

CHEMETRON
Fire Systems™

CARDOX

CO₂

**Application
Bulletin**

CHEMETRON
Fire Systems™
A World of Protection



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Carbon Dioxide Fire Suppression —

Vertical Carousel Storage Systems

Managing storage methods has developed from an art to a science with the increased use of computerized storage systems, such as the Vertical Carousel Storage system shown on the attached drawing.

Inventories of vital parts can be minimized and their retrieval achieved at a moment's notice with these modern storage systems. Combined with sophisticated computer programs, which provide inventory updates, the ability to pick orders on a first in-first out basis, ensure security and control access, and many other functions, these systems have become a vital tool in today's high-tech world.

Space required for storage can be minimized and adapted to the space available by a number of configurations up to heights over 30 feet (9 meters). Multiple units can be installed adjacent for increased capacity.

However beneficial to operations these units are, their very nature can present a greater exposure to an excessive loss in case of a fire. Limited personnel access to the high value stored material or vital records when the unit is shut down prevents plant or office personnel from identifying a fire situation and dealing with same manually. Automatic detection and suppression is the answer.

The value of the material stored, together with its vital nature, necessitates fast fire suppression with an extinguishant that does not contribute to the loss or increase the time period needed to get back in full operation.

Internal congestion and potential susceptibility to water damage dictates that the best protection is an automatic gaseous agent system for internal flooding of the enclosure. Such a system, being three dimensional, allows the extinguishant to reach any point within the enclosure quickly.

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Carbon dioxide (CO₂) works very well. Its effectiveness in controlling burning in solid materials of various kinds (i.e., plastics), including Class A materials, is well established. When discharged to the proper level and maintained, as described below, extinguishment can be accomplished with minimal fire loss.

The use of an early warning and system releasing smoke detection system will ensure minimum delay between fire detection and suppression. These systems also incorporate a personnel warning system. The immediate area of the carousel protected should be evacuated before the discharge starts as a safety precaution.

These systems can be integrated into a security program to protect against the arson potential. All system detection and operating electrical circuits, as well as the battery backed-up power supply, are supervised so that when the system is operated, or disabled, a signal can be given at a constantly attended location or to a supervisory service providing security, etc. If the arsonist has disabled the normal methods of system operation, this condition will be known while the system is still capable of being operated by the emergency manual release.

CO₂ System Design

Protection is provided by the total flooding method, where nozzles at the top of the unit distribute the inert CO₂ gas, resulting in the required design concentration throughout. For paper record storage, the National Fire Protection Association Standard (#12) calls for a design concentration of 65% by volume, or 1 lb of CO₂ for each 8 cubic feet of protected volume. The system is designed to give a flame suppressing concentration of 30% within the first 2 minutes of discharge. This discharge then continues until the required 65% concentration level is reached.

An important question is – for how long should the design concentration be held? For deep seated burning (where the fire burrows into the combustible and becomes somewhat isolated from the CO₂ fire extinguishant) the Standard requires a 20 minute holding time. The obvious problem in doing this is that these carousel units are not gas tight and the gas

would be expected to leak out before 20 minutes time has elapsed. This can be handled by adding an extended discharge that adds CO₂ at a low rate to make up for the rate of gas loss due to leakage. This also keeps the CO₂ atmosphere mixed in the carousel to prevent stratification, as the heavier air/CO₂ mixture tends to leak out the bottom and be replaced by the lighter fresh air at the top. We want to ensure there is protection throughout the unit.

However, another approach is to flood the unit with a single, shorter, continuous discharge and, at the same time, alert personnel at a constantly attended location and count on them to respond so they can handle any smoldering that might still be present when they inspect the unit. Many consider 5 minutes to be a reasonable estimate for this response time, and this has been used in designing for the CO₂ concentration holding time. This holding time can be obtained by the initial discharge alone, without the need for a separate extended discharge.

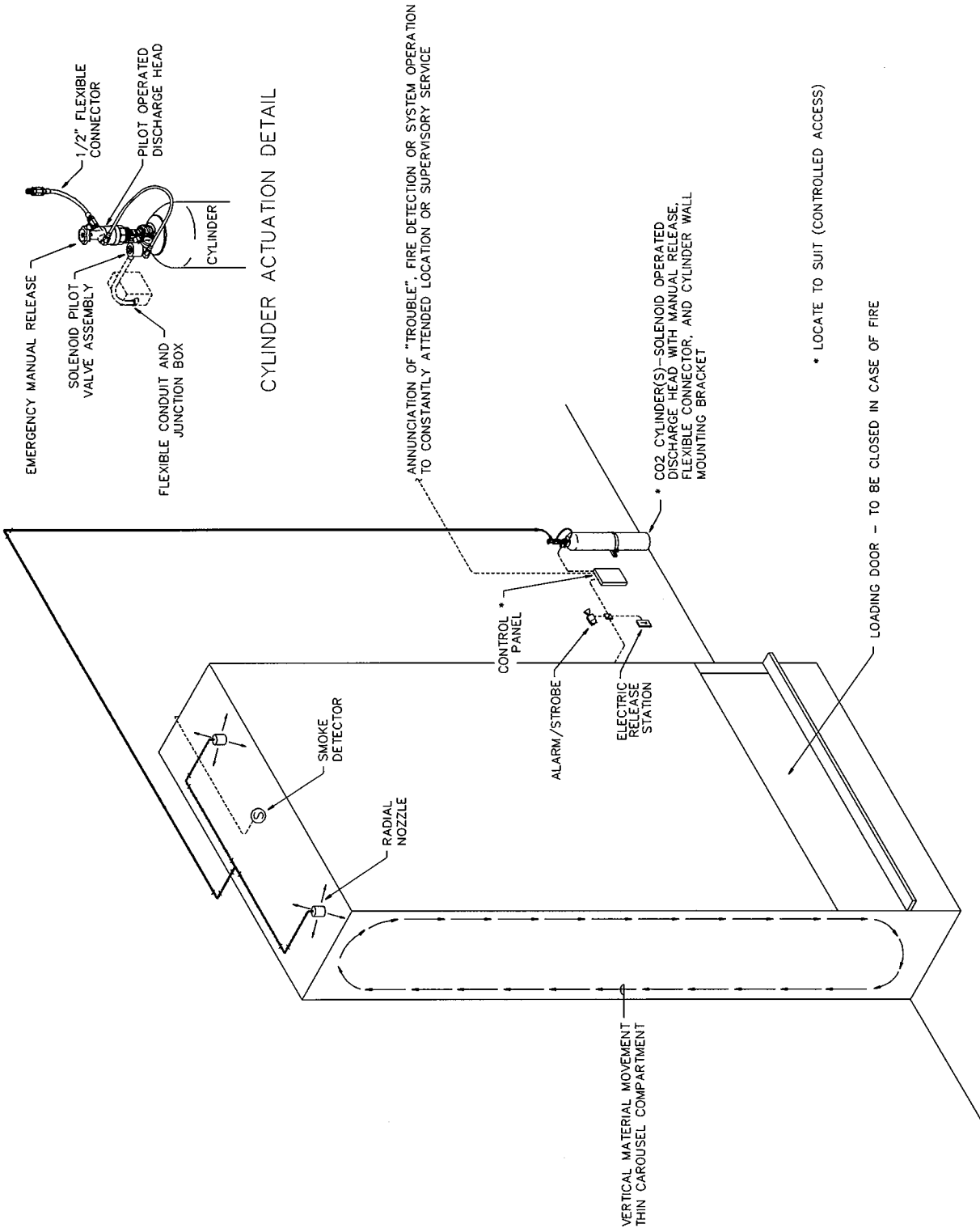
For the configuration where plastic trays hold the parts or where films are being handled, a surface fire extinguishing level of 34% by volume, held for 3 minutes, works well.

In an installation where a number of carousel units are in use in the same area, one CO₂ supply with selector (directional) valves can be used. Each carousel has its own controls and discharge piping is fed from a selector valve at the CO₂ supply. Upon system operation, the CO₂ cylinder(s) is tripped and the appropriate selector valve also opened to direct the discharge to the proper unit.

Chemetron is available to help analyze the most cost effective, operator compatible approach.

REFERENCE LIST

- Factory Mutual Loss Prevention Data Sheet 8-33S.1.
- HSB/Industrial risk Insurers IM.10.1.2.3.



High Pressure CO₂ Fire Protection System for Vertical Carousel Storage System