

CO₂

Carbon Dioxide Fire Suppression Systems

Owner's Manual

CO₂

**Carbon Dioxide
Fire Suppression
Systems**

Owner's Manual

THIS PAGE INTENTIONALLY LEFT BLANK.

FOREWORD

This Manual is written for those who fill Kidde Carbon Dioxide (CO₂) Suppression System Cylinders.

IMPORTANT

Kidde assumes no responsibility for application of any systems other than those addressed in this manual. The technical data contained herein is limited strictly for information purposes only. Kidde believes this data to be accurate, but it is published and presented without any guarantee or warranty whatsoever. Kidde disclaims any liability for any use that may be made of the data and information contained herein by any and all other parties.

Kidde Carbon Dioxide Engineered Fire Suppression Systems are to be designed, installed, inspected, maintained, tested and re-charged by qualified, trained personnel in accordance with the following:

- Standard of the National Fire Protection Association No. 12, titled "Carbon Dioxide Extinguishing systems." (Latest Edition)
- All instructions, limitations, etc., contained in the manual, P/N 81-CO2MAN-002.
- All information contained on the system nameplate(s).

Storage, handling, Transportation, service, maintenance, recharge and test of agent storage containers shall be performed only by qualified, trained personnel in accordance with the information in the manual and Compressed Gas Association* pamphlets C-1, C-6, G-6, G-6.3 and P-1.

- C-1, "Methods for Hydrostatic Testing of Compressed Gas Cylinders"
- C-6, "Standards for Visual Inspection of Steel Compressed Gas Cylinders"
- G-6, "Carbon Dioxide"
- G-6.3, "Carbon Dioxide Cylinder Filling and Handling Procedures"
- P-1, "Safe Handling of Compressed Gas In Containers"

*CGA pamphlets are available from:

Compressed Gas Association
Crystal Square Two
1725 Jefferson Davis Highway
Arlington, VA 22202-4102

Any questions concerning the information presented in the manual should be addressed to:

Kidde-Fenwal, Inc.
400 Main Street
Ashland, MA 01721
Phone: (508) 881-2000
Fax: (508) 881-8920

THIS PAGE INTENTIONALLY LEFT BLANK.

TABLE OF CONTENTS

Foreword	i
List of Tables	iv

Paragraph	Title	Page
1	General Information	1-1
1-1	Introduction	1-1
1-2	Moving of Containers	1-1
1-2.1	Moving by Trucks	1-1
1-2.2	Rough Handling	1-1
1-2.3	Storage	1-1
1-3	Protection Cap	1-1
1-4	About the System	1-2
1-5	Carbon Dioxide (CO ₂) Overview	1-2
2	Installation, Operation and Maintenance	2-1
2-1	Introduction	2-1
2-2	Installation	2-1
2-3	Instructions in Case of Fire	2-1
2-3.1	CO ₂ System Operation Procedures	2-2
2-3.1.1	Automatic Operation	2-2
2-3.1.2	Cable Actuator and Electric System Operation	2-2
2-3.1.3	Remote Nitrogen Actuator Operation (Pneumatic)	2-2
2-3.1.4	Local Manual Operation—All Systems	2-2
2-3.1.5	Hose Reel or Rack System Manual Operation	2-3
2-3.1.5.1	Surface Fires	2-3
2-3.1.5.2	Electrical Fires—Switchboards, Motors, etc.	2-3
2-4	Post-Operation Instructions	2-3
2-5	Inspection and Maintenance of the System	2-3
2-5.1	Monthly Inspection	2-4
2-5.2	Semi-Annual Inspection	2-5
2-5.3	Annual Inspection	2-5
2-5.4	5 Year and 12 Year Inspection and Test Guidelines	2-5
2-6	Additional Requirements	2-5
2-7	Additional Specifications and Documentation	2-5

LIST OF TABLES

Table	Title	Page
2-1	Inspection and Maintenance Schedule	2-4

LIST OF APPENDICES

Appendix	Title	Page
A	MSDS Sheets	A-1
B	Component Descriptions	B-1

ATTENTION INSTALLER

This form must be signed by the system owner indicating that he/she has received a copy of this Owner's Manual P/N 81-CO2MAN-002. Have the system installer fill-out this form.

Note: Retain a copy of this form for your records.

1. System Installed:

2. Listing of Major System Components:

3. Description of Hazard Protected by System:

Owner or Authorized Representative

Date

Title

THIS PAGE INTENTIONALLY LEFT BLANK.

SAFETY SUMMARY

Safety precautions are essential whenever electrical or mechanical equipment is involved. Take precautions when handling, servicing, and charging CO₂ fire suppression systems cylinders. Using this equipment with the respect and caution demanded will considerably lessen the possibility of personal injury. If safety precautions are overlooked or ignored, personal injury or property damage may occur.

The following symbols are used throughout this manual. Always heed these precautions. They are essential to the safe use of the equipment described in this manual.

WARNING

The warning symbol identifies immediate hazards and provides specific instructions or procedures which if not correctly followed may result in severe personal injury or death.

CAUTION

This caution symbol identifies specific instructions or procedures which if not correctly followed could result in equipment or property damage.

The following safety precautions should always be followed:

WARNING

Pressurized (charged) cylinders are extremely hazardous and if not handled properly are capable of causing bodily injury, death or property damage.

1. Read and understand this manual and the other documents referenced herein.
2. The valve cylinder safety cap **MUST** be installed on the cylinder at all times and only removed when performing charging, testing, or salvaging operations in accordance with the procedures contained in this manual.
3. Wear safety glasses when working with pressurized cylinders and charging equipment
4. Make sure that all control heads, pressure operated control heads, or other type of actuation devices have been removed from the cylinder valves. Ensure the protection caps are installed before performing any charging, leak tests or salvage operations.

Don't get careless. Never assume a cylinder is empty. Treat all cylinders as if they are fully charged.

Smoking is prohibited in carbon dioxide fill and charging areas.

THIS PAGE INTENTIONALLY LEFT BLANK.

CHAPTER 1

GENERAL INFORMATION

1-1 INTRODUCTION

This document is provided to instruct and familiarize the owner with the Kidde Carbon Dioxide (CO₂) Fire Suppression System. This manual covers:

- Information about the system
- How the CO₂ system operates
- How CO₂ works
- Installation of the system
- Instructions in case of fire
- Post-operation instructions
- Inspection and maintenance of the system
- Responsibilities and related equipment requirements
- Additional specifications and documentation

Note: This owner's manual does not cover every detail of step-by-step installation procedures for Kidde Carbon Dioxide (CO₂) Fire Suppression System.

The system consists of components tested within the limitations defined in the detailed design, installation, operation and maintenance manual (P/N 81-CO2MAN-001) which is available from Kidde. **The system designer must be consulted whenever changes are planned for the system or area of protection.**

A certified Kidde distributor must be consulted after the system has been discharged.

The technical data contained herein is limited strictly for informational purposes only.

CAUTION

It is the owner's responsibility to read this manual and to ensure proper system operation and personnel safety.

Follow the instructions in this manual and on the CO₂ cylinder nameplates. Review this information semi-annually, or as needed. Place this manual in an accessible place near the CO₂ system for ready reference.

Kidde believes this data to be accurate, however, it is published and presented without any guarantee or warranty whatsoever. Kidde disclaims any liability for the information contained herein by any, and all, other parties.

Before handling Kidde products, all personnel must be thoroughly trained in the safe handling of the containers as well as in the proper procedures for installation, removal, filling

and connection of other critical devices, such as solenoids, cable assemblies, pressure switches and safety caps. READ, UNDERSTAND and ALWAYS FOLLOW the operation and maintenance manuals, owner's manuals, service manuals, etc., that are provided with the individual systems.

WARNING

Pressurized (charged) containers are extremely hazardous and if not handled properly, are capable of violent discharge. This may result in serious bodily injury, death and property damage.

1-2 MOVING OF CONTAINERS

1-2.1 Moving by Trucks

All CO₂ cylinders over 40 lb. are to be laid horizontally on the pallet in pyramidal form and securely strapped during shipment. No more than 10 CO₂ cylinders may be shipped on a single pallet. Containers must not be rolled, dragged, slid or allowed to be slid from tailgates of vehicles. A suitable hand truck, fork truck, roll platform or similar device must be used.

1-2.2 Rough Handling

Containers must not be dropped or permitted to strike violently against each other or other surfaces.

1-2.3 Storage

Containers must be stored upright and secured in place.

1-3 PROTECTION CAP

WARNING

The 35 lb. through 100 lb. size cylinders are factory-equipped with a protection cap threaded securely over the valve assembly. This device is a safety feature and provides protection during shipment and handling. This cap must be installed at all times, except when the cylinders are connected into the system piping or being filled. Do not move or handle a carbon dioxide cylinder unless the protection cap is installed.

The 35 through 100 lb. containers are shipped with a protective safety cap. This device is a safety feature that will protect the discharge valve from damage or rupture in a case where the container is mishandled.

The safety cap must be installed on the container **at all times** except when the container is attached to the system piping; i.e., when the discharge head is connected to the container discharge valve.

The safety cap must remain in close proximity to the container to prevent loss while in service. Do not move or handle cylinders without the cap installed.

For additional information on safe handling of compressed gas containers, see CGA Pamphlet P1 titled "Safe Handling of Compressed Gases in Containers." (CGA pamphlets may be purchased from the Compressed Gas Association, Crystal Square Two, 1725 Jefferson Davis Highway, Arlington, VA, 22202).

1-4 ABOUT THE SYSTEM

The Kidde CO₂ 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 as the extinguishant, designed in accordance with the National Fire Protection Association (NFPA) 12, "Standard on Carbon Dioxide Extinguishing Systems", (latest edition).

Kidde CO₂ Fire Suppression Systems are designed for suppression of Class A (wood, paper, and other cellulosic materials), Class B (flammable liquids and gases), and Class C (electrical equipment) hazards. Carbon dioxide must be applied with due consideration of the hazard being protected and its contents. Carbon dioxide should not be used on Class D (reactive metals, metal hydrides and chemicals containing their own oxygen supply) hazards, such as magnesium, potassium, sodium, and cellulose nitrate.

Examples of typical carbon dioxide system applications include:

- Industrial
- Dip tanks
- Mixing tanks
- Spray booths
- Ovens and dryers
- Quench tanks
- Coating machines
- Marine
- Dry cargo spaces
- Machinery spaces
- Paint lockers

WARNING

Because carbon dioxide reduces the available oxygen in the atmosphere, it will not support life. Care must be taken, and appropriate alarms shall be used, to ensure that all personnel are evacuated from the protected space prior to discharging the system. A suitable warning sign must be prominently displayed, in clear view at the point of entry into the protected area, to alert people to the asphyxiation properties of carbon dioxide.

The discharge of carbon dioxide in fire suppression concentrations can create a serious threat to people. Carbon dioxide should not be used for spaces normally occupied if sufficient safeguards cannot be taken to ensure that all personnel can evacuate the space before discharge.

1-5 CARBON DIOXIDE (CO₂) OVERVIEW

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. In general, a reduction in oxygen concentration in the combustion zone to 15% or less by volume is sufficient to extinguish most diffusion-flame fires in flammable liquids.

Carbon dioxide is stored as a liquid under its own vapor pressure of 850 psi at 70° F (58.6 bar at 21° C). This pressure propels the agent through the valve and subsequent pipe network to the nozzle or nozzles. Upon discharge from the nozzle the CO₂ undergoes a rapid expansion and subsequent phase change from liquid to gas. The large volumetric expansion ratio, from liquid to gas, allows for the storage of a large quantity of agent in a small cylinder.

CHAPTER 2

INSTALLATION, OPERATION AND MAINTENANCE

2-1 INTRODUCTION

The Kidde CO₂ Fire Suppression System is designed to discharge a specific amount of CO₂ through nozzles located within the hazard area as either a local application or total flooding application. The amount of CO₂ necessary for the system has been carefully calculated to meet strict requirements set by Underwriters Laboratories, Factory Mutual Research and the National Fire Protection Association. Additional requirements may apply depending upon the application, design specifications and the Authority Having Jurisdiction.

The Kidde Carbon Dioxide Fire Suppression System consists of:

- CO₂ container(s), discharge piping and nozzles
- Manual and/or automatic actuation devices—electric, pneumatic, cable or local manual
- Detection devices, alarm devices and control panel.

The system must be provided with a means for operation using either an automatic or manual control. However, a manual control of actuation must accompany an automatic means of actuation as a redundant control. Automatic system operation (if provided) can be electric using UL Listed heat detectors, photoelectric smoke detectors, ionization smoke detectors or optical flame detectors.

A control head (electric, pneumatic, cable or local manual) is used to operate the CO₂ agent container. Pressure from the discharge may be used to open the container valves on additional containers.

If the system has a control panel, refer to the appropriate Kidde control panel manual as applicable.

2-2 INSTALLATION

Kidde CO₂ Fire Suppression Systems must be installed by authorized Kidde distributors only. Each system must be installed using genuine Kidde components and installation materials in accordance with the Design, Installation, Operation and Maintenance Manual (P/N 81-CO2MAN-001).

Note: The installer must have a current Kidde training certificate.

Check your system before acceptance. Do not accept poor workmanship, missing system parts or substitute system components. The following items must be checked after the system is installed:

- All areas requiring protection are adequately covered.
- A means of manually discharging the CO₂ system is provided in a readily accessible location where it can be operated while leaving the vicinity of the hazard area. The manual control must be clearly labeled.
- The installer of the CO₂ system should answer any questions regarding the components, coverage and operation of the system.
- The installer has demonstrated that the installed system conforms to the requirements of the Kidde Carbon Dioxide (CO₂) Fire Suppression Systems Design, Installation, Operation and Maintenance Manual, (P/N 81-CO2MAN-001), the requirements of the insurance carrier and the Authorities Having Jurisdiction in the area.

2-3 INSTRUCTIONS IN CASE OF FIRE

In case of fire, take the following steps:

1. Direct all occupants to leave the fire area immediately.
- Note:** Once all occupants have exited the fire area and protected enclosure, operate the system manually using the manual release if necessary. (Do not wait for the system to actuate automatically.)
2. Suspend all operations in the fire area.
 3. Contact the fire department and local fire brigade (if applicable) immediately, no matter how small the fire appears to be. Post the street address of the building containing the protected area and the fire department's telephone number beside each phone. Familiarize yourself with the location of the nearest telephone box or pay-phone outside the building, in the event that the fire department must be notified from outside the facility.
 4. Make sure all persons have evacuated the fire area in accordance with building management emergency procedures.
 5. To operate the extinguishing system, follow the instructions on the manual release device, i. e., "LIFT COVER, PULL DOWN," etc. The remote manual release is a device, which works electrically and/or mechanically. Exit the vicinity of the hazard immediately following actuation of the manual release device.
 6. Do not re-enter the fire area until the fire department gives approval.

2-3.1 CO₂ System Operation Procedures

The following operation procedures are based on the CO₂ system being used in normally occupied areas or where occupancy is possible. In these instances a pressure operated time delay and a pressure operated siren are required, to ensure that personnel are alerted and afforded the time to evacuate the hazard area prior to system discharge, regardless of the actuation mode. In addition, a lock-out valve should be installed if the hazard is occupied by people not familiar with the system operation. During a lock-out period, a trained employee should be assigned as a “fire watch” with a suitable portable device, to maintain protection of the hazard until the CO₂ system is restored.

Note: In occupied protected spaces, particularly those occupied by personnel unfamiliar with the presence of, or operational procedure of the Kidde CO₂ system, Kidde recommends a lock-out valve be provided per Section 1-5.1.7 of NFPA 12, “Standard on Carbon Dioxide Extinguishing Systems.”

These procedures are for reference to the system owner. For additional information, refer to the Kidde Carbon Dioxide (CO₂) Fire Suppression Systems Design, Installation, Operation and Maintenance Manual, (P/N 81-CO2MAN-001). Appendix B includes component descriptions of typical equipment that the personnel in charge of the equipment should be aware of in the event of system actuation.

Note: Be sure the Kidde distributor installing the system provides a written description of the CO₂ system procedure of operation at the time the system is commissioned.

WARNING

If the pressure operated time delay fails to operate, actuate the manual control head lever installed on the time delay to immediately discharge the system once personnel have evacuated the area.

2-3.1.1 AUTOMATIC OPERATION

When a system is operated automatically by the electric or pneumatic detection system, proceed as follows:

1. All personnel must evacuate the hazard area promptly. Close all doors.
2. Call the fire department immediately.
3. If the system is provided with a reserve cylinder(s), see Paragraph 6.4 of the Design, Installation, Operation and Maintenance Manual.
4. Contact a Kidde distributor for service.

2-3.1.2 CABLE ACTUATOR AND ELECTRIC SYSTEM OPERATION

Operate the system using the controls as follows:

1. Immediately evacuate all personnel from the hazard area. Close all doors.
2. Proceed to cable pull station or manual electric station, (whichever applies) for the appropriate hazard.
3. Operate the station as directed on the device to actuate the CO₂ cylinders.
4. For multiple hazard systems, operate the cable pull station for the appropriate stop valve.
5. Call the fire department immediately.
6. If the system is provided with a reserve cylinder(s), see Paragraph 6.4 of the Design, Installation, Operation and Maintenance Manual.
7. Contact a Kidde distributor for service.

2-3.1.3 REMOTE NITROGEN ACTUATOR OPERATION (PNEUMATIC)

1. Immediately evacuate all personnel from the hazard area. Close all doors.
2. Proceed to the remote nitrogen actuator station for the appropriate hazard.
3. Operate the control head mounted on the nitrogen actuation cylinder.
4. Move the ball valve, installed in the actuation piping downstream of the nitrogen cylinder to the OPEN position.
5. Call the fire department immediately.
6. If the system is provided with a reserve cylinder(s), see Paragraph 6.4 of the Design, Installation, Operation and Maintenance Manual.
7. Contact a Kidde distributor for service.

2-3.1.4 LOCAL MANUAL OPERATION—ALL SYSTEMS

CAUTION

This manual control is not part of the normal system actuation mode and should only be used in a last resort, emergency condition.

1. Immediately evacuate the hazard area. Close all doors.
2. Proceed to the cylinder(s) for the hazard.
3. Remove the locking pin from the cylinder control head(s).
4. Rotate the local manual release lever to the RELEASED or OPEN position.
5. Proceed to hazard area stop (directional) valve if one is installed. Remove the locking pin from the stop (directional) valve control head. Rotate the local manual release lever to the RELEASED or OPEN position.
6. Proceed to the system lock-out valve and be sure it is in the OPEN position.
7. Call the fire department immediately.
8. Contact a Kidde distributor for service.

2-3.1.5 HOSE REEL OR RACK SYSTEM MANUAL OPERATION

1. Proceed to the carbon dioxide cylinder(s).
2. Remove the locking pin from the cylinder control head, and rotate the local manual release lever to the RELEASED or OPEN position.
3. Unwind hose from reel or rack. Approach fire carefully. Do not allow hose to lie in the path of the flames.
4. Point horn at hazard. Open horn valve by pushing stirrup handle forward.
5. Direct carbon dioxide discharge at base of the flames. As flames recede, follow slowly. Follow detailed instructions below.

2-3.1.5.1 Surface Fires

1. Direct carbon dioxide discharge close to the edge of the fire nearest you. DO NOT point the horn at the center of the flame. If the hose horn must be aimed into an inaccessible fire, the horn must be in the OPEN position.
2. Sweep the horn slowly back and forth across the base of the flames. Chase flames slowly as the fire is extinguished. For bulkhead fires arising in Marine (shipboard) applications, direct the discharge at the bottom and gradually work upward as the fire recedes.
3. Continue discharging carbon dioxide until all smoldering material is covered with carbon dioxide "snow".

2-3.1.5.2 Electrical Fires—Switchboards, Motors, etc.

1. Discharge carbon dioxide into all openings on burning substances.
2. Continue to discharge carbon dioxide until flames have been extinguished and the burned material is coated with carbon dioxide "snow". This will prevent any incandescent material from re-igniting.

CAUTION

While it is not necessary to de-energize equipment before discharging carbon dioxide onto electrical fires, equipment must be de-energized as soon as possible after system discharge to prevent the fire from spreading.

6. After the fire has been extinguished, leave the horn valve open to relieve all pressure from the hose.
7. Perform post-fire maintenance.
8. Contact a Kidde distributor for service.

2-4 POST-OPERATION INSTRUCTIONS

After the system has discharged and the fire has been extinguished, do not attempt to resume operations in the protected area containing the fire until the following steps have been completed:

1. The fire department has given authorization to re-occupy the area.

2. The protected space has been thoroughly ventilated, ensuring that all products of combustion and carbon dioxide are discharged into the atmosphere external of the building. Forced ventilation may need to be required.
3. In order to remove all traces of combustion products, arrange for all affected equipment to be cleaned at the first available opportunity.
4. Contact the Kidde distributor to reset and recharge the system. The system must be recharged immediately and with the proper type and quantity of agent to ensure continued protection.

2-5 INSPECTION AND MAINTENANCE OF THE SYSTEM

WARNING

The owner of the Kidde Carbon Dioxide (CO₂) Fire Suppression System must comply with these instructions. Failure to do so may result in inadequate system performance, property damage and personal injury.

CAUTION

CO₂ and nitrogen cylinder assemblies must be stored, handled, transported, serviced, maintained, tested and installed only by trained personnel and in accordance with the instructions contained in the Kidde Carbon Dioxide (CO₂) Fire Suppression Systems Design, Installation, Operation and Maintenance Manual, (P/N 81-CO2MAN-001), NFPA-12, and CGA pamphlets C-1, C-6, G-6, G-6.3 and P-1. CGA pamphlets may be obtained from the Compressed Gas Association, 1725 Jefferson Davis Highway, Arlington, VA 22202-4102. Before performing maintenance procedures, refer to the material safety data sheets and safety bulletins in this manual and in the Appendix of the Kidde Carbon Dioxide (CO₂) Fire Suppression Systems Design, Installation, Operation and Maintenance Manual, (P/N 81-CO2MAN-001).

WARNING

All actuation devices (control heads, discharge heads, etc.) must be removed from the system cylinders prior to performing system maintenance. Observe all safety precautions applicable to handling pressurized equipment. Recharge of CO₂ and nitrogen cylinder assemblies must be performed by personnel trained in Kidde CO₂ systems equipment. Failure to do so may result in property damage or personal injury.

CO₂ Fire Suppression Systems

Fire suppression systems require proper care to ensure normal operation at all times. Periodic inspections must be made to determine the exact condition of the system equipment.

A regular program of systematic maintenance is essential for proper operation of the carbon dioxide system. A periodic maintenance schedule must be followed and an inspection log maintained for ready reference. As a minimum, the log should record inspection interval, inspection procedure performed, maintenance performed, if any, as a result of inspection, and name of inspector performing task. If inspection indicates areas of rust or corrosion, immediately clean and repaint the area.

Perform inspections and preventative maintenance in accordance to the schedule in Table 2.1. The inspection procedures and intervals are recommended and may be modified to fit into normal facility schedules providing the intervals do not exceed the time periods indicated. A drawing of the major CO₂ Fire Suppression System components is included with appropriate part numbers in Appendix B of this manual. The component drawings are for owner reference only.

Table 2-1. Inspection and Maintenance Schedule

Schedule	Requirement
Monthly	Inspect hazard area system components
	Check nitrogen cylinder pressure
Semi-Annually	Check CO ₂ cylinder weight
	Test electric control head
	Test pressure switch
Annually	Check nitrogen cylinder pressure
	Check CO ₂ cylinder weight
	Blow out distribution piping
	Perform complete system function
	Test pneumatic detection system
Every 5 years	Hydrostatic test all CO ₂ and nitrogen system hoses and flexible connectors.
Every 5 or 12 years	CO ₂ cylinder hydrostatic test
	N ₂ cylinder hydrostatic test

2-5.1 Monthly Inspection

The following monthly inspection program should be conducted visually only. If any defects are apparent as described below, **SUSPEND ALL OPERATIONS IN THE PROTECTED AREA**, and immediately contact a Kidde Distributor. In addition, Kidde recommends that all inspections, including the monthly inspection, be conducted by an authorized Kidde distributor.

1. Check that all personnel who may have to operate the system are properly trained and authorized to do so. In particular, check that all new employees have been instructed in the use of the system.
2. Make a general inspection survey of all cylinders and equipment for damaged or missing parts. If any equipment requires replacement, contact a Kidde distributor.
3. Ensure that access to hazard areas, remote nitrogen or cable pull stations, discharge nozzles, and cylinders are unobstructed and there are no obstructions that would hinder the operation of the equipment or distribution of carbon dioxide.
4. Inspect flexible actuation hoses for loose fittings, damaged threads, cracks, distortion, cuts, dirt and frayed wire braid. Inspect flexible actuation hose adapters for stripped threads and damage. Inspect couplings and tees for tightness. If any of these defects are present, contact a Kidde distributor to replace, tighten, or clean system parts.
5. Inspect control heads attached to CO₂ cylinders, nitrogen cylinders, stop valves and time delays for physical damage, deterioration, corrosion, distortion, cracks, dirt, and loose couplings. If a defect is found, contact a Kidde distributor; a replacement may be necessary. Ensure that all control heads, actuation devices, etc., are all in the SET or CLOSED position with the locking pin installed and seal wire intact.
6. Inspect carbon dioxide cylinder and valve assembly for leakage, physical damage such as cracks, dents, distortion, and worn parts.
7. Inspect cylinder straps, cradles, and attaching hardware for loose, damaged, or broken parts. Check straps and associated parts for corrosion, oil, grease, grime, etc.
8. Inspect CO₂ system discharge heads for cracks, corrosion, grime, etc.
9. Inspect flexible discharge hoses for loose fittings, damaged threads, cracks, rust, kinks, distortion, dirt, and frayed wire braid.
10. Inspect discharge manifold for physical damage, corrosion, and dirt. Inspect manifold support brackets and clamps for looseness and damage. Inspect check and stop valves, where applicable, for deformation, leakage, cracks, wear, corrosion, and dirt.

CAUTION

Do not paint nozzle orifices. The part number of each nozzle is stamped on the nozzle. Nozzles must be replaced by nozzles of the same part number. Nozzles must never be interchanged, since random interchanging of nozzles will adversely affect proper CO₂ distribution within a hazard area.

11. Inspect discharge nozzles for dirt, clogs and physical damage. Where flangible discs are used, ensure they are intact and clean. Look for holes or cuts. Broken discs will allow vapors, oils, etc., to enter into the nozzles and system piping from the hazard, and seriously affect or block system discharge.
12. Inspect pressure switches for deformations, cracks, dirt or other damage.
13. Check nitrogen cylinder pressure gauge for proper operating pressure. If pressure loss (adjusted for temperature) exceeds 10%, recharge with nitrogen to 1800 psig at 70°F. See Figure 7.18.2 of the Kidde Carbon Dioxide (CO₂) Fire Suppression Systems Design, Installation, Operation and Maintenance Manual, (P/N 81-CO2MAN-001), for the pressure-temperature relationship.
14. Inspect the lock-out valve. The valve must be secured and locked in the OPEN position.
15. Visually inspect control panel and detection system. Ensure that the system is in "Normal" status and free from any "Alarm" or "Trouble" signals.
16. If any defects are found during the monthly inspection, immediately contact a Kidde Distributor to service the systems.

2-5.2 Semi-Annual Inspection

The system must be thoroughly inspected on a semi-annual basis by a certified Kidde distributor ONLY. The semi-annual inspection includes a weighing of the agent cylinders, an electric control head test, and a pressure switch test. A detailed description of the semi-annual inspection can be found in the Design, Installation, Operation and Maintenance Manual, Paragraphs 7.4, 7.5 and 7.6.

2-5.3 Annual Inspection

The system must be thoroughly inspected on an annual basis by a certified Kidde distributor ONLY. The annual inspection includes a check of the CO₂ cylinder weight, a check of the nitrogen cylinder pressure, a blowout procedure for the distribution piping, a complete system performance function test, and a pneumatic detection system test. A detailed description of the annual inspection can be found in the Design, Installation, Operation and Maintenance Manual, Paragraphs 7.7 and 7.8.

2-5.4 5 Year and 12 Year Inspection and Test Guidelines

The carbon dioxide and nitrogen cylinders must undergo hydrostatic testing and be marked in accordance with DOT CFR 49 Section 173.34 every 5 years after a cylinder is discharged or, if no discharge has occurred, every 12 years. The cylinders must undergo hydrostatic testing **immediately** if they show evidence of distortion, damage, cracks, corrosion, or mechanical damage. **Testing must be conducted by a certified Kidde distributor ONLY.**

The flexible hoses must undergo hydrostatic testing every 5 years in accordance with NFPA12. **Testing must be conducted by a certified Kidde distributor ONLY.** A detailed description of the 5 and 12 year inspection can be found in the Design, Installation, Operation and Maintenance Manual, Paragraph 7.9.

2-6 ADDITIONAL REQUIREMENTS

In addition to the CO₂ system and for areas not protected by the system, portable fire extinguishers are required. Consult with the insurance carrier, local Authorities Having Jurisdiction and a portable fire extinguisher distributor for sizes, types, spacing and location requirements.

Read, understand and follow the instructions in this manual and on the container nameplates. Review these instructions with employees semi-annually, or more frequently. Place this manual in an accessible area near the CO₂ system for ready reference. Post the name, phone number and address of the Kidde distributor near all telephones. Also, post the emergency telephone number of the fire department and the building street address near all telephones.

If any condition exists which would render the CO₂ systems inoperative or ineffective, **SUSPEND ALL OPERATIONS IN THE PROTECTED AREA IMMEDIATELY.** Have the condition corrected by a Kidde distributor before resuming operations.

2-7 ADDITIONAL SPECIFICATIONS AND DOCUMENTATION

The system must be designed, installed, operated and maintained only in accordance with the following documents and specifications:

- Kidde Carbon Dioxide (CO₂) Design, Installation, Operation and Maintenance Manual (P/N 81-CO2MAN-001), available from Kidde Distributors or from Kidde at:

Kidde-Fenwal, Inc.
400 Main Street
Ashland, MA 01721
Phone: 508-881-2000
Fax: 508-881-8920

- National Fire Protection Association Standard No. 12, current edition, available from:

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269

- Copies of the Material Safety Data Sheet (MSDS) for Carbon Dioxide are available in the back of this manual (Appendix A).

THIS PAGE INTENTIONALLY LEFT BLANK.

APPENDIX A

MATERIAL SAFETY DATASHEETS

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Carbon dioxide, refrigerated liquid (MSDS No. P-4573-A)	Trade Name: LIQUIFLOW
Chemical Name: Carbon dioxide	Synonyms: Carbon dioxide (cryogenic liquid), LCO ₂ , liquefied CO ₂
Formula: CO ₂	Chemical Family: Acid anhydrides
Telephone:	Company Name: Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113
Emergencies: 1-800-645-4633* CHEMTREC: 1-800-424-9300* Routine: 1-800-PRAXAIR	

* Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).

2. Composition/Information on Ingredients

This section covers materials of manufacture only. See sections 3, 8, 10, 11, 15, and 16 for information on by-products generated during use, especially use in welding and cutting. For custom mixtures of this product, request an MSDS for each component. See section 16 for important information about mixtures.

INGREDIENT	CAS NUMBER	CONCENTRATION	OSHA PEL	ACGIH TLV-TWA
Carbon Dioxide	124-38-9	>99%	5,000 ppm*	5,000 ppm**

* The symbol > means "greater than"; the symbol <, "less than."

** See section 3.

3. Hazards Identification

EMERGENCY OVERVIEW

WARNING! Cold liquid and gas under pressure.

Can cause rapid suffocation.

Can cause frostbite.

Can increase respiration and heart rate.

May cause nervous system damage.

May cause dizziness and drowsiness.

Self-contained breathing apparatus may be required by rescue workers.

Odor: None to slightly pungent

THRESHOLD LIMIT VALUE: TLV-TWA, 5,000 ppm (ACGIH, 1998). TLV-TWA, 15 min STEL, 30,000 ppm. ACGIH recommends a TLV-TWA of 5 mg/m³ for welding fumes not otherwise classified (NOC) that may be generated during welding with this product. TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION—Carbon dioxide gas is an asphyxiant with effects due to lack of oxygen. It is also physiologically active, affecting circulation and breathing. Moderate concentrations may cause headache, drowsiness, dizziness, stinging of the nose and throat, excitation, rapid breathing and heart rate, excess salivation, vomiting, and unconsciousness. Lack of oxygen can kill.

SKIN CONTACT—No harm expected from vapor. Prolonged contact with carbon dioxide crystals (snow) could cause frostbite. Coldgas, or liquid or solid carbon dioxide may cause severe frostbite.

SWALLOWING—An unlikely route of exposure. This product is a gas at normal temperature and pressure. But severe frostbite of the lips and mouth may result from contact with the liquid or solid.

EYE CONTACT—No harm expected from vapor. Coldgas, or liquid or solid carbon dioxide may cause severe frostbite.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: No harm expected to healthy individuals. Where competent medical authority deems that such illness would be aggravated by exposure to carbon dioxide, persons in ill health should be restricted from working with or handling this product.

OTHER EFFECTS OF OVEREXPOSURE: Damage to retinal or ganglion cells and central nervous system may occur.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: The toxicology and the physical and chemical properties of carbon dioxide suggest that overexposure is unlikely to aggravate existing medical conditions.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION: A single study has shown an increase in heart defects in rats exposed to 6% carbon dioxide in air for 24 hours at different times during gestation. There is no evidence that carbon dioxide is teratogenic in humans.

CARCINOGENICITY: Carbon dioxide is not listed by NTP, OSHA, or IARC.

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

SKIN CONTACT: For exposure to cold liquid, vapor, or solid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). In case of massive exposure, remove contaminated clothing while showering with warm water. Call a physician.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure.

EYE CONTACT: For exposure to cold liquid, vapor, or solid, immediately flush eyes thoroughly with warm water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN: *There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.*

5. Fire Fighting Measures

FLASH POINT (test method)	Not applicable	AUTOIGNITION TEMPERATURE	Not applicable
FLAMMABLE LIMITS IN AIR, % by volume	LOWER	Not applicable	UPPER Not applicable

EXTINGUISHING MEDIA: Carbon dioxide cannot catch fire. Use media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES: WARNING! Cold liquid and gas under pressure. Evacuate all personnel from danger area. Immediately spray containers with water from maximum distance until cool, taking care not to direct spray onto vents on top of container. Do not discharge sprays into liquid carbon dioxide, which will freeze water rapidly. When containers have cooled, move them away from fire area if without risk. Self-contained breathing apparatus may be required by rescue workers. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Heat of fire can build pressure in cylinder and cause it to rupture. No part of container should be subjected to a temperature higher than 125°F (52°C). Liquid carbon dioxide containers are equipped with pressure relief devices.

HAZARDOUS COMBUSTION PRODUCTS: None known.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: WARNING! Cold liquid and gas under pressure. Carbon dioxide is an asphyxiant. Lack of oxygen can kill. Evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Liquid carbon dioxide will not "spill." Flakes of solid carbon dioxide will form at pressures below 67 psig (461.95 kPa) and fall as snow. Shut off leak if you can do so without risk. Ventilate area or move container to a well-ventilated area. Test for sufficient oxygen, especially in confined spaces, before allowing reentry.

WASTE DISPOSAL METHOD: Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. Do not store in a confined space. Storage areas should be clean and dry, free of oils and dust, which collect on condensing coils and impair their efficiency. Temperatures should not exceed 125°F (51.1°C). Cryogenic containers are equipped with a pressure relief device and a pressure-controlling valve. Under normal conditions these containers will periodically vent product to control internal pressure. Use adequate pressure relief devices in systems and piping to prevent pressure buildup; entrapped liquid can generate extremely high pressures.

PRECAUTIONS TO BE TAKEN IN HANDLING: Never allow any unprotected part of your body to touch uninsulated pipes or vessels containing cryogenic fluids. Flesh will stick to the extremely cold metal and will tear when you try to pull free.

Use a suitable hand truck to move containers. Cryogenic containers must be handled and stored in an upright position. Do not drop or tip containers, or roll them on their sides. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using carbon dioxide, see section 16.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST–Use a local exhaust system, if necessary, to control the concentration of carbon dioxide in the worker's breathing zone.

MECHANICAL (general)–Under certain conditions, general exhaust ventilation may be acceptable to keep carbon dioxide below the exposure limit.

SPECIAL–None

OTHER–None

RESPIRATORY PROTECTION: None required under normal use. An air-supplied respirator must be used in confined spaces. Respiratory protection must conform to OSHA rules as specified in 29 CFR 1910.134.

SKIN PROTECTION: Wear insulated neoprene gloves for cylinder handling.

EYE PROTECTION: Select in accordance with OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling. Protective clothing where needed. Cuffless trousers should be worn outside shoes. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. When using carbon dioxide or carbon dioxide mixtures in welding and cutting, see Praxair MSDS P-4574, gaseous carbon dioxide, for requirements. Regardless of protective equipment, never touch live electrical parts.

9. Physical and Chemical Properties

MOLECULAR WEIGHT:	44.01
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm:	1.522
GAS DENSITY at 70°F (21.1°C) and 1 atm:	0.1444 lb/ft ³ (1.833 kg/m ³)
LIQUID DENSITY (saturated) at 70°F (21.1°C) and 1 atm:	47.6 lb/ft ³ (762 kg/m ³)
VAPOR PRESSURE at 70°F (21.1°C):	838 psig (5778 kPa)
SOLUBILITY IN WATER , vol/vol at 68°F (20°C) and 1 atm:	0.90
PERCENT VOLATILES BY VOLUME:	100
EVAPORATION RATE (Butyl Acetate = 1):	High
pH:	3.7 (for carbonic acid)
SUBLIMATION POINT at 1 atm:	-109.3°F (-78.5°C)

APPEARANCE, ODOR, AND STATE: Colorless, odorless, liquid. Converts to white crystalline particles when discharged from container. The gas is slightly acid and is felt by some to have a slight, pungent odor and biting taste.

10. Stability and Reactivity

STABILITY: Unstable Stable

INCOMPATIBILITY (materials to avoid): Alkali metals, alkaline earth metals, metal acetylides, chromium, titanium above 1022°F (550°C), uranium above 1382°F (750°C), magnesium above 1427°F (775°C)

HAZARDOUS DECOMPOSITION PRODUCTS: Electrical discharges and high temperatures decompose carbon dioxide into carbon monoxide and oxygen.

HAZARDOUS POLYMERIZATION: May Occur Will Not Occur

CONDITIONS TO AVOID: None known.

11. Toxicological Information

The welding process may generate hazardous fumes and gases. If using carbon dioxide for welding and cutting, see Praxair MSDS P-4574, gaseous carbon dioxide.

Carbon dioxide is an asphyxiant. It initially stimulates respiration and then causes respiratory depression. High concentrations result in narcosis. Symptoms in humans are as follows:

EFFECT:	CONCENTRATION:
Breathing rate increases slightly.	1%
Breathing rate increases to 50% above normal level. Prolonged exposure can cause headache, tiredness.	2%
Breathing increases to twice normal rate and becomes labored. Weak narcotic effect. Impaired hearing, headache, increased blood pressure and pulse rate.	3%
Breathing increases to approximately four times normal rate, symptoms of intoxication become evident, and slight choking may be felt.	4 - 5%
Characteristic sharp odor noticeable. Very labored breathing, headache, visual impairment, and ringing in the ears. Judgment may be impaired, followed within minutes by loss of consciousness.	5 - 10%
Unconsciousness occurs more rapidly above 10% level. Prolonged exposure to high concentrations may eventually result in death from asphyxiation.	50 - 100%

12. Ecological Information

No adverse ecological effects expected. Carbon dioxide does not contain any Class I or Class II ozone-depleting chemicals. Carbon dioxide is not listed as a marine pollutant by DOT.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME: Carbon dioxide, refrigerated liquid

HAZARD CLASS:	IDENTIFICATION NUMBER:	PRODUCT RQ:
2.2	UN 2187	Not applicable

SHIPPING LABEL(s): NONFLAMMABLE GAS

PLACARD (when required): NONFLAMMABLE GAS

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of extremely hazardous substances (40 CFR Part 355):

Threshold Planning Quantity (TPQ): None

Extremely Hazardous Substances (40 CFR 355): None

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes

PRESSURE: Yes

DELAYED: No

REACTIVITY: No

FIRE: No

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Carbon dioxide does not require reporting under Section 313.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Carbon dioxide is not listed as a regulated substance.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Carbon dioxide is listed on the TSCA inventory.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Carbon dioxide is not listed in Appendix A as a highly hazardous chemical.

STATE REGULATIONS:

CALIFORNIA: Carbon dioxide is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

WARNING: The combustion of this gas produces carbon monoxide—a chemical known to the State of California to cause birth defects or other reproductive harm.

(California Health and Safety Code §25249.5 *et seq.*)

PENNSYLVANIA: Carbon dioxide is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

ADDITIONAL SAFETY AND HEALTH HAZARDS: The welding process may generate hazardous fumes and gases. If using carbon dioxide for welding and cutting, see Praxair MSDS P-4574, gaseous carbon dioxide.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: *Cold liquid and gas under pressure.* Contact may cause frostbite. Use piping and equipment adequately designed to withstand pressures to be encountered. Avoid materials incompatible with cryogenic use; some metals such as carbon steel may fracture easily at low temperature. *Gas can cause rapid suffocation due to oxygen deficiency.* Store and use with adequate ventilation. Carbon dioxide is heavier than air. It tends to accumulate near the floor of an enclosed space, displacing air and pushing it upward. This creates an oxygen-deficient atmosphere near the floor. Ventilate space before entry. Verify sufficient oxygen concentration. Close cylinder valve after each use; keep closed even when empty. *Prevent reverse flow.* Reverse flow into container may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. *Never work on a pressurized system.* If there is a leak, close the container valve. Blow the system down in a safe and environmentally sound manner in compliance with all federal, state, and local laws; then repair the leak *Never place a compressed gas cylinder where it may become part of an electrical circuit.*

MIXTURES: When you mix two or more gases or liquefied gases, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:**NFPA RATINGS:**

HEALTH = 3
FLAMMABILITY = 0
REACTIVITY = 0
SPECIAL = SA (CGA recommends this to designate Simple Asphyxiant.)

HMIS RATINGS:

HEALTH = 3
FLAMMABILITY = 0
REACTIVITY = 0

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:**THREADED:**

CGA-320
CGA-622 for withdrawal of refrigerated liquid

PIN-INDEXED YOKE:

Not applicable

ULTRA-HIGH-INTEGRITY CONNECTION: Not applicable

Use the proper CGA connections **DO NOT USE ADAPTERS**. Additional limited-standard connections may apply. See CGA pamphlet V-1 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information about this product can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 1725 Jefferson Davis Highway, Arlington, VA 22202-4102, Telephone (703) 412-0900.

AV-1	<i>Safe Handling and Storage of Compressed Gases</i>
G-6	<i>Carbon Dioxide</i>
G-6.1	<i>Standard for Low Pressure Carbon Dioxide Systems at Customer Sites</i>
G-6.2	<i>Commodity Specification for Carbon Dioxide</i>
P-1	<i>Safe Handling of Compressed Gases in Containers</i>
P-14	<i>Accident Prevention in Oxygen-Rich, Oxygen-Deficient Atmospheres</i>
SB-2	<i>Oxygen-Deficient Atmospheres</i>
V-1	<i>Compressed Gas Cylinder Valve Inlet and Outlet Connections</i>
—	<i>Handbook of Compressed Gases, Third Edition</i>

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

Praxair MSDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current Praxair MSDSs for these products, contact your Praxair sales representative or local distributor or supplier. If you have questions regarding Praxair MSDSs, would like the form number and date of the latest MSDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (**Phone:** 1-800-PRAXAIR; **Address:** Praxair Call Center, Praxair, Inc., PO Box 44, Tonawanda, NY 14150-7891).

PRAXAIR, the FLOWING AIRSTREAM design, and LIQUIFLOW are trademarks or registered trademarks of Praxair Technology, Inc. in the United States and other countries.



Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113

THIS PAGE INTENTIONALLY LEFT BLANK.

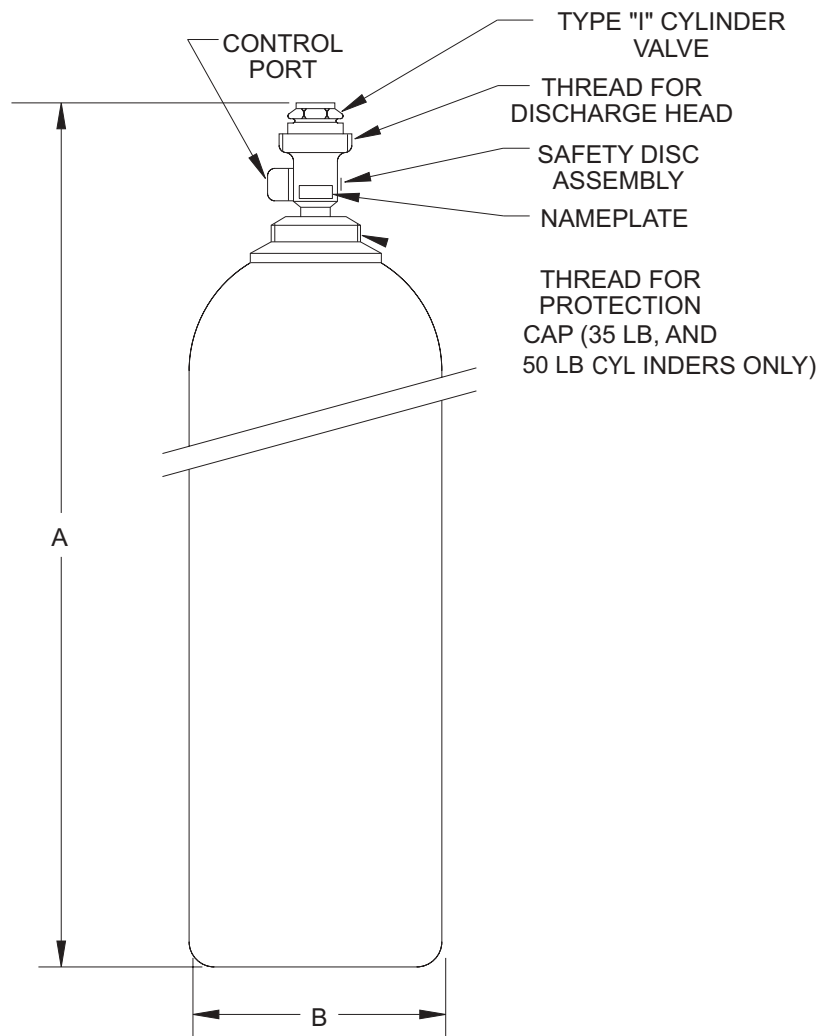
APPENDIX B

COMPONENT DESCRIPTIONS

LIST OF ILLUSTRATIONS

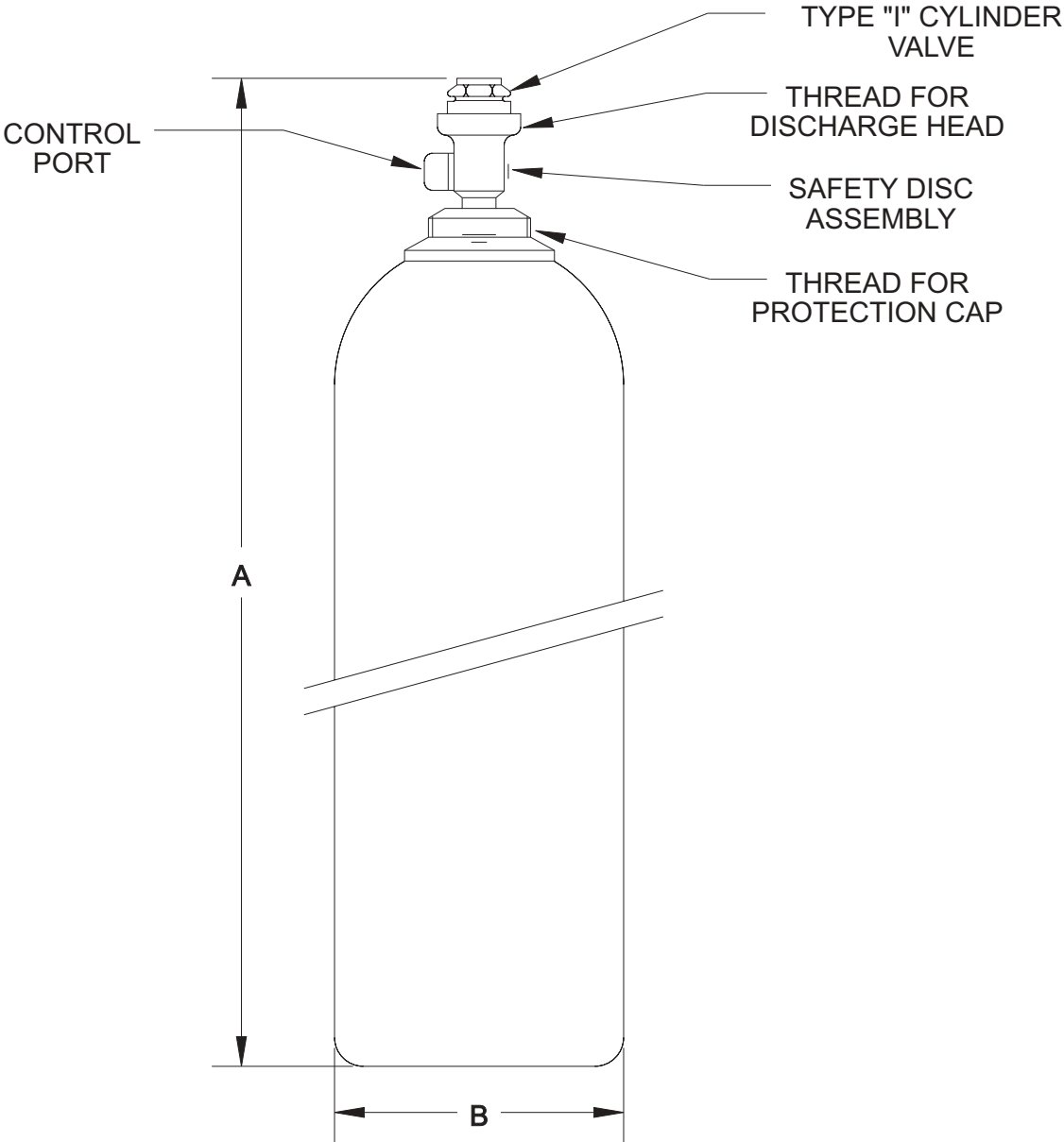
APPENDIX B

Figure	Title	Page
B-1	25 lb. thru 50 lb. Carbon Dioxide Cylinders, Bent Siphon Tube	1-2
B-2	75 lb. and 100 lb. Carbon Dioxide Cylinders	1-3
B-3	Discharge Head, Plain Nut	1-4
B-4	Flex Hose - 3/4" and 1/2"	1-4
B-5	Nozzle Part Numbers	1-5
B-6	Multijet Nozzle, Type "S"	1-6
B-7	Multijet Nozzle, Type "S" Flanged	1-6
B-8	Multijet Nozzle, Type "M"	1-7
B-9	Multijet Nozzle, Type "L"	1-7
B-10	Lever or Pressure Operated Control Head	1-8
B-11	Nitrogen Pilot Cylinder and Bracket	1-8
B-12	Ball Valve 1/4"	1-9
B-13	Stop (Directional) Valves, 1/2" thru 2"	1-9
B-14	Stop (Directional) Valves, 2-1/2" and 3"	1-10
B-15	4" Stop (Directional) Valve	1-10
B-16	Valve, CO ₂ Lock Out w/Limit Switch	1-11
B-17	Safety Outlets	1-11
B-18	Pressure Operated Switch	1-12
B-19	Pressure Operated Switch, Explosion Proof	1-12
B-20	Discharge Delay with Manual Operated Control Head	1-13
B-21	Pull Box, Break Glass	1-13



PART NUMBER	CYLINDER	VALVE TYPE	A	B
870486	25 lb.	1/2"	30.0"	8.50"
982547	35 lb.		40.0"	8.50"
982548	50 lb.		55.0	8.50

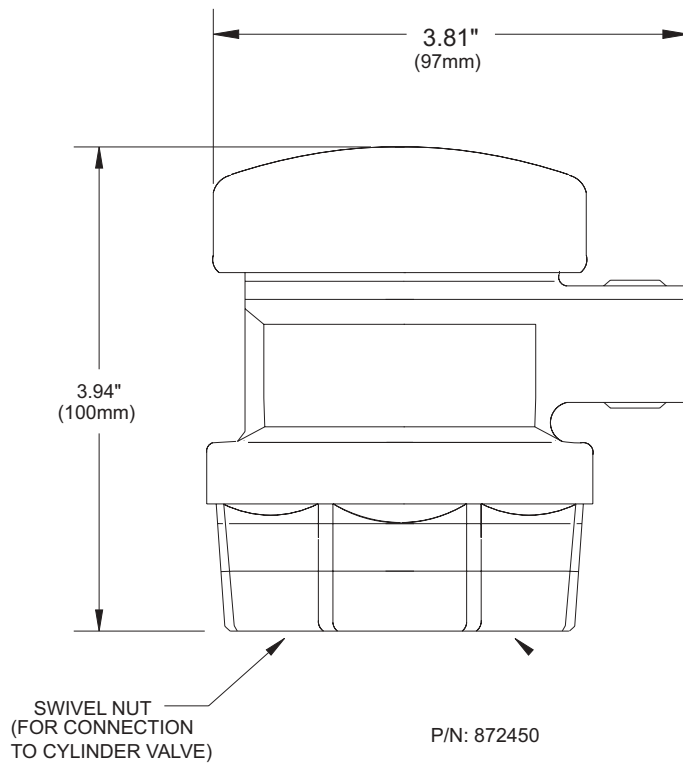
Figure B-1. 25 lb. thru 50 lb. Carbon Dioxide Cylinders, Bent Siphon Tube



Pressure Ratings:
 Working Pressure = 1800 psig
 Maximum Pressure at T = 130°F = 2250 psig
 Hydrostatic Test Pressure = 3000 psig

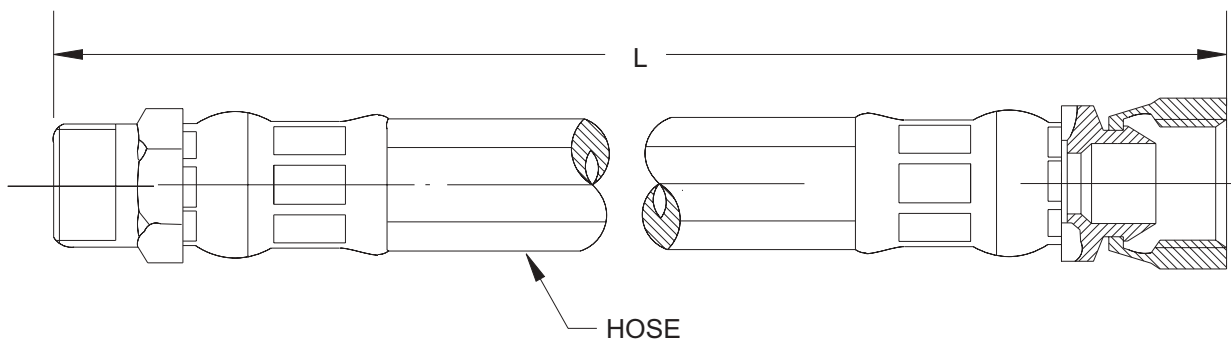
PART NUMBER	CYLINDER	VALVE TYPE	A	B
870287	75 lb.	5/8"	60.0"	9.25"
870269	100 lb.		62.0"	10.50"

Figure B-2. 75 lb. and 100 lb. Carbon Dioxide Cylinders



P/N 872450

Figure B-3. Discharge Head, Plain Nut

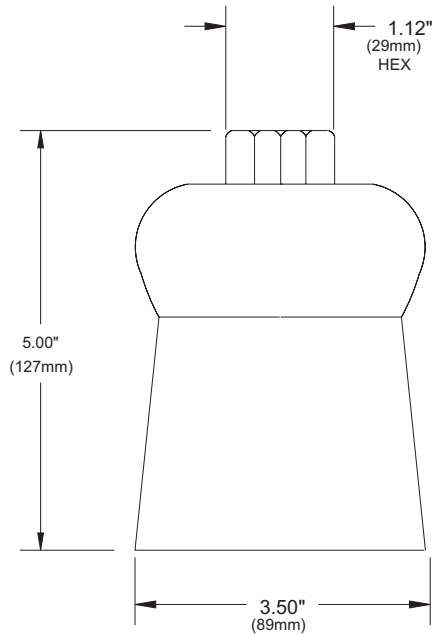


Size	P/N	L
1/2"	252184	14.5"
3/4"	251821	16.4"

Figure B-4. Flex Hose - 3/4" and 1/2"

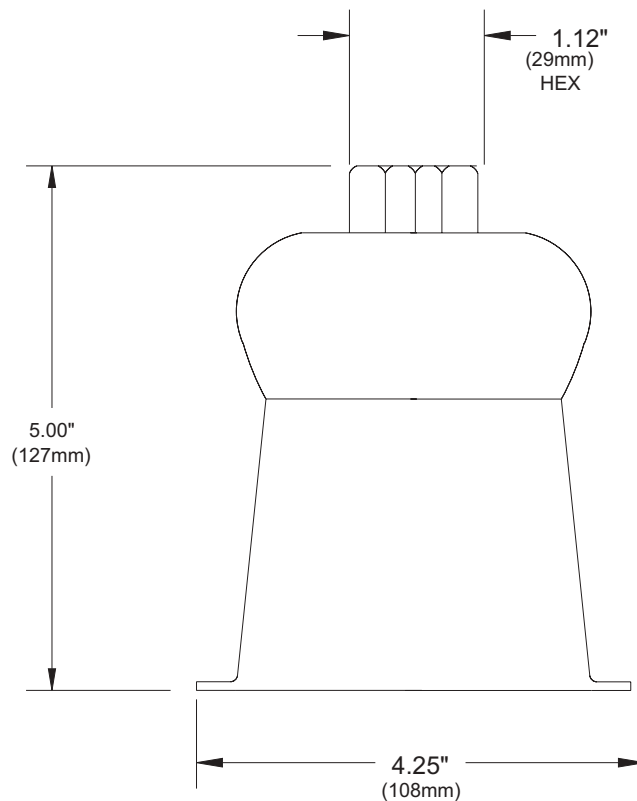
SIZE	V	S	S-ZINC	S-FLANGED	M	L
1+	930067	X	X	X	X	X
2	919309	803381	803897	802290	X	X
2+	803327	803365	803881	802974	X	X
3	929242	803366	803882	802975	X	X
3+	803328	803369	803883	802976	X	842334
4	915876	803368	803884	802977	842319	842335
4+	803329	803369	803885	802978	842320	242336
5	214721	803370	803886	802979	842321	842337
5+	214722	803371	803887	802980	842322	242338
6	214723	803372	803888	802981	842323	842339
6+	214724	803373	803889	802982	842324	242340
7	214725	803374	803890	802983	842325	842341
7+	214726	803375	803891	802984	X	842342
8	214727	803376	803892	802985	842326	842343
8+	214728	803377	803893	802986	X	842344
9	214729	803378	803894	802987	842327	842345
9+	X	803379	803895	802988	X	842346
10	X	803380	803896	802989	842328	842347
11	X	X	X	X	842329	X
12	X	X	X	X	842330	X
13	X	X	X	X	842331	X
14	X	X	X	X	842332	X
15	X	X	X	X	842333	X

Figure B-5. Nozzle Part Numbers



For P/N, refer to Table in Figure B-5.

Figure B-6. Multijet Nozzle, Type "S"

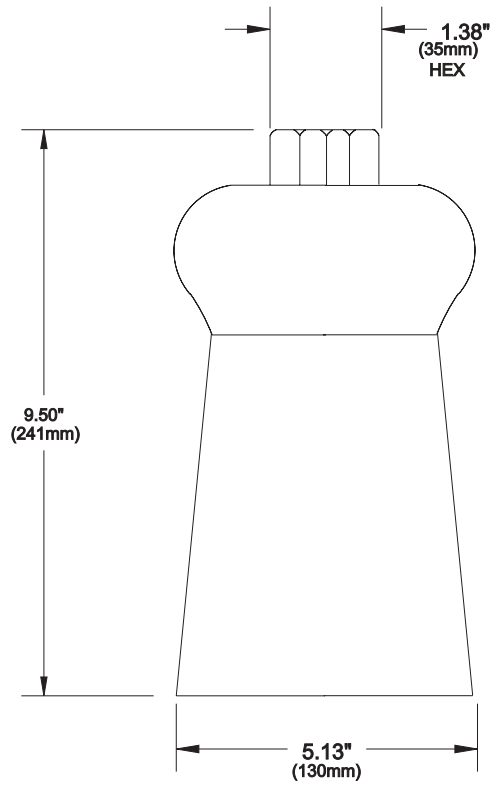


For P/N, refer to Table in Figure B-5.

Available Finishes (nozzle only):

1. Red Paint
2. Zinc Plated

Figure B-7. Multijet Nozzle, Type "S" Flanged

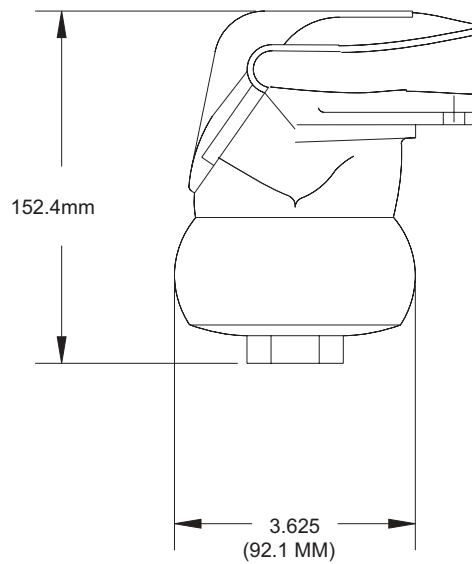


For P/N, refer to Table in Figure B-5.

Available Finishes (nozzle only):

1. Red Paint
2. Zinc Plated

Figure B-8. Multijet Nozzle, Type "M"

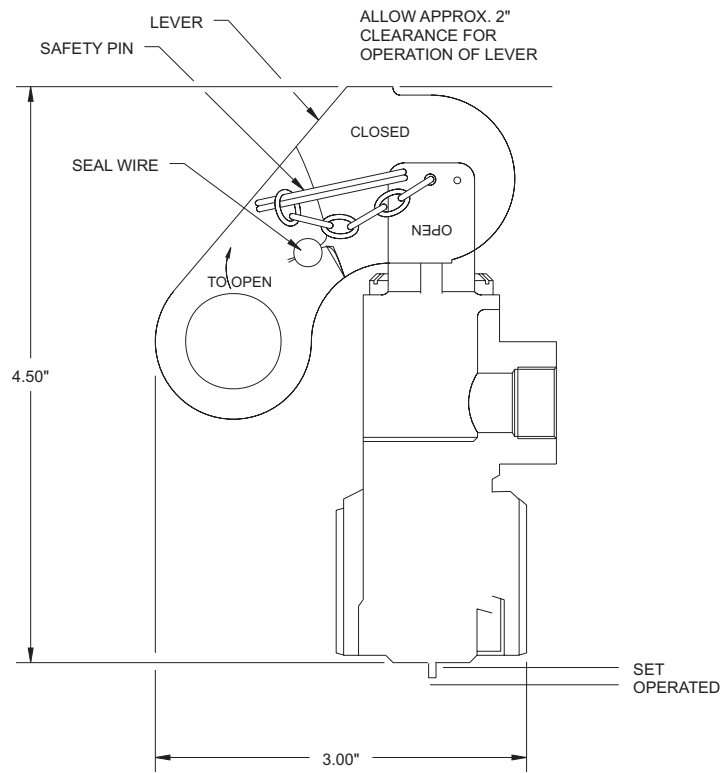


For P/N, refer to Table in Figure B-5.

Available Finishes (nozzle only):

1. Red Paint

Figure B-9. Multijet Nozzle, Type "L"



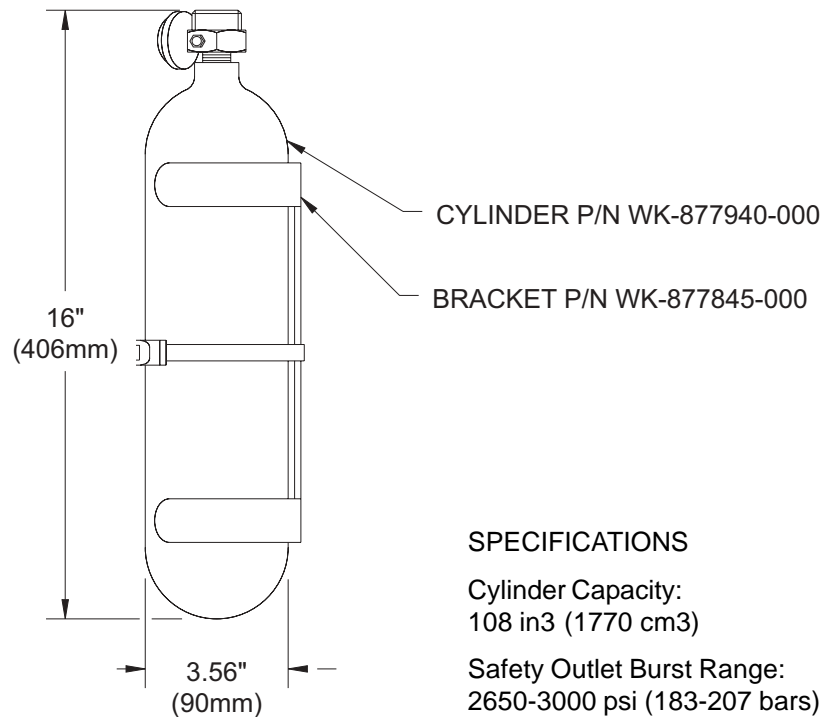
MATERIAL

Lever: Stainless Steel

Body and Piston: Brass

P/N 878751

Figure B-10. Lever or Pressure Operated Control Head



MATERIAL

Cylinder: Steel, Painted Black

Valve: Brass

Bracket: Steel, Painted Black

Adapter: Brass

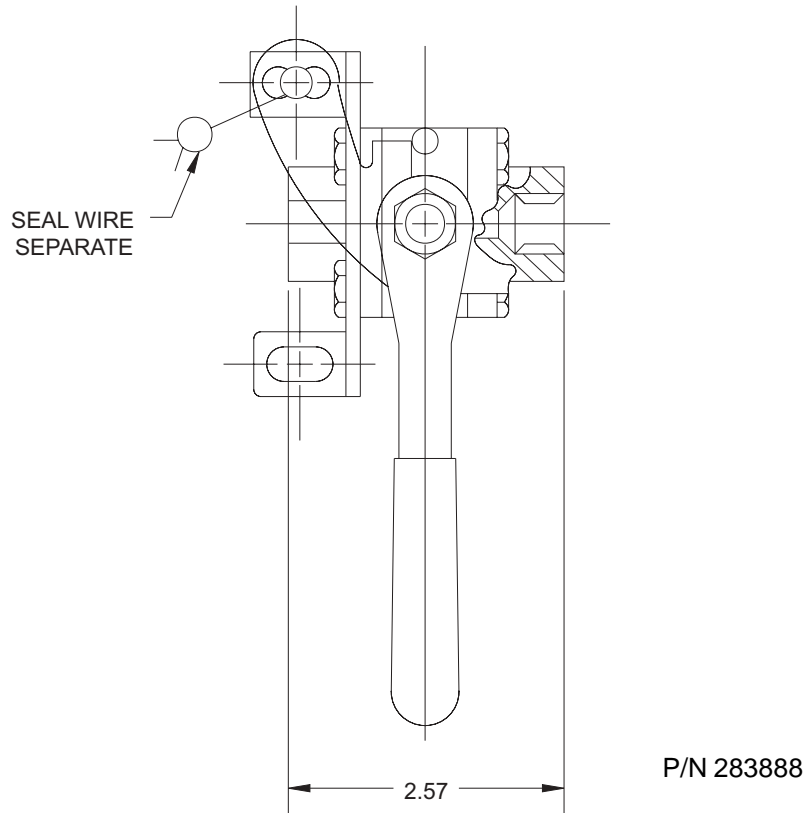
SPECIFICATIONS

Cylinder Capacity:
108 in³ (1770 cm³)

Safety Outlet Burst Range:
2650-3000 psi (183-207 bars) at 70°F (20°C)

Nitrogen-BB-n-411b, Grade A, Type 1 1800 psi
(124 bars at 70°F (20°C))

Figure B-11. Nitrogen Pilot Cylinder and Bracket



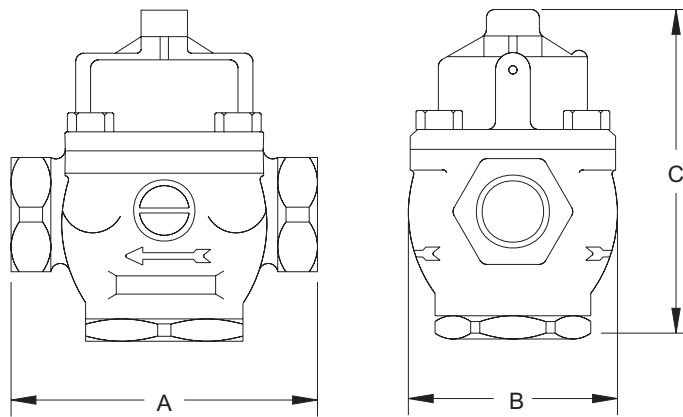
MATERIAL

Stainless Steel, Type 316

Operating Pressure:
3000 psig @ 170°F (77°C)

Minimum Bursting Pressure:
10000psi (680 bars)

Figure B-12. Ball Valve 1/4"



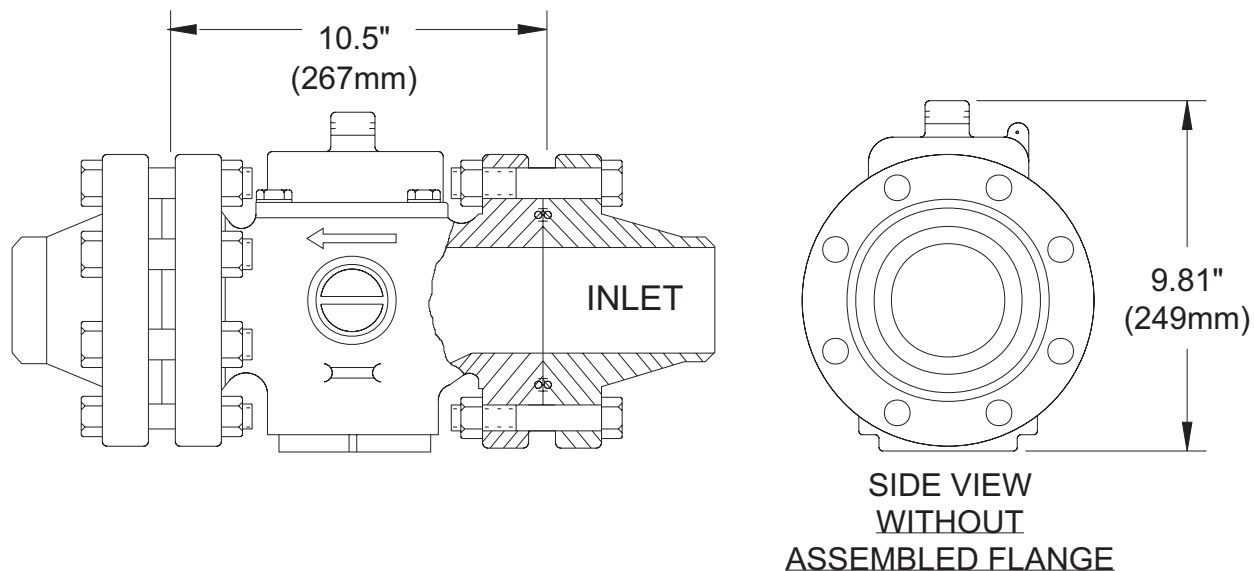
Operating Pressure @ 70°F (20°C):
850 psi (58 bar)

Test Pressure:
2250 psi (155 bar)

Burst Pressure:
6000 psi (413 bar)

PART NUMBER	VALVE SIZE NPT	A		B		C	
		IN	MM	IN	MM	IN	MM
870023	1/2"	3.75	95	2.5	64	4.68	119
870022	3/4"	4.25	108	2.81	71	5.68	144
870122	1"	5.5	140	3.62	92	6.87	175
870032	1-1/4"	5.5	140	3.62	92	6.87	175
870123	1-1/2"	7.5	191	4.75	121	8.43	214
870049	2"	7.5	191	4.75	121	8.43	214

Figure B-13. Stop (Directional) Valves, 1/2" thru 2"



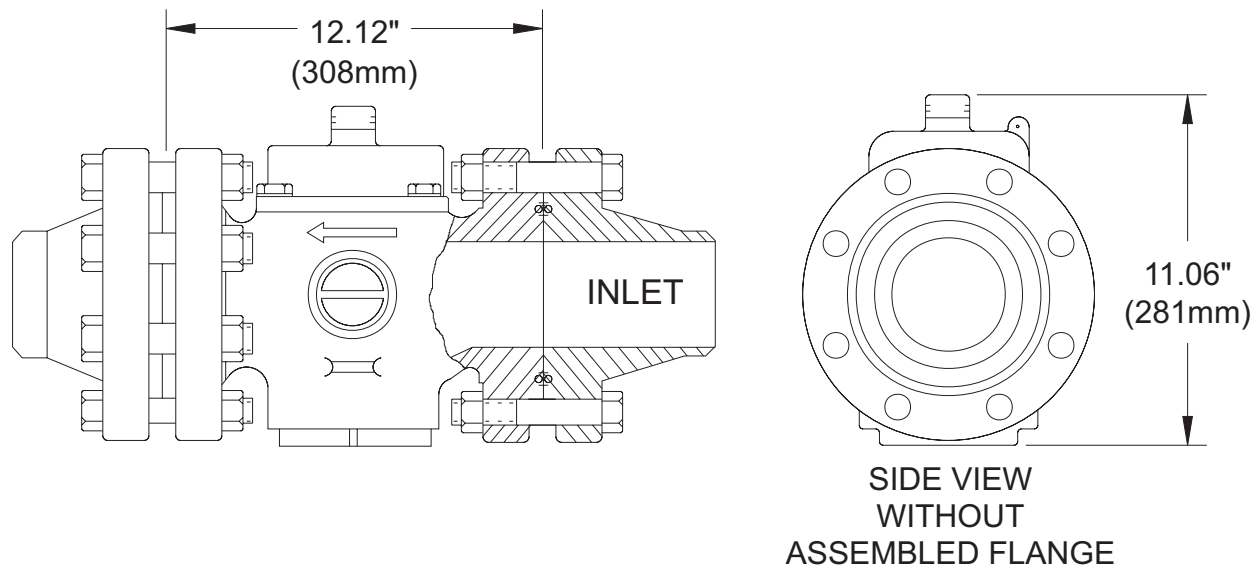
Operating Pressure @ 70°F (20°C):
850 psi (58 bar)

Test Pressure:
2250 psi (155 bar)

Burst Pressure:
6000 psi (413 bar)

P/N 890010

Figure B-14. Stop (Directional) Valves, 2-1/2" and 3"



Operating Pressure @ 70°F (20°C):
850 psi (58 bar)

Test Pressure:
2250 psi (155 bar)

Burst Pressure:
6000 psi (413 bar)

P/N 890208

Figure B-15. 4" Stop (Directional) Valve

GENERAL DIMENSIONS - FOR REFERENCE ONLY								
ASSY. PART NO.	SIZE: IN.	A	B	C	D	E	F	G
81-934711-000	1/2	.660	3.939	1.938	2.250	5.500	2.800	2.500
81-934712-000	3/4	.810	4.500	2.188	2.600	5.500	2.800	2.500
81-934713-000	1	1.000	4.938	2.375	2.990	6.500	2.800	2.500
81-934714-000	1 1/2	1.440	5.875	2.750	3.870	8.500	2.800	2.750
81-934715-000	2	1.720	6.875	3.375	4.500	8.500	2.800	2.750

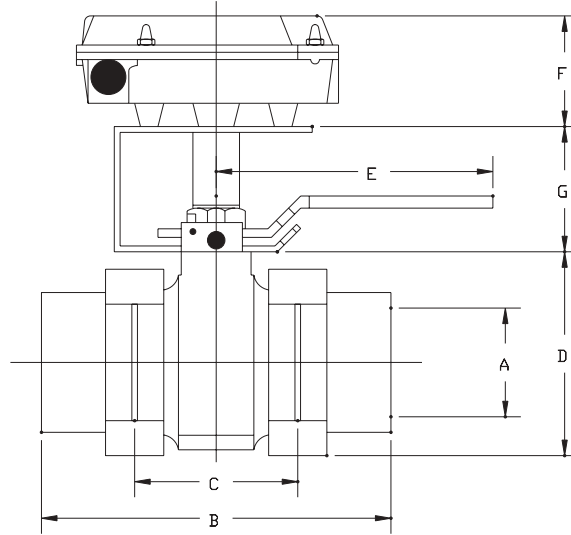
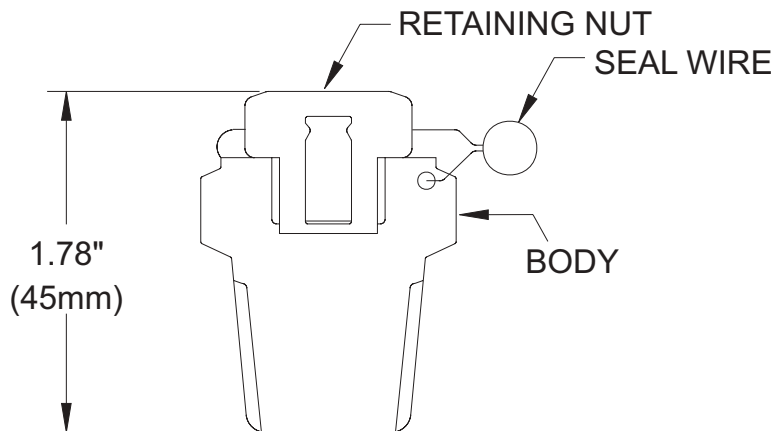
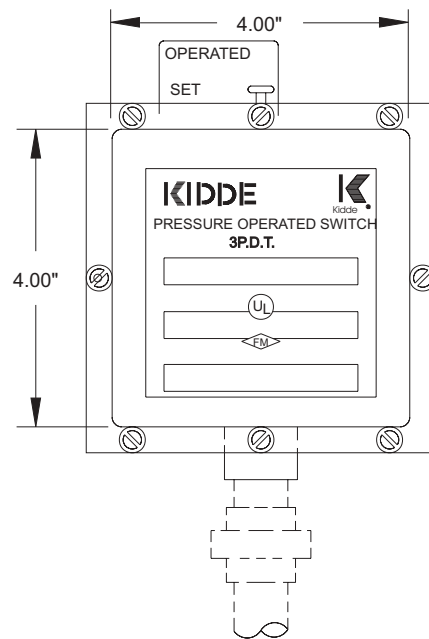


Figure B-16. Valve, CO₂ Lock Out w/Limit Switch



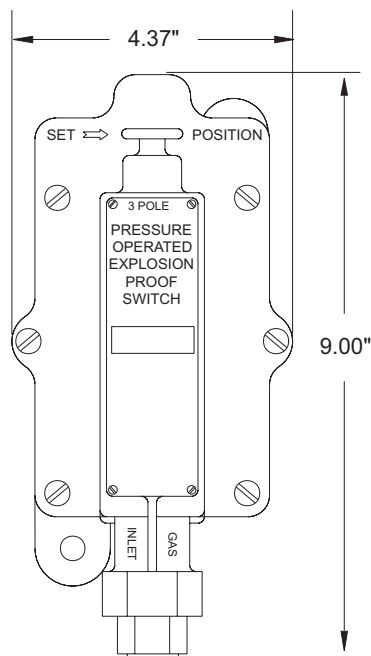
PART NUMBER	AGENT	PRESSURE RELIEF OPERATES AT	
		PSI	BARS
803242	N ₂ /CO ₂	2400-2800	166-193

Figure B-17. Safety Outlets



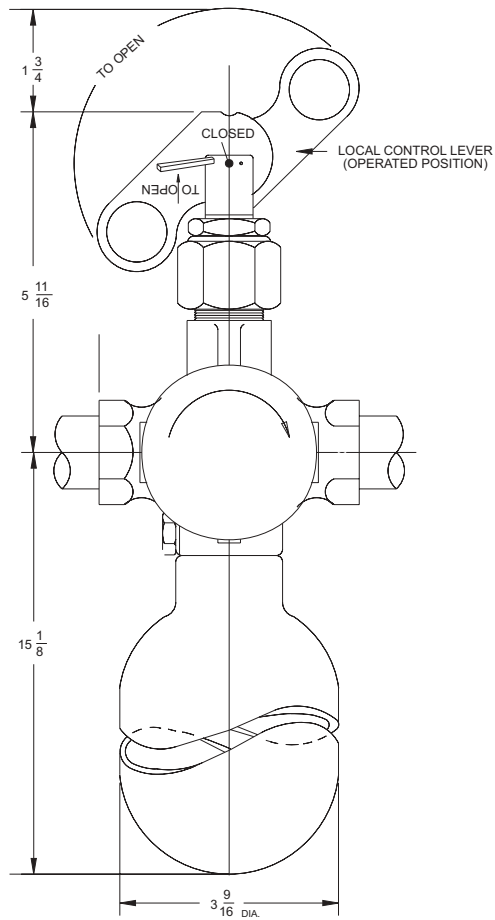
P/N: 486536

Figure B-18. Pressure Operated Switch



P/N: 981332

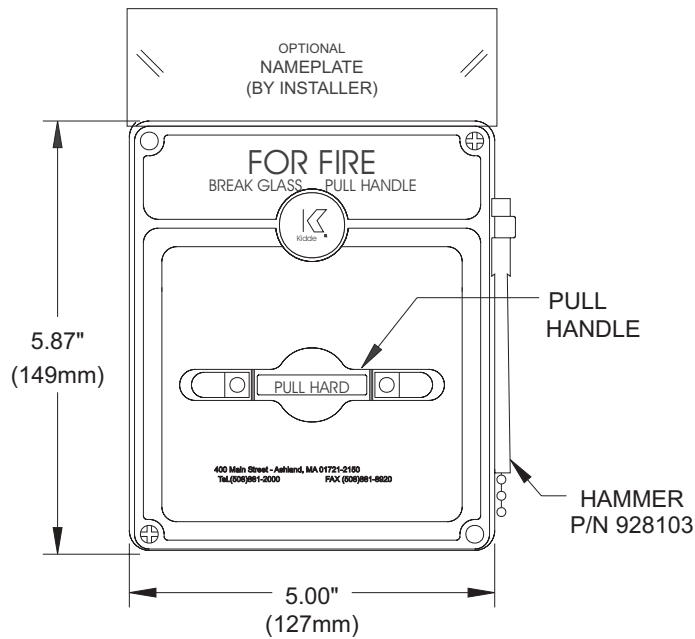
Figure B-19. Pressure Operated Switch, Explosion Proof



Finish: Red Paint

P/N	Nominal Delay Time
871071	30
897636	60

Figure B-20. Discharge Delay with Manual Operated Control Head



P/N: 871403

Figure B-21. Pull Box, Break Glass

THIS PAGE INTENTIONALLY LEFT BLANK.

TECHNICAL MANUAL USER FEEDBACK FORM

(Use this report to indicate deficiencies, user remarks and recommendations relating to the publication. Fold on dotted line, tape and mail to
KIDDE-FENWAL, Inc., 400 Main Street, Ashland, MA 01721, Attn. Documentation Manager or FAX to 508-881-8920)

DATE: _____

1. PART NUMBER	2. VOLUME NO.	3. TITLE (NOMENCLATURE)
-----------------------	----------------------	--------------------------------

4. CHANGE NO. OR REV. DATE	5. SYSTEM/EQUIPMENT	6. PRIORITY OF COMMENT
-----------------------------------	----------------------------	-------------------------------

7. USER EVALUATION

MANUAL IS: EXCELLENT GOOD FAIR POOR COMPLETE INCOMPLETE

8. PROBLEM QUESTION SUGGESTION COMMENT: (check one)

9. RECOMMENDED CHANGE TO PUBLICATION

PAGE NO.	PARAGRAPH NO.	LINE NO.	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Use Blank Continuation Sheets as Required)

10. ORIGINATOR	11. COMPANY NAME
-----------------------	-------------------------

12. ADDRESS

13. KIDDE-FENWAL USE ONLY

a. Received	b. Action Necessity	c. Priority	d. Comments

FOLD

Place
Stamp
Here

KIDDE-FENWAL, Inc.
400 Main Street
Ashland, MA 01721

Attn. Documentation Manager

FOLD

LIMITED WARRANTY STATEMENT

Kidde-Fenwal, Inc. represents that this product is free from defects in material and workmanship, and it will repair or replace any product or part thereof which proves to be defective in workmanship or material for a period of twelve (12) months from the date of purchase but not to exceed eighteen (18) months after shipment by Kidde-Fenwal Inc. For a full description of Kidde-Fenwal's LIMITED WARRANTY, which, among other things, EXCLUDES warranties of MERCHANTABILITY and FITNESS FOR A PARTICULAR PURPOSE and liability for CONSEQUENTIAL DAMAGES, please read the entire LIMITED WARRANTY on the Kidde-Fenwal Quotation, Acceptance of Order and/or Original Invoice which will become part of your sales agreement. Please contact Kidde-Fenwal directly for a return material authorization (RMA) number before returning material to the factory at Ashland, Massachusetts, shipment prepaid. Kidde-Fenwal will repair or replace and ship prepaid.

Kidde is a registered trademark of Kidde-Fenwal, Inc.



Kidde-Fenwal Inc.
400 Main Street, Ashland, MA 01721
Tel: (508) 881-2000 Fax: (508) 881-8920
<http://www.kiddefiresystems.com>

These instructions do not purport to cover all the details or variations in the equipment described, nor do they provide for every possible contingency to be met in connection with installation, operation and maintenance. All specifications subject to change without notice. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to Kidde-Fenwal, Inc., Ashland, Massachusetts