Fire Suppression Bulletin
NFPA Standard #12 Upgrade

PERSONNEL SAFETY AND RELIABILITY UPGRADE PROGRAM PER NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) STANDARD #12 - CARBON DIOXIDE EXTINGUISHING SYSTEMS, 2008 EDITION

Preface: In the interests of reducing risks to personnel and at the same time maintaining the reliability of carbon dioxide (CO_2) fire extinguishing systems, the NFPA has rewritten, revised and updated Standard #12 in the 2008 Edition.

The CO_2 fire system industry has always been cognizant of the potential risks involved in using CO_2, which extinguishes fire by oxygen deprivation. Since an adequate amount of oxygen is necessary for sustaining human life, protected spaces must be evacuated before the system is used. It is important to mitigate this risk in order to be able to utilize the unique fire extinguishing characteristics of CO_2 that have made it the ideal agent to use in many fire suppression applications.

A rare action by the NFPA in the revised standard is a requirement that existing systems be upgraded to be in compliance by December 31st, 2008. So even if you only service CO_2 systems, these changes offer you the opportunity to increase the safety and reliability of those systems.

The purpose of the bulletin is to bring to the reader's attention the more significant new or enhanced requirements so that planning to accommodate these changes can proceed as smoothly as possible.
Individual paragraph numbers and related text have been detailed to assist in identifying/locating the major changes to the standard. In some situations, the paragraphs noted may not follow in numerical order in an attempt to logically present the intent or to emphasize the extent of the requirements. In addition, annex (appendix) material has been brought forward to avoid the confusion of relating code requirements to pertinent information shown in the annex. The new NFPA 12, 2008 edition should be consulted in regards to the specific details of all noted changes and the many other alterations included in the revamping of NFPA 12, but not presented herein.

This bulletin is not intended to take the place of a complete review of the 2008 edition of NFPA Standard #12.

NEW INSTALLATIONS

4.1.1 New total flooding carbon dioxide systems shall not be installed in normally occupied enclosures except as permitted in 4.1.1.1, 4.1.1.2, 4.1.1.3, 4.1.1.4, or 4.1.1.5.

4.1.1.1 New total flooding carbon dioxide systems shall be permitted to be installed in normally occupied enclosures where it is determined that an inerting concentration is required and the inerting concentration required using alternate gaseous agents results in a concentration above the lowest observed adverse effect level (LOAEL) or the oxygen concentration is less than 8 percent.

4.1.1.2 New total flooding carbon dioxide systems shall be permitted to be installed in normally occupied enclosures for fires involving energized electrical equipment >400 volts and grouped electrical cables where no gaseous alternative agent has been successfully tested.

4.1.1.3 New total flooding carbon dioxide systems shall be permitted to be installed in normally occupied enclosures where design methods or hardware, or both, for unencloseable openings or extended discharge are not available for other gaseous agents.

4.1.1.4 New total flooding carbon dioxide systems shall be permitted to be installed in marine cargo holds.

4.1.1.5 New total flooding carbon dioxide systems shall be permitted to be installed in normally occupied enclosures in marine engine rooms where it is determined that an inerting concentration is required and the inerting concentration required using alternate gaseous agents results in a concentration above the LOAEL or the oxygen concentration is less than 8 percent.

DEFINITIONS

3.3.5 **Normally Occupied Enclosure or Space.** An enclosure or space where one or more persons are present under normal circumstances.

3.3.6 *** Normally Unoccupied Enclosure or Space.** An enclosure or space not normally occupied but one that could be entered occasionally by one or more persons for brief periods.

3.3.7 **Occupiable Enclosure or Space.** An enclosure or space that has dimensions and physical characteristics such that it could be entered by a person.

3.3.11 **Unoccupiable Enclosure or Space.** An enclosure or space that has dimensions and physical characteristics such that it could not be entered by a person.

EXISTING INSTALLATIONS

The current NFPA 12 does **not** allow the use of Class 150 malleable iron fittings. NFPA 12, 1977 edition and prior editions allowed the use of Class 150 iron fittings for 3/4" and smaller pipe sizes. All system upgrades should include the use of Class 300 fittings for the modified portion of the systems.

1.3.4 Existing systems shall be upgraded to meet the requirements for safety signs in 4.3.2, lock-out valves in 4.3.3.4 and 4.3.3.4.1, and pneumatic time delays and pneumatic pre-discharge alarms in 4.5.6.1.

1.3.5 These upgrades shall be completed by December 31st, 2008.

A1.3.5 Exposure to carbon dioxide discharge poses a hazard to personnel; therefore, additional safety features for all new installations and for retrofitting of existing systems are provided in Section 4.3

Safety to personnel is of paramount importance, therefore, these additional safety features should be installed as soon as possible but no later than December 31st, 2008.

The installation of the safety signs per 4.3.2 does not require any modifications to the installation and should be accomplished immediately.

The addition of supervised lock-out valves, per 4.3.3.4 and 4.3.3.4.1, and pneumatic pre-discharge alarms and pneumatic time delays, per 4.5.5.7, require that the system flow calculations be verified and be in accordance with this standard. That is, the addition of piping equipment (valve and time delays) adds equivalent pipe length to the system. The pneumatic pre-discharge alarm requires carbon dioxide flow to sound. The revised design should be in accordance with the agent quantity requirements of this standard.

These modifications could necessitate revisions to, upgrading of, or replacement of system components, including control units

As part of the process of implementing these modifications, the authority having jurisdiction should be consulted for additional recommendations or requirements.

4.3.3.1 All persons who can at any time enter a space protected by carbon dioxide shall be warned of the hazards involved and provided with safe evacuation procedures.

4.3.3.1.1 Provisions shall be made to prohibit entry of unprotected personnel to spaces made unsafe by a carbon dioxide discharge until the space is ventilated and appropriate tests of the atmosphere have verified that it is safe for unprotected persons to enter. Persons who are not properly trained in the use of and equipped with self-contained breathing apparatus (SCBA) shall not remain in spaces where the concentration exceeds 4 percent.

A.4.5.6.2.2 All total flood hazards will be made unsafe for entry of unprotected personnel until such spaces are ventilated of carbon dioxide. Spaces containig equipment protected by local application systems could become unsafe, particularly if the protected equipment occupies a sizable portion of the volume of the room containing the equipment. Pits, cellars, and rooms adjacent to the protected hazard, especially those at lower elevations, can be made unsafe by migration of the discharged carbon dioxide.

Oil of wintergreen is a common and recommended odorizer addition to the discharging carbon dioxide to produce a distinctive odor that warns of the presence of carbon dioxide gas. Other odorizers that are especially appropriate for specific locations can also be used, but, if there is no specific reason to use an odorizer other than oil of wintergreen, oil of wintergreen should be used.

Olfactory indicators could be inappropriate for such applications used in clean rooms, food processing plants, aluminum rolling mills, and telecommunications facilities because they could adversely affect the process or equipment.
Provisions to help prevent the entry of persons into areas made unsafe by the discharge of carbon dioxide could include one or more of the following:

(1) Addition of a distinctive odor to the discharging carbon dioxide, the detection of which serves as an indication to persons that carbon dioxide gases are present. Personnel should be trained to recognize the odor and evacuate spaces wherein the odor is detected.

(2) Provision of automatic alarms at the entry to and within such spaces for which alarms are activated by carbon dioxide detectors or oxygen detectors.

(3) Establishment and enforcement of confined space entry procedures for such areas.

Visual Alarm – Strobe

Audible Alarm

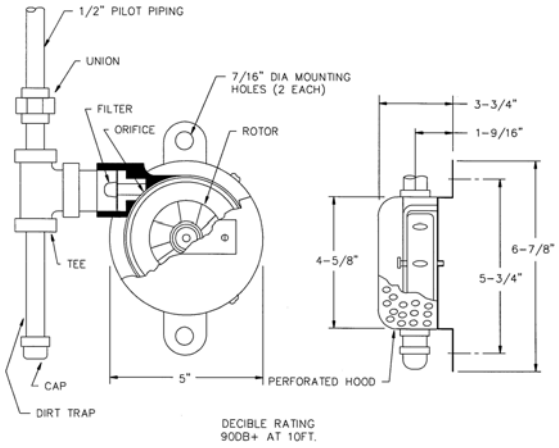
4.3.3.2 Audible and visible alarms shall be provided in accordance with 4.5.6.

4.3.3.3 ***** All personnel shall be informed that discharge of carbon dioxide gas from either high- or low-pressure systems directly at a person will endanger the person's safety by causing eye injury, ear injury, or even falls due to loss of balance upon the impingement of the high-velocity discharging gas.

4.3.3.4 A lockout shall be provided on all systems except where dimensional constraints prevent personnel from entering the protected space.

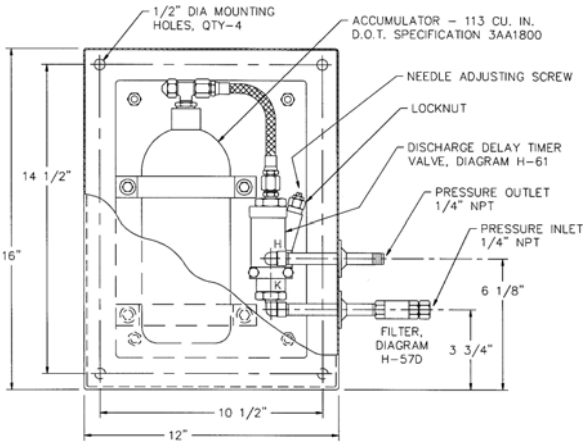
4.3.3.4.1 Lockout valves shall be installed on all systems where carbon dioxide could migrate, creating a hazard to personnel.

4.3.3.4.2 ***** A service disconnect switch shall not be used as a means of preventing agent discharge in lieu of a lockout valve.



Pneumatic pre-discharge alarm

In excess of 90 db at 10 ft distance, with CO2 vapor discharges at approximately 3 lbs. of CO2 vapor per minute at 280 psig



Automatic Mechanical Timer

Stock units are factor set for 22 seconds delay. Limit of adjustment is 5 seconds minimum to 90 seconds maximum

4.5.6.1 Pre-discharge Alarm and Time Delay. A pneumatic pre-discharge alarm and pneumatic time delay and visible Pre-discharge alarm shall be provided for the following enclosures:

(1) Normally occupied and occupiable enclosures protected by total flooding systems except as outlined in 4.5.6.1.3.

(2) Local application systems protecting hazards where the discharge exposes personnel to concentrations of carbon dioxide in excess of 7.5 percent by volume of agent in air for longer than 5 minutes

4.5.6.1.1 The pre-discharge alarms, where required, shall be located within the enclosure.

4.5.6.1.2 The pre-discharge time delay shall provide a time delay for purpose of pre-discharge alarm of sufficient duration to allow evacuation of personnel from areas within the spaces most remote from the exits.

4.5.6.1.3 * Time delays shall be permitted to be eliminated for occupiable hazard areas where the provision of a time delay would result in unacceptable risk to personnel or unacceptable damage to critical pieces of equipment.

4.5.6.1.4 Where time delays are omitted, provision shall be made to ensure that the carbon dioxide system is locked out at any time that personnel are present in the protected area or space.

4.5.6.1.5 Dry runs shall be made to determine the minimum time needed for persons to evacuate the hazard area, allowing time to identify the warning signal.

4.5.6.1.6 Audible signal appliances shall have either sound levels in accordance with 4.5.6.1.6.1 through 4.5.6.1.6.2 or acoustic characteristics in accordance with 7.4.5, Narrow Band Tone Signaling for Exceeding Masked Thresholds, of NFPA72.

4.5.6.1.1.1 Audible pre-discharge alarms shall be at least 15 dB above ambient noise level or 5 dB above maximum sound level, whichever is greater, measured 5 ft (1.5 m) above the floor of the occupiable area.

4.5.6.1.1.2 Audible signal appliances shall have a sound level not more than 120 dB at the minimum hearing distance from the audible appliance.

4.5.6.1.1.3 The predischarge alarm shall have a minimum decibel rating of 90 dBA at 10 ft (3 m).

4.5.6.2 Visible and audible alarms shall be located outside each entrance to the following:

(1) Normally occupied and occupiable space protected by a total flooding carbon dioxide system
(2) Normally occupied and occupiable enclosures where the discharge from a local application system will expose personnel to hazardous concentrations of carbon dioxide
(3) Normally occupied and occupiable spaces where carbon dioxide could migrate, creating a hazard to personnel

4.5.6.2.1 These alarms shall begin operation prior to or at the start of the discharge.

4.5.6.2.2 * These alarms shall continue to operate after agent discharge until one of the following occurs:

(1) Other positive action has been taken to prevent entry of personnel to the space containing an atmosphere made unsafe by the carbon dioxide discharge.
The space is ventilated and the safety of the atmosphere for entry by unprotected persons has been verified

4.5.4.14 **Discharge Pressure Switch**

4.5.4.14.1 A discharge pressure switch shall be installed between the carbon dioxide supply and the lockout valve.

4.5.4.14.1.1 In a low-pressure system, the tank shutoff valve shall not be considered as a lockout valve, except as permitted by 4.5.4.13.1.2.

4.5.4.14.1.2 Where a single low-pressure storage tank supplies single or multiple systems protecting interrelated hazards, and when none of the hazards require protection if the equipment being protected is shut down, the storage tank shutoff valve shall be permitted to be used as a lockout valve for the entire system.

4.5.4.14.1.3 For low-pressure CO2 systems where the manual, supervised, main shutoff valve can be considered a lockout valve (meets requirements of 4.3.3.4, 4.3.3.4.1, 4.3.3.4.2, 4.3.3.4.3, and 4.5.4.13.1.2), the pressure switch shall be located downstream of the automatic valve (master-selector, selector valve) supplying the hazard or hazards.

4.5.4.14.2 The discharge pressure switch shall provide an alarm-initiating signal to the releasing panel to operate electric/electronic alarm appliances.

4.4.2.14 The system owner shall maintain an instruction and maintenance manual that includes a full sequence of operation, and a full set of system drawings and calculations shall be maintained in a protective enclosure.

4.5.5 **Supervision and Lockout Valves**

4.5.5.1 Supervision of automatic systems and manual lockout valves shall be provided unless specifically waived by the authority having jurisdiction.

4.5.5.2 Supervision of automatic systems shall be provided, and the lockout required by 4.3.3.4 shall be supervised for both automatic and manual systems unless specifically waived by the authority having jurisdiction.

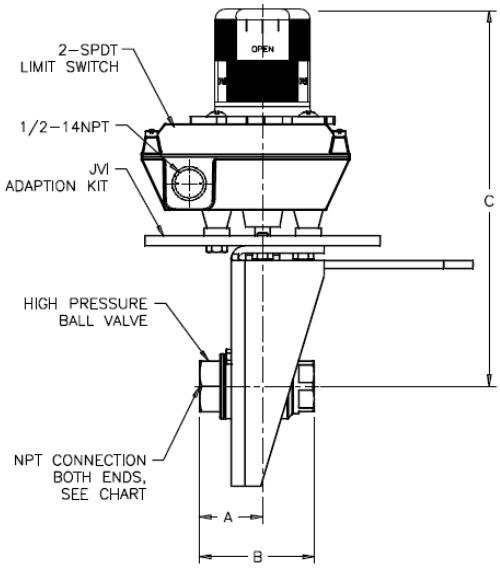
4.5.5.3 * Interconnections between the components that are necessary for the control of the system and life safety shall be supervised. *Exception: Normally unpressurized interconnections of pipe and tube shall not be required to be supervised.*

4.5.5.4 An open circuit, ground-fault condition, or loss of integrity in the pneumatic control lines that would impair full system operation shall result in a trouble signal.

4.5.5.5 The alarm and trouble signals shall be transmitted by one of the methods described in *NFPA 72*.

4.5.5.6 High-pressure pneumatic-operated slave cylinder connections immediately adjacent to pilot cylinders shall not be required to be supervised.

4.5.5.7 Where manual bypasses are provided and such bypasses are capable of being left in an open position, these bypasses shall be supervised.



4.3.3.4.0 A lockout shall be provided on all systems except where dimensional constraints prevent personnel from entering the protected space.

4.3.3.4.1 Lockout valves shall be installed on all systems where carbon dioxide could migrate, creating a hazard to personnel.

4.3.3.4.2 * A service disconnect switch shall not be used as a means of preventing agent discharge in lieu of a lockout valve.

4.3.3.4.3 When maintenance or testing is being conducted on the system, it shall be locked out, or the protected space and affected spaces (migration) shall be evacuated.

4.3.3.4.4 When protection is to be maintained during the lockout period, a person(s) shall be assigned as a "fire watch" with suitable portable or semi-portable fire-fighting equipment or means to restore protection.

4.3.3.4.4.1 The fire watch shall have a communication link to a constantly monitored location.

4.3.3.4.4.2 Authorities responsible for continuity of fire protection shall be notified of the lockout and subsequent restoration of the system.

4.3.2 **Signs**

4.3.2.1.1 Warning signs shall be affixed in a conspicuous location in every protected space; at every entrance to protected spaces; in spaces near the protected spaces where it is determined that carbon dioxide could migrate, creating a hazard to personnel; and at each entrance to carbon dioxide storage rooms and where carbon dioxide can migrate or collect in the event of a discharge from a safety device of a storage container.

4.3.2.2 The safety sign format, color, letter style of signal words, message panel lettering, lettering size, and the safety provisions of symbols shall be in accordance with ANSI Z535.

4.3.2.3 Safety signs and message wording shall be provided using a three-panel format as required by 4.3.2.3.1 through 4.3.2.3.6.2.

4.3.2.3.1 The sign in Figure 4.3.2.3.1 shall be used in every protected space.

4.3.2.3.2 The sign in Figure 4.3.2.3.2 shall be used at every entrance to protected space.

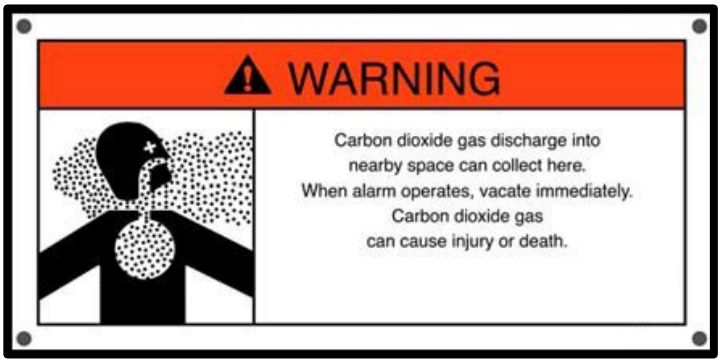
4.3.2.3.3 The sign in Figure 4.3.2.3.3 shall be used at every entrance to protected space for systems provided with a wintergreen odorizer.

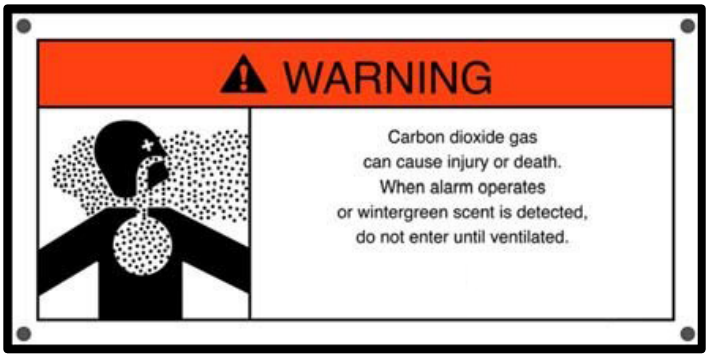
4.3.2.3.4 The sign in Figure 4.3.2.3.4 shall be used in every nearby space where carbon dioxide could accumulate to hazardous levels.

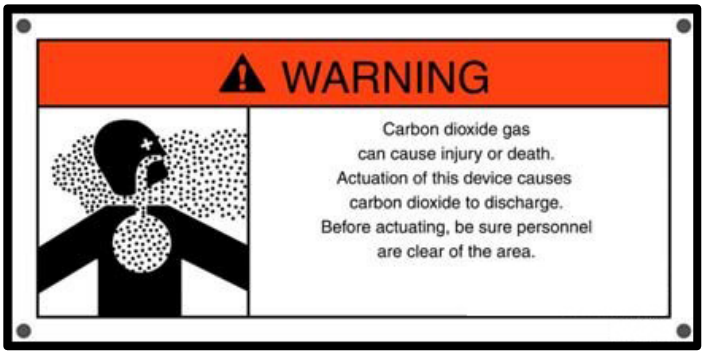
4.3.2.3.5 The sign in Figure 4.3.2.3.5 shall be used outside each entrance to carbon dioxide storage rooms.

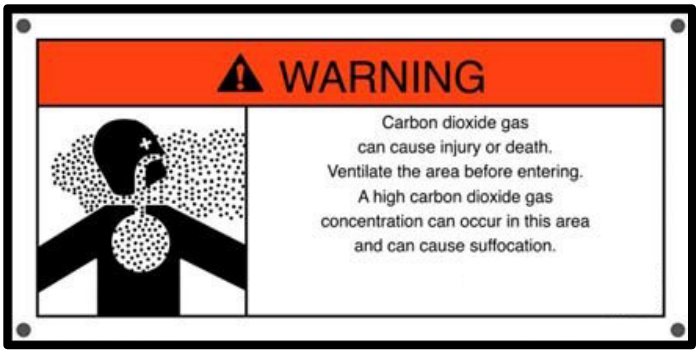
The installation of safety signs per 4.3.2 does not require any modifications to the installation and should be added immediately


WARNING
Carbon dioxide gas
can cause injury or death.
When alarm operates,
vacate immediately.


WARNING
Carbon dioxide gas discharge into
nearby space can collect here.
When alarm operates, vacate immediately.
Carbon dioxide gas
can cause injury or death.

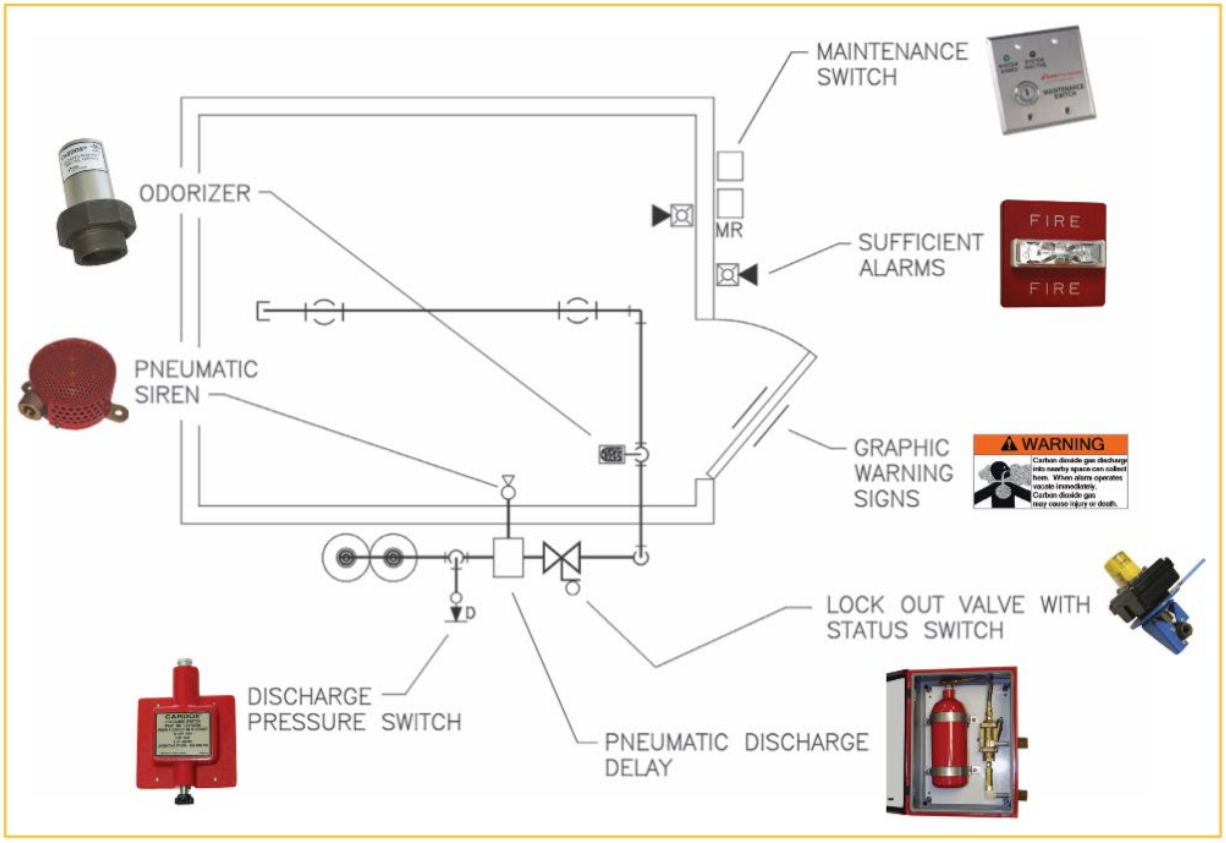

WARNING
Carbon dioxide gas
can cause injury or death.
When alarm operates
or wintergreen scent is detected,
do not enter until ventilated.


WARNING
Carbon dioxide gas
can cause injury or death.
Actuation of this device causes
carbon dioxide to discharge.
Before actuating, be sure personnel
are clear of the area.


WARNING
Carbon dioxide gas
can cause injury or death.
Ventilate the area before entering.
A high carbon dioxide gas
concentration can occur in this area
and can cause suffocation.


WARNING
Carbon dioxide gas
can cause injury or death.
When alarm operates,
do not enter until ventilated.

Example of High-Pressure CO2 System Layout



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