kitemark, Kiwa, ABS.

Best practice

CAFES can be used in both 'streaming' and 'total flooding' applications. In streaming applications, extinguishment depends upon the flow of agent over the risk. The flow can be directed by aiming at the protected object (local application) or by partial containment, such as might be afforded by a cabinet with openings.

By using the momentum of the discharge, rapid extinguishment can be achieved even in complex geometries. Total flooding compartment applications are less reliant on the momentum of the agent during discharge, and more dependent upon establishing a homogenous atmosphere of agent within the compartment at a concentration above that required to extinguish all burning fuels present, and hold this for a period that prevents reignition (in association with other controls).

Standard methods of detection and activation of the system can be used but controls similar to that which would be used for CO_2 are pertinent when used in occupiable spaces to avoid human exposure.

Best uses of CAFES

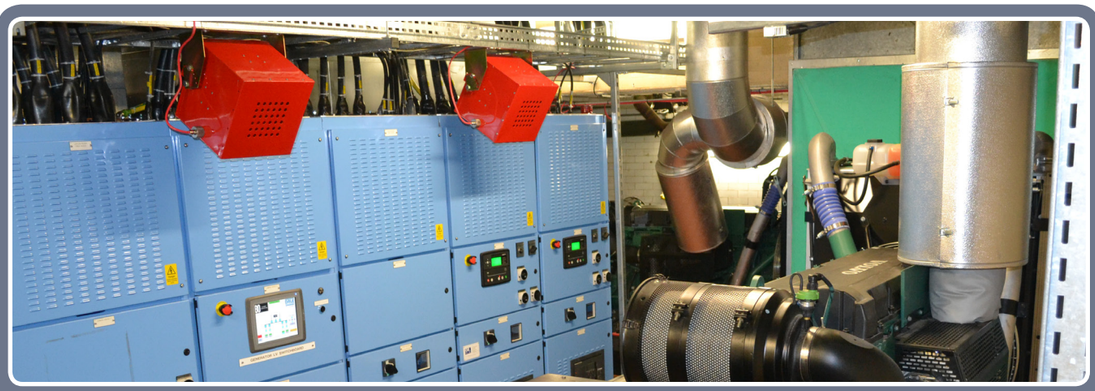
'Asset protection' – CAFES is generally designed as an extinguishing system for use in business-critical areas to protect specific assets from fire damage.

'Life safety' – Not installed for life safety (exposure should be avoided), however, as a full system inclusive of fire detection system, it can aid in early detection and evacuation.

'Property protection' – Will only be considered as an extinguishment system. Failure of extinguishment and the fire will rekindle and continue unopposed.

Environmental credentials

CAFES has 0 ozone depleting potential and does not contribute to global warming.



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