FIREPRO CONDENSED AEROSOL BASED FIRE SUPPRESSION SYSTEM

FirePro Condensed aerosol suppressants, like gaseous suppressants, use four methods to extinguish fires. They act on the four elements of the "fire tetrahedron," the disparate components that combine to create the chemical reaction underlying any fire. These four means of fire extinction are:

1. Reduction or isolation of fuel
2. Reduction of heat
3. Reduction or isolation of oxygen
4. Inhibiting the chain reaction of the above components

FirePro condensed aerosols' primary extinguishing mechanism involves the **Fourth element of the fire tetrahedron** by means of chemical chain reactions with the free radicals of the flame, therefore interfering with the combustion process of the fire. Typically, FirePro condensed aerosol particulates consist of potassium carbonate (K2CO3)) that are produced from the thermal decomposition of a solid aerosol-forming compound that includes potassium nitrate as an oxidizer. As the aerosol particles surround and come into contact with the flame, the particulates absorb the flame heat energy, breaking down and releasing large concentrations of potassium radicals (K+) (ions with an unpaired electron). **The potassium radicals bond with the hydroxide (OH+), hydrogen (H+) and oxygen (O+) free radicals which sustain flame's combustion process, producing harmless by-product molecules such as potassium hydroxide (KOH) and water (H2O).**

K• + OH• = KOH

KOH + H• = K• + H2O

The potassium radicals are propagated since they are both consumed and produced by reaction with the fire radicals. Disrupting the reactions necessary to sustain the flame's combustion, the cycle continues until the combustion's chain reactions are terminated and the flame is extinguished.

FirePro condensed aerosol agents also have secondary extinguishing mechanisms implicating the other three elements of the fire tetrahedron described above. The aerosol cools the flame by engulfing it with a cloud with large concentrations of micro particles which have mass median aerodynamic diameter sizes (MMAD) as small as 1 to 2 microns. Though the surface area of each micro particle is extremely small, the large quantity of particles surrounding and penetrating the flame offers a sufficiently large combined surface area to absorb the flame's heat. On the surface of the particles, recombination of the fire radicals takes place as energy is absorbed:

O• + H• = OH•

H• + OH• = H_2O

Flame is the gaseous part of a fire resulting from the combustion of fuel. Aerosols particles and gases mixing with the gaseous components of the flame isolate the fire's fuel.

Attacking all the elements of the fire tetrahedron, condensed aerosol fire suppression agents are among the more effective flame-extinguishing agents. For example, some condensed aerosol fire suppressants can extinguish a Class B flammable liquid pool fire with 1/5 the amount of Halon 1301 agent or 1/10 the amount of a hydrofluorocarbon or fluoroketone based clean agent gaseous fire suppression system in terms of kilogram mass of agent per cubic meter.

Performance

The extinguishing performance of FirePro condensed aerosol fire suppressants is dependent on the density of aerosol particulates in the immediate vicinity of the flame. As with gaseous fire suppression systems, the faster the agent can build around the flame, the more efficient the extinguishing agent will be in terminating the flame's combustion process. The extinguishing and design densities of aerosol fire suppression agents are generally expressed in kilograms per cubic meter (kg/m^3). Thus, the efficiency of aerosol extinguishing agents varies depending on a

number of factors, such as the location of the aerosol relative to the flame, the proximity of other combustible flammable materials, the type of fuel involved etc.

FirePro condensed aerosol devices are designed to provide a controlled discharge. The aerosol-forming compound is installed inside of the device, which is then fitted with an electric or mechanical actuator. The electric actuator is interfaced with a **Fire Detection Control Panel**, which can be remotely operated by physical means such as by cable, hand operated with a fuse mechanism such as those used in smoke dispensing grenades or automatic and self-triggering when outfitted with an integral heat-sensing device.

FirePro Aerosol is: Non Pyrotechnic, Non Corrosive, Non Toxic, Non Conductive with 0 ODP, 0 GWP, Negligible ALT and having the shelf life of 15 years. It is completely green product certified by SNAP.

Uses and applications

There are two uses for applying fire extinguishing agents: as a total flooding fire protection system or as a local application fire suppression system.

To provide total flooding fire suppression, the total quantity of aerosol required to extinguish a fire inside of fixed space must be determined. The corresponding number of aerosol devices that would collectively discharge the aerosol quantity required are then mounted, typically on the ceiling or wall. Aerosol devices equipped with electric initiators are interconnected and relayed by a fire alarm control panel. Because the aerosol devices are self-contained and function as both a storage container and as a nozzle that propels the gas, no distribution network is required to transport or distribute the fire-extinguishing agent from a remote storage location, resulting in floor space savings and transportation efficiency gains.

Local application fire suppression is typically applied by a handheld portable device tossed directly toward the fire. Unlike streaming portable fire extinguishing units, the operators are not required to place themselves at risk by approaching the fire while applying the extinguishing agent directly at the flames. The portable condensed aerosol device is typically designed to disperse aerosol in a 360° spray pattern, forming a large aerosol cloud around the vicinity of the fire. The aerosol immediately attacks the flames as its particles approach the fire and generate flame-neutralizing potassium radicals. The flames are suppressed as long as the aerosol retains sufficient density. If the aerosol fails to achieve sufficient density to extinguish the fire, it will still suppress the fire, which will retain significantly lower heat. This offers firefighters, for instance, a tool to bring down flames to a manageable heat level and reduce room temperatures while the hose team enters the burning area. As another example, First Responders can deploy condensed aerosols within an enclosed area to suppress fires while evacuating occupants to safety.

Condensed aerosol systems are suitable for special hazards applications as replacements for Halon 1301 systems and high-pressure carbon dioxide systems. Aerosol systems can also be used as alternatives to clean agent gaseous suppressants or water-mist systems

Phase-out of Ozone-Depleting Substances

In the United States, ozone-depleting substances (ODS) are regulated as class I or class II controlled substances. Class I substances have a higher ozone depletion potential and have been completely phased out in the U.S.; with a few exceptions, this means no one can produce or import class I substances. Class II substances are all hydrochlorofluorocarbons (HCFCs), which are transitional substitutes for many class I substances. New production and import of most HCFCs will be phased out by 2020. The most common HCFC in use today is HCFC-22 or R-22, a refrigerant still used in existing air conditioners and refrigeration equipment.

Global Emissions of Substitutes for Ozone Depleting Substances

The emissions of hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) used as substitutes for ozone-depleting substances (ODS) are rising worldwide. EPA and various industries are working together to measure, manage, and reduce these emissions (e.g., through EPA partnerships).

Under the United Nations Framework Convention on Climate Change (UNFCCC), many nations including the United States, annually submit greenhouse gas emissions inventories that estimate emissions of HFCs, PFCs, and other greenhouse gases.

Furthermore, EPA has analyzed the anticipated economic effects of proposed standards and policies to reduce greenhouse gas emissions. These analyses have shown that there is a variety of cost-effective policies available to reduce greenhouse gas emissions. In 2015, EPA released a report, Climate Change in the United States: Benefits of Global Action, estimating the physical and monetary benefits to the United States of reducing global greenhouse gas emissions. EPA has also released other research that underlies its economic modeling of climate policies.

Applications for FirePro Condensed Aerosol must only be installed in areas according to the fire hazard that the systems are listed for.

1. *Service Risers (closed type)*
2. *Generator Rooms*
3. *Generators (Container Type Models)*
4. *Oil Storage Areas*
5. *Electrical Panels (Distribution Boards, Power Factor Capacitors, Switch Gears, etc.)*
6. *Electrical Rooms (High and Low Voltage Type)*
7. *Transformers (Up to 132,000volts)*
8. *Cable Ducts (closed type)*
9. *UPS Rooms - (Follow Annex 7 manual for cleaning procedures and equipment shutdown)*
10. *Battery Rooms*
11. *Radar Stations - (Follow Annex 7 manual for cleaning procedures and equipment shutdown)*
12. *Mobile Switching Centers - (Follow Annex 7 manual for cleaning procedures and equipment shutdown)*
13. *PABX Rooms - (Follow Annex 7 manual for cleaning procedures and equipment shutdown)*
14. *Strong Rooms (Vaults)*
15. *ATM's (Used in conjunction with gas detection systems)*
16. *Archives*
17. *Computer Room (Follow Annex 7 manual for cleaning procedures and equipment shutdown)*
18. *Kitchen Exhaust Hood (Vertical Section – riser)*
19. *Gas Banks*
20. *Boiler Rooms*
21. *Furnaces (max. temp. 200 deg C)*
22. *Air Compressors (Cabinet Type Models)*
23. *Paint Cabins*
24. *Air Handling Units*
25. *Solvent Rooms*

26. *Storage Spaces (Small, Medium & Large)*
27. *Historic Buildings (Museums, Churches, Monuments, etc.)*
28. *Office Areas (Occupied Area requires system to have sufficient time delay)*
29. *Engine Bay Area – Vehicles*
30. *Engine Bay Area - Railways*
31. *Engine Bay Area – Marine Vessels*

Environmental issues

The United States Environmental Protection Agency has approved condensed aerosol fire suppression systems as acceptable substitutes for Halon 1301, FM-200 and Inert gas etc in Total Flooding Systems. Aerosol extinguishers are also non-ozone depleting and carry little or no global warming potential. It is Non Toxic and Non corrosive total fire suppression system.