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Engineered Carbon Dioxide (CO_2)

Fire Suppression Systems

Design, Installation, Operation and Maintenance Manual

KiddeFire Systems
A UTC Fire & Security Company

CHAPTER 1
GENERAL INFORMATION

1-1 INTRODUCTION

The Kidde Fire Systems carbon dioxide fire suppression system is an engineered, special-hazard system utilizing a fixed pipe and nozzle distribution network, hose reels, or a combination of both. These systems provide fire protection, using carbon dioxide (CO_2) as the extinguishant, designed in accordance with the National Fire Protection Association (NFPA) 12, "Standard on Carbon Dioxide Extinguishing Systems", (latest edition). All components referenced in this manual are listed by Underwriters Laboratories (UL) and approved by Factory Mutual (FM), unless as noted.

1-2 CLASSIFICATION OF FIRE

The classification of fire is defined as the following:

- Class A: Surface Type Fires; wood or other cellulose-type material (ordinary combustibles)
- Class B: Flammable liquids
- Class C: Energized electrical equipment
- Class D: Combustible metals (such as magnesium, sodium, zirconium, potassium, and titanium, or reactive metals, metal hydrides and chemicals containing their own oxygen supply)
- Class K: Combustible cooking media (vegetable or animal oils and fats)

Note: Kidde Fire Systems carbon dioxide fire suppression system is not suited for Class D type of fires.

Carbon dioxide is an effective agent for Class A, Class B, Class C, and Class K hazards. Carbon dioxide must be applied with due consideration of the hazard being protected and its contents. Carbon dioxide shall not be used on Class D hazards, such as magnesium, potassium, sodium, and cellulose nitrate. These Class D hazards can only be controlled by special extinguishing agents and procedures.

1-3 GENERAL CHARACTERISTICS OF THE SYSTEM

Carbon dioxide fire suppression systems are used for applications where the potential property damage and business interruption from fire are high. Carbon dioxide can control and suppress fires in easily ignitable fast-burning substances such as flammable liquids. It is also used on fires involving electrically energized equipment and, in some instances, on fires in ordinary combustibles such as paper, cloth, and other cellulose materials.

Carbon dioxide is a colorless, odorless, electrically non-conductive gas with a density approximately 50% greater than air. When applied to a fire, it provides a blanket of heavy gas which reduces the oxygen content of the atmosphere to a point in which combustion can not be sustained.

WARNING

Carbon dioxide is present in the atmosphere. It is also a normal product of human and animal metabolism; human life cannot be sustained if this carbon dioxide is not expelled from the body. The concentration of carbon dioxide in the air governs the rate at which the carbon dioxide produced by the human metabolism is released from the lungs. An increasing concentration in the air where humans are present, therefore, can cause serious personal injury or death.

Carbon dioxide offers many advantages as a fire suppressant. It is a clean agent, does not leave a residue, and does not wet material or machinery upon which it is discharged, helping keep costly cleanup or downtime to a minimum. Carbon dioxide may be stored from 0°F (-18°C) to 130°F (54°C). Carbon dioxide does not deteriorate and is non-corrosive. It is readily available throughout the world and is inexpensive. Carbon dioxide is effective for the rapid suppression of Class A (surface or deep seated), B, and C fires and offers a wide range of hazard protection.

1-4 SYSTEM DESCRIPTION

Carbon dioxide is stored in steel cylinders as a liquid under its own vapor pressure which is approximately 850 psi at 70°F. This pressure is used to propel the agent out of the container and through the valve, piping, and nozzles during the discharge. When released, carbon dioxide will change from a liquid to a gas and expand. The ratio of this expansion is high; approximately 9 to 1. This allows a large volume of carbon dioxide to be stored in a small container, minimizing space taken up by the system equipment.

Kidde Fire Systems engineered carbon dioxide suppression systems may be manually operated or integrated with detection and control devices for automatic operation. A single carbon dioxide fire suppression system can protect single or multiple hazards by total flooding, local application, or a combination of both.

1-5 TYPE OF SUPPRESSION SYSTEM

There are two types of fixed carbon dioxide systems: total flooding and local application.

1-5.1 Total Flooding

In a total flooding system, a predetermined amount of carbon dioxide is discharged through fixed piping and nozzles into an enclosed space or enclosure around the hazard. Total flooding is applicable when the hazard is totally enclosed and when all openings surrounding the hazard can be closed automatically prior to or at the start of system discharge. If all the openings cannot be closed, additional carbon dioxide must be provided to compensate for agent loss through these openings during the discharge and appropriate concentration retention periods. The carbon dioxide concentration must be maintained for a sufficient period of time to allow the fuel and any other surfaces or equipment in contact with the fuel to cool below the ignition temperature of the combustibles.

1-5.2 Local Application

Local application systems differ from total flooding in that the nozzles are arranged to discharge directly onto the fire. Local application is practical in those situations where the protected equipment can be isolated from other combustibles so that fire will not spread beyond the area protected, and where the entire hazard can be protected. One of the principal uses of local-application systems is to protect open tanks containing flammable liquids, but this technique can be generalized to protect three-dimensional hazards such as paint spray booths and printing presses. Suppression by local application is transitory, and will not be effective unless suppression occurs quickly and all potential re-ignition sources are eliminated.