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<b>Addenda</b>		
Kidde Fire Systems Errata Addendum for Natura™ Inert Gas System Design, Installation, Operation, and Maintenance Manual with FM Approvals and UL Listing, Rev AC	06-237619-002	AA
TPED Approved Cylinder Addendum for Kidde Fire Systems Natura™ Inert Gas System Design, Installation, Operation, and Maintenance Manual with FM Approvals and UL Listing, Rev AC	06-237619-003	AA
2-Way NPT and Grooved Selector and Lockout Valve Addendum for Kidde Fire Systems Clean Agent Systems	06-237873-001	AA





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# **Kidde Fire Systems Natura™ Inert Gas System**

Design, Installation, Operation, and  
Maintenance Manual with FM Approvals  
and UL Listing

EXPORT INFORMATION (USA)

Jurisdiction: EAR

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This document contains technical  
data subject to the EAR



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# FOREWORD

This manual is written for those who design, install, operate, or maintain the Kidde Fire Systems Natura™ Inert Gas System (Natura IGS system) using IG-100, IG-541, IG-55, or IG-01 (herein refer to collectively as the “agent”) with FM Approvals and UL Listing. For Kidde Fire Systems Argonite® Engineered Fire Systems with UL Listing (Not FM Approvals), see DIOM P/N: 06-236432-001. For Kidde Fire Systems Nitrogen Engineered Fire Systems with UL Listing (Not FM Approvals), see DIOM P/N: 06-237459-001.

## IMPORTANT

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

Natura IGS system is to be designed, installed, inspected, maintained, tested and recharged by authorized, trained personnel in accordance with the following:

- Standard of the National Fire Protection Association No. 2001, Edition 2022 titled Clean Agent Fire Extinguishing Systems.
- ISO 14520, BS EN 15004 and any other applicable national standards
- All instructions, limitations, cautions, and warnings, contained in this manual, 06-237619-001.
- All information contained on the system container nameplate(s).

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

- C-1, Methods for Hydrostatic Testing of Compressed Gas Cylinders.
- C-6, Standards for Visual Inspection of Compressed Gas Cylinders.
- P-1, Safe Handling of Compressed Gases In Containers.

CGA pamphlets are published by the Compressed Gas Association: [cganet.com](http://cganet.com)

All personnel should be trained by Kidde Fire Systems and should have attended a Cylinder Handling/Installation training session provided by Kidde Fire Systems.

For additional reference information refer to:

- National Fire Protection Association (USA): [nfpa.org](http://nfpa.org)
- Fire Industry Association (UK): [fia.uk.com](http://fia.uk.com)

The design concentration for Class A and C fires applies to systems designed to meet and comply with UL 2127, FM5600, and NFPA 2001, Edition 2022 requirements. As such, our customers are reminded and advised:

- In accordance with 9.1.2 and 9.1.1.1 of NFPA 2001, Edition 2022, automatic detection and automatic actuation shall be used. Manual actuation is permitted only if acceptable by the authority having jurisdiction.
- Designers should also take note of 9.7 in NFPA 2001, Edition 2022 with regard to discharge delays.
- The designer should also review 7.2.1.2 in NFPA 2001, Edition 2022 and confirm that a protected Class A hazard does not include any Class B materials (flammable or combustible liquids or gases) which would classify the protected space as a Class B hazard.
- In addition, the designer should refer to section A.7.4 in NFPA 2001, Edition 2022 and confirm that the protected space does not include electrical equipment that will not be de-energized prior to or at the time of agent discharge. Such energized electrical equipment has the potential to act as a persistent re-ignition source. If electrical equipment cannot be de-energized, the design agent concentration shall be at least that required by 7.2.2.4 in NFPA 2001, Edition 2022. In some cases consideration should be given to the use of extended agent discharge or higher design agent concentration. When exploring these options, keep in mind the possibility of the formation of combustion and decomposition products. Please contact applications engineering for design guidance in such instances.

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Questions concerning the information presented in this manual should be addressed to:

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## SAFETY DATA SHEETS

The Safety Data Sheets (SDS) can be found in Appendix B. The latest version of the SDS can also be found online at the Kidde Fire Systems website ([kiddefiresystems.com](http://kiddefiresystems.com)). Use the built-in navigation links to view the desired sheet.

## SAFETY SUMMARY

Natura IGS system uses pressurized equipment; therefore, personnel responsible for fire suppression systems must be aware of the dangers associated with the improper handling, installation or maintenance of this equipment.

Fire suppression system service personnel must be trained in the proper handling, installation and service of Natura IGS system equipment and follow the instructions used in this manual and in the Safety Bulletin and cylinder nameplate.

Kidde Fire Systems has provided warnings and cautions at appropriate locations throughout the text of this manual. These warnings and cautions are to be adhered to at all times. Failure to do so may result in serious injury to personnel.

### DEFINITIONS



**Indicates an imminently hazardous situation which, if not avoided, could result in death, serious bodily injury and/or property damage.**



**Indicates a potentiality hazardous situation which, if not avoided, could result in property or equipment damage.**

## SAFETY FIRST

Always follow these safety rules:

- Always fit transport cap and other safety caps before any movement of the cylinder takes place.
- Transport caps shall only be removed once the cylinder is secured.
- Never leave a cylinder unsecured.
- Never work on a suppression system unless the means for actuation has been rendered safe.
- Never use cylinders that have signs of damage or corrosion.
- Never assume a cylinder is empty. Treat all cylinders as if they are fully pressurized.
- Never install, maintain, modify or repair compressed gas systems without a permit to work system or clear detailed safety control methods in place.
- All transportation of cylinders shall only be undertaken when the cylinder(s) are secured and fitted with approved valve assembly protection.
- All cylinders to be secured in a manner to ensure that the valve assembly is protected from damage.
- Any area where inert gas containers are stored must be adequately ventilated. A person working in a container storage room must first secure the doors in the open position and, if necessary, wear a personal oxygen monitoring device.

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# SAFE CYLINDER HANDLING PROCEDURES



**Any area in which inert gas agent is used or stored must be properly ventilated. A person working in an area where air has become enriched with agent can become unconscious without sensing the lack of oxygen. Remove the victim to fresh air. Administer artificial respiration if necessary and summon a physician.**



**Pressurized (charged) cylinders are capable of violent discharge and, as such, are extremely hazardous. Pressurized cylinders must be handled safely to avoid accidents that could cause bodily injury, death, or property damage.**

Before handling Natura IGS system products, all personnel must be 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 flex hoses; actuation devices; pressure monitoring devices; transportation safety caps, guards, or shrouds; and anti-recoil devices.

READ, UNDERSTAND and ALWAYS FOLLOW the design, installation, operation and maintenance manuals, owners manuals, service manuals, etc., that are provided with the individual systems.



**The instructions contained in this foreword and throughout the manual must be followed in the exact sequence as written to prevent serious injury, death, or property damage.**

The following safety procedures must be observed at all times:

## **TRANSPORTING CONTAINER**

Containers must be shipped securely either upright in steel stillages or horizontally on pallets using a minimum of 3 bands to secure the container/s to the pallet.

On site, containers must not be rolled, dragged, or slid, nor allowed to be slid from tailgates of vehicles. A suitable hand truck, fork truck, single cylinder trolley, roll platform, or similar device must be used.

## **ROUGH HANDLING**

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

## **STORAGE**

Containers must be stored standing upright where they are not likely to be knocked over and the containers must be secured.

For additional information on safe handling of compressed gas cylinders, see CGA Pamphlet P-1 titled "Standard for Safe Handling of Compressed Gases in Containers". CGA pamphlets may be purchased from The Compressed Gas Association: <http://www.cganet.com>

## **ANTI-RECOIL SAFETY CAP**

- Each agent cylinder is factory equipped with an anti-recoil safety cap installed on the valve discharge outlet, and securely fixed to the valve via a stainless steel, PVC coated cable to prevent loss. This device is a safety feature, and will prevent discharge when installed if the cylinder is actuated accidentally.
- The anti-recoil safety cap must be installed on the valve outlet AT ALL TIMES except when the cylinders are connected into the system piping.

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## **SAFETY TRANSPORTATION CAP, GUARD, OR SHROUD**

The Safety Transportation cap, guard, or shroud is factory installed on the cylinder. The safety transportation cap, guard, or shroud covers the cylinder valve to protect it during transportation and handling. No attachments (release unit or secondary gauge assemblies) are to be connected to the cylinder valve during shipment, storage, or handling.

## **INSTALLATION**

THIS SEQUENCE FOR CYLINDER INSTALLATION MUST BE FOLLOWED AT ALL TIMES:

1. Install cylinder into bracketing.



**In order to prevent injury in the event of accidental cylinder discharge, the discharge hose must be connected to the system piping before attaching to the cylinder valve outlet.**

2. Remove the Transport cap.
3. Remove the anti-recoil safety cap and connect all cylinder valves into system piping using appropriately sized discharge hose.



**The safety pin for the manual release must be fully inserted and secured using anti-tamper seal before attempting to fit the release unit to the valve actuation port**

4. Install all pilot hoses, Pilot Line Bleed Valves etc. leaving the release unit available for installation by the commissioning engineer only.

## **REMOVAL FROM SERVICE**

THIS SEQUENCE FOR CYLINDER REMOVAL MUST BE FOLLOWED AT ALL TIMES:

1. Remove all release units, secondary cylinder pressure gauge units, and pilot lines from cylinder valve.
2. Disconnect discharge hose at the valve outlet.
3. Immediately install anti-recoil safety cap on valve outlet.



**The cylinder valve anti-recoil safety cap must be immediately available for installation on the cylinder valve outlet before disconnecting the cylinder discharge hose from system piping. If the safety cap (P/N: 38-400011-001) is missing obtain a new safety cap from Kidde Fire Systems.**

4. Attach the transport cap to the cylinder/valve assembly.
5. Remove cylinder from bracketing.



**Failure to follow all instructions in this manual on the use and handling of system components could result in serious bodily injury, death, and property damage in the event of inadvertent and unexpected cylinder discharge.**

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# CHAPTER 1

## GENERAL INFORMATION

### 1-1 INTRODUCTION

The Kidde Fire Systems Natura™ Inert Gas System (Natura IGS system) using IG-100, IG-541, IG-55, or IG-01 inert-gas agent (herein refer to collectively as the “agent”) are designed to extinguish fires involving specific hazards or equipment in spaces located where an electrically non-conductive agent is required and where agent clean-up creates a problem. These agents are approved by the EPA, NFPA, and ISO for use in fire suppression systems. Use Natura IGS systems as a total flooding system for protection against hazards that are enclosed or for protecting equipment that includes an enclosure within itself that will contain the agent.

Key features of all the offered inert agents are:

- Zero ozone depletion potential
- Zero global warming potential
- Atmospheric lifetime is not a consideration as the gases are benign to the environment
- Colorless, with no odor and no particulate or residue
- Electrically non-conductive

#### 1-1.1 Use

The Natura IGS system is used to extinguish fires in almost all flammable substances with only a few exceptions. The Natura IGS system itself does not leave any hazardous substances after a release. Cleaning up from the fire involves only repairing parts damaged by the fire; machine downtime and other secondary damage can therefore be kept to a minimum.

The gases used in the Natura IGS system are non-conductive and therefore suitable for the extinguishment of fires involving electrical and electronic equipment.

Natura IGS systems are also useful for extinguishing fires involving:

- Flammable and combustible liquids
- Subfloors and other concealed spaces
- Delicate artifacts such as clothing, paintings, and other high-value items
- In places where other extinguishing media could be directly destructive

**Note:** Fires in solid materials (deep-seated) require that the design concentration is maintained for a sufficient period of time (hold time) to achieve total extinguishment.

#### 1-1.2 Unsuitable Risks

Natura IGS systems shall not be used to extinguish fires in:

- Chemicals containing their own supply of oxygen and which are capable of rapid oxidation in the absence of air, such as cellulose nitrate or gunpowder
- Mixtures containing oxidizing materials, such as sodium chlorate or sodium nitrate
- Chemicals capable of undergoing auto thermal decomposition, such as some organic peroxides and hydrazine
- Reactive metals, such as sodium, potassium, magnesium, titanium, and zirconium
- Reactive hydrides, or metal amides, some which may react violently with a gaseous agent
- Flammable gas fires such as methane

All of the materials listed above could potentially create the risk of an explosion in a fire.

### 1-1.3 Fire Class Table

Different standards have different fire classifications. The table below outlines the classifications for fires based on the various standards.

Table 1-1. Fire Classifications

Hazard Type	NFPA Standard	European Standard	Asia
Combustible materials (wood, paper, fabric, refuse)	Class A	Class A	Class A
Flammable liquids or liquifiable solids	Class B	Class B	Class B
Flammable gas	Class B	Class C	Class C
Flammable metals	Class D	Class D	Class D
Electrically energized equipment	Class C	not classified (formerly Class E)	Class E

LOAEL (Lowest Observed Adverse Effect Level) is the lowest concentration at which an adverse toxicological or physiological effect has been observed in humans. For Natura IGS agents this value is 52%, corresponding to a residual Oxygen concentration of 10% (sea level equivalent). The human exposure limit is 3 minutes for inert gas systems designed to concentrations between 43% and 52%.

**Note:** For inert gases the LOAEL is based on asphyxiation, i. e. low oxygen concentration.

NOAEL (No Observed Adverse Effect Level) is the highest concentration at which no adverse toxicological or physiological effect has been observed in humans. For Natura IGS agents this value is 43%, corresponding to a residual Oxygen concentration of 12% (sea level equivalent). The human exposure limit is 5 minutes for Inert gas systems designed to concentrations below 43%.

For specific design concentrations see Section 3-3.

### 1-1.4 Technical Limitation on Size of Agent Cylinder Bank

There are no limits to the number of agent cylinders that can be used in an Natura IGS system. However, the size of the system is limited by the space available for storage of the agent cylinders. There is no restriction with regard to positioning the cylinders horizontally or vertically. There are limits on the number of cylinders that can be activated by each release unit.

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## 1-2 FIRE EXTINGUISHMENT METHODS

Fire extinguishing using Natura IGS agent can be achieved in the following ways:

- Total flooding of the room: Release of agent into a room (Total Flooding) means that the minimum design concentration is created within the entire room volume.
- Dedicated protection: Release of Natura IGS systems may be executed inside protected unit(s) (machine/equipment) within the room, but not flood the full room. For example with EDP equipment or electrical cabinets, it may be more appropriate to flood the enclosure than total flooding of the entire room. It shall, however, be noted that the turbulences from the discharge nozzle may present a risk to the equipment/electronics within the enclosure.

### 1-2.1 Selector Valve Systems

If more than one room or an enclosure is to be protected, a common cylinder bank (central bank) may be used. The capacity of the cylinder bank shall be calculated for protection of the largest room or enclosure together with any adjoining rooms or enclosures which may be involved in a fire simultaneously. Selector valve systems can involve total flooding and dedicated protection.

## 1-3 SAFETY

The agents used in Natura IGS systems do not decompose when extinguishing a fire. As such, the agents do not produce toxic or corrosive decomposition products as a by-product of the combustion mechanism. However, heat and breakdown products from the fire itself can still be substantial and could make the area unfit for human occupancy until the enclosure is properly ventilated.

Avoid unnecessary exposure to atmospheres flooded with an inert gas agent. Provide a pre-discharge alarm and time delay in accordance with the provisions of NFPA 2001 latest edition.

### 1-3.1 Personal Safety

Avoid unnecessary exposure to atmospheres flooded with inert gas agent systems in low-oxygen atmospheres. The maximum exposure time in any case shall not exceed 5 minutes. Provide provisions for a prompt exit from a protected enclosure that are compliant with the maximum exposure times given in the latest edition of NFPA 2001.

Safety items such as personnel training, warning signs, discharge alarms, self-contained breathing apparatus, evacuation plans, and fire drills shall be considered and implemented as required. Consideration shall be given to the possibility of agent migration into adjacent areas outside of the protected space (pressure relief, vent openings, and such).

If employees can vacate the area within 3 minutes, Natura IGS systems may be designed for a Residual Oxygen Level (ROL) as low as 10% (sea level equivalent). Where evacuation may take up to five minutes the system may be designed to have a minimum ROL of 12% (sea level equivalent).

- LOAEL: 52% equal to 10% ROL, sea level equivalent
- NOAEL: 43% equal to 12% ROL, sea level equivalent

If the ROL could potentially drop to 8-10% (sea level equivalent) employees must be evacuated prior to introducing this higher degree of oxygen depletion. A design concentration resulting in a ROL of 8-10% (sea level equivalent) may only be used in normally unoccupied areas, and even then only if any occupants who could possibly be exposed can vacate the area within 30 seconds. Pre-warning alarms and evacuation drills shall therefore always be applied when the necessary design concentration will result in a ROL of 8-10%. For NFPA 2001 designed systems, the following items should be installed:

- Pressure-operated Discharge Delay
- Pressure-operated Siren
- Lockout Valves
- Proper Signage

**Note:** These instructions do not apply to personnel remaining in the enclosure after system release during a fire if they are properly trained and equipped with self contained breathing apparatus.



**During discharge, the agent passing through the system nozzles can emit a noise at a level which could cause hearing injury.**



**Direct contact with the agent during discharge can cause frostbite burns to the skin.**

### 1-3.2 Agent Concentrations and Safety

The Natura IGS agents are used at relatively high concentrations to extinguish fires, typically in the range of 40 to 50% agent in air, or more. At a Natura IGS agent concentration of 45%, the residual oxygen concentration is 11.5%, compared with 21% in normal air. The principal health risk from exposure to atmospheres having such low oxygen concentrations is "hypoxia," meaning insufficient oxygen concentration in the blood. The resulting guidelines for exposures to atmospheres flooded with Natura IGS agents are as follows:

- Unnecessary exposure to Natura IGS agent resulting in low oxygen atmospheres shall be avoided.
- The maximum exposure time in any case shall not exceed 5 minutes. See NFPA 2001 latest edition for atmospheric correction factors that shall be considered when determining the design concentrations.
- For systems that must meet NFPA standards, a pre-discharge alarm and discharge delay shall be provided in accordance with the provisions of NFPA 2001, latest edition.
- Unprotected personnel shall not enter the area during or after agent discharge.

The following additional provisions shall apply:

- Natura IGS systems that are designed to concentrations below 43 percent (corresponding to an oxygen concentration of 12 percent, sea level equivalent of oxygen) shall be permitted where means are provided to limit exposure to no longer than 5 minutes.
- Natura IGS systems that are designed to concentrations between 43 and 52 percent (corresponding to between 12 and 10 percent oxygen, sea level equivalent of oxygen) shall be permitted where means are provided to limit exposure to no longer than 3 minutes.
- Natura IGS systems that are designed to concentrations between 52 and 62 percent (corresponding to between 10 and 8 percent oxygen, sea level equivalent of oxygen) shall be permitted given the following:
  - The space is normally unoccupied
  - Where personnel could possibly be exposed, means are provided to limit the exposure to less than 30 seconds
- Natura IGS systems that are designed to concentrations above 62 percent (corresponding to 8 percent oxygen or below, sea level equivalent of oxygen) shall be used only in unoccupied areas where personnel are not exposed to such oxygen depletion. The hazard in such cases should be provided with the following safety measures.
- Pressure-operated Discharge Delay
- Pressure-operated Siren
- Lockout Valves
- Proper Signage

**1-3.2.1 Clarifying "Sea Level Equivalent of Oxygen"**

The allowed exposure limit to air diluted with Natura IGS agents relates to the residual oxygen concentration. At sea level the atmospheric pressure is 14.7 psi (101,325 Pa). The sea level equivalent of oxygen is the "partial pressure" of oxygen in air when the atmospheric pressure is 14.7 psi. The volume fraction of air that is oxygen is 0.21, or 21%. Thus, at sea level the partial pressure of oxygen in air is 3.09 psi (21,290 Pa). Thus, the provisions outlined above can be summarized in as shown in Table 1-2.

Table 1-2. Egress Time Limits for Spaces Flooded with a Natura IGS Agent

Agent Conc. vol %	% O <sub>2</sub> at Sea Level	P <sub>O<sub>2</sub></sub> , psi	Allowed Occupancy	Egress Time Limit
C < 43	%O <sub>2</sub> > 12	P <sub>O<sub>2</sub></sub> > 1.78	Normally occupied	5 min
43 < C < 52	12 > %O <sub>2</sub> > 10	1.78 > P <sub>O<sub>2</sub></sub> > 1.47	Normally occupied	3 min
52 < C < 62	10 > %O <sub>2</sub> > 8	1.47 > P <sub>O<sub>2</sub></sub> > 1.18	Not normally occupied	30 s
C > 62	%O <sub>2</sub> < 8	P <sub>O<sub>2</sub></sub> < 1.18	Unoccupied areas only	n/a

**1-3.2.2 Oxygen Concentration Above or Below Sea Level**

At altitudes different than sea level, calculate atmospheric pressure using the following equation:

$$P(h) = 14.7 (1 - 6.88 \times 10^{-6} h)^{5.25588}$$

The partial pressure of oxygen at altitude h is, therefore:

$$PO_2 = 0.21 P(h)$$

where:

h = Altitude above sea level, ft

P(h) = Atmospheric pressure at altitude h, psi

PO<sub>2</sub> = Partial pressure of oxygen, psi

The partial pressure of oxygen in an enclosure after the discharge of a gaseous agent system is given by

$$PO_{2,POST-DISCHARGE} = 0.21(1-C/100) PO_2$$

where C is concentration, vol %.

Therefore, interpreting the "sea level equivalent" requirement with respect to egress provisions from a protected space requires that the local altitude be known.

### 1-4 SYSTEM DESCRIPTION

The Natura IGS system combines an environmentally safe fire suppression agent, highly effective detection devices, and specially developed components for fast agent discharge. The resulting rapid suppression of a fire reduces property damage and products of combustion to the lowest possible level. These systems are electrically or manually operated, with a normal design discharge time of 60 seconds maximum for US Class B fires and EU Class B and C fires. A maximum discharge time of 120 seconds is allowed for all Class A fires and for US Class C fires. Agent storage containers can be strategically located throughout a protected zone, eliminating expensive piping.

Natura IGS Systems are designed for the following classes of fire:

- Class A Surface Fires—cellulosic material (wood, paper, etc.)
- Class B—flammable liquids (USA Class B includes flammable gases)
- Class C (EU)—flammable gases
- Class C (USA)—electrically energized equipment

For hazards beyond the scope of this manual, the designer should consult with a qualified fire protection engineer regarding the suitability of the agent for the hazard and design concentration. The agent shall not be used on fires involving the following materials, unless they have been tested to the satisfaction of the Authority Having Jurisdiction (AHJ):

- Certain chemicals or mixtures of chemicals, such as cellulose nitrate and gunpowder, that are capable of rapid oxidation in the absence of air
- Reactive metals such as lithium, sodium, potassium, magnesium, titanium, zirconium, uranium and plutonium
- Mixtures containing oxidizing materials, such as sodium chlorate or sodium nitrate.
- Metal hydrides
- Chemicals capable of undergoing autothermal decomposition, such as certain organic peroxides and hydrazine

A Natura IGS system may involve several elements as described in the following sections.

#### 1-4.1 Central Cylinder Bank

When multiple cylinders are required, Natura IGS cylinders can be set up in central cylinder banks with sufficient total capacity to store the required quantity of selected inert agent for the largest space to be protected. The cylinders in the bank are each connected to a discharge manifold or series of manifolds via flexible high-pressure discharge hoses. The hoses connect to a manifold check valve on the manifold to allow for the removal of single cylinders for maintenance as required. This check valve leaves the system in operation without loss of agent through the connection point, should a release of the remaining cylinders be required. Cylinder banks should abide by the following requirements:

- Do not locate a cylinder bank where it can be rendered inoperable or unreliable due to mechanical damage, exposure to chemicals or harsh weather conditions, or by any other foreseeable cause. Where exposure to any such conditions is unavoidable, then a suitable enclosure or other protective measures must be employed to protect the cylinders.
- The cylinders in a bank shall be securely supported to a wall or other solid structure in a manner that allows for safe, convenient individual inspecting/servicing.
- Ensure that access to each cylinder valve's pressure gauge is available for routine maintenance procedures.

Additionally if required by space constraints, one common bank could be split into multiple groups. Each group would have to be accounted for in the flow calculation software with separate piping and nozzles, and requires its own release unit. Where required, a reserve bank shall consist of as many multiples of the primary supply as the authority having jurisdiction considers necessary. Main and reserve supplies may be permanently connected to the distribution piping, arranged so that a safe and easy exchange from main to reserve cylinders can be undertaken.



**Electronic main and reserve switches must not be located inside the protected space.**

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### 1-4.2 Selector Valve System

Should the system be designed to protect more than one area from a common cylinder bank, then use one or more pneumatically operated selector valves.

The pressure required to operate the pneumatic actuators is taken from the main distribution manifold via a pressure-regulating valve (pressure is reduced to 8 bar) and is channeled through a pilot line to a series of low pressure solenoid valves. Activation of a solenoid valve will release pressure to the pneumatic actuator on the selected 2-way Selector valve.

The selector valve is provided with a dual-action, pneumatically-operated actuator capable of opening the valve in under 2 seconds.

For safety reasons the selector valve has to be manually closed after a release.

### 1-4.3 Release Time

For Industrial systems, ISO 14520/EN 15004-1, NFPA 2001, and VdS requires that 95% of the minimum design quantity of the required agent be released within 120 seconds for Class A fires and 60 seconds for Class B. Standard Australia requires the extinguishing concentration to be achieved within 60 seconds and the remaining agent up to the minimum design concentration be discharged within 120 seconds.

Other countries/authorities may have different requirements than those mentioned above.

### 1-4.4 Pressure Monitoring

Natura IGS systems offer instrumentation for optional remote and local pressure monitoring of the content within the cylinders:

- Local monitoring by visual inspection of a pressure gauge on each cylinder
- Remote monitoring by either wiring the pressure gauge/switch on each cylinder to report individually or by wiring as a single loop installation i.e. all electrical contacts are connected in a single loop giving a common indication of lost pressure in any of the cylinders within the group.

### 1-4.5 Placement Supervision

The solenoid coil of the release unit is an integral part of the assembly. Removal of the assembly from the cylinder will cause the supervisory pressure switch to change contact positions, which is monitored by the panel. This condition satisfies the NFPA 2001, latest edition requirements for placement supervision.

**1-5 EXTINGUISHING AGENT**

Natura IGS systems are approved for use with the following agents:

- IG-100: Fixed fire extinguishing systems that use the pure inert gas Nitrogen
- IG-541: Fixed fire extinguishing systems that use inert, gaseous mixture of 52% Nitrogen, 40% Argon, and 8% Carbon Dioxide
- IG-55: Fixed fire extinguishing systems that use inert, gaseous mixture of 50% Nitrogen and 50% Argon
- IG-01: Fixed fire extinguishing systems that use the pure inert gas Argon

The gases used in Natura IGS occur naturally within the earth’s atmosphere. Carbon Dioxide constitutes approximately 0.04%, Nitrogen constitutes approximately 78%, and Argon approximately 0.9% of the atmosphere. As a result, the global warming effect of the Natura IGS is zero, the Ozone depleting factor is zero, and the atmospheric lifetime is not a consideration as the gases are benign to the environment.

Table 1-3. Natura IGS System Agents

Agent	Composition	UN Number
IG-100	Nitrogen	1066
IG-541	52% Nitrogen 40% Argon 8% Carbon Dioxide	1956
IG-55	50% Nitrogen 50% Argon	1956
IG-01	Argon	1006

**1-5.1 Design Concentration Safety Factor**

The minimum inert-gas agent design concentration for specific hazard types is equal to the minimum extinguishing concentration, as determined by the applicable standard, times a safety factor as follows:

Table 1-4. Safety Factor

Hazard	NFPA 2001	ISO-14520-1 EN 15004-1
Class A	1.2	1.3
Class B	1.3	1.3
Class C	1.35	See Note
<p><b>Note:</b> Higher-Hazard Class A hazards are those having the characteristics described in the CAUTION statement of ISO 14520-1 paragraph 7.5.1.3. The minimum design concentration for Higher Hazard Class A fuels shall be the higher of the Surface Class A or 95% of the Class B minimum design concentration.</p>		

Other countries/authorities may have different requirements than above.

**Note:** There are certain Class B and EU Class C fuels which have cup burner values below that of heptane. For agency compliance, systems designed to protect such fuels must still use the MDC value of Heptane.

### 1-5.2 IG-100 (Nitrogen)

Natura IGS systems using IG-100 are fixed fire extinguishing systems that use the inert gas Nitrogen, UN number 1066. The purity of the Nitrogen shall be as follows:

- Nitrogen greater than or equal to 99.7%.
- Oxygen less than or equal to 10 ppm.
- Water less than or equal to 10 ppm.

**Note:** Only principal contaminants are shown. Other contaminants may include: Carbon Monoxide, Carbon Dioxide, Nitrogen Oxide, and Nitrogen Dioxide which are at most less than 20 ppm.

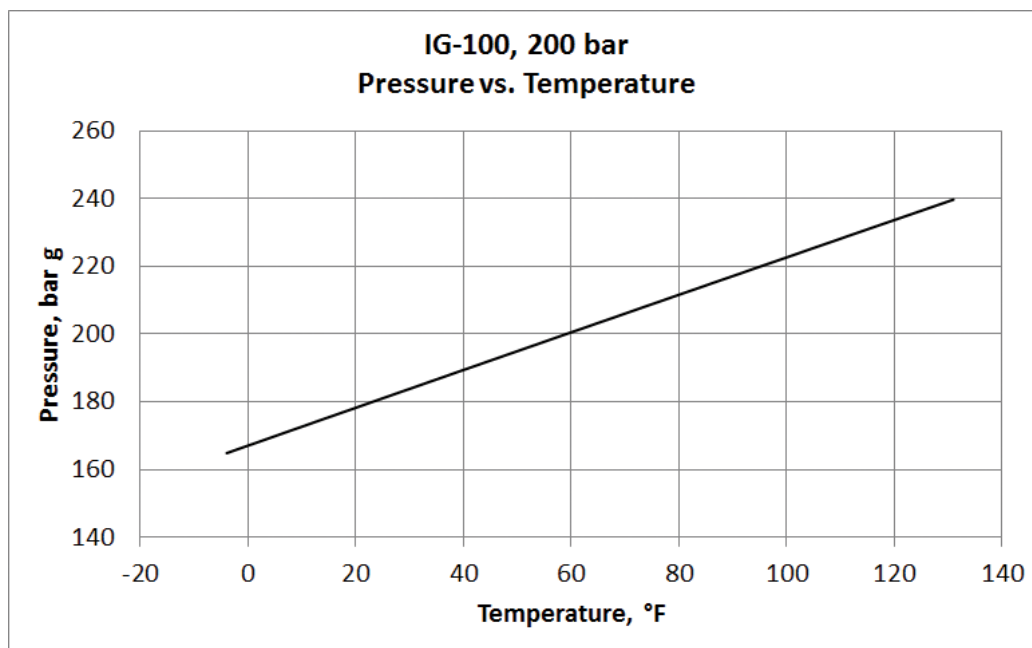


Figure 1-1. IG-100 Pressure vs Temperature (°F) for 200 bar System

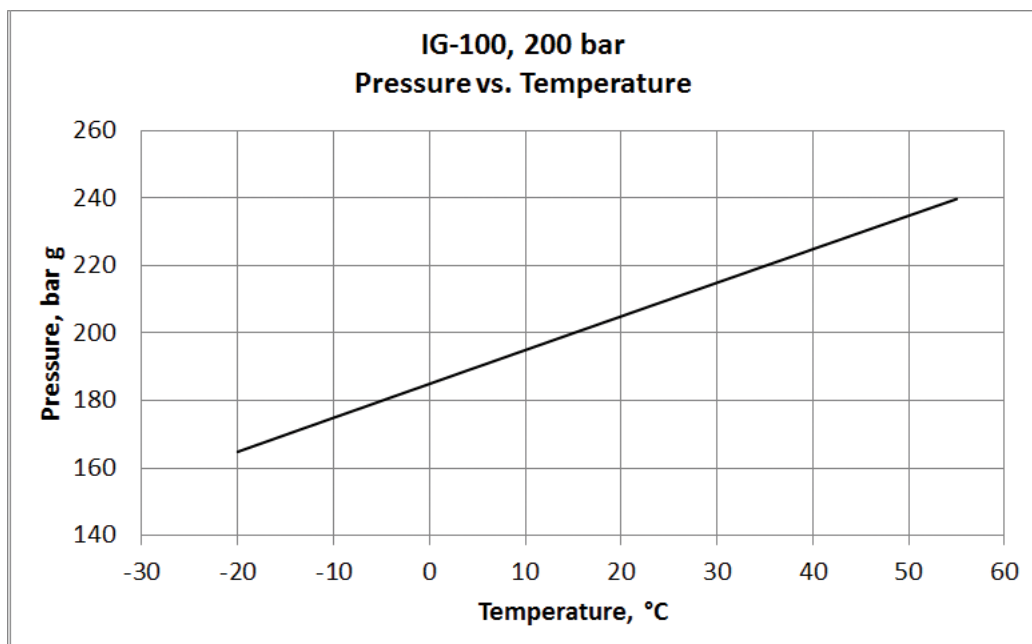


Figure 1-2. IG-100 Pressure vs Temperature (°C) for 200 bar System

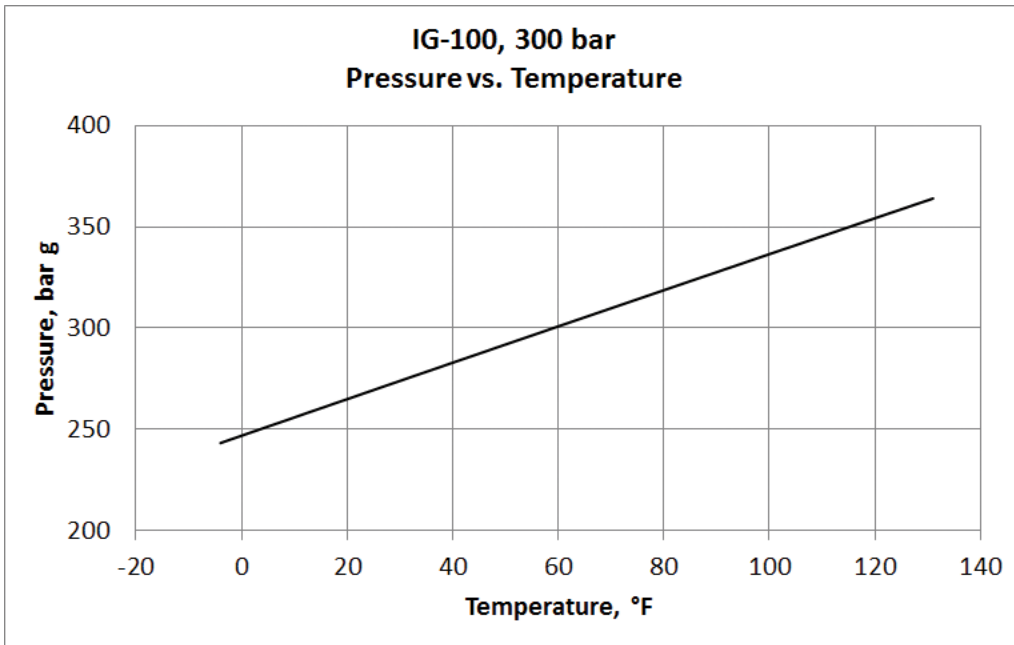


Figure 1-3. IG-100 Pressure vs Temperature (°F) for 300 bar System

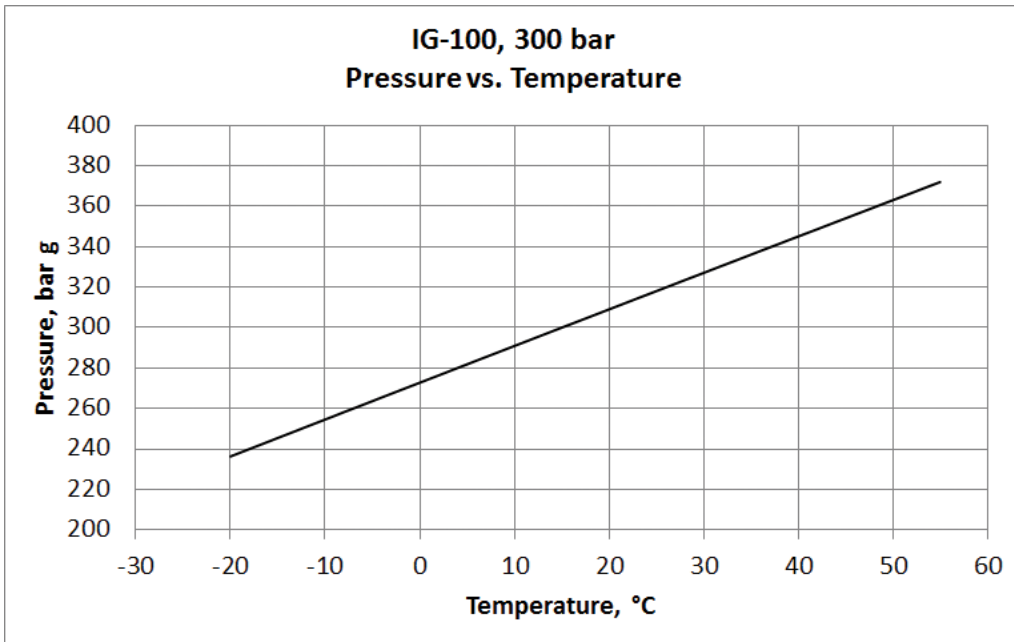


Figure 1-4. IG-100 Pressure vs Temperature (°C) for 300 bar System

### 1-5.3 IG-541 (Nitrogen, Argon, and Carbon Dioxide)

Natura IGS systems using IG-541 are fixed fire extinguishing systems that use an inert gaseous mixture of 52% Nitrogen, 40% Argon, and 8% Carbon Dioxide (IG-541), UN number 1956.

The tolerance of IG-541 in air is as follows:

- Nitrogen: 52% +/- 4 %
- Argon: 40% +/- 4%
- Carbon Dioxide: 8% + 1%/- 0%

#### 1-5.3.1 Purity

Each element shall conform to the following purity specification:

Argon:

- Argon greater than or equal to 99.99%.
- Oxygen less than or equal to 10 ppm.
- Water less than or equal to 10 ppm.

Nitrogen:

- Nitrogen greater than or equal to 99.7%
- Oxygen less than or equal to 10 ppm.
- Water less than or equal to 10 ppm.

Carbon Dioxide:

- Carbon Dioxide greater than or equal to 99.7%
- Oxygen less than or equal to 10 ppm.
- Water less than or equal to 10 ppm.

**Note:** Only principal contaminants are shown. Other measurements may include: Carbon Monoxide, Carbon Dioxide, Nitrogen Oxide, and Nitrogen Dioxide most < 20 ppm.

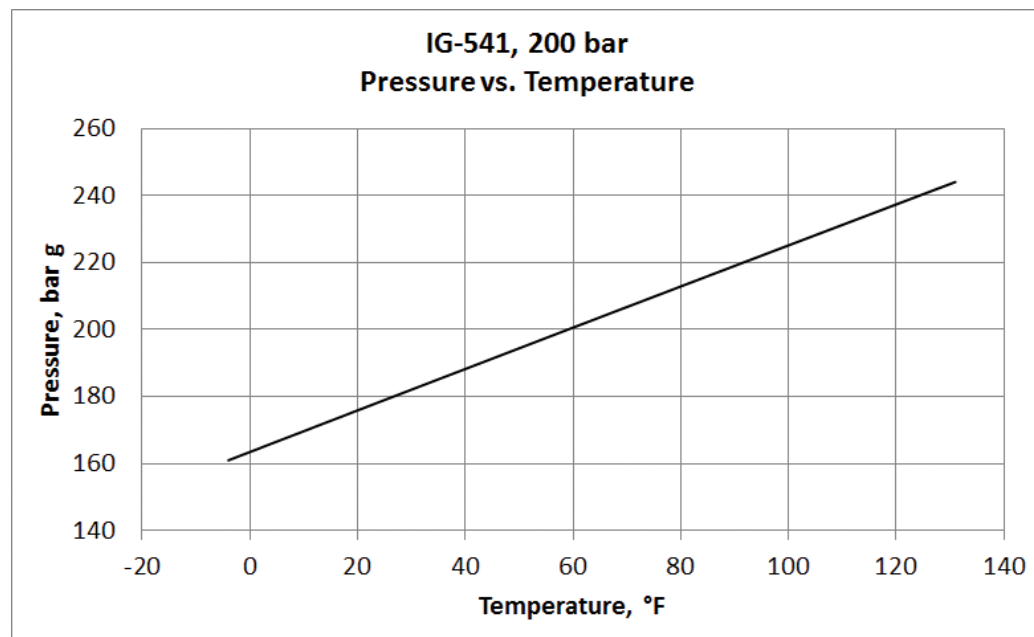


Figure 1-5. IG-541 Pressure vs Temperature (°F) for 200 bar System

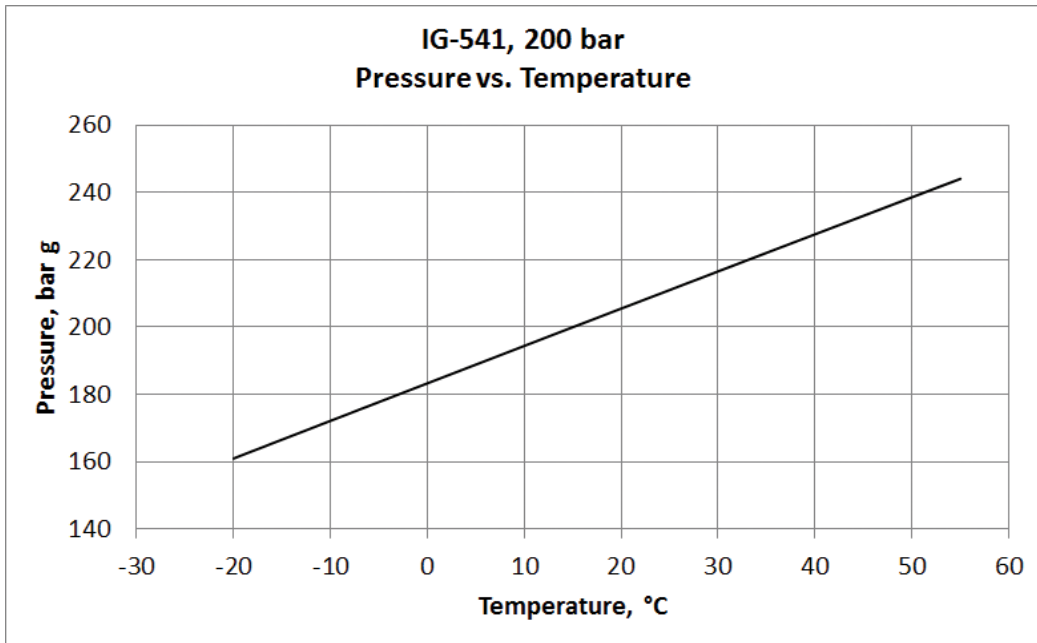


Figure 1-6. IG-541 Pressure vs Temperature (°C) for 200 bar System

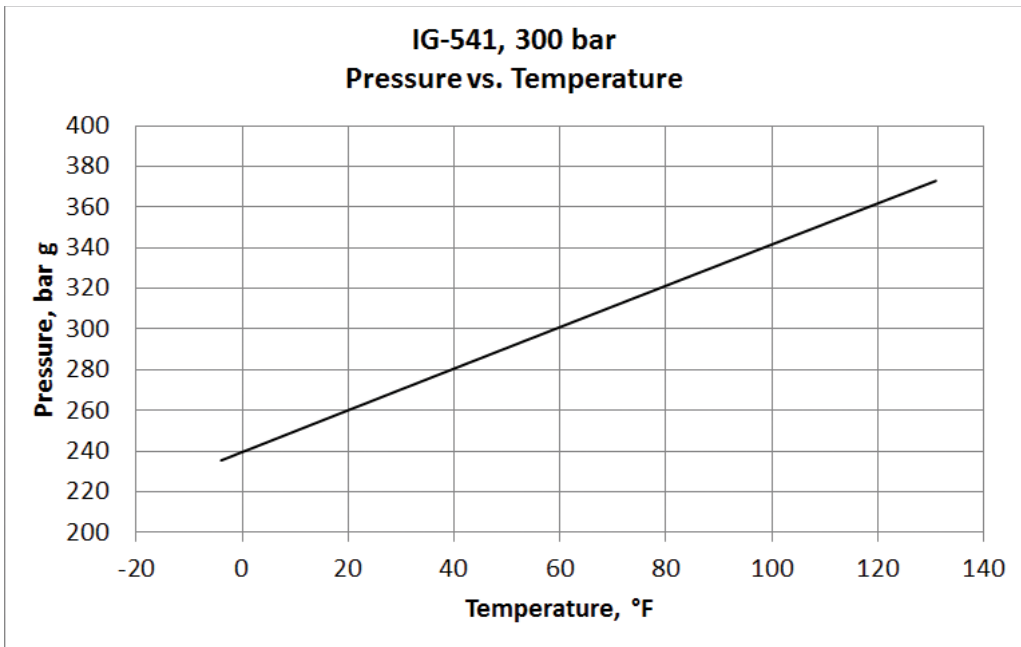


Figure 1-7. IG-541 Pressure vs Temperature (°F) for 300 bar System

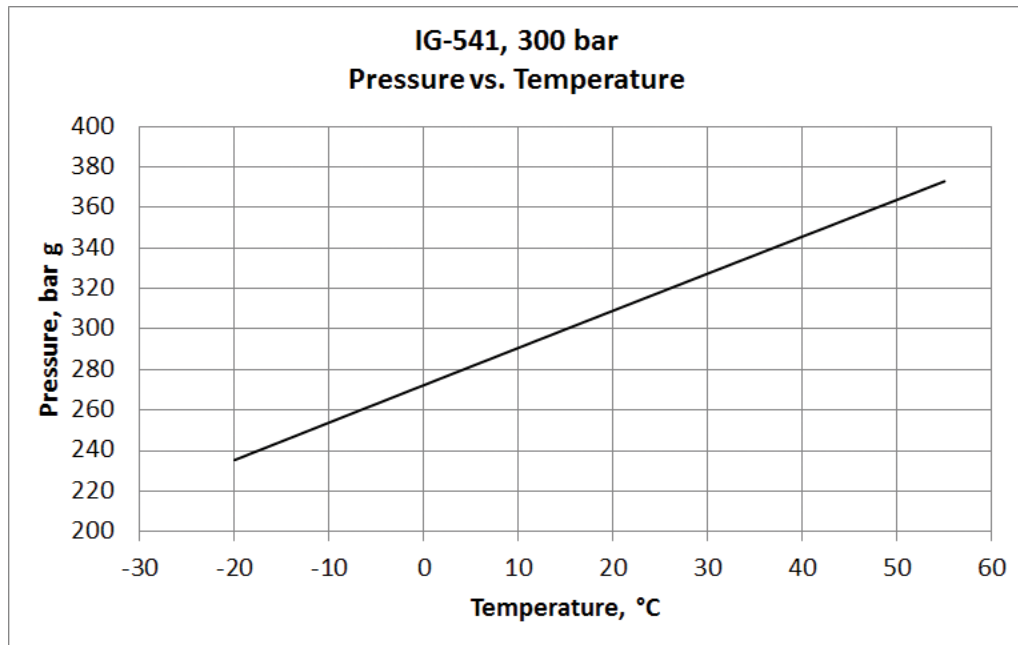


Figure 1-8. IG-541 Pressure vs Temperature (°C) for 300 bar System

### 1-5.4 IG-55 (Nitrogen and Argon)

Natura IGS systems using IG-55 are fixed fire extinguishing systems that use an inert, gaseous mixture of 50% Nitrogen and 50% Argon known as Argonite<sup>®</sup>, UN number of 1956.

The specification for IG-55 is an Argon/Nitrogen 50%/50% ratio by volume. Tolerance of mixture in air is as follows:

- Argon: 50% +/- 5%
- Nitrogen: 50% +/- 5%

#### 1-5.4.1 Purity of Argon and Nitrogen

Each element shall conform to the following purity specification:

Argon:

- Argon greater than or equal to 99.99%
- Oxygen less than or equal to 10 ppm
- Water less than or equal to 10 ppm

Nitrogen:

- Nitrogen greater than or equal to 99.7%
- Oxygen less than or equal to 10 ppm
- Water less than or equal to 10 ppm

**Note:** Only principal contaminants are shown. Other measurements may include: Carbon Monoxide, Carbon Dioxide, Nitrogen Oxide, and Nitrogen Dioxide most < 20 ppm.

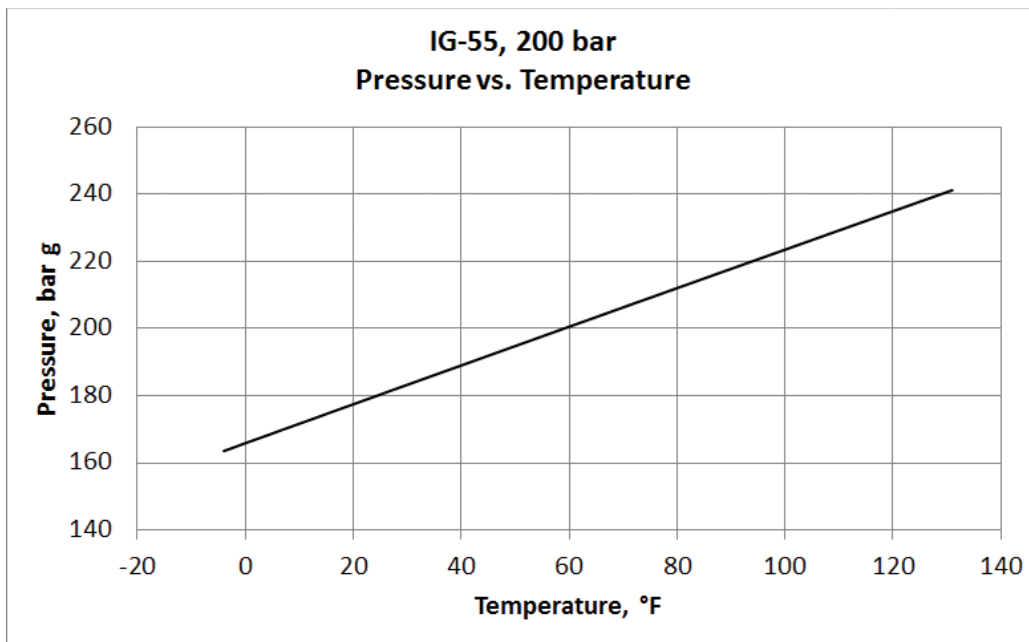


Figure 1-9. IG-55 Pressure vs Temperature (°F) for 200 bar System

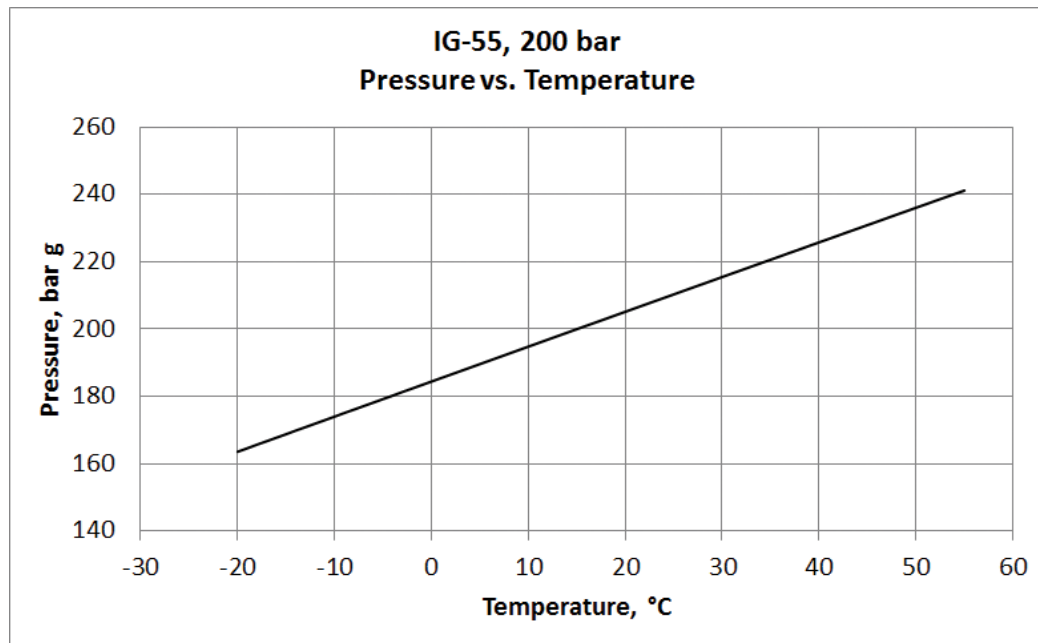


Figure 1-10. IG-55 Pressure vs Temperature (°C) for 200 bar System

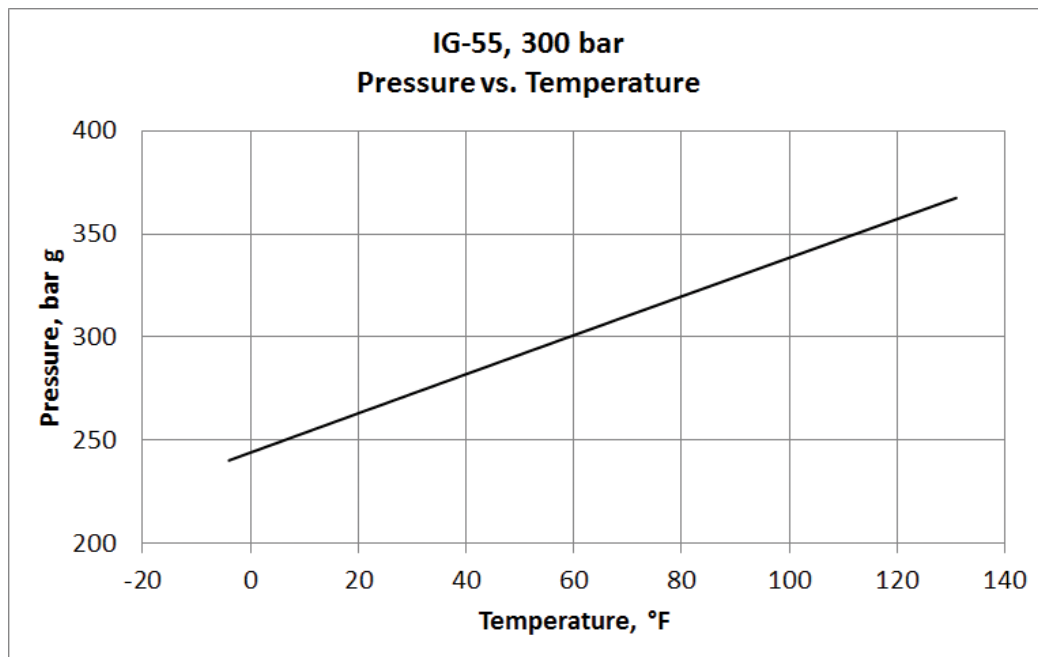


Figure 1-11. IG-55 Pressure vs Temperature (°F) for 300 bar System

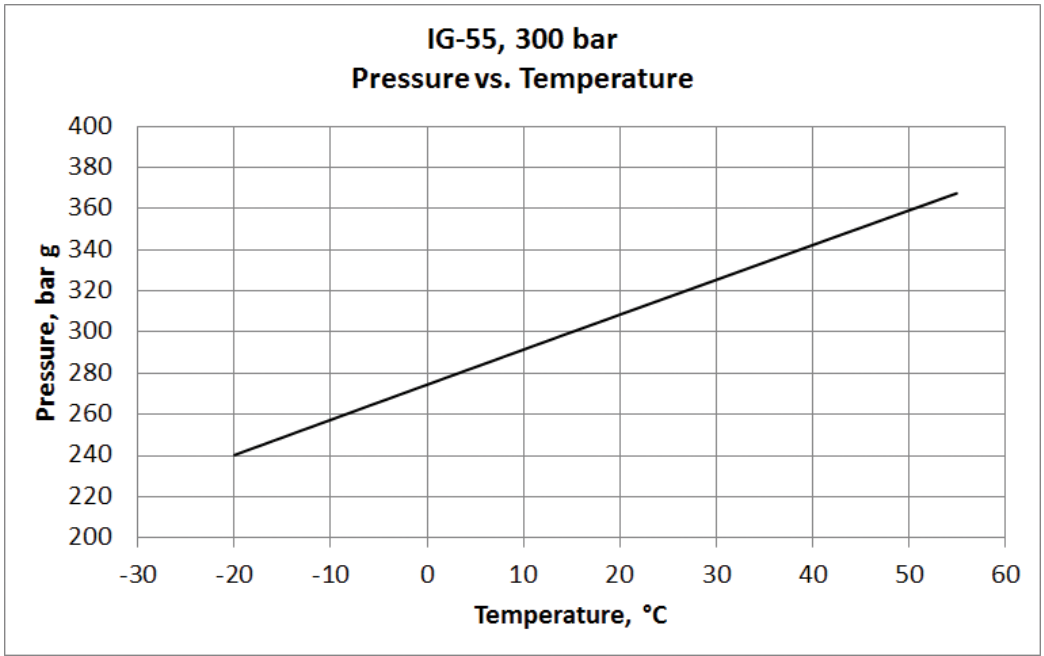


Figure 1-12. IG-55 Pressure vs Temperature (°C) for 300 bar System

**1-5.5 IG-01 (Argon)**

Natura IGS systems using IG-01 are fixed fire extinguishing systems that use the inert gas Argon, UN number 1006. The purity of the Argon shall be as follows:

- Argon greater than or equal to 99.99%
- Water less than or equal to 5 ppm

**Note:** Only principal contaminants are shown.

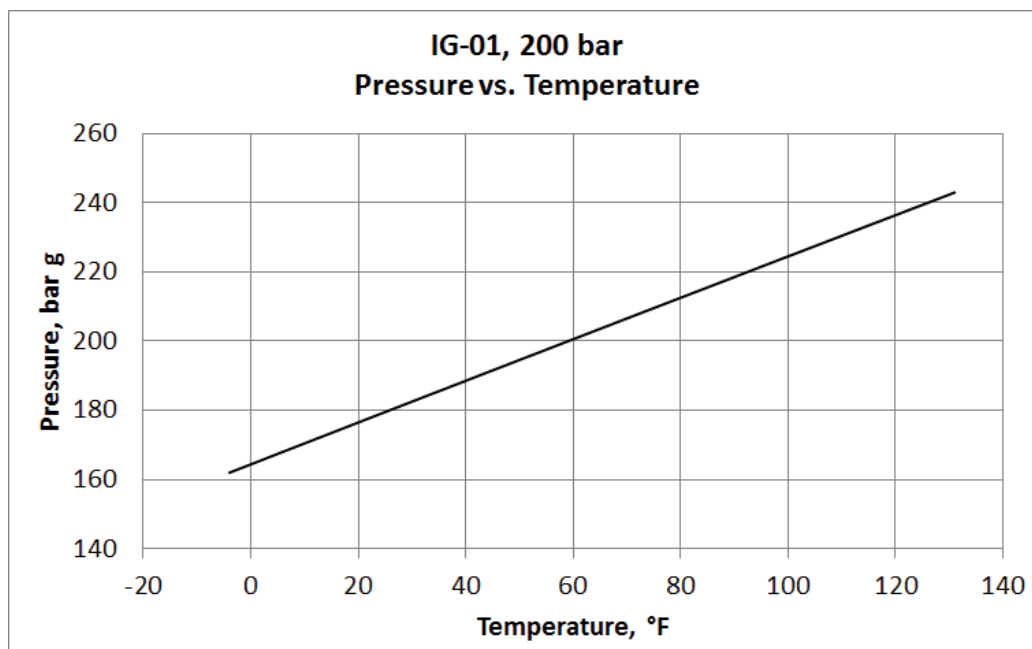


Figure 1-13. IG-01 Pressure vs Temperature (°F) for 200 bar System

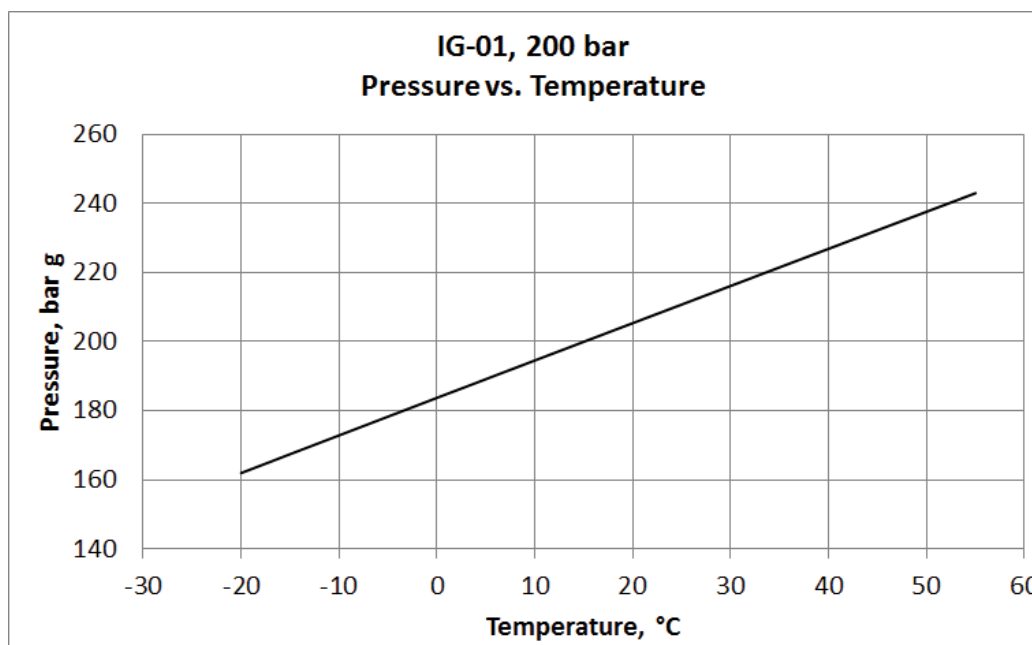


Figure 1-14. IG-01 Pressure vs Temperature (°C) for 200 bar System

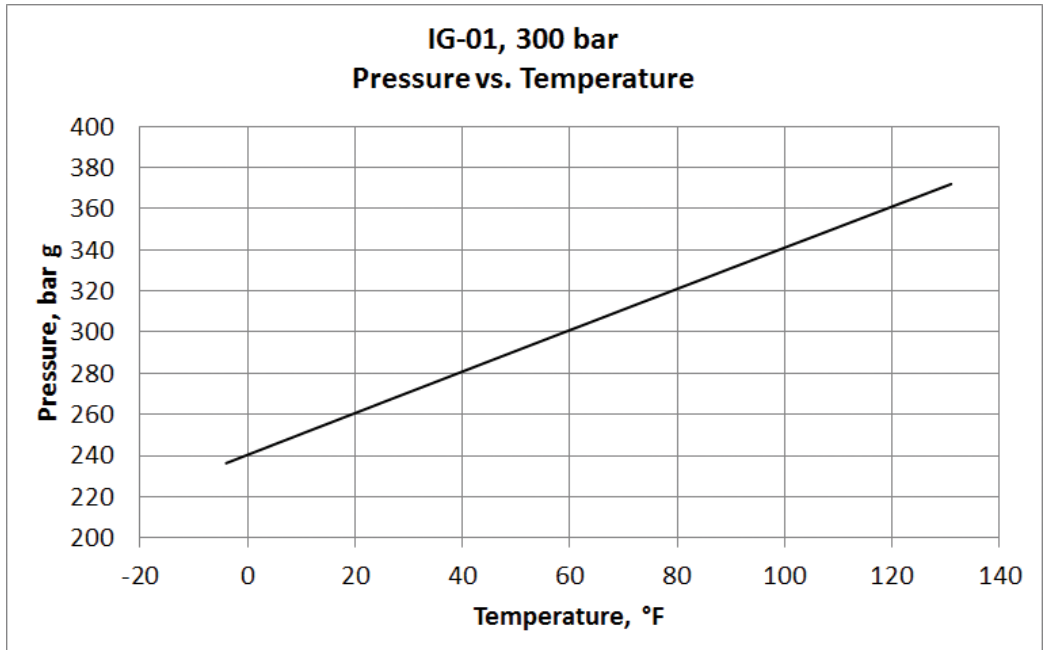


Figure 1-15. IG-01 Pressure vs Temperature (°F) for 300 bar System

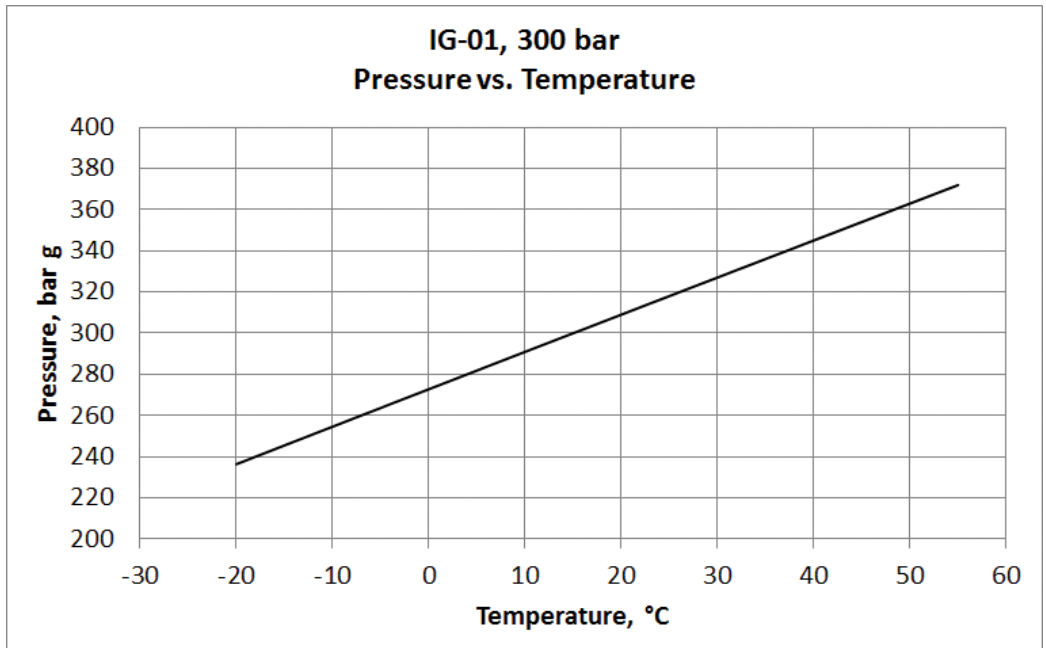


Figure 1-16. IG-01 Pressure vs Temperature (°C) for 300 bar System

## 1-5.6 Agent Pressure verse Temperature Formulas

See the individual agent sections for the corresponding graphs.  
In the formulas for Table 1-5, P is pressure and T is temperature.

Table 1-5. Agent Pressure Verse Temperature Formulas

Agent	Temp. Unit	200 bar	300 bar
IG-100	°F	$P = 0.555(T) + 167.2$	$P = 0.894(T) + 247.1$
	°C	$P = 0.999(T) + 185.0$	$P = 1.610(T) + 275.7$
IG-541	°F	$P = 0.616(T) + 163.6$	$P = 1.019(T) + 239.7$
	°C	$P = 1.108(T) + 183.3$	$P = 1.835(T) + 272.4$
IG-55	°F	$P = 0.575(T) + 166.0$	$P = 0.943(T) + 244.2$
	°C	$P = 1.035(T) + 184.4$	$P = 1.697(T) + 274.4$
IG-01	°F	$P = 0.600(T) + 164.5$	$P = 1.005(T) + 240.6$
	°C	$P = 1.080(T) + 183.7$	$P = 1.809(T) + 272.8$

## 1-5.7 Operating Temperature Range Limitations

Natura IGS systems have an operating temperature range of -4° to 130°F (-20° to 54°C).  
During discharge the temperature within the protected enclosure will drop approx. 9-18 °F (5 – 10 °C). The temperature will rise again after approx. 2 – 3 min.

## 1-5.8 Agent Storage Container Temperature Range Limitations

The temperature of the location for the agent storage containers depends on the design of the system.

### 1-5.8.1 Balanced System Agent Storage Container Temperature Range

In balanced systems, where agent flow through each nozzle is equal, the agent cylinder storage temperature range is -4° to 130°F (-20° to 54°C).

### 1-5.8.2 Unbalanced System Agent Storage Container Temperature Range

In unbalanced systems, where agent flows through the nozzles at varying rates, the agent cylinder storage temperature range is 60°F to 80°F (16°C and 27°C).

The latest version of the flow calculation software is written and tested for a 70°F (21°C) agent cylinder storage temperature (for more information see latest version of the Kidde Fire Systems Natura IGS Flow Calculation Software User's Guide 06-237621-001).

If the agent cylinder storage temperature is outside of this range, a minor variation from the calculated results should be expected. The agent concentrations listed in this DIOM adds a safety factor that compensate for this variation.

### 1-5.8.3 Storage

The seamless steel container is filled to 300 bar(4351 psig) at 59°F (15°C) or 200 bar (2901 psig) at 59°F (15°C) as listed on the label. The pressure of the stored agent varies substantially with temperature changes, as illustrated by the temperature verses pressure graphs shown previously for each agent. When discharged, the agent is a gas and is uniformly distributed as it enters the fire area.

## 1-6 NOISE CONSIDERATION

Hard disc drives may fail during release of a Natura IGS system due to acoustic noise issues. At specific frequencies and decibel (dB) levels, vibrations transfer through the flexible stainless steel cover of a hard drive case transmitting vibration into the inner workings of the drive, causing the read/write element to misalign and fail. The combination of audible warning alarms and nozzle sound are currently believed to be the most important factor that may cause hard discs to “vibrate” and fail. Typical sound level from an Inert gas nozzle is approx. 120 – 130 db measured in a distance of 6.6 feet (2 meters).

**Note:** Warning alarms are typically 110 – 120 db or must be a minimum of 10 db above the ambient sound level during normal operation processes.

To the best of Kidde Fire Systems’s knowledge, the reported failures happened during testing or from unexpected releases where no fires were involved. As such, normal server shutdown was not initiated and discharge delays did not operate, thus not permitting sufficient time for the discs to stop spinning. Therefore, it is important to ensure proper shutdown of computer systems prior to discharge if possible. Additionally, when testing systems, it is advisable to initiate a shutdown prior to the test.

Other precautionary measures may also be taken such as housing the drives within sound proof cabinets or the use of solid state drives. For further information consult your drive manufacturer and/or Kidde Fire Systems.

## 1-7 SYSTEM DETECTION AND CONTROL

Detection, actuation, and control systems shall be installed, tested, and maintained in accordance with the requirements of the authority having jurisdiction, the applicable DIOM Manual, and are not covered under the scope of this manual.

Automatic detection, alarm and actuation (release) is preferred, provided as a dual stage detection alarm control system. Selection of detection devices shall involve due consideration of the involved flammables, the environment, and the response time anticipated.

Means for manual release of the system shall be provided unless not allowed by the AHJ. Manual releases must be located, installed, or suitably protected so that they are not subject to mechanical, chemical or other damage that would render them inoperative. Installation of all manual releases must conform to local requirements from the AHJ.

The control equipment shall supervise the actuating and monitoring devices and the associated wiring and shall indicate / warn of failure of any supervised device.

Alarms or indicators (or both) shall be installed in the protected enclosures to indicate the operation of the system, first stage alarm, and second stage release alarm. The type (audible, visual, or olfactory), their quantity, and location shall be such that their purpose is satisfactorily accomplished.

Audible and visual pre-discharge alarms shall be provided within the protected area to give positive warning of impending discharge. The operation shall be continued after discharge until positive action has been taken to acknowledge the alarm and proceed with appropriate action.

A discharge delay between pre-alarm and discharge, sufficient to allow personnel to evacuate prior to discharge shall, where required, be provided. For hazard areas subject to fast growth fires, where the provision of a discharge delay would seriously increase the threat to life and property, a discharge delay may be omitted if agreed upon by the AHJ and all relevant parties.

Discharge delays shall be used only to safeguard personnel evacuation or to prepare the hazard area for discharge (by closing of doors or vents, shutting down equipment etc.).

Inhibit switches shall be provided for protected enclosures where the concentration after a release will be hazardous to personnel. Inhibition of a system release will not be possible; inhibit switches may only be activated between the first and second alarm (release).

Care shall always be taken to thoroughly evaluate and correct any factors that could result in unintended system activation / release.

The release unit used for the Natura IGS system shall be listed with the fire alarm and suppression control panel.

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## 1-8 RELEASE MODES

The system is capable of electric and manual actuation and can be released by one or more of the following methods:

### 1-8.1 Automatic Release

The fire detection and control panel will determine that a detector has entered the alarm state. In response to this, the panel will initiate a visual or audible alarm. When a second detector enters the alarm state and after the preset discharge delay has expired, the panel energizes the solenoid on the release unit connected to the primary cylinder, causing a system discharge.

### 1-8.2 Manual Remote Release

**Note:** Where allowed by local Authority Having Jurisdiction.

Remote manual release can be achieved by operating the remote manual release station or operating the manual release facility on the extinguishing control panel.

### 1-8.3 Manual Emergency Release

In the unlikely event of total power failure and total drainage of the emergency batteries, the cylinder bank can be manually released by removing the locking pin and turning the handle on the manual release unit (fitted next to the solenoid valve) on the primary cylinder.

For systems with selector valves, identify the selector valve and associated low pressure solenoid. Remove the locking pin from the manual override on the solenoid valve and turn the thumbscrew to actuate (a flat screw driver can also be used) allowing the pressure to open the required selector valve.

The selector valves should always be left in the closed position (standby), and only opened during a system discharge. Following a system discharge, the selector valves must be closed manually using the handle supplied.

**Note:** Where allowed by local Authority Having Jurisdiction. The feature for manual emergency release is not to be included in system installations in Germany due to regulations by VdS.

## 1-9 FLOW CALCULATIONS

Flow calculations are to be based on the approved isometric drawings, and should be verified prior to installation of the nozzles.

Any significant changes to the design require a re-evaluate of the system and the flow calculation repeated. If necessary, the orifices in the nozzles may need to be replaced with ones suitable for the as-built system.

All calculations to determine the size of pipes and nozzle orifices must be carried out using the software related to the specific agent used.

### **1-10 PRESSURE RELIEF/VENT**

When released, fixed fire extinguishing systems employing compressed gases will introduce an additional volume of gas due to expansion within the room.

To compensate for the increase in pressure, a suitable means of pressure relief/vent opening(s) to free air shall be employed.

The free area of these openings/vents shall be sufficient to avoid structural damage.

Normal rooms can withstand an increase in pressure of approx. 0.07 psig (5 mbar). The structural strength should always be obtained in writing from the client/end user or project consultant. If unable to obtain such information, use the lowest available structural strength within the hydraulic calculation software.

Pressure relief/vents should always have a fire rating in accordance with the structural element in which they are sited. Large glass surfaces and light constructions may demand a lower pressure than 0.07 psig (5 mbar).

Pressure relief/vents should be fitted at high level, clear of any direct nozzle discharge, and at the end of the discharge the pressure relief/vent shall close maintaining the extinguishing concentration for as long as possible. Gravity dampers or pressure rated dampers can be used for this purpose. It is recommended to vent the extra volume through a duct connected to relief/vent and expel it outside the building.

### **1-11 SERVICE AND MAINTENANCE**

It is not uncommon for routine maintenance to be overlooked or given insufficient attention by the owner of the system. Neglecting routine maintenance puts the premises, the equipment being protected, the lives of occupants at risk, and could cause potentially crippling financial losses.

The importance of maintenance cannot be emphasized enough.

Trained distributors and competent personnel shall regularly service a Natura IGS system.

The service engineer shall be proficient at installation and commissioning of a Natura IGS system as well as having detailed knowledge of the system's components.

A minimum of two thorough inspections per year shall be undertaken for an installation. The inspections shall include a check of the integrity of the protected volume and a comparison with the volume used at the design and installation of the system. Any significant change to the room's volume from that used at the design stage will affect the resulting oxygen concentration after a release and may require corrective action to be taken.

Maintenance shall be performed in accordance with Chapter 6 of this manual and applicable National Standards.

### **1-12 RETROFITABILITY**

Retrofitting a Natura IGS system into an existing piping network shall only be done after close examination of the installed pipe work, including verification of installed pipe and fittings material by hydraulic calculation, visual check of surface treatment condition, corrosion, external/internal leak and pressure testing

## **1-13 REFERENCES**

At present, the below mentioned international standards are in force but any subsequent changes to the relevant standards must be observed and supersede this list.

- NFPA 2001, 2022 Edition.
- ISO 14520 part 1 / EN 15004 part 1 General requirement
- IG-100: ISO 14520 part 13 / EN 15004 part 8
- IG-541: ISO 14520 part 15 / EN 15004 part 10
- IG-55: ISO 14520 part 14 / EN 15004 part 9
- IG-01: ISO 14520 part 12 / EN 15004 part 7

## **1-14 APPROVALS**

The approval(s) required for installation of a Natura IGS system may vary from country to country.

Local fire authorities should always be contacted for their input.

A number of international as well as local authorities around the world have approved the use of Natura IGS systems for fixed fire protection systems. This system has been approved for use as a fixed (total flood) fire extinguishing system.

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## CHAPTER 2

# COMPONENT DESCRIPTIONS

### 2-1 INTRODUCTION

This chapter provides a functional description of the modules and assemblies in Kidde Fire Systems Natura™ Inert Gas System (Natura IGS system) using IG-100, IG-541, IG-55, or IG-01 inert-gas agent (herein refer to collectively as the “agent”).

### 2-2 FUNCTIONAL DESCRIPTION

The agent is held in the Natura IGS system storage cylinder by a discharge valve. When the discharge valve is actuated, the agent discharges through the valve outlet and is directed through the distribution piping to the nozzles. The nozzles provide the proper flow rate and distribution of the agent.

The Natura IGS system is composed of the following components and assemblies:

- Section 2-3, Natura IGS System Agent Cylinders and Release Units
- Section 2-4, Discharge Accessories
- Section 2-5, Selector Valves
- Section 2-6, Lockout Valves
- Section 2-7, Discharge Nozzles
- Section 2-8, Nitrogen Pilot System and Pressure Driven Accessories
- Section 2-9, Fill Adapter
- Section 2-10, Manifold Equipment
- Section 2-11, Racking Components

Figure 2-1 shows some of the above components in a typical configuration.

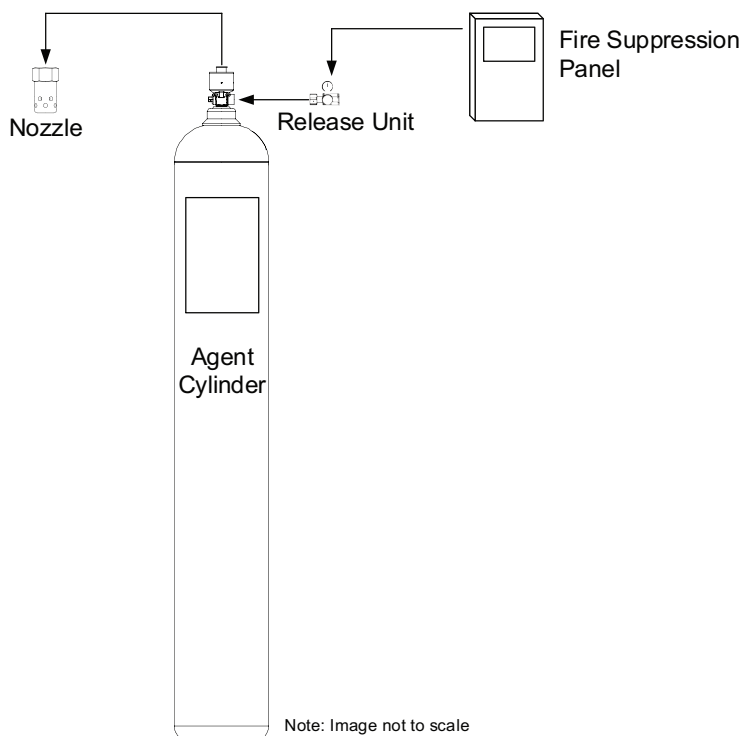


Figure 2-1. Typical Natura IGS System

### 2-3 NATURA IGS SYSTEM AGENT CYLINDERS AND RELEASE UNITS

The agents are stored in high pressure cylinders having a filling pressure of 200 bar (2900 PSI) or 300 bar (4351 PSI). The 80 and 140 liter cylinders can be installed in single, double, and triple row configurations.

Because the agents are stored as a non-liquefied gas, dip tubes are not used, allowing the cylinders to be installed either vertically or horizontally, as required. All rack configurations are for vertical mounting only.

**Note:** Cylinders in a system must all be of the same size, pressure, and agent.

#### 2-3.1 Cylinder and Valve Assemblies

The agent is stored in steel cylinders as a gas with a safety burst disc in compliance with DOT or TPED requirements.

Each agent cylinder is factory equipped with an anti-recoil safety cap installed on the valve discharge outlet, and securely fixed to the valve via a stainless steel, PVC coated cable to prevent loss. This device is a safety feature, and will prevent discharge when installed if the cylinder is actuated accidentally. In addition, a safety transport cap, shroud, or guard is provided to protect the cylinder valve during transportation or handling.

Each cylinder, manufactured in accordance with TPED and/or UN (DOT Recognized) ISO 9809-2, is fitted with a pressure operated Natura IGS system high pressure cylinder valve.

Standard cylinders are available in volumes of 80 liters filled with agent at pressures of 200 bar or 300 bar at a filling temperature of 15°C and 140 liters filled with agent at a pressure of 300 bar at a filling temperature of 15°C. Empty Cylinders eligible for filling at an authorized first fill site are also available.

The cylinders are provided with the body painted red and the shoulder painted green. The cylinder labelling includes agency markings where applicable.

**Note:** All cylinders are fitted with a valve protection device in accordance with UN ADR.



**The safety cap must be installed on the discharge outlet whenever a charged cylinder/valve assembly is not connected to the system piping. Failure to install the safety cap could result in violent movement of the container in the event of inadvertent actuation. Failure to follow these instructions could cause death, personal injury and/or property damage.**

Figure 2-2 represents a typical cylinder assemblies. See Table 2-1 for cylinder dimensions.

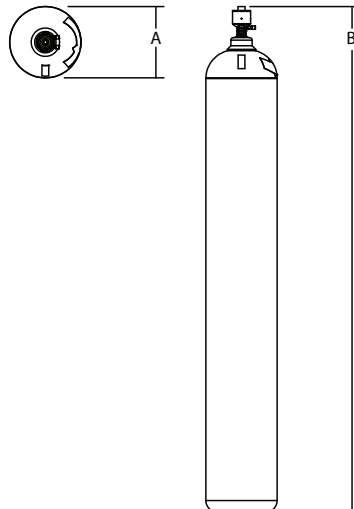


Figure 2-2. Typical Cylinder Assembly

Table 2-1. Dimensions, Cylinder and Valve Assemblies

Part Number	Capacity		Approximate Empty Weight		Height		Diameter	
	Liter	in <sup>3</sup>	lb	kg	B		A	
					in	mm	in	mm
38-4280XX-XXX	80	4882	227.1	103.0	73.3	1862	10.5	267
38-4X1431-XXX	140	8543.3	436.5	198.0	73.5	1867	14.2	360

**Note:** Agent and pressure choice does not alter cylinder dimensions, only filled weights. For weights, see Table 2-2.

Table 2-2. Filled Cylinder Weights

Part Number	Capacity	Pressure	IG-100		IG-541		IG-55		IG-01	
			lb	kg	lb	kg	lb	kg	lb	kg
38-42802X-XXX	80 L	200 bar	266.4	120.8	279.1	126.6	277.4	125.8	289.9	131.5
38-42803X-XXX	80 L	300 bar	281.4	127.6	300.0	136.1	297.9	135.1	317.0	143.8
38-4X1431-XXX	140 L	300 bar	531.5	241.1	564.1	255.9	560.4	254.2	593.8	269.3

The Natura IGS system equipment listed herein is designed for an operating temperature range of -4° to 130°F (-20° to 54°C). The agent information found in Section 1-5 shows the cylinder temperature-pressure relationship formulas based on fill density.

The Kidde Fire Systems Natura IGS Flow Calculation Program is designed for a 68°F (20°C) cylinder operating/storage temperature.

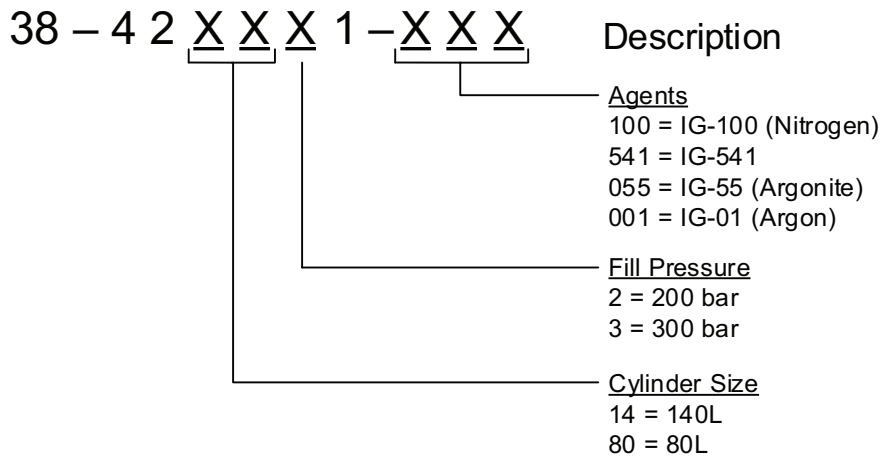


Figure 2-3. Natura IGS System Agent and Cylinder Part Number Breakdown

**Note:** For a list of part numbers, see Table 8-1 and Table 8-2.

**2-3.1.1 Spare Parts for Cylinders**

The following spare parts are available for the cylinder:

Table 2-3. Natura IGS System Cylinder Spare Parts

Part Number	Description
38-400011-001	Anti-recoil cap, with actuation test pin
15-9604-0011	Transport Cap for 80L cylinders
15-9604-0014	Transport Cap for 140L cylinders

## Component Descriptions

### 2-3.1.2 Cylinder Valves

The Natura IGS system uses a pneumatically operated, high pressure cylinder valve, designed for an operating pressure of up to 366 bar (tested and CE marked according to EN 12094-4, tested and PI marked according to ATR D 2/11:2012 (TPED)).

Each valve includes Quick Connect fitting for the pilot actuation line to allow pneumatic opening of the valve. Each primary cylinder in the bank will be fitted with an electrical/manual release unit.

A pressure gauge/switch included in the release unit or secondary cylinder gauge assembly (with quick connect cable joints) provides local and optional remote monitoring of the cylinder pressure. Normally the gauge/switch is electrically connected in a single loop configuration for common remote monitoring.

During discharge, a continuous pressure of 8 bar is applied to the valve through the actuation hose, operating the valve. This pressure is supplied from the agent cylinder through the actuation hose and release unit.

After a discharge the cylinder valve will close automatically when the pressure has fallen to <3 bar. The residual gas content will prevent ingress of moisture ensuring the inside of the cylinder will remain dry, thus providing protection against corrosion.

Figure 2-4 represents the valve arrangement.

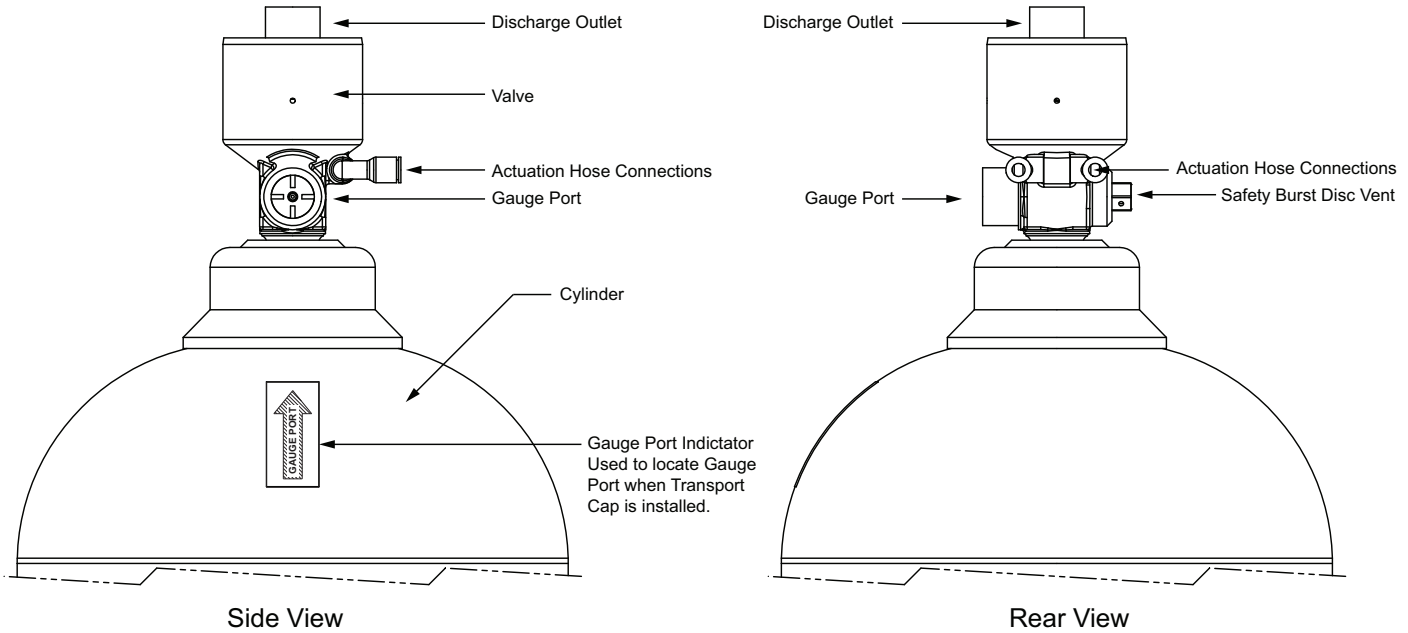


Figure 2-4. Valve General Arrangement, P/N 38-40000-001



**Valve replacement is not UL Listed or FM Approved.**

### 2-3.2 Release Units

Release units connect to the gauge port of the primary cylinder and are used to release the agent to the piping system. Release units are electrically and manually operated. The supervisory pressure switch on the gauge is designed to change the contact state when the pressure falls below 160 bar (2320 psi) for 200 bar (2900 psi) cylinders and 240 bar (3480 psi) for 300 bar (4350 psi) cylinders.

**Note:** When installed and if possible, the release unit should be on the left most cylinder, protected under the manifold.

Release units with manual operation have a tamper seal on the operation pin. Replacement seals are included in the Release Unit Service kit, P/N: 38-400001-010.

**Note:** Release unit solenoids must be continuously powered during system discharge.

#### Solenoid Specifications

- Operating Voltage: 24 VDC 18W
- Current Draw: 0.75 Amps

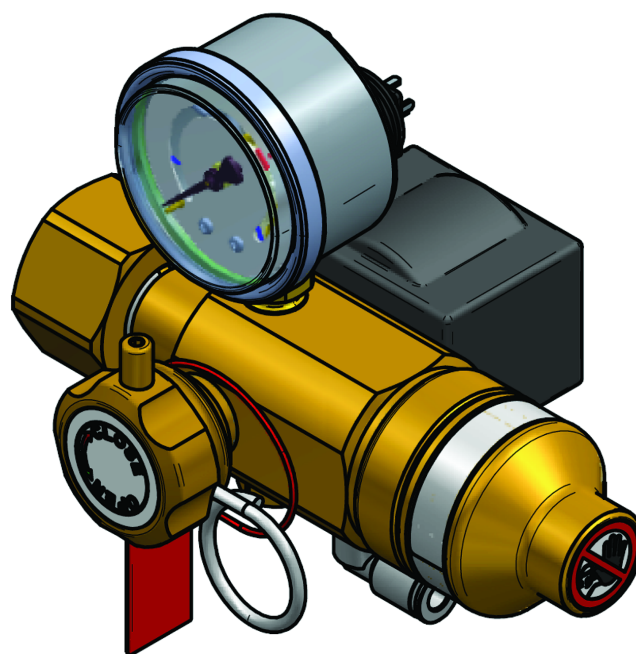


Figure 2-5. Release Unit

Table 2-4. Natura IGS System Release Unit Part Numbers

Part Number	Pressure Rating	Operation	Contact	Current Draw
38-400001-001	200 bar	Manual/Electric	Normally Open	Continuous .75 Amps
38-400001-003	300 bar			

### 2-3.3 Secondary Cylinder Gauge Assemblies

Secondary Cylinder Gauge Assemblies provide a pressure indicator for all secondary cylinders in a system. The Secondary Cylinder Gauges Assemblies are connected to the valve's gauge port and the switch contacts for low pressure monitoring. The supervisory pressure switch on the gauge is designed to change the contact state when the pressure falls below 160 bar (2320 psi) for 200 bar (2900 psi) cylinders and 240 bar (3480 psi) for 300 bar (4350 psi) cylinders.

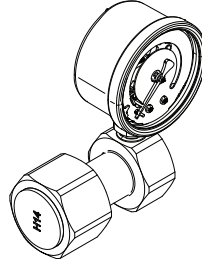


Figure 2-6. Secondary Cylinder Gauge Assembly

Table 2-5. Natura IGS System Secondary Cylinder Gauge Part Numbers

Part Number	Pressure Rating	Contact
38-400005-001	200 bar	Normally Open
38-400005-003	300 bar	

### 2-3.4 Actuation Hoses

The Actuation Hoses are used in multiple cylinder systems. Pressure is directed to the valve on each agent cylinder using an actuation hose (see Figure 2-7, Figure 2-8, and Table 2-6). These hoses include Quick Connect fittings for ease of installation and maintenance. The groove on the Quick Connect provides additional grip surface when the connector is installed into the mated connection.

**Note:** During discharge, a continuous pressure of 8 bar is required in the actuation hose. This pressure is supplied from the agent cylinder.

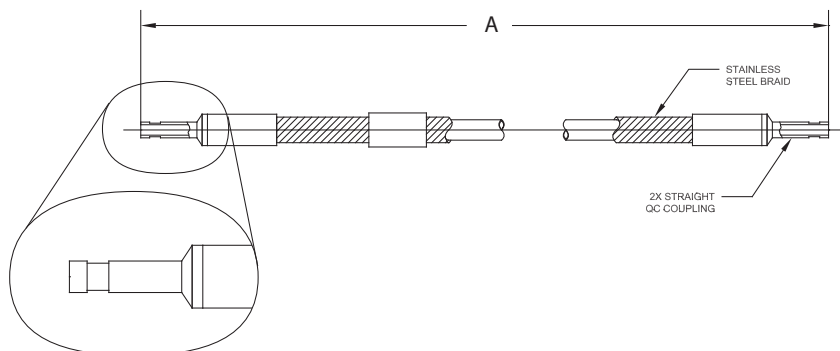


Figure 2-7. Flexible Actuation Hose with Straight to Straight Couplings

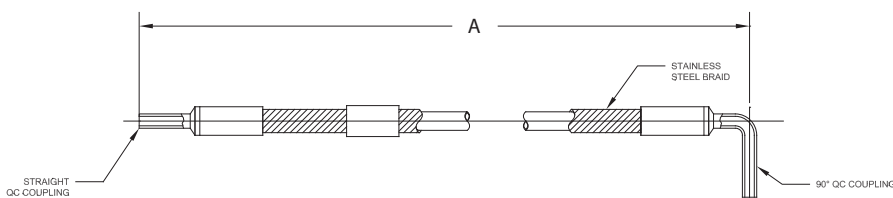


Figure 2-8. Flexible Actuation Hose with Straight to 90° Couplings

Table 2-6. Dimensions, Flexible Actuation Hose

Part Number	Connection Angle	Dimension A	Min. Bend Radius
38-401110-500	Straight to Straight	19.68"	3" (76 mm)
38-401110-600	Straight to Straight	23.62"	3" (76 mm)
38-401130-600	Straight to 90°	23.62"	3" (76 mm)
38-401130-700	Straight to 90°	27.56"	3" (76 mm)

Depending on location, different size actuation hoses are required when connecting agent cylinders. Table 2-7 shows which actuation hoses to use when connecting multiple cylinders.

Table 2-7. Actuation Hose Usage

Connection Type	Actuation Hose Used
<b>80 Liter Cylinders</b>	
Release Unit to Cylinder Valve	38-401110-500
Interconnecting Valves in the same row (in-line valve to valve)	38-401110-500
Interconnecting Valves in different rows (in-between cylinder rows)	38-401130-600
<b>140 Liter Cylinders</b>	
Release Unit to Cylinder Valve	38-401110-500
Interconnecting Valves in the same row (in-line valve to valve)	38-401110-600
Interconnecting Valves in different rows (in-between cylinder rows)	38-401130-700

### 2-3.5 Pilot Line Bleed Valve

Install a Pilot Line Bleed Valve (P/N 38-40007-001) in the unused actuation hose connection in the last cylinder of a cylinder bank, even if the bank only contains one cylinder. The pilot line bleed valve prevents a possible gradual pressure build-up in the pilot line should the solenoid release unit develop a leak, thus preventing an unintended system discharge.

The pilot line bleed valve includes a Quick Connect fitting for ease of installation and maintenance. The groove on the Quick Connect provides additional grip surface when the connector is installed into the mated connection.

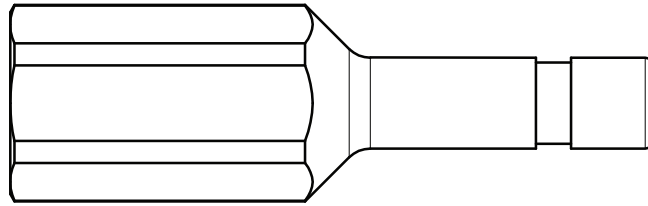


Figure 2-9. Pilot Line Bleed Valve

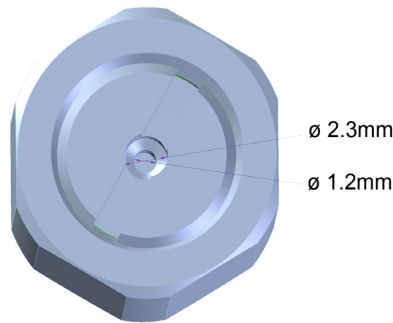


Figure 2-10. Pilot Line Bleed Valve Rear View (Vent Hole Diameter Shown)

### 2-3.6 Quick Connect Cables

Quick Connect cables provide a fast method of wiring the pressure gauges of the Release Unit and Secondary Cylinder Gauge Assemblies.

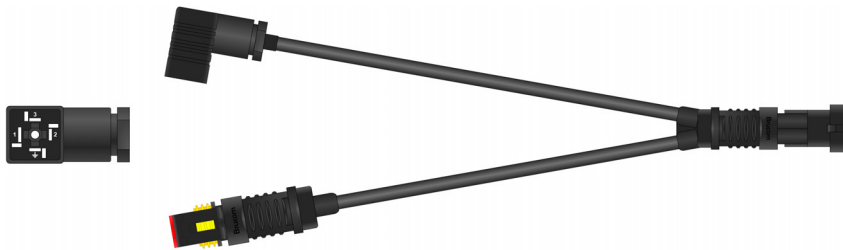


Figure 2-11. L Plug x 2 Cable, Dual Core (0.34mm x 300mm) x Quick Connects (Male & Female)



Figure 2-12. Gauge Signal Line - Quick Connect (MALE) Connector with 3m Fly-Lead (Dual Core Cable)



Figure 2-13. Quick Connect (Male) x Dual Core (0.34mm x 1000mm) Fly-Lead



Figure 2-14. Quick Connect (Female) x Dual Core (0.34mm x 1000mm) Fly-Lead

Table 2-8. Natura IGS System Quick Connect Cable Part Numbers

Part Number	Description
38-400005-100	L Plug x 2 Cable, Dual Core (0.34mm x 300mm) x Quick Connects (Male & Female)
38-400005-102	Gauge Signal Line - Quick Connect (MALE) Connector with 3m Fly lead (Dual Core Cable)
38-400005-103	Quick Connect (Male) x Dual Core (0.34mm x 1000mm) Fly-Lead
38-400005-105	Quick Connect (Female) x Dual Core (0.34mm x 1000mm) Fly-Lead

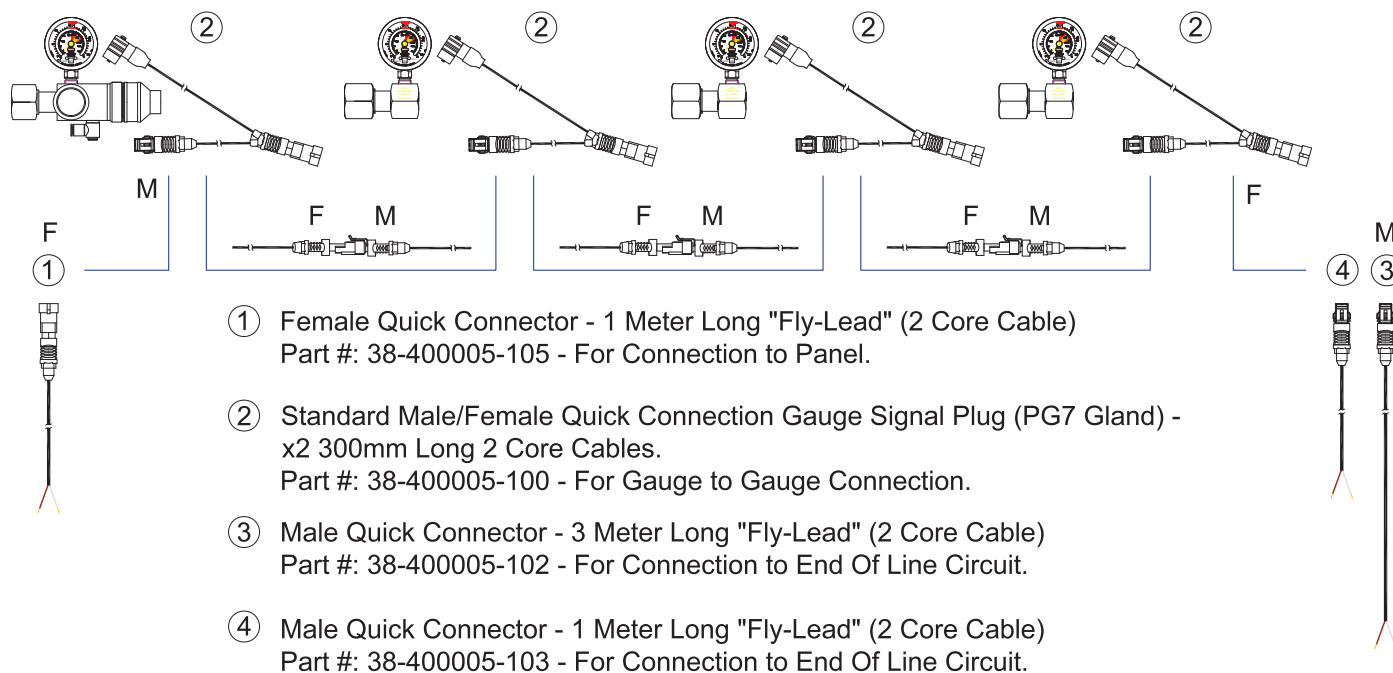


Figure 2-15. Quick Connect Cabling Example

**2-4 DISCHARGE ACCESSORIES**

**2-4.1 Discharge Hoses**

Use the discharge hoses to route the agent from the storage cylinders to the manifold piping (see Figure 2-16, and Table 2-9). The hose is connected to the discharge outlet of the agent cylinder valve and terminates at a check valve on the discharge manifold or leads to the system piping where allowed by the AHJ.

Use the 16.1" (410 mm) hose with 80L cylinders and the 20.1" (510 mm) hose with 140L cylinders.

**Note:** An alternate to the discharge hose, is to use a hard pipe (3/4" BSPT male) connecting the discharge port with a union at one end and coupling at the manifold check valve end.

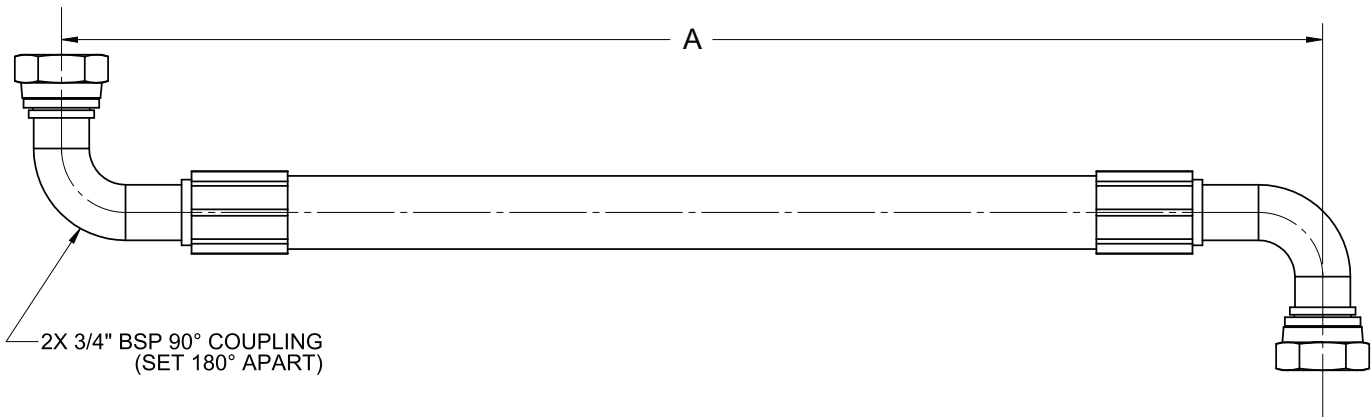


Figure 2-16. Discharge Hose with 90° to 90° Couplings

Table 2-9. Dimensions, Flexible Discharge Hoses

Part Number	Connection Angle	Dimension A	Min. Bend Radius
38-400330-410	90° to 90°	16.1" (410 mm)	9.6" (240mm)
38-400330-510	90° to 90°	20.1" (510 mm)	9.6" (240mm)



**If a cylinder is removed and the system discharges, the manifold check valve prevents agent from flowing back through the manifold into the cylinder storage area. Failure to include a manifold check valve could lead to injury or death if the system discharges when one or more cylinders is removed from the manifold.**

## 2-4.2 3/4" Manifold Check Valves



If a cylinder is removed and the system discharges, the manifold check valve prevents agent from flowing back through the manifold into the cylinder storage area. Failure to include a manifold check valve could lead to injury or death if the system discharges when one or more cylinders is removed from the manifold.

Use the 3/4" Manifold Check Valve (P/N 38-400002-002) between the discharge hose and the manifold. Manifold Check Valves are included with the pre-built manifolds available for purchase and included in the flow calculation software.

**Note:** If creating a manifold using NPT tooling, use a 1" BSPT Female to 1" NPT Male adapter that matches the pipe rating of the manifold.

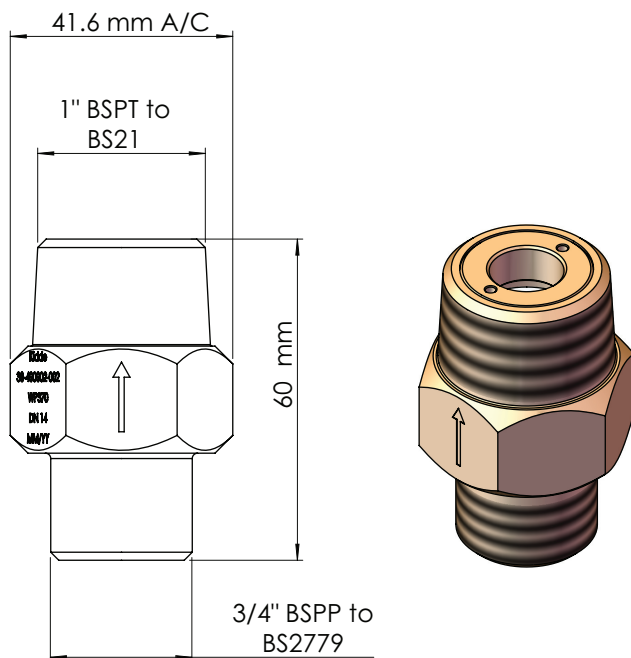


Figure 2-17. Manifold Check Valves

Table 2-10. Natura IGS System Manifold Check Valve

Part Number	Description
38-400002-002	3/4" BSP Manifold Check Valve

### 2-4.3 Manifold Safety Device

The manifold safety device (P/N 38-400006-002) contains a safety disc housed in a threaded body. The safety disc is designed to relieve at a pressure of 90-100 bar. Manifold safety devices have an NPT fitting on the side that connects to the manifold and a BSP threading on the side that would connect to the venting pipe if applicable.

Use the manifold safety device in systems with selector valves and lockout valves where the design of the system creates a closed section of piping. The safety outlet is installed in the piping upstream of the valve(s) to prevent over pressurization in the event of entrapment of agent in the closed pipe segment. The safety device may also be piped to vent directly to atmosphere.

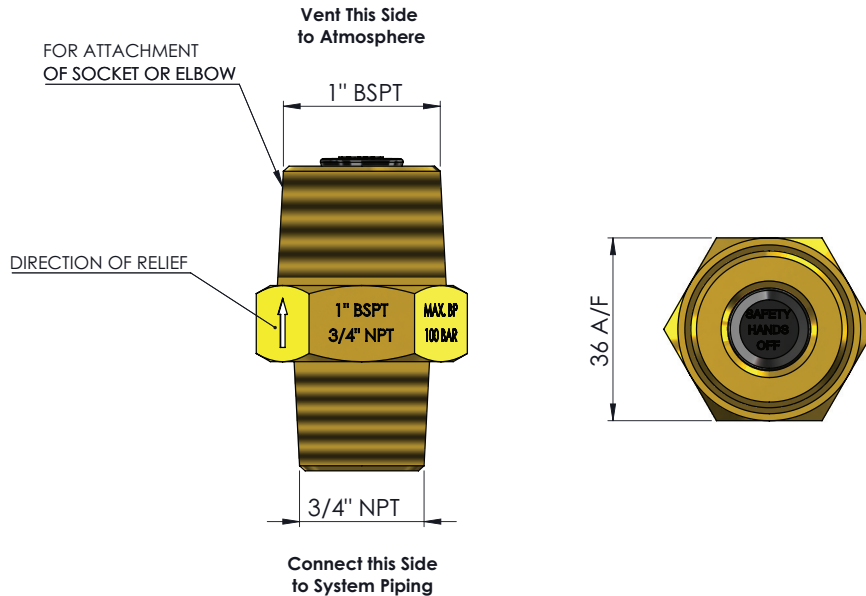


Figure 2-18. Manifold Safety Device

Table 2-11. Natura IGS System Discharge Accessories Part Numbers

Part Number	Description
38-400006-002	BSP Manifold Safety Device

### 2-4.4 Discharge Indicator (Optional)

The discharge indicator (P/N 81-967082-000), may be installed in the discharge piping to visually indicate a system discharge. In the set position, the discharge indicator acts as a vent allowing agent pressure that may have accumulated in the manifold (due to a leaking cylinder valve) to vent to atmosphere.

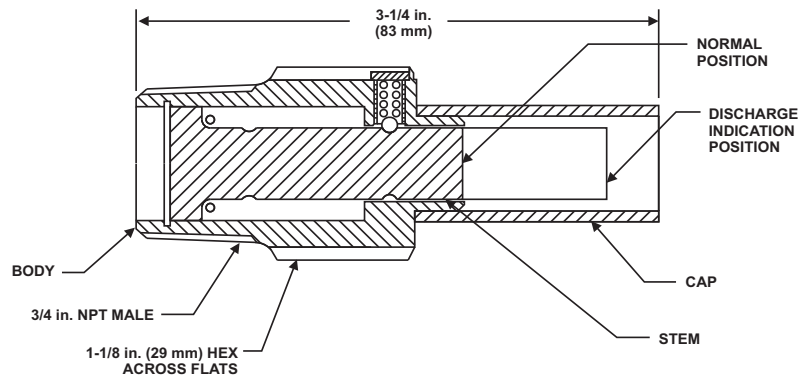


Figure 2-19. Discharge Indicator

## 2-4.5 Pressure Operated Switches

Pressure operated switches (Figure 2-20 and Figure 2-21) are connected to the distribution piping and use the pressure of the discharging agent for activation. The agent actuates a pressure operated stem which toggles the electrical switch. Each switch can also be operated manually by pulling up on the stem. These switches are used to enunciate alarms, to shut down ventilation and/or other electrical equipment, and to turn on electrical automatic dampers or other electrical equipment. These switches can also be used to create feedback to the control panel in case of a manual, mechanical discharge of the system. Each pressure switch must be manually reset, by pushing down on the stem to return the switch to the set position. The minimum operating pressure required is 50 PSI.

Pressure switches are available in standard (Part No. 81-486536-000) and explosion proof (Part No. 81-981332-000) models. The standard switch is three-pole, double-throw; the explosion proof switch is three-pole, single-throw.

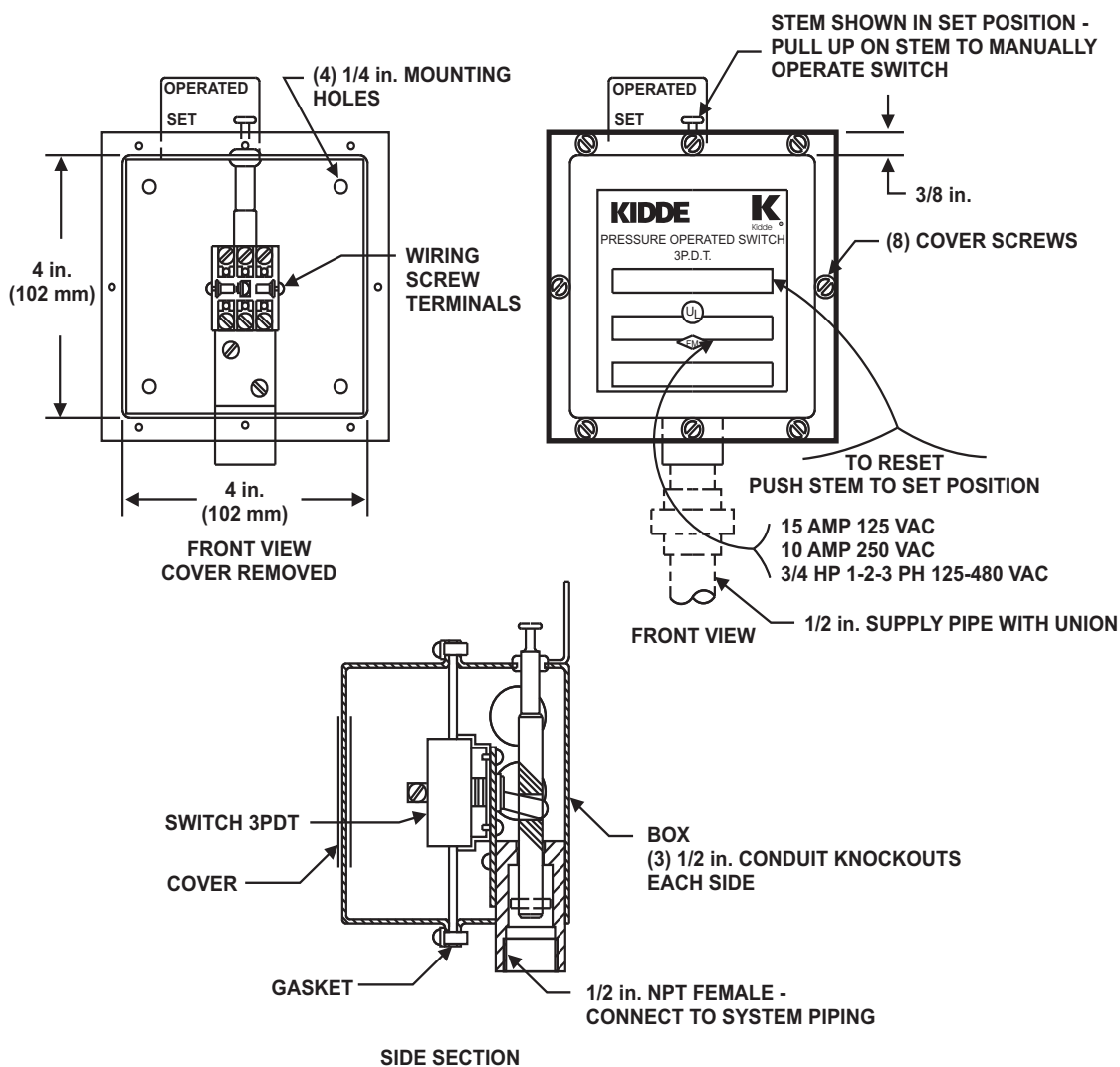


Figure 2-20. Pressure Operated Switch

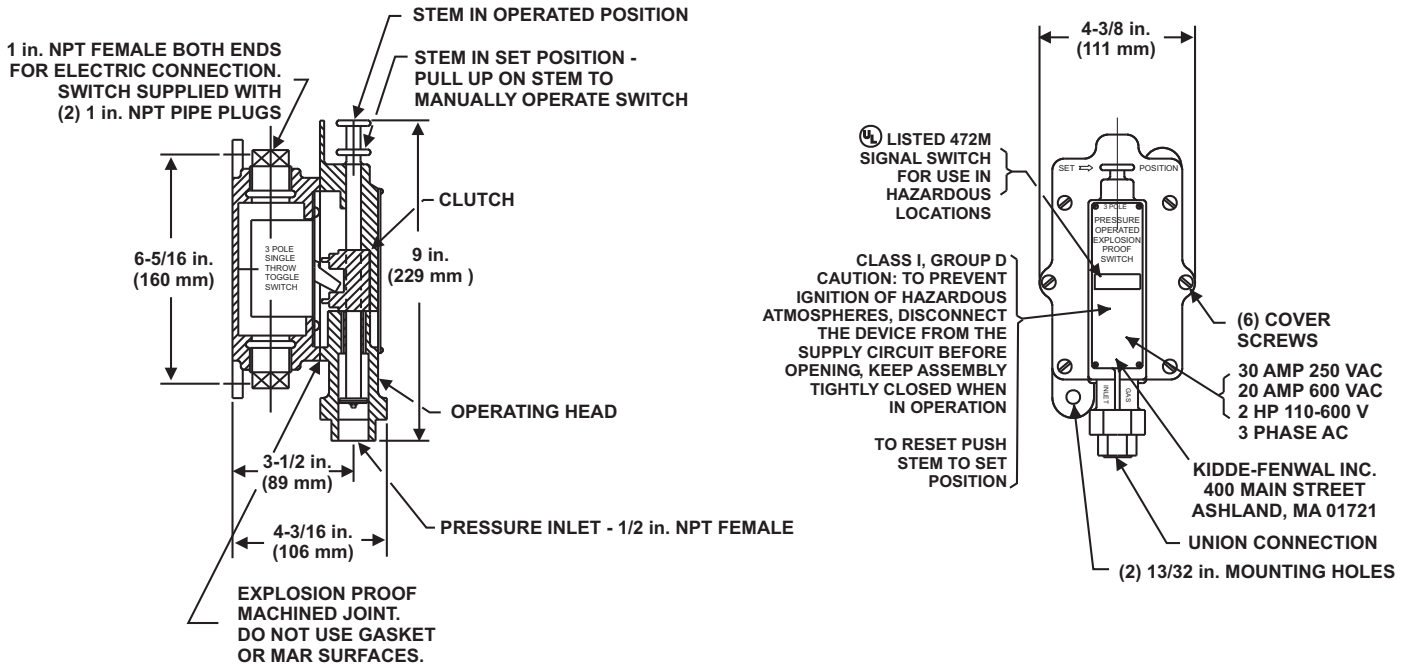


Figure 2-21. Pressure Operated Switch, Hazloc

## 2-4.6 Pressure Operated Release

The pressure operated release, Part No. 81-874290-000 (Figure 2-22), is connected to the distribution piping and utilizes agent pressure for actuation. The agent pressure displaces a spring-loaded piston to disengage a holding ring from the stem connected to the piston.

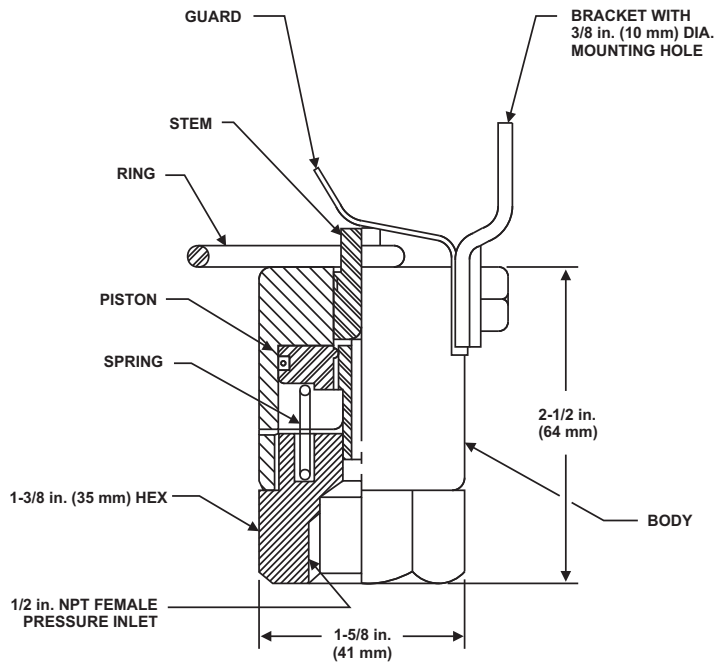


Figure 2-22. Pressure Operated Release

**2-4.7 Main-to-Reserve Transfer Switch, P/N 85-802398-001**

The Main-to-Reserve Switch is installed on systems having main and reserve cylinders. Placing the switch in either the MAIN or RESERVE position provides uninterrupted fire protection during system maintenance or in the event of a system discharge (see Figure 2-23).

Switch Rating: 30 Amps at 120 VAC

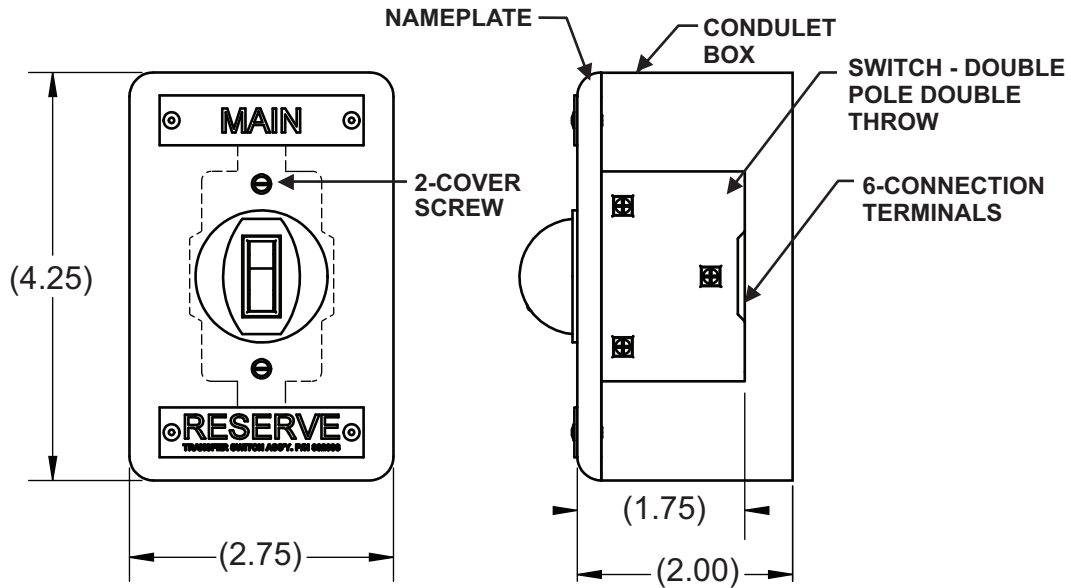


Figure 2-23. Main-to-Reserve Transfer Switch

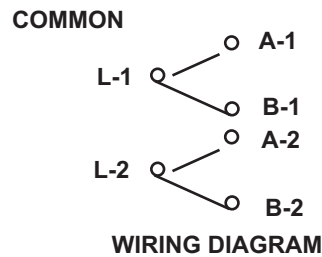


Figure 2-24. Wiring Diagram

Table 2-12. Part Numbers

Part Number	Description
85-802398-001	Main-to-Reserve Transfer Switch

### 2-4.8 Odorizer Assembly

The odorizer assembly, P/N 81-897600-001, injects a scent of wintergreen into the agent during a discharge. Upon discharge, the agent pressure ruptures a burst disc to release the scent of wintergreen. This scent warns personnel in the vicinity of the area protected by the fire suppression system that agent is present.

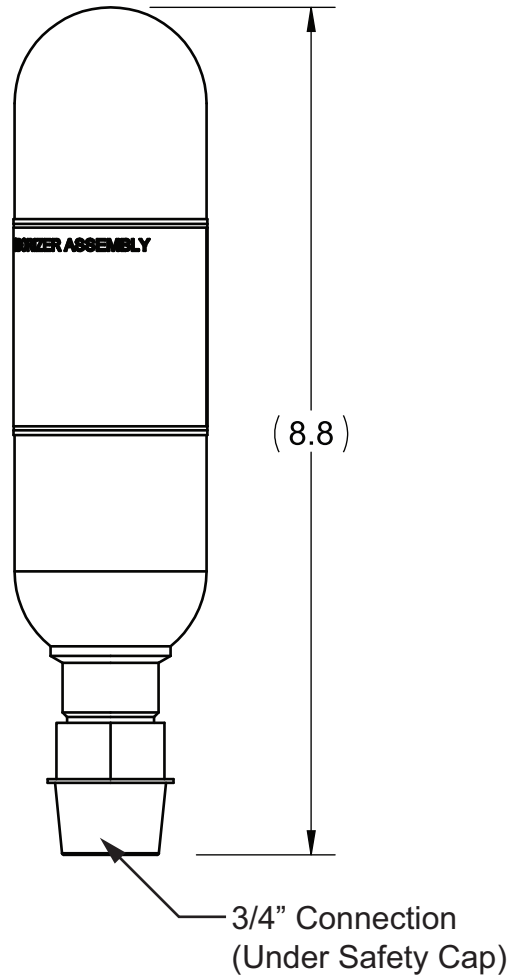


Figure 2-25. Odorizer Assembly

### 2-4.9 Main and Reserve Nameplates

The main and reserve nameplates, P/N: WK-310330-000 and WK-310340-000 respectively (Figure 2-26), are used to identify the primary (main) and backup (reserve) agent cylinders.

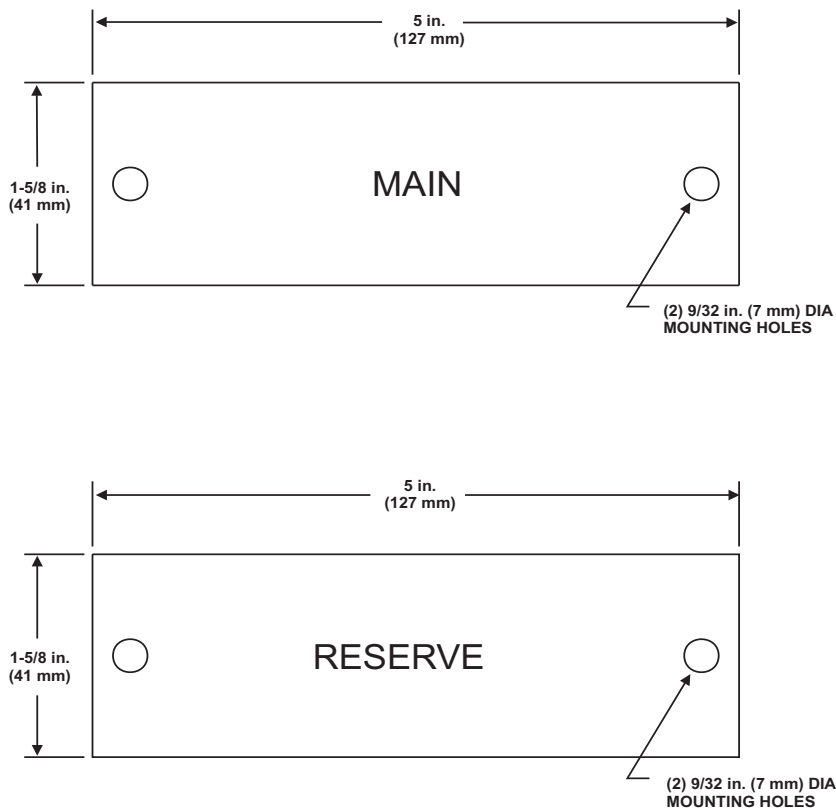


Figure 2-26. Main and Reserve Nameplates

### 2-4.10 Caution Signs

There are two warning signs available for use with Natura IGS systems, a caution sign used for entrances to the protected area (P/N 85-909300-001), and one for the exits from the protected area (P/N 85-909300-002). Additional signs to assist with BS Compliance are also available.

Table 2-13. Natura IGS System Caution Sign Part Numbers

Part Number	Description
85-909300-001	Caution Label - Entrance
85-909300-002	Caution Label - Exit
01-2173-0200	Caution Sign - Evacuate on Alarm Sound (BS Compliant)
01-2172-0200	Caution Sign - Vent Keep Clear
K4076-2	Caution Sign - Entrance Inert System (BS Compliant)
K4076-1	Caution Sign - Manual Actuation Point (BS Compliant)

**Note:** Alternative signs may be purchased from third party vendors so long as the signs are accepted by the local Authority Having Jurisdiction and conform to all required regional and national standards.

**2-5 SELECTOR VALVES**

Selector valves are used to distribute agent where multiple spaces are protected from the same or multiple banks of cylinders.

All Natura IGS system selector valves are 2-way ball valves with full bore. They operate pneumatically, using pressure tapped from the manifold and routed through a pressure regulator on the back-plate manifold. This pressure passes through the associated solenoid on the back-plate which is opened via the control panel, allowing agent pressure to flow to the required selector valve.



**Selector valves do NOT prevent flow in the direction opposite the arrow.**

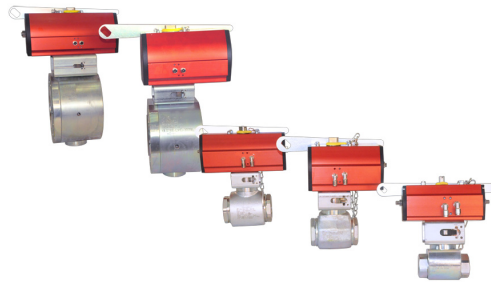


Figure 2-27. Selector Valves

Table 2-14. Natura IGS System Selector Valve Part Numbers

Part Number	Description
22-37140-025	1" Selector valve, DN 25, 8-10 bar Actuator
22-37140-040	1 1/2" Selector valve, DN 40, 8-10 bar Actuator
22-37140-050	2" Selector valve, DN 50, 8-10 bar Actuator
22-37140-080	3" Selector valve, Flange DN 80, 8-10 bar Actuator
22-37140-100	4" Selector valve, Flange DN 100, 8-10 bar Actuator

Selector valve sizes 1", 1 1/2", and 2" have BSP threaded inlet and outlet ports for connection to the distribution piping. Selector valve sizes 3" and 4" use flanges to connect to the system piping. When using NPT pipe threads, the following BSP to NPT adapters are used for the threaded ports:

Table 2-15. Natura IGS System Selector Valve Adapter Part Numbers

Part Number	Description
01-3711-3000	1" BSPT (M) to NPT (F) Adapter (2 required per valve, entry/exit)
01-3711-4000	1 1/2" BSPT (M) to NPT (F) Adapter (2 required per valve, entry/exit)
01-3711-5000	2" BSPT (M) to NPT (F) Adapter (2 required per valve, entry/exit)

To connect the actuation hose to the selector valve, the following adapters are required:

Table 2-16. Natura IGS System Selector Valve Hose Adapter Part Numbers

Part Number	Description
15-8662-0041	Selector Valve Hose Adapter For 1", 1 1/2" and 2" Selector Valves
15-8662-0042	Selector Valve Hose Adapter For 3" and 4" Selector Valves

## 2-5.1 Back-Plate Manifold

To simplify the selector valve installation, the back-plate manifold comes with the pressure regulator, piping, and the required number of solenoids to provide pressure to the appropriate selector valve. The back-plate manifold includes one hose (P/N 01-3273-1200) used to connect the pressure regulator on the back-plate to the agent manifold. If using a pre-built manifold as supplied from Kidde Fire Systems, including an extra port on the manifold can simplify this connection. The 3/4 inch check must be removed to use this extra port.

**Note:** The solenoid on the back-plate manifold leading to the hazard being protected by the discharge must be continuously powered during the system discharge. For solenoid specifications, see Section 2-5.1.3.

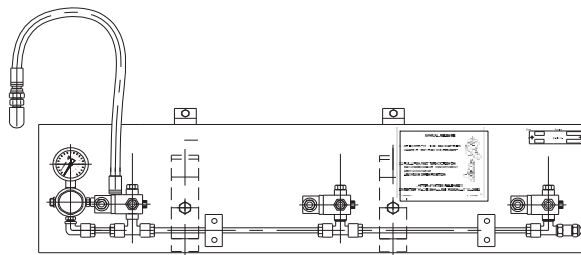


Figure 2-28. 3 Area Back-Plate Manifold

Table 2-17. Natura IGS System Back-Plate Manifold Part Numbers

Part Number	Description
01-3508-0002	Back-Plate Manifold - 2 Area, Selector/Divertor Valve Control, 8 bar
01-3508-0003	Back-Plate Manifold - 3 Area, Selector/Divertor Valve Control, 8 bar
01-3508-0004	Back-Plate Manifold - 4 Area, Selector/Divertor Valve Control, 8 bar
01-3508-0005	Back-Plate Manifold - 5 Area, Selector/Divertor Valve Control, 8 bar

### 2-5.1.1 Back-Plate Manifold Hose

Use the hose (P/N 01-3273-1200) to connect the solenoid to the selector valves.

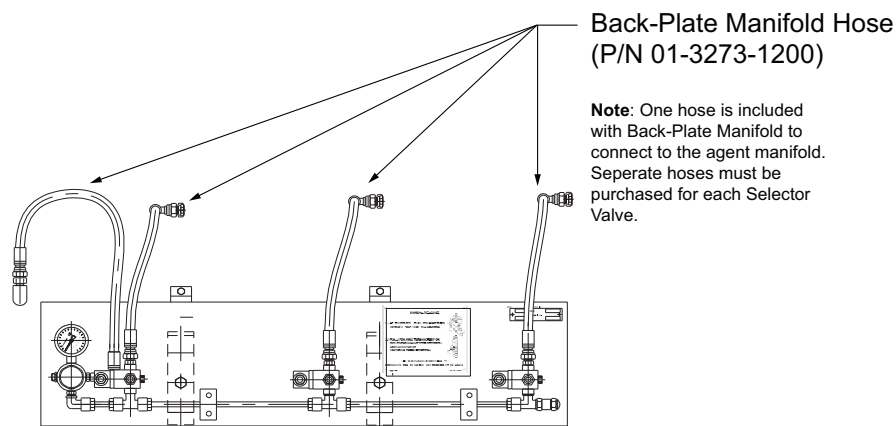


Figure 2-29. Back-Plate Manifold Hose

Table 2-18. Natura IGS System Back-Plate Manifold Hose Part Numbers

Part Number	Description
01-3273-1200	Back-Plate Manifold Hose

**2-5.1.2 Pressure Regulator**

The pressure regulator (P/N 01-6017-0000) reduces the incoming pressure from an agent cylinder down to the 8 bar needed to operate the selector valves. The regulator is included with the back-plate manifold, but may be ordered separately if needed.

The pressure regulator is also used with the discharge delay setup. The regulator reduces the pressure coming from the discharge delay to 8 bar for proper activation of the cylinder valve.

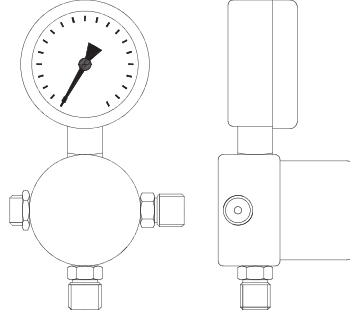


Figure 2-30. Pressure Regulator

Table 2-19. Natura IGS System Pressure Regulator Part Numbers

Part Number	Description
01-6017-0000	Pressure Regulator

**2-5.1.3 Back-Plate Manifold Spare Solenoids**

If necessary, the solenoids on the back-plate manifold can be replaced using the spare solenoid P/N: 38-350800-001.

Solenoid Specifications:

- Operating Voltage: 24 VDC 10W
- Current Draw: 0.42 Amps

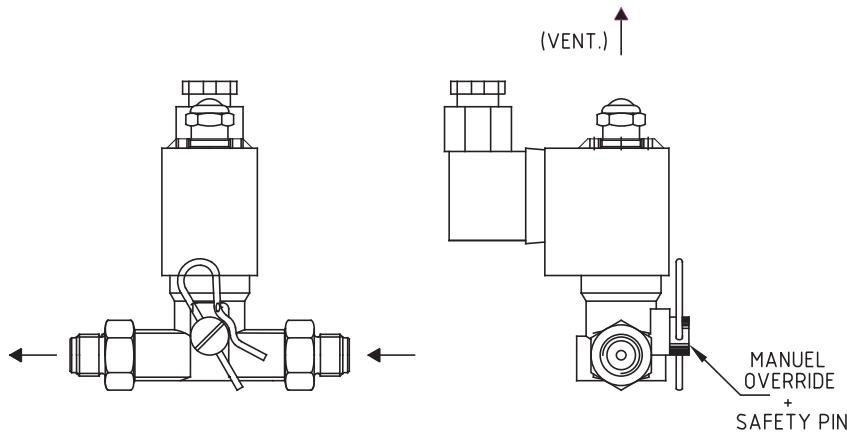


Figure 2-31. Back-Plate Manifold Spare Solenoid

Table 2-20. Natura IGS System Back-Plate Manifold Spare Solenoid Part Numbers

Part Number	Description
38-350800-001	Back-Plate Manifold Spare Solenoid

## 2-6 LOCKOUT VALVES

**Note:** Lockout valves are required to be used in conjunction with use of a time delay.

A lockout valve is a manually operated valve installed between the agent manifold and the discharge pipe to the protected area. Lockout valves are normally open but, can be locked in the closed position when maintenance is being carried out to prevent agent from discharging into the protected area for the safety of the personnel. The lockout valve shall be installed at the end of the agent manifold or, if a common manifold protects multiple hazards, after each selector valve. Lockout valves include a limit switch.

Lockout valve assemblies include a high visibility indicator and weatherproof limit switch. The limit switch shall initiate a "Trouble" signal at the control panel when the valve is in the closed position. All valves have a maximum pressure rating of 140 bar (2031 PSI). When using lockout valves, a pressure relief valve shall also be installed wherever pressure could be trapped in closed sections of pipe.

The lockout valves are available in sizes 1" through 4".

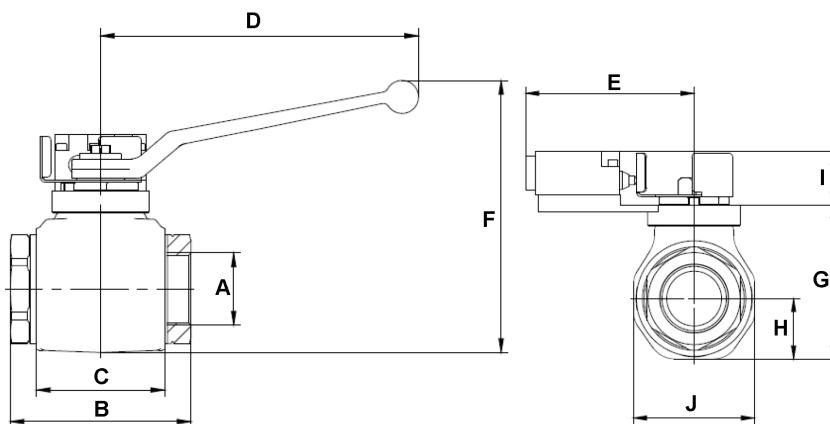


Figure 2-32. 1", and 2" Lockout Valves

Table 2-21. Lockout Valves Dimensions and Part Numbers for 1" and 2" valves (U.S. Customary Units)

Valve Size	Part Number	Approximate Dimensions (inches)									
		A	B	C	D	E	F	G	H	I	J
1"	38-409830-005	1.0	4.1	2.6	6.5 ± .1	4.5	6.1 ± .1	3.0	1.1	1.4	2.9
2"	38-409830-007	1.9	7.1	3.9	8.3 ± .1	4.6	7.8 ± .1	5.0	2.1	1.5	4.2

Table 2-22. Lockout Valves Dimensions and Part Numbers for 1" and 2" valves (SI Units)

Valve Size	Part Number	Approximate Dimensions (mm)									
		A	B	C	D	E	F	G	H	I	J
1"	38-409830-005	24	103.1	66.2	164 ± 3	113	156 ± 3	75.6	28.5	36	74
2"	38-409830-007	47.5	180	100	211 ± 3	116	198 ± 3	126.1	53.3	37	107

## Component Descriptions

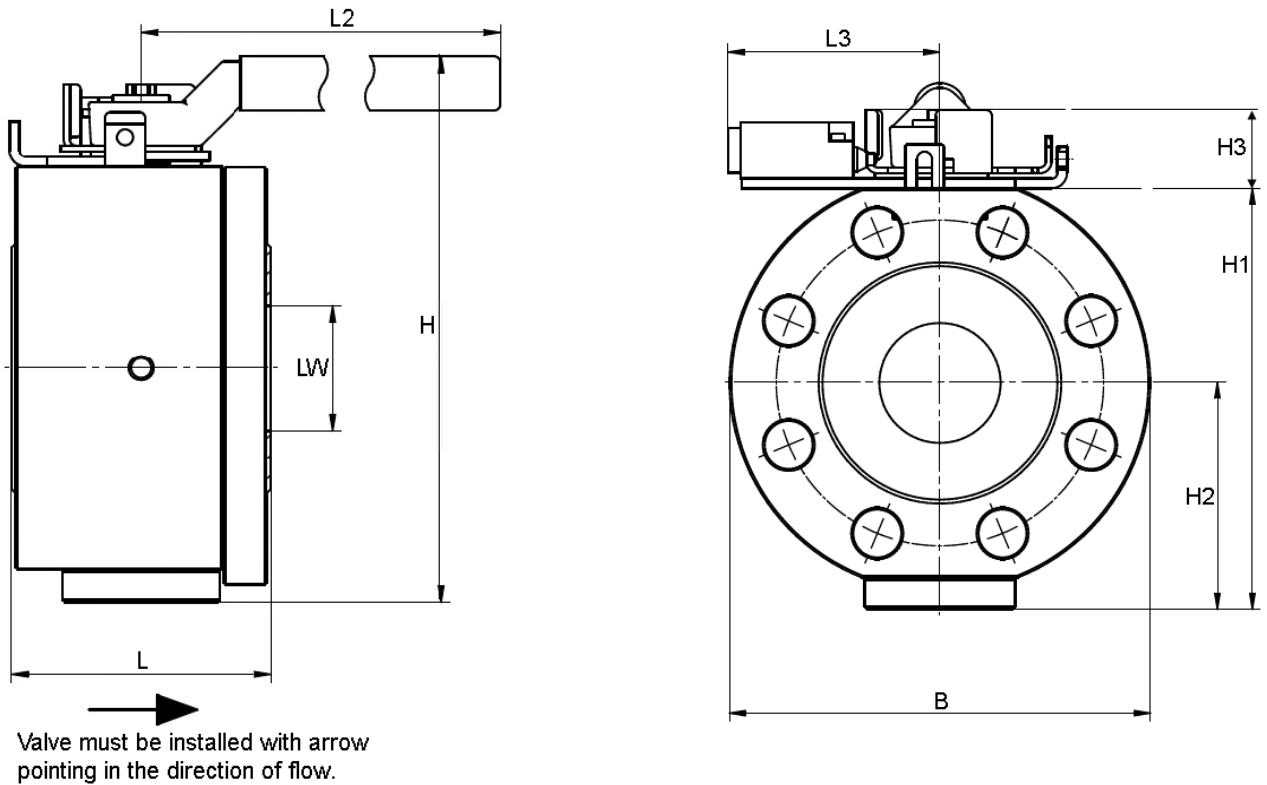


Figure 2-33. 3", and 4" Lockout Valves

Table 2-23. Lockout Valves Dimensions and Part Numbers for 3" and 4" valves (U.S. Customary Units)

Valve Size	Part Number	Approximate Dimensions (inch)								
		LW	L	L2	L3	H	H1	H2	H3	B
3"	38-409830-009	Ø 3.0	6.3	23.6	4.4	11.5	9.5	5.0	1.5	9.4
4"	38-409830-010	Ø 4.0	7.5	27.4	4.9	14.3	11.1	6.0	3.2	10.9

Table 2-24. Lockout Valves Dimensions and Part Numbers for 3" and 4" valves (SI Units)

Valve Size	Part Number	Approximate Dimensions (mm)								
		LW	L	L2	L3	H	H1	H2	H3	B
3"	38-409830-009	Ø 78	160	600	111	291	238.7	127.5	38.3	238
4"	38-409830-010	Ø 100	190	696.5	123.5	364	283	151.5	81	277

Table 2-25. Natura IGS System Lockout Valve Part Numbers

Part Number	Description
38-409830-005	Valve, 1" NPT Lockout (Isolation)
38-409830-007	Valve, 2" NPT Lockout (Isolation)
38-409830-009	Valve, 3" NPT Lockout (Isolation)
38-409830-010	Valve, 4" NPT Lockout (Isolation)

2-7 DISCHARGE NOZZLES



Only listed Natura IGS system nozzles are to be used on Kidde Fire Systems Natura Inert Gas System. Failure to comply with this WARNING can result in unpredictable agent distribution.

**Note:** For the full list of NPT nozzles with corresponding orifice areas, see Table 8-11 and Table 8-13. For the full list of BSP nozzles with corresponding orifice areas, see Table 8-12 and Table 8-14.

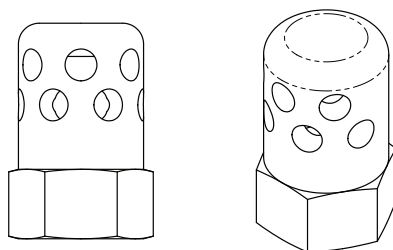


Figure 2-34. 180 Degree Nozzle

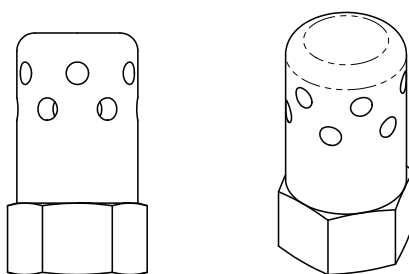


Figure 2-35. 360 Degree Nozzle

Table 2-26. Natura IGS System Nozzle Part Numbers

NPT Nozzles		BSP Nozzles	
Part Number	Description	Part Number	Description
38-407100-XXX	Nozzle Assembly, 1/2" NPT, 360°	38-417100-XXX	Nozzle Assembly, 1/2" BSP, 360°
38-407200-XXX	Nozzle Assembly, 3/4" NPT, 360°	38-417200-XXX	Nozzle Assembly, 3/4" BSP, 360°
38-407300-XXX	Nozzle Assembly, 1" NPT, 360°	38-417300-XXX	Nozzle Assembly, 1" BSP, 360°
38-407400-XXX	Nozzle Assembly, 1-1/2" NPT, 360°	38-417400-XXX	Nozzle Assembly, 1-1/2" BSP, 360°
38-407500-XXX	Nozzle Assembly, 1/2" NPT, 180°	38-417500-XXX	Nozzle Assembly, 1/2" BSP, 180°
38-407600-XXX	Nozzle Assembly, 3/4" NPT, 180°	38-417600-XXX	Nozzle Assembly, 3/4" BSP, 180°
38-407700-XXX	Nozzle Assembly, 1" NPT, 180°	38-417700-XXX	Nozzle Assembly, 1" BSP, 180°
38-407800-XXX	Nozzle Assembly, 1-1/2" NPT, 180°	38-417800-XXX	Nozzle Assembly, 1-1/2" BSP, 180°

## 2-8 NITROGEN PILOT SYSTEM AND PRESSURE DRIVEN ACCESSORIES

A nitrogen pilot cylinder supplies pressure to run nitrogen powered discharge delays or pressure operated sirens.

**Note:** These devices may be required per NFPA 2001, latest edition.



**Discharge Delays and Sirens must be driven by a dedicated nitrogen pilot cylinder. Do not use agent cylinders to drive the discharge delay or siren. The agent cylinders operate at a different pressure and would not operate a discharge delay or siren as listed.**

### 2-8.1 Nitrogen Discharge Delay Kits, P/N 38-401140-030 and P/N 38-401140-060

This device uses nitrogen pressure to provide a pneumatic (automatic mechanical) means to delay the release of pilot media by a predetermined period following the initial actuation event. The time delay consists of a metering tube, a cylinder, and a differential pressure-operated valve with a control port. The control port allows the connection of a lever operated control head that can be operated to bypass the delay.

Two versions are available with factory preset (non-adjustable) delay. Both versions include the necessary adapters to connect the discharge delay to the pressure regulator using a back-plate manifold hose also included in the kit. The kits also include the adapters to connect the pressure regulator to the cylinder valve using an actuation hose (P/N 38-401110-X00 or 38-401130-X00). See Figure 2-36 and Table 2-27 for more details.

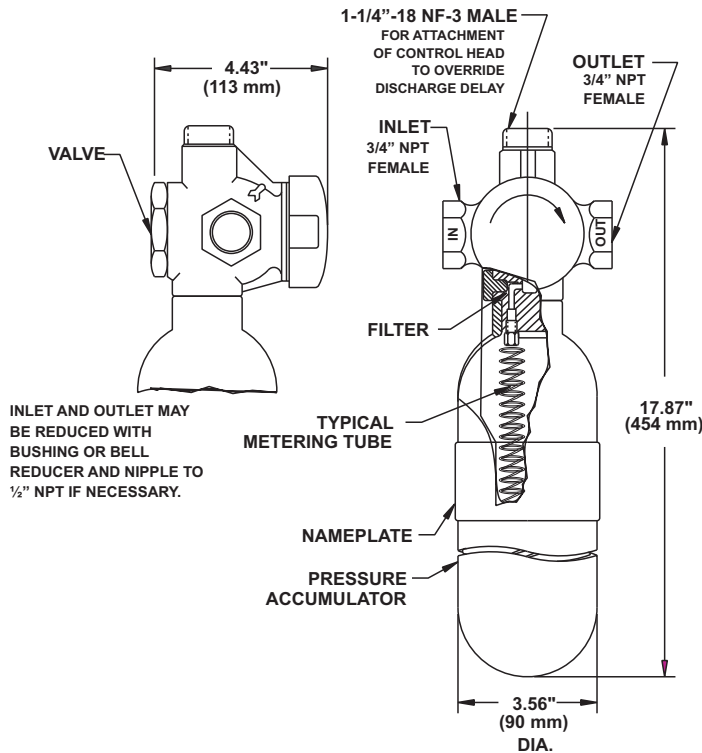


Figure 2-36. Discharge Delays

Table 2-27. Discharge Delays

Part Number	Actuation Method	Nominal Delay Time Approx.
38-401140-030	Nitrogen	34 seconds
38-401140-060	Nitrogen	61 seconds

## 2-8.2 Pressure Operated Siren

The pressure operated siren (P/N 90-981574-001) provides a mechanical means to generate an audible alarm. The flow of nitrogen into the siren spins a rotor and creates a high pitch and high decibel sound. The audible alarm warns personnel of an impending agent discharge and the need to immediately evacuate the protected area prior to the discharge.

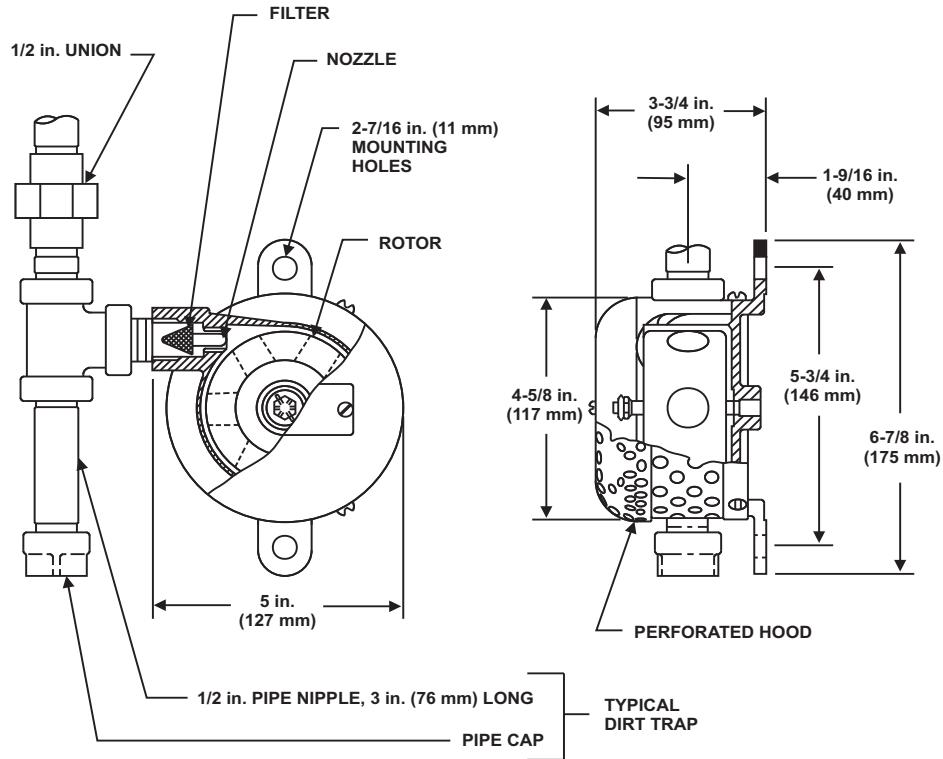


Figure 2-37. Pressure Operated Siren

Table 2-28. Pressure Operated Siren Limitations

Nitrogen Pilot Cylinder Part Number	Maximum Number of Sirens per Cylinder
85-877690-001	1
85-101040-001	4

### 2-8.3 Nitrogen Pilot Cylinders

Two different sized cylinder capacities are provided for use with Natura IGS systems. Each cylinder is of steel material and designed in accordance with USDOT and TC requirements. Each cylinder is factory pressurized to 1800-psig at 70°F and fitted with a pressure gauge and pressure relief device. Either pipe, tube, or flexible hose connects each pilot cylinder to the siren or the discharge delay.

Table 2-29. Natura IGS System Nitrogen Pilot Cylinder Part Numbers

Part Number	Description
85-877690-001	108 cu. in. (1.77 L) Nitrogen Pilot Cylinder
85-101040-001	1040 cu. in. (17.0 L) Nitrogen Pilot Cylinder

For information pressure actuation limitations for these Nitrogen Pilot Cylinders, see Section 3-17.7

#### 2-8.3.1 108 cu. in. Nitrogen Pilot Cylinder

The 108 cu. in. N<sub>2</sub> pilot cylinder (P/N 85-877690-001) can be used to operate one N<sub>2</sub> pressure operated siren or one discharge delay. Any compatible control head can be fitted to the pilot cylinder to provide the desired means of operation. The cylinder valve has a 1/8-in NPT outlet. Any of the 1/8-in NPT x 5/16-in flare fittings can be used to connect the valve to the siren or discharge delay line. The cylinder is secured using the wall mount bracket (P/N WK-877845-000). Approved for use in environments from 32°F to 130°F (0°C to 54°C).

##### 2-8.3.1.1 108 cu. in. Nitrogen Pilot Cylinder Mounting Bracket

Use the wall mount bracket (P/N WK-877845-000) to secure a 108 cu. in. pilot cylinder.

**Note:** This bracket can also be used to mount the nitrogen time delay.

##### 2-8.3.1.2 5/16" Flare x 1/8" NPT Male Connector

Use a 1/8-in NPT x 5/16-in flare fitting (P/N WK-699205-010) to connect the valve of the 108 cu. in. pilot cylinder to the corresponding siren line.

##### 2-8.3.1.3 30" Actuation Hose

Use the actuation hose (P/N WK-264986-000), to connect a pilot cylinder to the siren or discharge delay valve. The 1/4-inch flexible hose is constructed with wire-braided reinforcements and swivel nuts at both ends for ease of assembly.

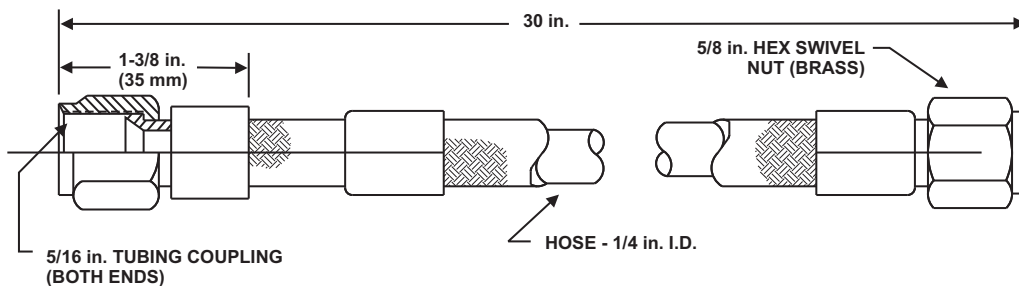


Figure 2-38. 1/4-inch Actuation Hose

### 2-8.3.2 1040 cu. in. Nitrogen Pilot Cylinder

The 1040 cu. in. nitrogen pilot cylinder (P/N85-101040-001) can be used to operate up to 4 nitrogen pressure operated sirens or one discharge delay. Any compatible control head can be fitted to the cylinder to provide the desired means of operation. The cylinder has a 5/8-in Type "I" style valve affixed with a pressure gauge. In addition to the control head, this valve requires attachment of a plain nut discharge head to allow discharge of the cylinder contents. The 3/4-in NPT nitrogen discharge hose (P/N WK-251821-000) connects the discharge head to the corresponding siren line or discharge delay line. The cylinder is secured using the single cylinder strap (P/N WK-270014-000). Approved for use in environments from 32°F to 130°F (0°C to 54°C).

#### 2-8.3.2.1 1040 cu. in. Nitrogen Pilot Cylinder Strap

Use the single cylinder strap (P/N WK-270014-000) to secure the 1040 cu. in. nitrogen pilot cylinder.

#### 2-8.3.2.2 3/4 in. Nitrogen Discharge Hose

The 3/4 in. flexible hose (P/N WK-251821-000) is used to connect the discharge head with the pilot distribution manifold or piping. The hose is manufactured from reinforced rubber and is supplied with crimp-on 3/4 in. NPT fittings, a fixed male and swivel female connector (see Figure 2-39).

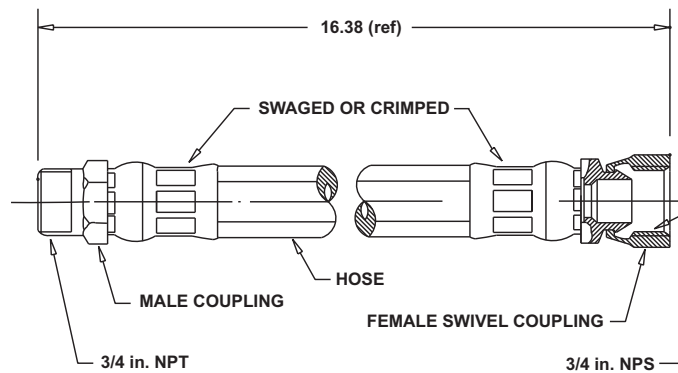


Figure 2-39. Discharge Hose, 3/4 in.

### 2-8.3.3 Nitrogen Pilot and Siren Driver Supervisory Pressure Switch, P/N 85-111540-001 and 85-111540-100

The Nitrogen driver supervisory pressure switch is intended to detect a drop in pressure in the Kidde Fire Systems ADS™ Nitrogen Driver cylinders (see Figure 2-49). A new port has been introduced on the I-Valve with a Schrader valve to facilitate the installation of the supervisory pressure switch. The supervisory pressure switch can be installed on site on any capacity Kidde Fire Systems ADS Nitrogen Driver cylinders manufactured after October 2020.

With the introduction of this supervisory pressure switch, the En-Gauge switch (P/N: 06-118328-001) will be discontinued.

**Note:** The I-Valve Supervisory Pressure Switch differentiator is a green colored band on both the box and switch (see Table 2-31). See Table 2-30 for approvals for each switch.

The Nitrogen driver supervisory pressure switch can be wired for either normally-open (N.O.) or normally-closed (N.C.) operation, depending on installation requirements and those of the Authority Having Jurisdiction (AHJ). When wired for N.O. under pressure, if the pressure inside the cylinder drops below 1540 psig (106.2 bar), the switch contacts will transfer and, if wired correctly, invoke a "supervisory" signal at the control panel.

## Component Descriptions

**Note:** When the Nitrogen driver supervisory pressure switch (P/N 85-111540-001 or P/N 85-111540-100) is connected to a supervised control panel circuit, and the switch is wired N.C. under pressure, it is not possible to distinguish between a wiring fault and a loss of cylinder pressure. This configuration should only be used if accepted by the AHJ.

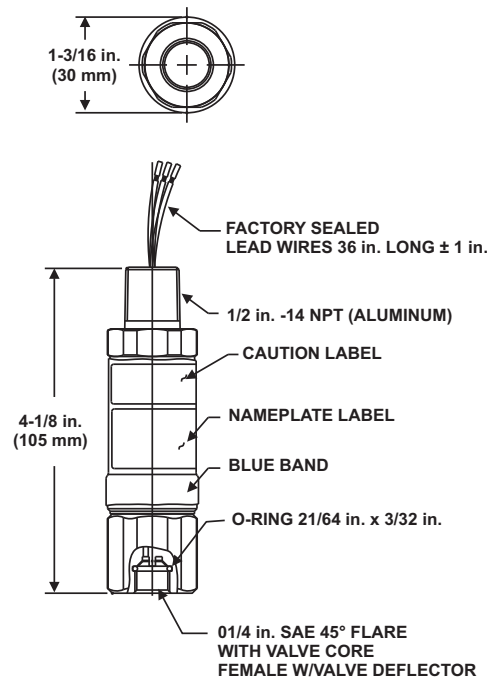


Figure 2-40. Supervisory Pressure Switch, Female Fitting, (P/N 85-111540-001 shown)

Table 2-30. Approvals

Part Number	Approvals
85-111540-001	UL, FM
85-111540-100	UL, FM, ATEX





**Note:** Nitrogen pilot cylinders and siren drivers valves manufactured prior to November 2020 do not include the necessary port for the Nitrogen driver supervisory pressure switch and must use a Nitrogen driver pressure gauge, either P/N 06-118253-001 or P/N 06-118328-001.

**2-8.3.3.1 Supervisory Pressure Switch Differentiation**

Kidde Fire Systems offers supervisory pressure switches for multiple products and product lines. When ordering and installing supervisory pressure switches, please select the appropriate switch. The switches have a colored band to help differentiate them.

**Note:** Due to the various differences in screen displays and printers, the colors displayed here may not perfectly match the colors on the actual products.

Table 2-31. Supervisory Pressure Switch Specifications

Switch	Part Numbers	Band Color	Pressure Trip Setting	Compatible with
	85-111540-001 85-111540-100 (ATEX)	Blue	1540 psig (106.2 bar)	ADS Systems Nitrogen Drivers Nitrogen Pilot Cylinders Nitrogen Siren Drivers
	06-118262-001 06-118537-001 (ATEX)	Silver	288 psig (19.9 bar)	ECS 360 psi Agent Cylinders
	45-118500-001 45-500537-001 (ATEX)	Orange	435 psig (30.0 bar)	ECS-500™ psi Agent Cylinders
	81-111350-001 81-111350-100 (ATEX)	Red	1350 psig (93.1 bar)	Carbon Dioxide Pilot Cylinders and Siren Drivers (High and Low Pressure systems)

## Component Descriptions

### 2-8.3.3.2 Plain-nut Discharge Head

The plain-nut discharge head (P/N WK-872450-000) discharges the contents of the 1040 cu. in. nitrogen pilot cylinder upon activation of its associated control head.

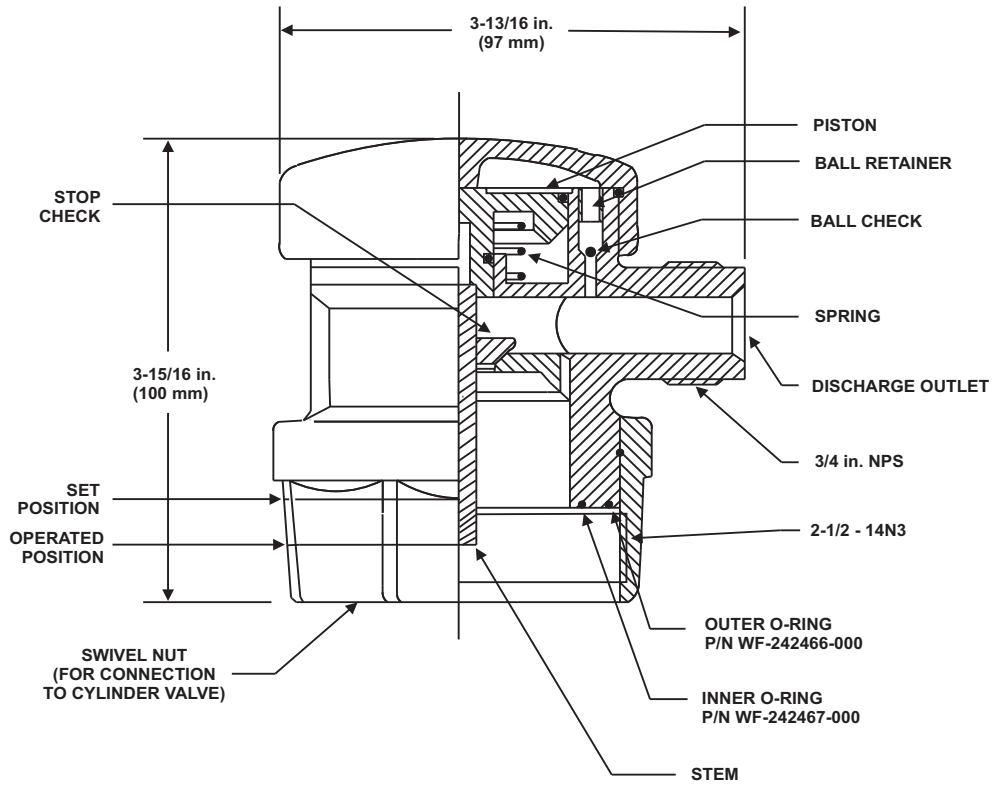


Figure 2-41. Discharge Head, Plain Nut

### 2-8.4 Electric Control Heads Kit, P/N 85-890181-200

The Electric Control Head provides electric actuation of the 1040 cu. in. nitrogen pilot cylinder’s “I” valve or the 108 cu. in. Nitrogen pilot cylinder’s valve. It is operated electrically from a detection and control system, a remote manual station, or locally with a manual lever on the electric control head. See Figure 2-42 and Table 2-33.

**Note:** The Electric Control Head cannot be used to activate an agent cylinder. Only the release unit can accomplish this task.

The Electric Control Head kit includes the following items:

Table 2-32. Natura IGS System Electric Control Head Kit Contents

Part Number	Description
85-890181-200	Electric Control Head Kit, Includes: <ul style="list-style-type: none"> <li>Control Head Monitor, P/N 85-100000-100</li> <li>Electrical Control Head, 24 VDC, P/N WK-890181-200</li> </ul>

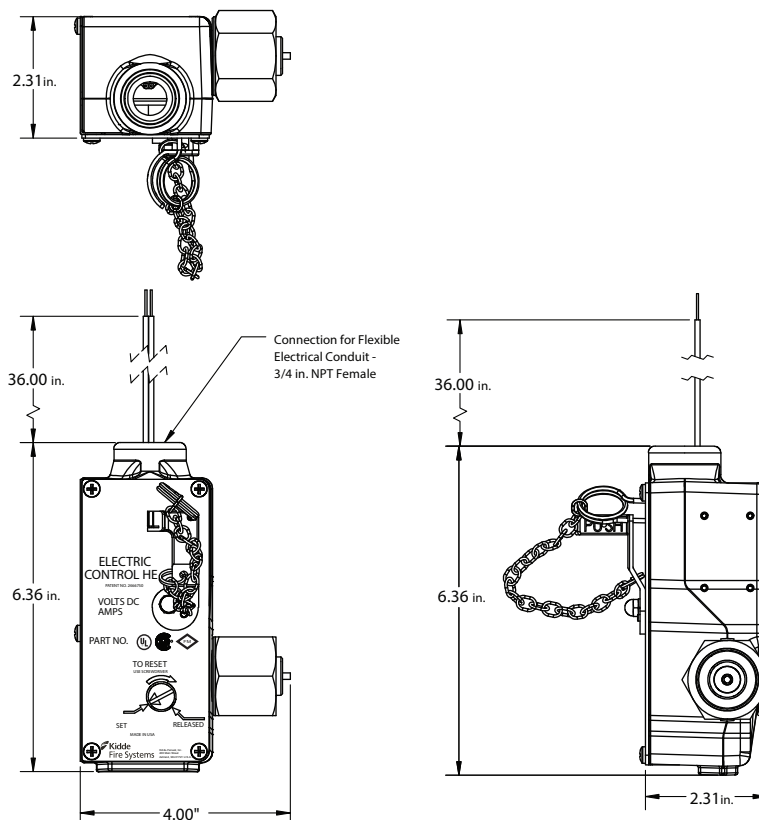


Figure 2-42. Electric Control Head

Table 2-33. Electric Control Head Specifications

Part Number	Nominal Voltage	Current
WK-890181-200	24 VDC	2.0 A momentary

**2-8.4.1 Lever Operated Control Head (P/N WK-870652-000)**

Use the lever operated control head on top of the time delay to bypass the delay. The lever operated control head is equipped with an operating lever that is secured in the closed position by a safety pull pin. By removing the safety pin, the lever can be manually rotated to the open position, thereby opening a valve inside the discharge delay, bypassing the delay. (see Figure 2-43).

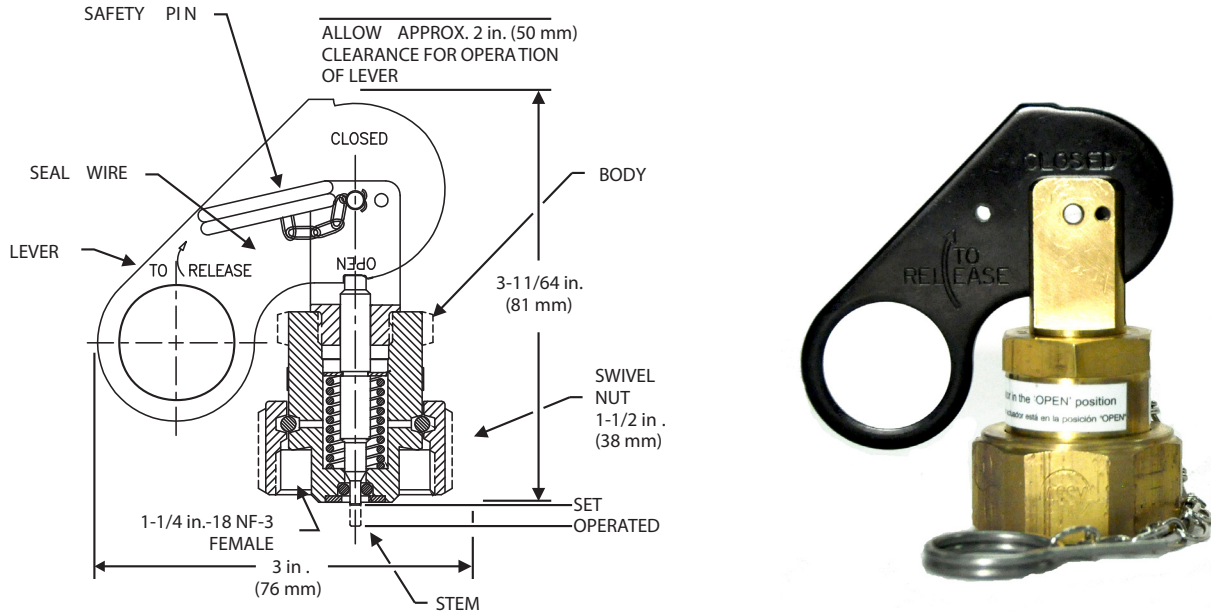


Figure 2-43. Lever Operated Control Head



**When attaching the Lever operated control head to the valve, the swivel nut must be tightened to a torque of 55ft-lb. Failure to tighten the swivel nut may result in leakage during actuation.**

### 2-8.4.1.1 Lever/Pressure Operated Control Head, P/N 82-878751-000

The Lever/Pressure Operated Control head allows manual or pressure actuation (see Figure 2-44) of a nitrogen pilot cylinder. The lever/pressure operated control head is self-venting to prevent accidental system discharge.

Use the lever/pressure operated control head on the nitrogen pilot cylinders used for pneumatic sirens. The control head can be fired by the same nitrogen pilot cylinder that drives the discharge delay, but allows the sirens to be driven by their own dedicated nitrogen supply. The lever offers a manual override option if necessary.

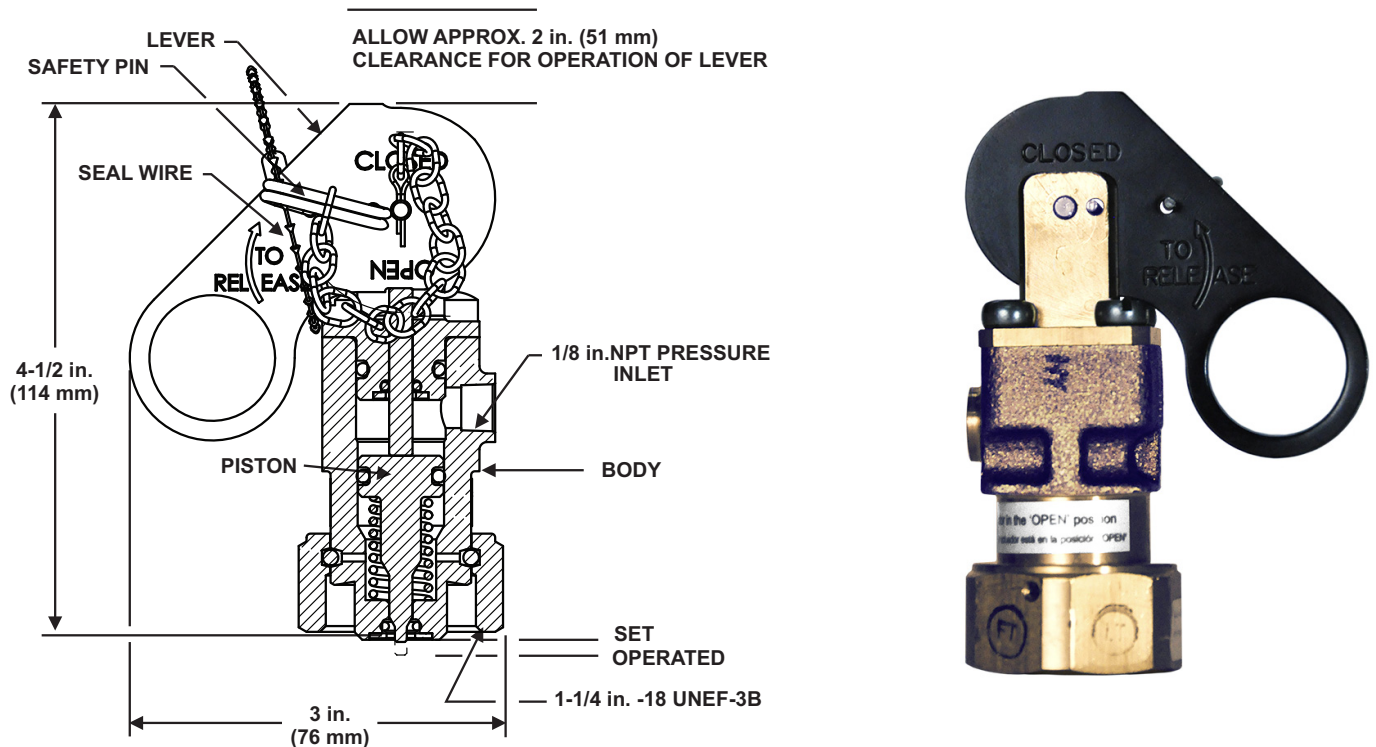


Figure 2-44. Lever/Pressure Operated Control Head

**Before resetting the lever/pressure operated control head, all pressure must be relieved from the cylinder and actuation lines.**

**Pressure can be relieved from unvented actuation tubing by loosening the fitting on the control head slightly and allowing the line to bleed out completely. Failure to perform this action can result in damage to the control head.**

**When attaching the Lever/Pressure operated control head to the valve, the swivel nut must be tightened to a torque of 55ft-lb. Failure to tighten the swivel nut may result in leakage during actuation.**



### 2-8.4.2 Control Head Monitor with Hazloc Assembly, P/N 85-10000-100

**Note:** HazLoc rating is FM Approved only.

To comply with NFPA 2001, latest edition, all electric control heads must be under placement supervision such that, if an electric actuator is removed, an audible and visual signal will be initiated at the control panel indicating system impairment. The Control Head Monitor with Hazloc assembly provides this supervision for control head placement in normal and explosive environments in one easy to install component.

**Note:** The control head monitor is only needed when using an electric control head on a Nitrogen Pilot cylinder. The normal agent release unit already includes supervision.

The following specifications apply to the Placement Supervision Component:

- Rated Voltage: 42 VDC maximum
- Resistive Load: 0.5A maximum

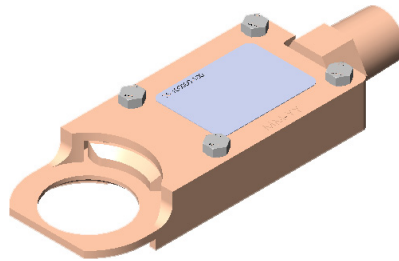


Figure 3. Control Head Monitor

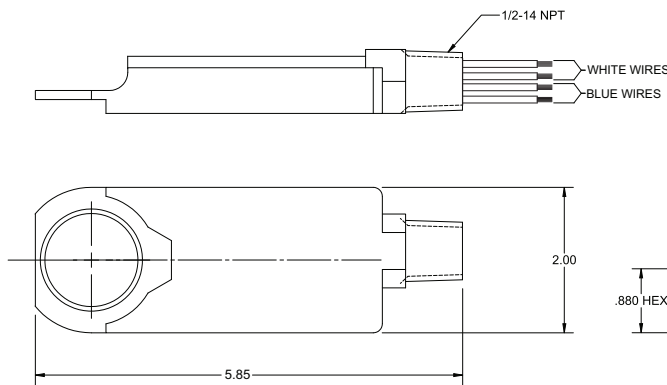


Figure 4. Control Head Monitor Dimensions

This component can be placed between the Nitrogen Pilot valve and one of the following Electric or Electric/Cable operated control heads (P/N: WK-890181-000, WK-897494-000, 82-486500-010, and 81-895630-000):

**For field wiring installation applicable to ATEX and IECEx certification the following specific conditions of use apply:**

- **The flameproof joints of the equipment are not intended to be repaired. Consult the manufacturer if repair of the flameproof joints is necessary.**
- **A suitably certified conduit sealing device must be installed at the threaded entry and connected to a certified Ex d or Ex e rated terminal box.**

**For US and Canada explosion proof installations, seal all conduits within 18 inches from the end of the component.**



**2-8.4.2.1 Standards for US Hazloc Approval**

Number	Issue Date
FM 3600	2011
FM 3615	2006
FM 3616	2011
FM 3810	2005
ANSI/ISA 60079-0	2013
ANSI/ISA 60079-1	2013
ANSI/ISA 60079-31	2013

US Hazardous Location Markings:

- Class I, Div 1, Groups CD
- Class I, Zone 1, AEx d IIB T6
- Class II, III, Div 1, Groups EFG
- Zone 21, AEx tb IIIC T85°C
- Ta = -40°C to 60°C

**2-8.4.2.2 Standards for Canadian Hazloc Approval**

Number	Issue Date
CSA C22.2 NO. 0.4	2013
CSA C22.2 NO. 0.5	2012
CSA C22.2 NO. 25	2014
CSA C22.2 NO. 30	2012
61010-1	2012
CAN/CSA 60079-0	2011
CAN/CSA 60079-1	2011

Canada Hazardous Location Markings:

- Class I, Div 1, Groups CD
- Class I, Zone 1, Ex d IIB T6
- Class II, III, Div 1, Groups EFG
- Zone 21, Ex tb IIIC T85°C
- Ta = -40°C to 60°C

**2-9 FILL ADAPTER**

Use the fill adapter (P/N 38-406000-001) when filling the agent cylinder/valve assemblies. The adapter is attached to the cylinder valve gauge port during cylinder charging.

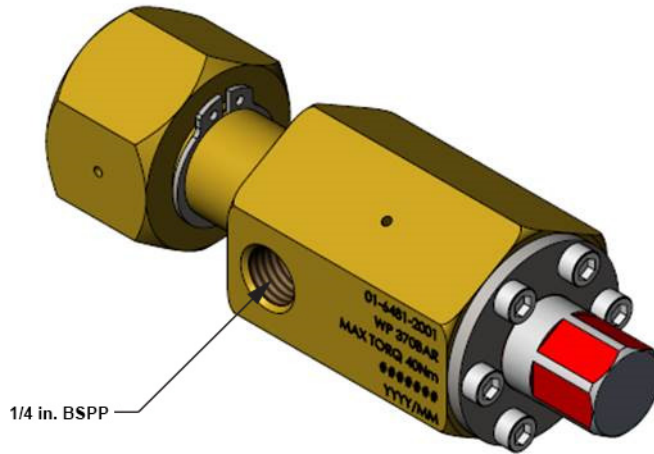


Figure 2-1. Charging Adapter

**Note:** Spare O-rings (P/N 38-406000-003) are available for the filling adapter.



**Do not install a tapered threaded fitting such as 1/4 in. BSPT or 1/4 in. NPT into this port. The adapter must be 1/4 in. BSPP male at the fill adapter end.**

Table 2-34. Natura IGS System Fill Adapter Part Numbers

Part Number	Description
38-406000-001	Filling Adapter
38-406000-003	Spare O-Ring for Filling Adapters

## 2-10 MANIFOLD EQUIPMENT

Manifolds are available in single and double row configurations. Manifolds can be coupled together using the 2" BSP Manifold Coupling (P/N: 38-400020-100). Cylinder capacity must match the selected manifold to ensure proper offset location.

Table 2-35. Natura IGS System Manifold Equipment Part Numbers

Part Number	Description
38-351000-004	80 Liter 2 Stub 1 Row 2 in. Manifold BSP, with 2 manifold check valves
38-351000-005	80 Liter 3 Stub 1 Row 2 in. Manifold BSP, with 3 manifold check valves
38-351000-006	80 Liter 4 Stub 1 Row 2 in. Manifold BSP, with 4 manifold check valves
38-351000-007	80 Liter 5 Stub 1 Row 2 in. Manifold BSP, with 5 manifold check valves
38-351000-008	80 Liter 6 Stub 1 Row 2 in. Manifold BSP, with 6 manifold check valves
38-351000-009	80 Liter 4 Stub 2 Row 2 in. Manifold BSP, with 4 manifold check valves
38-351000-010	80 Liter 6 Stub 2 Row 2 in. Manifold BSP, with 6 manifold check valves
38-351000-011	80 Liter 8 Stub 2 Row 2 in. Manifold BSP, with 8 manifold check valves
38-351140-004	140 Liter 2 Stub 1 Row 2 in. Manifold BSP, with 2 manifold check valves
38-351140-005	140 Liter 3 Stub 1 Row 2 in. Manifold BSP, with 3 manifold check valves
38-351140-006	140 Liter 4 Stub 1 Row 2 in. Manifold BSP, with 4 manifold check valves
38-351140-007	140 Liter 5 Stub 1 Row 2 in. Manifold BSP, with 5 manifold check valves
38-351140-008	140 Liter 6 Stub 1 Row 2 in. Manifold BSP, with 6 manifold check valves
38-351140-009	140 Liter 4 Stub 2 Row 2 in. Manifold BSP, with 4 manifold check valves
38-351140-010	140 Liter 6 Stub 2 Row 2 in. Manifold BSP, with 6 manifold check valves
38-351140-011	140 Liter 8 Stub 2 Row 2 in. Manifold BSP, with 8 manifold check valves
38-400020-100	2 in. BSP Manifold Coupling
38-400020-101	2 in. BSP Manifold End Cap
38-400020-102	3/4 in. BSP Manifold End Cap For 14mm Check Valve



Figure 2-2. 4 Stub 1 Row Manifold

### 2-10.1 Manifold Bracket

Use to support the manifold.



Figure 2-3. Manifold Bracket

Table 2-36. Natura IGS System Manifold Bracket Part Numbers

Part Number	Description
01-8160-0200	Bracket for 80L Cylinder manifold 1 Row 200mm (inc 2 in. Clamp)
01-8160-0520	Bracket for 80L Cylinder Manifold 2 Rows 520mm (inc 2 in. Clamp)
01-8160-0830	Bracket for 80L Cylinder Manifold 3 Rows 830mm (inc 2 in. Clamp)
01-8160-0250	Bracket for 140L Cylinder Manifold 1 Row 250mm (inc 2 in. Clamp)
01-8160-0600	Bracket for 140L Cylinder Manifold 2 Row 600mm (inc 2 in. Clamp)
01-8160-1000	Bracket for 140L Cylinder Manifold 3 Row 1000mm (inc 2 in. Clamp)

### 2-10.2 Manifold Clamp

Use to clamp the manifold to unistrut channels.

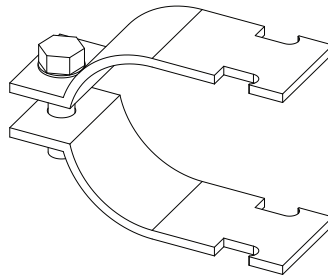


Figure 2-4. Manifold Clamp

Table 2-37. Natura IGS System Manifold Clamp Part Numbers

Part Number	Description
01-8143-0000	2 in. Pipe Clamp $\varnothing$ 58.7 - $\varnothing$ 63.5 mm

### 2-10.3 2" Adapter, BSPT (F) to NPT (F)

Use this female-to-female adapter (P/N 38-351000-001) to convert the BSPT manifold piping to NPT piping.

## 2-11 RACKING COMPONENTS

The racking system for the Natura IGS system is modular and can be adjusted to fit any number of cylinders in a variety of row combinations. This section outlines the components used in the racking system. The components include:

- Section 2-11.1, Unistrut® Wall Rail
- Section 2-11.2, Front Clamping Bar
- Section 2-11.3, Rear Wooden Spacer
- Section 2-11.4, Center Wooden Spacer
- Section 2-11.5, Single Cylinder Clamping Bracket
- Section 2-11.6, Clamping Bolt
- Section 2-11.7, End Cover
- Section 2-11.8, Distance Pipe

**Note:** The racking components can be configured using the Natura IGS Cylinder Racking Configuration Calculator which can be downloaded from the Kidde Fire Systems distributor extranet.

### 2-11.1 Unistrut® Wall Rail

Unistrut is used in conjunction with cylinder bracketing to support the cylinders. Secure the Unistrut from a solid structure such as a brick or concrete wall or a free standing steel frame structure secured to floor and ceiling where possible.

**Note:** The length of unistrut needed depends on the number of cylinders used, but is the same whether using the clamps or the wooden racking components.

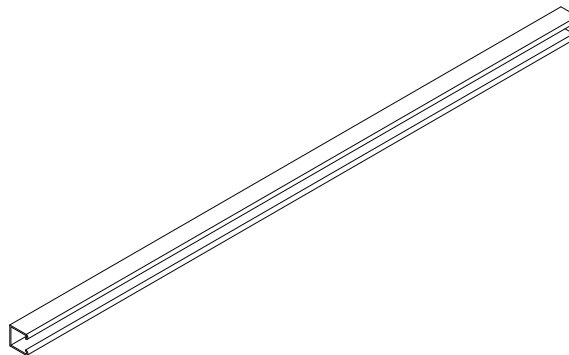


Figure 2-5. Unistrut

Table 2-38. Natura IGS System Unistrut Part Numbers

Part Number	Length	Holds X 80L Cylinders	Holds X 140L Cylinders
01-8121-1000	400mm	1	N/A
01-8121-1400	440mm	N/A	1
01-8122-1000	650mm	2	N/A
01-8123-1000	950mm	3	2
01-8124-1000	1250mm	4	N/A
01-8125-1000	1550mm	5	3
01-8126-1000	1850mm	6	N/A

### 2-11.2 Front Clamping Bar

The front clamping bar presses the cylinders against either the rear wooden spacer or center wooden spacer.

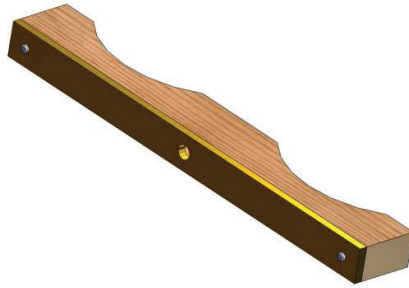


Figure 2-6. 2 Cylinder Front Clamping Bar

Table 2-39. Natura IGS System Front Clamping Bar Part Numbers

Part Number	Description
03-8266-0000	Clamping Bar 1 x 2 for 80L Cylinder (Front)
03-8267-0000	Clamping Bar 1 x 3 for 80L Cylinder (Front)
03-8366-0000	Clamping Bar 1 x 2 for 140L Cylinder (Front)
03-8367-0000	Clamping Bar 1 x 3 for 140L Cylinder (Front)

### 2-11.3 Rear Wooden Spacer

The rear wooden spacer sits between the cylinder and the Unistrut.



Figure 2-7. 2 Cylinder Rear Wooden Spacer

Table 2-40. Natura IGS System Rear Wooden Spacer Part Numbers

Part Number	Description
03-8162-0000	Wooden Spacer 1 x 2 for 80L Cylinder (Rear)
03-8163-0000	Wooden Spacer 1 x 3 for 80L Cylinder (Rear)
03-8462-0000	Wooden Spacer 1 x 2 for 140L Cylinder (Rear)
03-8463-0000	Wooden Spacer 1 x 3 for 140L Cylinder (Rear)

### 2-11.4 Center Wooden Spacer

Use center wooden spacers between rows on multi-row cylinder banks.

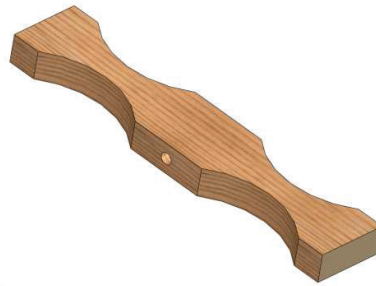


Figure 2-8. 2x2 Cylinder Center Wooden Spacer

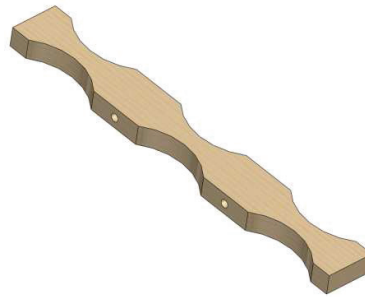


Figure 2-9. 2x3 Cylinder Center Wooden Spacer

Table 2-41. Natura IGS System Center Wooden Spacer Part Numbers

Part Number	Description
03-8164-0000	Wooden Spacer 2 x 2 for 80L Cylinder (Center)
03-8165-0000	Wooden Spacer 2 x 3 for 80L Cylinder (Center)
03-8464-0000	Wooden Spacer 2 x 2 for 140L Cylinder (Center)
03-8465-0000	Wooden Spacer 2 x 3 for 140L Cylinder (Center)

### 2-11.5 Single Cylinder Clamping Bracket

Use the single cylinder clamping bracket when using a single row of cylinders or a single cylinder system.

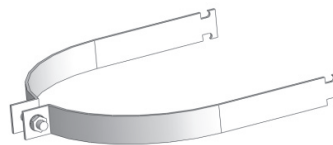


Figure 2-10. Single Cylinder Clamping Bracket

Table 2-42. Natura IGS System Single Cylinder Clamping Bracket Part Numbers

Part Number	Description
01-8131-0000	Single Clamp 80L Cylinder Galvanized Steel
01-8131-1000	Single Clamp 140L Cylinder Galvanized Steel

### 2-11.6 Clamping Bolt

Bolt used to connect the front clamping bar to the Unistrut rail. Clamping bolt comes with relevant nuts and washers.

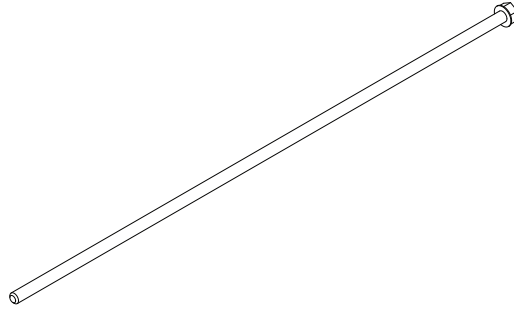


Figure 2-11. Clamping Bolt

Table 2-43. Natura IGS System Clamping Bolt Part Numbers

Part Number	Description
01-8337-0200	Clamping Bolt, 2 Row, 80L - 28.2 in. (715 mm Long)
01-8337-0300	Clamping Bolt, 3 Row, 80L - 40.6 in. (1030 mm) Long
01-8437-0200	Clamping Bolt, 2 Row, 140L - 35.2 in. (895 mm) Long

### 2-11.7 End Cover

Use an end Cover on each edge of the unistrut rail to protect the edge.

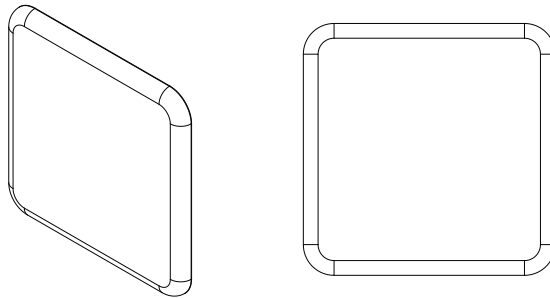


Figure 2-12. End Cover

Table 2-44. Natura IGS System End Cover Part Numbers

Part Number	Description
01-8131-0002	End Cover, White PVC

## 2-11.8 Distance Pipe

Use the distance pipe as a spacer when the front row of a cylinder rack has fewer cylinders than the rear row of the rack. Distance Pipes are only used on multi-row systems.



Figure 2-13. Distance Pipe

Table 2-45. Natura IGS System Distance Pipe Part Numbers

Part Number	Description
03-8331-0000	Distance Pipe 3/4 in. + Washers 80L
03-8331-0140	Distance Pipe 3/4 in. + Washers 140L

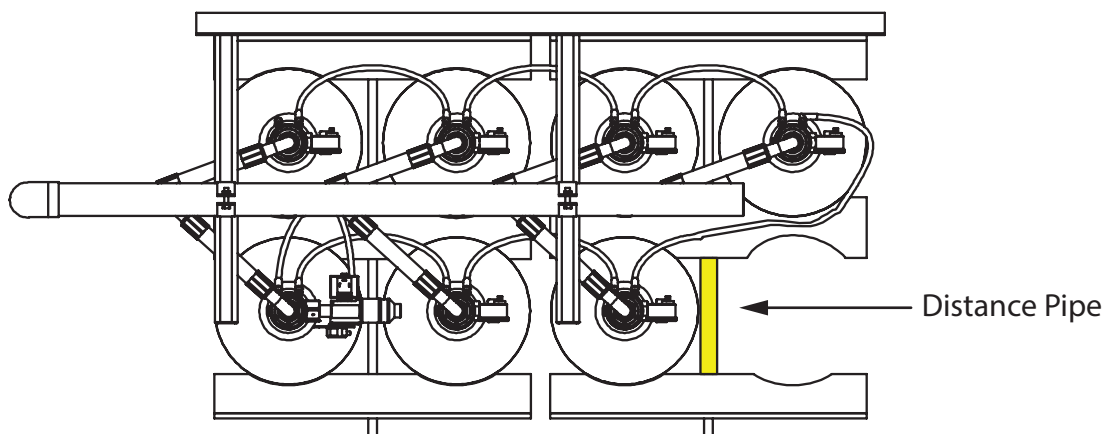


Figure 2-14. Installed Distance Pipe

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# CHAPTER 3

## SYSTEM DESIGN

### 3-1 INTRODUCTION

The Kidde Fire Systems Natura™ Inert Gas System (Natura IGS system) using IG-100, IG-541, IG-55, or IG-01 inert-gas agent (herein refer to collectively as the “agent”) are listed by Underwriters Laboratories, Inc. (UL) and approved by FM Approvals (FM). These systems are designed in accordance with the current standards, i.e. NFPA 2001, ISO 14520, BS EN 15004 and this manual or other applicable National Standards. These systems have been tested to the limits established jointly by UL and FM. In any situation not specifically covered by this manual, the application and installation of the system must meet the requirements of the standards as stated. In any case, all installations must meet the requirements of the local Authority Having Jurisdiction (AHJ).

The flow calculations and design criteria described in this manual have been incorporated into a computer software program. The calculations are based on conserving mass, energy, and momentum in the pipe network. The routine calculates the flow in quasi-steady state steps from the initiation of the discharge to the final gas blowdown.

The system designer must become thoroughly familiar with the Kidde Fire Systems Natura IGS Flow Calculation Software User's Guide (P/N 06-237621-001) in order to learn the proper procedures for applying the input parameters to the Kidde Fire Systems Natura IGS Flow Calculation Program. There are a number of limitations to these input parameters which must be observed in order to obtain accurate results.

**Note:** Please ensure when designing systems, ordering parts, or installing that the manifolds, racking components, and other equipment match the cylinder size. Using the incorrect size may cause issues with the design or installation of the system.

### 3-2 EVALUATION OF RISK/HAZARD

The design and installation of a Natura IGS system requires due consideration of many relevant factors. The enclosure to be protected shall be examined with all relevant information extracted from detailed drawings and site visit(s). These details at a minimum includes:

- Assess the room or hazard integrity and obtain a Door Fan test report.
- Evaluate all non-closable openings, ventilation, and exhaust ducts as their location could jeopardize the hold time and could require additional agent to be discharged over time (extended discharge).
- Evaluate the volume of air ducts, air intakes, and exhausts (volume of duct/s up to damper, if fitted, to be included for agent quantity calculation).
- Evaluate the volume of air moved by recirculation air-handling equipment.
- Evaluate how automatic shutdown of forced ventilation upon detection of a fire impacts the hazard.
- Take into consideration any spring operated fire damper(s) when calculating the required pressure relief/vent opening
- Review the flammable material involved in the hazard area. Plan to use the highest design concentration of agent required based on the material present.
- Evaluate the quantity of flammable material occurring in the enclosure.
- Is there or can there be automatic shutoff of the fuel supply upon detection of a fire?
- Calculate the location of the most probable place for a fire to start.
- Evaluate the worst possible fire scenario and plan accordingly.
- Can there be an automatic shutdown of electric equipment prior to system discharge?

- For server rooms, consider the duration of the discharge delay from first alarm until all hard discs have properly parked the head before agent release to prevent head crashing. Consider the location of nozzle in relations to servers using turning hard discs.
- Determine if total flooding or dedicated protection is the appropriate solution for this hazard or series of hazards.
- Measure the shape of enclosure or room.
- Take into consideration the layout and type of equipment installed or to be installed in the protected enclosure/room. Will this impact nozzle placement, add to the fire hazard, or create a need for less agent as the volume of the room is reduced.
- Calculate the net volume of enclosure or room.
- Take into consideration any suspended ceiling or elevated floor voids. Determine any impact this will have on the location of discharge nozzles.
- Are there provision for automatically closing doors upon fire detection? Should these be added? Can the windows be replaced with fixed shut type or would this create its own hazard? If the latter, can there be provisions for automatically closing the windows upon fire detection?
- Ensure that pressure relief vents to atmosphere or to a room having sufficient volume to accommodate the increase in pressure. The flow calculation software output includes the required pressure venting area.

**Pressure relief vents must conform to the following:**

- **Pressure relief vents should always vent out to atmosphere.**
- **Pressure relief vents should not vent out into fire escape routes.**
- **If "cascade" venting through another room (other than the protected room) to atmosphere, then the intermediate room should be of a low fire risk.**



- Take special consideration for pressure relief venting of enclosures or rooms which have large glass areas (windows) or weak building parts.
- Plan escape routes.
- Plan access routes for moving cylinder to the final installed location.
- Select fire detectors according to the type of fire anticipated (response time).
- Plan what audible and visual alarms are needed for the site and hazard.

**Note:** In order to avoid excessive pressure, appropriate pressure relief vents shall always be provided. These should open when pressure builds up at the beginning of the discharge, and close as soon as the pressure inside/outside has equalized.

After achieving the minimum design concentration, the extinguishing concentration shall be maintained within the enclosure until the fire department or trained firefighting personnel can take over (hold time).

Anticipated minimum hold time required is typically 10 minutes. However, local fire brigades may have a longer traveling time and the Authorities Having Jurisdiction may therefore require a longer hold time.

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### 3-2.1 Requirements for a Cylinder Storage Room

For cylinder storage, weight and space considerations are normally the main concern. In most cases these considerations could be negligible as the cylinders are commonly kept inside a separate protected room. However, a number of issues need further consideration including:

- Never install cylinders in an atmosphere containing ammonia or severe weather conditions.
- When cylinders are all connected to a common manifold, they shall contain the same agent, be the same size, and filled to the same pressure.
- Always store cylinders in a location and manner where they will not be knocked over.
- Always secure the cylinders against a solid structure.
- Always allow for sufficient free space for ease of inspection, service, and maintenance.
- Ensure easy access to manual actuation on the release unit.

When planning the storage area, check the following:

- Ambient storage temperature (see below)
- Humidity of surrounding air ("relative humidity")
- Vibrations and shock
- Closed manifold and pipe sections involved
- Pressure relief can be vented to atmosphere/largest protected volume
- Cylinder storage room natural or equipped with extract ventilation
- Room large enough for storage
- Room height sufficient for cylinder bank assembly and distribution pipe connection
- Allowance for proper access to cylinders during installation and service/maintenance
- Floor capable of carrying the load. For floor loads, see Section 3-13).
- Wall/structure strong enough for mounting wall brackets supports
- Storage room not to be used for other purposes, which could result in fire exposure, mechanical damage or chemical damage to cylinders
- The access route to and from the cylinder storage area to be confirmed suitable for unhindered movement of cylinders.
- It is recommended that cylinder storage room doors open outward, preferably to open air, with facilities to enable the doors to be secured in the open position.

### 3-2.2 Extended Discharge

In systems protecting enclosures that have non-closable openings or where the ventilation system cannot be stopped, use extended discharge. The rate of the agent's extended discharge shall be equal to that which escapes through openings and or ventilating systems.

The rate required shall be based on a door fan test and the flammable materials involved. An extended discharge shall continue for the hold time required by the authorities having jurisdiction. As the rate normally will be different from that required for the initial discharge a secondary distribution piping and arrangement shall be installed.

Extended discharge is usually not required in a normal, relatively tight enclosure (such as EDP-rooms) which has a ventilation system that stops upon fire detection.

### 3-3 EXTINGUISHING VALUES

When calculating the required quantity of the selected Agent to be stored, use the most demanding flammable material involved and the net volume of the protected enclosure/room. The resulting oxygen concentration after release shall be calculated based on the net volume and the total quantity of Agent released.

The values listed below are all based on fire extinguishing tests at 20°C:

Table 3-1. Design Concentrations

Fuel	IG-100	IG-541	IG-55	IG-01
	Minimum design % by volume	Minimum design % by volume	Minimum design % by volume	Minimum design % by volume
Class B (Heptane)	44.1	47.6	47.8	59.5
Class A	41.7	42.6	41.2	50.2
Class C	46.9	47.9	46.4	56.5

The extinguishing concentration required is independent of the temperature. However, the quantity (in kg/m<sup>3</sup>) needed to reach the required concentration is dependent on the temperature. i.e. the quantity (kg/m<sup>3</sup>) needed reduces at higher temperatures.

Noted that for systems having a relatively large distribution piping system, additional gas may be required. For systems with relatively short pipe work any such supplement may not be needed.

**Note:** The actual minimum required stored Agent quantity can only be verified using the flow calculation software. Consult the flow calculations software for the specific Agent used.



**Should the required agent quantity cause the oxygen level of the room to drop below 12%, it is not safe for the room to be occupied and steps must be taken to ensure the area is vacated immediately.**

### 3-4 DISCHARGE TIME

The discharge time required to achieve 95 percent of the minimum design concentration for flame extinguishment shall not exceed 60 seconds for Class B fires, 120 seconds for Class A surface fire hazards or Class C hazards, or as otherwise required by the authority having jurisdiction.

### 3-5 MINIMUM DESIGN CONCENTRATIONS (MDC'S)

The residual oxygen level (ROL) of the hazard area after a discharge shall always be within the project/safety regulations (NOAEL 43% / LOAEL 52%)

Abbreviations used in table below:

EC = Extinguishing Concentration

SF = Safety Factor

MDC = Minimum Design Concentration

MDQ = Minimum Design Quantity

ROL = Residual O2 Level (Concentration)

Values calculated at 20 degree Celsius and atmospheric pressure 1.013 bar. For certain Class B fuels, should the MEC be below the heptane, the value for heptane shall be used to calculate the MDC.

**3-6 IG-100 TOTAL FLOODING CONCENTRATION FACTOR TABLES**

Table 3-2. IG-100 US Customary Units Total Flooding Quantity

Temperature  t °F	Specific Vapor Volume S	IG-100 mass required per unit volume of protected space, $m/V$ (lb/ft <sup>3</sup> )							
		Design Concentration (volume %)							
	ft <sup>3</sup> /lb	34%	36%	38%	42%	46%	50%	54%	58%
-10	11.715	0.0355	0.0381	0.0408	0.0465	0.0526	0.0592	0.0663	0.0740
0	11.976	0.0347	0.0373	0.0399	0.0455	0.0515	0.0579	0.0648	0.0724
10	12.237	0.0340	0.0365	0.0391	0.0445	0.0504	0.0566	0.0635	0.0709
20	12.497	0.0332	0.0357	0.0383	0.0436	0.0493	0.0555	0.0621	0.0694
30	12.758	0.0326	0.0350	0.0375	0.0427	0.0483	0.0543	0.0609	0.0680
40	13.018	0.0319	0.0343	0.0367	0.0418	0.0473	0.0532	0.0596	0.0666
50	13.279	0.0313	0.0336	0.0360	0.0410	0.0464	0.0522	0.0585	0.0653
60	13.540	0.0307	0.0330	0.0353	0.0402	0.0455	0.0512	0.0574	0.0641
70	13.800	0.0301	0.0323	0.0346	0.0395	0.0447	0.0502	0.0563	0.0629
80	14.061	0.0296	0.0317	0.0340	0.0387	0.0438	0.0493	0.0552	0.0617
90	14.321	0.0290	0.0312	0.0334	0.0380	0.0430	0.0484	0.0542	0.0606
100	14.582	0.0285	0.0306	0.0328	0.0374	0.0423	0.0475	0.0533	0.0595
110	14.843	0.0280	0.0301	0.0322	0.0367	0.0415	0.0467	0.0523	0.0584
120	15.103	0.0275	0.0295	0.0317	0.0361	0.0408	0.0459	0.0514	0.0574
130	15.364	0.0270	0.0290	0.0311	0.0355	0.0401	0.0451	0.0505	0.0565

$m = (V/s) \cdot \ln(100/(100-C))$ , agent mass, lb  
 $FF = m/V = (1/s) \cdot \ln(100/(100-C))$ , mass flooding factor, lb/ft<sup>3</sup>  
 $C =$  agent concentration, vol %  
 $V =$  volume, ft<sup>3</sup>  
 $s = a + b \cdot T$ , specific volume of agent, ft<sup>3</sup>/lb, where  $a$  and  $b$  are agent-specific constants  
IG-100:  $a = 11.976$  ft<sup>3</sup>/lb  
IG-100:  $b = 0.02606$  ft<sup>3</sup>/lb-°F  
 $T =$  temperature, °F

Table 3-3. IG-100 SI Units Total Flooding Quantity

Temperature t °C	Specific Vapor Volume S	IG-100 mass required per unit volume of protected space, m/V (kg/m3)							
		Design Concentration (volume %)							
	m3/kg	34%	36%	38%	42%	46%	50%	54%	58%
-25	0.7265	0.572	0.614	0.658	0.750	0.848	0.954	1.069	1.194
-20	0.7411	0.561	0.602	0.645	0.735	0.831	0.935	1.048	1.171
-15	0.7558	0.550	0.591	0.633	0.721	0.815	0.917	1.027	1.148
-10	0.7704	0.539	0.579	0.621	0.707	0.800	0.900	1.008	1.126
-5	0.7851	0.529	0.568	0.609	0.694	0.785	0.883	0.989	1.105
0	0.7997	0.520	0.558	0.598	0.681	0.771	0.867	0.971	1.085
5	0.8144	0.510	0.548	0.587	0.669	0.757	0.851	0.954	1.065
10	0.8290	0.501	0.538	0.577	0.657	0.743	0.836	0.937	1.046
15	0.8437	0.493	0.529	0.567	0.646	0.730	0.822	0.920	1.028
20	0.8583	0.484	0.520	0.557	0.635	0.718	0.808	0.905	1.011
25	0.8730	0.476	0.511	0.548	0.624	0.706	0.794	0.890	0.994
30	0.8876	0.468	0.503	0.539	0.614	0.694	0.781	0.875	0.977
35	0.9023	0.461	0.495	0.530	0.604	0.683	0.768	0.861	0.961
40	0.9169	0.453	0.487	0.521	0.594	0.672	0.756	0.847	0.946
45	0.9316	0.446	0.479	0.513	0.585	0.661	0.744	0.834	0.931
50	0.9462	0.439	0.472	0.505	0.576	0.651	0.733	0.821	0.917
55	0.9609	0.432	0.464	0.498	0.567	0.641	0.721	0.808	0.903
60	0.9755	0.426	0.457	0.490	0.558	0.632	0.711	0.796	0.889

$m = (V/s) \cdot \ln(100/(100-C))$ , agent mass, kg  
 $W = m/V = (1/s) \cdot \ln(100/(100-C))$ , mass flooding factor, kg/m3  
 $C =$  agent concentration, vol %  
 $V =$  volume, m<sup>3</sup>  
 $s = a + b \cdot T$ , specific volume of agent, m<sup>3</sup>/kg, where  $a$  and  $b$  are agent-specific constants  
 IG-100:  $a = 0.7997$  kg/m<sup>3</sup>  
 IG-100:  $b = 0.00293$  kg/m<sup>3</sup>-°C  
 $T =$  temperature, °C

### 3-7 IG-541 TOTAL FLOODING CONCENTRATION FACTOR TABLES

Table 3-4. IG-541 US Customary Units Total Flooding Quantity

Temperature t °F	Specific Vapour Volume S	IG-541 mass required per unit volume of protected space, m/V (lb/ft <sup>3</sup> )							
		Design Concentration (volume %)							
	ft <sup>3</sup> /lb	34%	38%	42%	46%	50%	54%	58%	62%
-10	9.644	0.0431	0.0496	0.0565	0.0639	0.0719	0.0805	0.0900	0.1003
0	9.858	0.0422	0.0485	0.0553	0.0625	0.0703	0.0788	0.0880	0.0982
10	10.072	0.0413	0.0475	0.0541	0.0612	0.0688	0.0771	0.0861	0.0961
20	10.287	0.0404	0.0465	0.0530	0.0599	0.0674	0.0755	0.0843	0.0941
30	10.501	0.0396	0.0455	0.0519	0.0587	0.0660	0.0739	0.0826	0.0921
40	10.715	0.0388	0.0446	0.0508	0.0575	0.0647	0.0725	0.0810	0.0903
50	10.929	0.0380	0.0437	0.0498	0.0564	0.0634	0.0710	0.0794	0.0885
60	11.144	0.0373	0.0429	0.0489	0.0553	0.0622	0.0697	0.0778	0.0868
70	11.358	0.0366	0.0421	0.0480	0.0543	0.0610	0.0684	0.0764	0.0852
80	11.572	0.0359	0.0413	0.0471	0.0532	0.0599	0.0671	0.0750	0.0836
90	11.787	0.0353	0.0406	0.0462	0.0523	0.0588	0.0659	0.0736	0.0821
100	12.001	0.0346	0.0398	0.0454	0.0513	0.0578	0.0647	0.0723	0.0806
110	12.215	0.0340	0.0391	0.0446	0.0504	0.0567	0.0636	0.0710	0.0792
120	12.430	0.0334	0.0385	0.0438	0.0496	0.0558	0.0625	0.0698	0.0778
130	12.644	0.0329	0.0378	0.0431	0.0487	0.0548	0.0614	0.0686	0.0765

$m = (V/s) \cdot \ln(100/(100-C))$ , agent mass, lb  
 $FF = m/V = (1/s) \cdot \ln(100/(100-C))$ , mass flooding factor, lb/ft<sup>3</sup>  
 $C =$  agent concentration, vol %  
 $V =$  volume, ft<sup>3</sup>  
 $s = a + b \cdot T$ , specific volume of agent, ft<sup>3</sup>/lb, where  $a$  and  $b$  are agent-specific constants  
IG-541:  $a = 9.8579$  ft<sup>3</sup>/lb  
IG-541:  $b = 0.02143$  ft<sup>3</sup>/lb-°F  
 $T =$  temperature, °F

Table 3-5. IG-541 SI Units Total Flooding Quantity

Temperature  t °C	Specific Vapour Volume S	IG-541 mass required per unit volume of protected space, m/V (kg/m <sup>3</sup> )							
		Design Concentration (volume %)							
	m <sup>3</sup> /kg	34%	38%	42%	46%	50%	54%	58%	62%
-25	0.5982	0.695	0.799	0.911	1.030	1.159	1.298	1.450	1.617
-20	0.6102	0.681	0.783	0.893	1.010	1.136	1.273	1.422	1.586
-15	0.6221	0.668	0.768	0.876	0.990	1.114	1.248	1.394	1.555
-10	0.6341	0.655	0.754	0.859	0.972	1.093	1.225	1.368	1.526
-5	0.6460	0.643	0.740	0.843	0.954	1.073	1.202	1.343	1.498
0	0.6580	0.631	0.727	0.828	0.936	1.053	1.180	1.318	1.471
5	0.6699	0.620	0.714	0.813	0.920	1.035	1.159	1.295	1.444
10	0.6819	0.609	0.701	0.799	0.904	1.017	1.139	1.272	1.419
15	0.6938	0.599	0.689	0.785	0.888	0.999	1.119	1.250	1.395
20	0.7058	0.589	0.677	0.772	0.873	0.982	1.100	1.229	1.371
25	0.7177	0.579	0.666	0.759	0.859	0.966	1.082	1.209	1.348
30	0.7297	0.569	0.655	0.747	0.844	0.950	1.064	1.189	1.326
35	0.7416	0.560	0.645	0.734	0.831	0.935	1.047	1.170	1.305
40	0.7536	0.551	0.634	0.723	0.818	0.920	1.030	1.151	1.284
45	0.7655	0.543	0.624	0.712	0.805	0.905	1.014	1.133	1.264
50	0.7775	0.534	0.615	0.701	0.793	0.892	0.999	1.116	1.244
55	0.7894	0.526	0.606	0.690	0.781	0.878	0.984	1.099	1.226
60	0.8014	0.518	0.597	0.680	0.769	0.865	0.969	1.082	1.207

$m = (V/s) \cdot \ln(100/(100-C))$ , agent mass, kg  
 $W = m/V = (1/s) \cdot \ln(100/(100-C))$ , mass flooding factor, kg/m<sup>3</sup>  
 $C =$  agent concentration, vol %  
 $V =$  volume, m<sup>3</sup>  
 $s = a + b \cdot T$ , specific volume of agent, m<sup>3</sup>/kg, where  $a$  and  $b$  are agent-specific constants  
 IG-541:  $a = 0.65799$  kg/m<sup>3</sup>  
 IG-541:  $b = 0.00239$  kg/m<sup>3</sup>-°C  
 $T =$  temperature, °C

### 3-8 IG-55 TOTAL FLOODING CONCENTRATION FACTOR TABLES

Table 3-6. IG-55 US Customary Units Total Flooding Quantity

Temperature <i>t</i> °F	Specific Vapor Volume <i>S</i>	IG-55 mass required per unit volume of protected space, <i>m/V</i> (lb/ft <sup>3</sup> )							
		Design Concentration (volume %)							
	ft <sup>3</sup> /lb	34%	38%	42%	46%	50%	54%	58%	62%
-10	9.666	0.0430	0.0495	0.0564	0.0637	0.0717	0.0803	0.0897	0.1001
0	9.881	0.0421	0.0484	0.0551	0.0624	0.0702	0.0786	0.0878	0.0979
10	10.096	0.0412	0.0473	0.0540	0.0610	0.0687	0.0769	0.0859	0.0958
20	10.311	0.0403	0.0464	0.0528	0.0598	0.0672	0.0753	0.0841	0.0938
30	10.526	0.0395	0.0454	0.0518	0.0585	0.0659	0.0738	0.0824	0.0919
40	10.741	0.0387	0.0445	0.0507	0.0574	0.0645	0.0723	0.0808	0.0901
50	10.956	0.0379	0.0436	0.0497	0.0562	0.0633	0.0709	0.0792	0.0883
60	11.171	0.0372	0.0428	0.0488	0.0552	0.0620	0.0695	0.0777	0.0866
70	11.386	0.0365	0.0420	0.0478	0.0541	0.0609	0.0682	0.0762	0.0850
80	11.601	0.0358	0.0412	0.0470	0.0531	0.0597	0.0669	0.0748	0.0834
90	11.816	0.0352	0.0405	0.0461	0.0521	0.0587	0.0657	0.0734	0.0819
100	12.031	0.0345	0.0397	0.0453	0.0512	0.0576	0.0645	0.0721	0.0804
110	12.246	0.0339	0.0390	0.0445	0.0503	0.0566	0.0634	0.0708	0.0790
120	12.461	0.0333	0.0384	0.0437	0.0494	0.0556	0.0623	0.0696	0.0776
130	12.676	0.0328	0.0377	0.0430	0.0486	0.0547	0.0613	0.0684	0.0763

$m = (V/s) \cdot \ln(100/(100-C))$ , agent mass, lb  
 $FF = m/V = (1/s) \cdot \ln(100/(100-C))$ , mass flooding factor, lb/ft<sup>3</sup>  
 $C$  = agent concentration, vol %  
 $V$  = volume, ft<sup>3</sup>  
 $s = a + b \cdot T$ , specific volume of agent, ft<sup>3</sup>/lb, where  $a$  and  $b$  are agent-specific constants  
IG-55:  $a = 9.8809$  ft<sup>3</sup>/lb  
IG-55:  $b = 0.0215$  ft<sup>3</sup>/lb-°F  
 $T$  = temperature, °F

Table 3-7. IG-55 SI Units Total Flooding Quantity

Temperature t °C	Specific Vapor Volume S	IG-55 mass required per unit volume of protected space, m/V (kg/m <sup>3</sup> )							
		Design Concentration (volume %)							
	m <sup>3</sup> /kg	34%	38%	42%	46%	50%	54%	58%	62%
-25	0.5993	0.693	0.798	0.909	1.028	1.157	1.296	1.448	1.615
-20	0.6114	0.680	0.782	0.891	1.008	1.134	1.270	1.419	1.583
-15	0.6235	0.666	0.767	0.874	0.988	1.112	1.245	1.391	1.552
-10	0.6356	0.654	0.752	0.857	0.969	1.091	1.222	1.365	1.522
-5	0.6477	0.642	0.738	0.841	0.951	1.070	1.199	1.339	1.494
0	0.6598	0.630	0.725	0.826	0.934	1.051	1.177	1.315	1.466
5	0.6719	0.618	0.711	0.811	0.917	1.032	1.156	1.291	1.440
10	0.6840	0.607	0.699	0.796	0.901	1.013	1.135	1.268	1.415
15	0.6961	0.597	0.687	0.783	0.885	0.996	1.116	1.246	1.390
20	0.7082	0.587	0.675	0.769	0.870	0.979	1.096	1.225	1.366
25	0.7203	0.577	0.664	0.756	0.855	0.962	1.078	1.204	1.343
30	0.7324	0.567	0.653	0.744	0.841	0.946	1.060	1.184	1.321
35	0.7445	0.558	0.642	0.732	0.828	0.931	1.043	1.165	1.300
40	0.7566	0.549	0.632	0.720	0.814	0.916	1.026	1.147	1.279
45	0.7687	0.541	0.622	0.709	0.802	0.902	1.010	1.129	1.259
50	0.7808	0.532	0.612	0.698	0.789	0.888	0.995	1.111	1.239
55	0.7929	0.524	0.603	0.687	0.777	0.874	0.979	1.094	1.220
60	0.8050	0.516	0.594	0.677	0.765	0.861	0.965	1.078	1.202

$m = (V/s) \cdot \ln(100/(100-C))$ , agent mass, kg  
 $W = m/V = (1/s) \cdot \ln(100/(100-C))$ , mass flooding factor, kg/m<sup>3</sup>  
 $C =$  agent concentration, vol %  
 $V =$  volume, m<sup>3</sup>  
 $s = a + b \cdot T$ , specific volume of agent, m<sup>3</sup>/kg, where  $a$  and  $b$  are agent-specific constants  
 IG-55:  $a = 0.6598$  kg/m<sup>3</sup>  
 IG-55:  $b = 0.00242$  kg/m<sup>3</sup>-°C  
 $T =$  temperature, °C

### 3-9 IG-01 TOTAL FLOODING CONCENTRATION FACTOR TABLES

Table 3-8. IG-01 US Customary Units Total Flooding Quantity

Temperature <i>t</i> °F	Specific Vapour Volume <i>S</i>  ft <sup>3</sup> /lb	IG-01 mass required per unit volume of protected space, <i>m/V</i> (lb/ft <sup>3</sup> )							
		Design Concentration (volume %)							
	34%	38%	42%	46%	50%	54%	58%	62%	
-10	8.329	0.0499	0.0574	0.0654	0.0740	0.0832	0.0932	0.1042	0.1162
0	8.514	0.0488	0.0561	0.0640	0.0724	0.0814	0.0912	0.1019	0.1136
10	8.699	0.0478	0.0550	0.0626	0.0708	0.0797	0.0893	0.0997	0.1112
20	8.884	0.0468	0.0538	0.0613	0.0694	0.0780	0.0874	0.0976	0.1089
30	9.069	0.0458	0.0527	0.0601	0.0679	0.0764	0.0856	0.0957	0.1067
40	9.254	0.0449	0.0517	0.0589	0.0666	0.0749	0.0839	0.0937	0.1046
50	9.439	0.0440	0.0506	0.0577	0.0653	0.0734	0.0823	0.0919	0.1025
60	9.624	0.0432	0.0497	0.0566	0.0640	0.0720	0.0807	0.0901	0.1005
70	9.809	0.0424	0.0487	0.0555	0.0628	0.0707	0.0792	0.0884	0.0986
80	9.994	0.0416	0.0478	0.0545	0.0617	0.0694	0.0777	0.0868	0.0968
90	10.179	0.0408	0.0470	0.0535	0.0605	0.0681	0.0763	0.0852	0.0951
100	10.364	0.0401	0.0461	0.0526	0.0595	0.0669	0.0749	0.0837	0.0934
110	10.549	0.0394	0.0453	0.0516	0.0584	0.0657	0.0736	0.0822	0.0917
120	10.734	0.0387	0.0445	0.0507	0.0574	0.0646	0.0723	0.0808	0.0901
130	10.919	0.0381	0.0438	0.0499	0.0564	0.0635	0.0711	0.0794	0.0886

$m = (V/s) \cdot \ln(100/(100-C))$ , agent mass, lb  
 $FF = m/V = (1/s) \cdot \ln(100/(100-C))$ , mass flooding factor, lb/ft<sup>3</sup>  
 $C$  = agent concentration, vol %  
 $V$  = volume, ft<sup>3</sup>  
 $s = a + b \cdot T$ , specific volume of agent, ft<sup>3</sup>/lb, where  $a$  and  $b$  are agent-specific constants  
IG-01:  $a = 8.514$  ft<sup>3</sup>/lb  
IG-01:  $b = 0.0185$  ft<sup>3</sup>/lb-°F  
 $T$  = temperature, °F

Table 3-9. IG-01 SI Units Total Flooding Quantity

Temperature t °C	Specific Vapour Volume S m3/kg	IG-01 mass required per unit volume of protected space, m/V (kg/m <sup>3</sup> )							
		Design Concentration (volume %)							
		34%	38%	42%	46%	50%	54%	58%	62%
-25	0.5165	0.804	0.926	1.055	1.193	1.342	1.503	1.680	1.873
-20	0.5269	0.789	0.907	1.034	1.169	1.316	1.474	1.646	1.836
-15	0.5373	0.773	0.890	1.014	1.147	1.290	1.445	1.615	1.801
-10	0.5477	0.759	0.873	0.995	1.125	1.266	1.418	1.584	1.767
-5	0.5581	0.745	0.857	0.976	1.104	1.242	1.391	1.554	1.734
0	0.5685	0.731	0.841	0.958	1.084	1.219	1.366	1.526	1.702
5	0.5789	0.718	0.826	0.941	1.064	1.197	1.341	1.499	1.671
10	0.5893	0.705	0.811	0.924	1.046	1.176	1.318	1.472	1.642
15	0.5997	0.693	0.797	0.908	1.027	1.156	1.295	1.447	1.613
20	0.6101	0.681	0.784	0.893	1.010	1.136	1.273	1.422	1.586
25	0.6205	0.670	0.770	0.878	0.993	1.117	1.251	1.398	1.559
30	0.6309	0.659	0.758	0.863	0.977	1.099	1.231	1.375	1.534
35	0.6413	0.648	0.745	0.849	0.961	1.081	1.211	1.353	1.509
40	0.6517	0.638	0.734	0.836	0.946	1.064	1.192	1.331	1.485
45	0.6621	0.628	0.722	0.823	0.931	1.047	1.173	1.310	1.461
50	0.6725	0.618	0.711	0.810	0.916	1.031	1.155	1.290	1.439
55	0.6829	0.608	0.700	0.798	0.902	1.015	1.137	1.270	1.417
60	0.6933	0.599	0.690	0.786	0.889	1.000	1.120	1.251	1.396

$m = (V/s) \cdot \ln(100/(100-C))$ , agent mass, kg  
 $W = m/V = (1/s) \cdot \ln(100/(100-C))$ , mass flooding factor, kg/m<sup>3</sup>  
 $C =$  agent concentration, vol %  
 $V =$  volume, m<sup>3</sup>  
 $s = a + b \cdot T$ , specific volume of agent, m<sup>3</sup>/kg, where  $a$  and  $b$  are agent-specific constants  
 IG-01:  $a = 0.5685$  kg/m<sup>3</sup>  
 IG-01:  $b = 0.00208$  kg/m<sup>3</sup>-°C  
 $T =$  temperature, °C

### 3-10 DESIGN FACTORS

The basic quantity of agent required may be further modified to suit any special conditions that would adversely affect the usual extinguishing efficiency. Such conditions could include unclosable openings, re-ignition from heated surfaces, enclosure geometry, and obstructions which impinge on the distribution pattern of the nozzles.

The design quantity shall further be adjusted to compensate for changes in the ambient pressure of more than 11% from the standard sea level value (see Section 3-10.8).

In each case, it is the project engineer's responsibility that the design concentration is chosen under the following conditions:

- Integrity of the room, unclosable openings, unstoppable extraction ventilating, etc.
- Combustible flammable materials involved
- Quantity of flammable material that may be expected within the enclosure
- Design concentration exceeding that required by most demanding flammable materials
- Ventilation conditions (re-circulating air handling units, stoppage of ventilation, etc.)
- Altitude of the protected risk (Atmospheric Correction Factor)
- Escape routes and time required to vacate the risk
- Personnel safety in general

#### 3-10.1 Electrical Clearance

When exposed electrical conductors are present in the protected enclosure, the clearance between those conductors and all parts of the system that may be approached during maintenance shall not be less than those listed below. Where these clearances cannot be achieved, warning notices shall be provided and a safe system of maintenance work shall be adopted.

Table 3-10. Electrical Clearance

Rated Voltage	Minimum clearance from any point on or about the permanent equipment where a person may be required to stand (measured from foot position)	
	To the nearest unshielded live conductor in air (section clearance)	To the nearest part of an insulator not at earth potential which supports a live conductor (ground clearance)
15	8.53' (2.60 m)	8.20 ft. (2.50 m)
33	9.02' (2.75 m)	
44	9.51' (2.90 m)	
66	10.17' (3.10 m)	
88	10.50' (3.20 m)	
110	10.99' (3.35 m)	
132	11.48' (3.50 m)	
165	12.47' (3.80 m)	
220	14.11' (4.30 m)	
275	15.09' (4.60 m)	
"Insulator" includes all forms of insulating supports, such as pedestals and suspension insulators, bushes, cable sealing ends and the insulating supports of certain types of circuit breaker		

### 3-10.2 Hold Time

“Hold time,” also called “duration of protection,” is the time period during which the concentration of agent is maintained to at least 85% of the adjusted minimum design concentration. It shall be maintained at the highest level of combustibles within the hazard space for a period of 10 minutes or for a time period to allow for response by trained personnel.\* This is important in all classes of fires (A, B, & C) since a persistent ignition source (e.g. an arc, heat source, or deep-seated fire) can lead to resurgence of the initial event once the agent has dissipated.

\*The hold time should not be less than 10 minutes or as agreed with AHJ or comply with ISO 14520/BS EN 15004 latest or NFPA 2001, latest edition requirements.

**Note:** The hold time for locations remote from a fire station may require a longer “Hold” time.

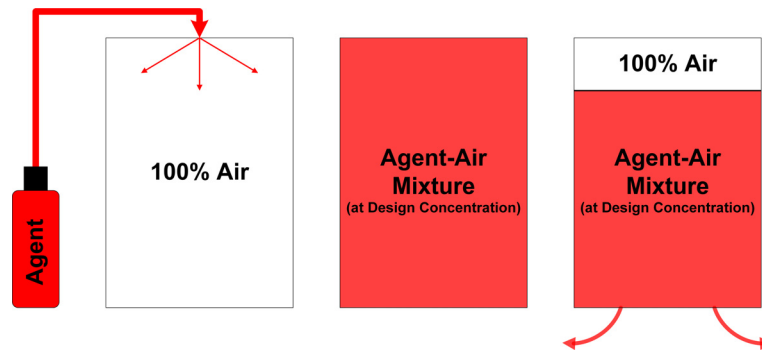


Figure 3-1. Hold Time Model

**Note:** Figure 3-1 is based on the NFPA model for descending interface where 100% of the initial concentration leaks out the bottom of the enclosure which replaces the lost volume with 100% above the interface.

### 3-10.3 Temperature Considerations

#### 3-10.3.1 Operating Temperature Range

The Natura IGS system is designed and tested to operate with a temperature range of -4 to 130 °F (-20 to 54 °C).

#### 3-10.3.2 Enclosure Temperature Decrease

During discharge the temperature within the protected enclosure will drop approximately 9-18 °F (5 – 10 °C). The temperature will rise again after approx. 2 – 3 min.

### 3-10.4 Flow Calculation

A listed flow calculation program shall be used to design a Natura IGS fixed fire-extinguishing system. Refer to the Kidde Fire Systems Natura IGS Flow Calculation manual (P/N 06-237621-001) for details of the Kidde Fire Systems Natura IGS flow-calculation software.

#### 3-10.4.1 Required Input Information

The flow calculation program requires the following input:

- Cylinder storage pressure in absolute pressure (at room temperature)
- Room temperature (start of pipe)
- Enclosure volumes including elevated floors & suspended ceilings
- Concentration of agent required for the hazard
- Cylinder size (80 or 140 liter)
- Number of cylinders
- Maximum discharge time required (60 or 120 seconds)
- Number of nozzles selected per void (even quantity of gas discharged per nozzle per void)

- Piping data, estimated pipe dimensions, pipe quality selected

**Note:** Due consideration to flow/length/pressure drop in pipe sections to be taken when estimating pipe dimensions.

- Maximum pressure that the enclosure can withstand (consult with a structural engineer to determine the value.)

### 3-10.4.2 Program Outputs

The flow calculation program shall calculate and determine/verify the following outputs:

- Pipe dimensions
- Orifice diameter for each individual discharge nozzle

**Note:** The calculated orifice may need to be changed to a standard orifice – verify calculated orifice size against those which are available once flow calculations are completed.

- Required area of pressure relief/vent opening
- Actual discharge time at nozzle
- Parts list of the components

Pipe and fittings selected/specified must be of a grade capable of withstanding the calculated pressure as well as the test pressure requirement. For recommended allowed pressure/pipe schedules see Section 3-17.4.

**Note:** The parts list of components may not contain all necessary ancillary equipment, adaptors, and connectors needed for the system. Review the parts list and ensure any additional supplies are included when purchasing.

### 3-10.5 Calculation of Room Volume

The volume used when calculating the required quantity of agent shall be the net volume, i.e. the gross enclosure volume less the volume of any solid/impermeable constructions. The volume shall include ventilation ducts and other related volumes.

### 3-10.6 Calculation of the Quantity of Agent

The fire extinguishing concentrations provided shall be used in determining the minimum design concentration for the particular flammable material. For combinations of flammable materials, the extinguishing value for the flammable material requiring the greatest concentration shall be used.

In order to make sure that all materials not specifically tested in a fire situation are effectively extinguished, it is generally accepted (ISO and NFPA) that the minimum design concentration required for extinguishing an n-Heptane fire may be used (class B fires).

**Note:** If the actual temperature is greater/lower than 68°F (20°C), the quantity of agent shall be corrected accordingly.

If a common battery of cylinders is used for several rooms, these are calculated as if they were single systems, and the number of cylinders required is selected to suit the largest demand (whether that be for a single room or multiple rooms which have a risk of combined fires).

Selector Valve systems, where varying multiples of cylinders are discharged into each area, will achieve this by using multiple solenoid release valves (one per area) and separation of the actuation line at each release unit so as to not discharge excess agent. The actuation arrangement will require special design and will place additional demands on the control panel.

### 3-10.7 Ventilation Considerations

When designing systems for floor voids, all floor voids shall be designed to the Class C concentration requirements. (See Section 3-3, Extinguishing Values.)

If a recirculation ventilation system is used and the room and floor void are designed at different concentrations, then the ventilation system shall be shut down prior to gas discharge so as to maintain the distinct concentrations in both room and floor void and both spaces shall be designed at the Class C concentration. (See Section 3-3, Extinguishing Values.)

### 3-10.8 Atmospheric Correction Factors

The ambient pressure is affected by changes in altitude, therefore the agent quantity shall be multiplied, where applicable, by the correction factor (at the associated altitude) as listed in Table 3-11.

Table 3-11. Atmospheric Correction Factors

Altitude		Enclosure Pressure		Correction Factor
ft.	km	PSIA	cm Hg	
-3000	-0.92	16.25	84.00	1.11
-2000	-0.61	15.71	81.20	1.07
-1000	-0.30	15.23	78.70	1.04
0	0	14.71	76.00	1.00
1000	0.30	14.18	73.30	0.96
2000	0.61	13.64	70.50	0.93
3000	0.92	13.12	67.80	0.89
4000	1.22	12.58	65.00	0.86
5000	1.52	12.04	62.20	0.82
6000	1.83	11.53	59.60	0.78
7000	2.13	11.03	57.00	0.75
8000	2.44	10.64	55.00	0.72
9000	2.74	10.22	52.80	0.69
10000	3.05	9.77	50.50	0.66

### 3-11 CYLINDER CONTENT

At a filling pressure of 200/300 bar at ref. temperature 15°C, standard cylinders will allow the listed quantity of agent to be released. The listed values exclude the quantity of gas remaining in the cylinder after valve closed:

Table 3-12. Nominal Fill

Agent	Cylinder Volume	Nominal Filling 200 bar	Nominal Filling 300 bar
IG-100	80L	39.3 lbs (17.8 kg)	54.3 lbs (24.6 kg)
	140L	N/A	95.0 lbs (43.1 kg)
IG-541	80L	52.1 lb (23.6 kg)	72.9 lb (33.1 kg)
	140L	N/A	127.66 lbs (57.9 kg)
IG-55	80L	50.3 lb (22.8 kg)	70.8 lb (32.1 kg)
	140L	N/A	123.9 lbs (56.2 kg)
IG-01	80L	62.8 lb (28.5 kg)	89.9 lb (40.8 kg)
	140L	N/A	157.3 lbs (71.4 kg)

**Note:** Cylinders may have a nominal volume variation of +5-0%. This may result in a variation in filling weight and/or resulting filling pressure.

### 3-12 CYLINDER BANK INSTALLATION

**Note:** The racking components can be configured using the Natura IGS Cylinder Racking Configuration Calculator which can be downloaded from the Kidde Fire Systems distributor extranet.

#### 3-12.1 Location

The cylinders and associated racking components shall be located and installed according to the relevant cylinder bank assembly layout. There is no restriction with regard to positioning the cylinders horizontally or vertically.

**Note:** As an 80 liter cylinder has a minimum weight of approximately 266.8 lbs (121 kg) at 200 bar and a maximum weight of approximately 317.5 lbs (144 kg) at 300 bar; a 140 liter cylinder a minimum weight of approximately 531.3 lbs (241 kg) and a maximum of 593.0 lbs (269 kg), it is vital to check that the floor is capable of supporting the total load. For filled cylinder weights, see Table 2-2.

#### 3-12.2 Typical Foot Print

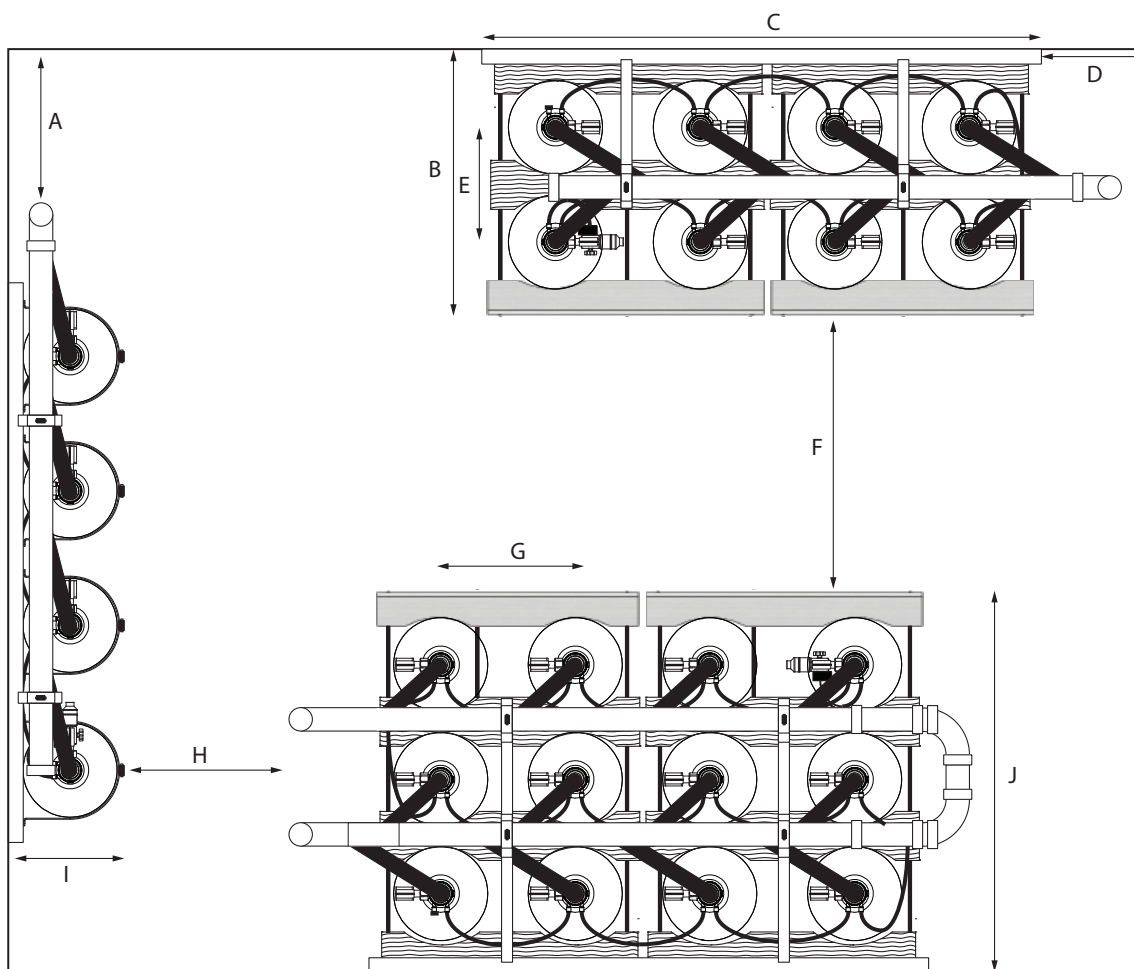


Figure 3-2. Typical Footprint of a Natura IGS System

Cylinder Size	Dimensions (inches)									
	A	B	C	D	E	F	G	H	I	J
80 L	MIN 9.5	29.1	$([NO\ Cyl - 1] \times 12.0) + 11.8$	MIN 9.8	12.2	MIN 31.5	12.0	MIN 31.5	13.4	41.3
140 L	MIN 9.5	29.1	$([NO\ Cyl - 1] \times 15.6) + 11.8$	MIN 9.8	15.7	MIN 47.2	15.6	MIN 47.2	17.7	51.0

**3-13 TYPICAL FLOOR LOAD**

Use these table to calculate the floor load of the cylinder bank based on the length of the cylinder racking (Dimension C in Figure 3-2).

Table 3-13. Approximate Weight per Foot of 80.0 Liter Cylinders

Number of Rows	IG-100		IG-541		IG-55		IG-01	
	Weight (lb)		Weight (lb)		Weight (lb)		Weight (lb)	
	200 bar	300 bar	200 bar	300 bar	200 bar	300 bar	200 bar	300 bar
Single row	244	257	256	274	254	272	266	290
Double row	487	515	511	549	508	545	531	580
Triple row	731	772	766	824	762	817	795	870

Table 3-14. Approximate Weight per Foot of 140.0 Liter Cylinders (300 bar only)

Number of Rows	IG-100	IG-541	IG-55	IG-01
	Weight (lb)	Weight (lb)	Weight (lb)	Weight (lb)
Single Row	486	516	513	543
Double Row	973	1032	1025	1086
Triple Row	1459	1548	1538	1629

**3-14 VIBRATIONS**

Give due consideration to cylinder installations in a storage room exposed to constant vibrations as well as storage rooms exposed to vibrations in the form of shock.

Agent cylinders subjected to vibrations may need to be installed on a “soft” plate between the floor and the bottom of the cylinder and between wall brackets and cylinders in order to avoid momentary low-pressure alarm signals caused by chattering of the contact in the contact pressure gauge.

**3-15 AGENT CYLINDER RELEASE CONSTRAINTS**

Each valve shall be actuated no more than 10 times.

The cylinder valve is capable of emptying a cylinder pressurized to 300 bar within 60 seconds. A typical cylinder bank can be emptied within 60 to 120 seconds. The emptying rate produces a high discharge thrust at the valve outlet port, however the valve does limit the discharge pressure to the same level regardless of cylinder pressure. The discharge thrust is approximately 278 lb-force (126 KG-force). These forces shall be neutralized by the cylinder brackets.

**3-15.1 Cylinder Actuation Limitations**

The following table lists how many cylinders can be actuation from one release unit or discharge delay:

Table 3-15. Maximum Number of Cylinders that can Be Actuated per Actuation Device

Actuation Method	Maximum Number of Cylinders	
	80L	140L
Release Unit	62	54
Discharge Delay	44	39

### 3-16 SELECTOR VALVES

Standard EN12094-5 requires that selector valves be opened within a maximum time span of 3 seconds, the following rules will be used for designing all selector valve systems:

- Always confirm the duration for which the solenoid valve will be kept energized by the control panel. The solenoid must be energized for the full discharge time.
- A handle shall always be provided with selector valves for manual opening or closing.

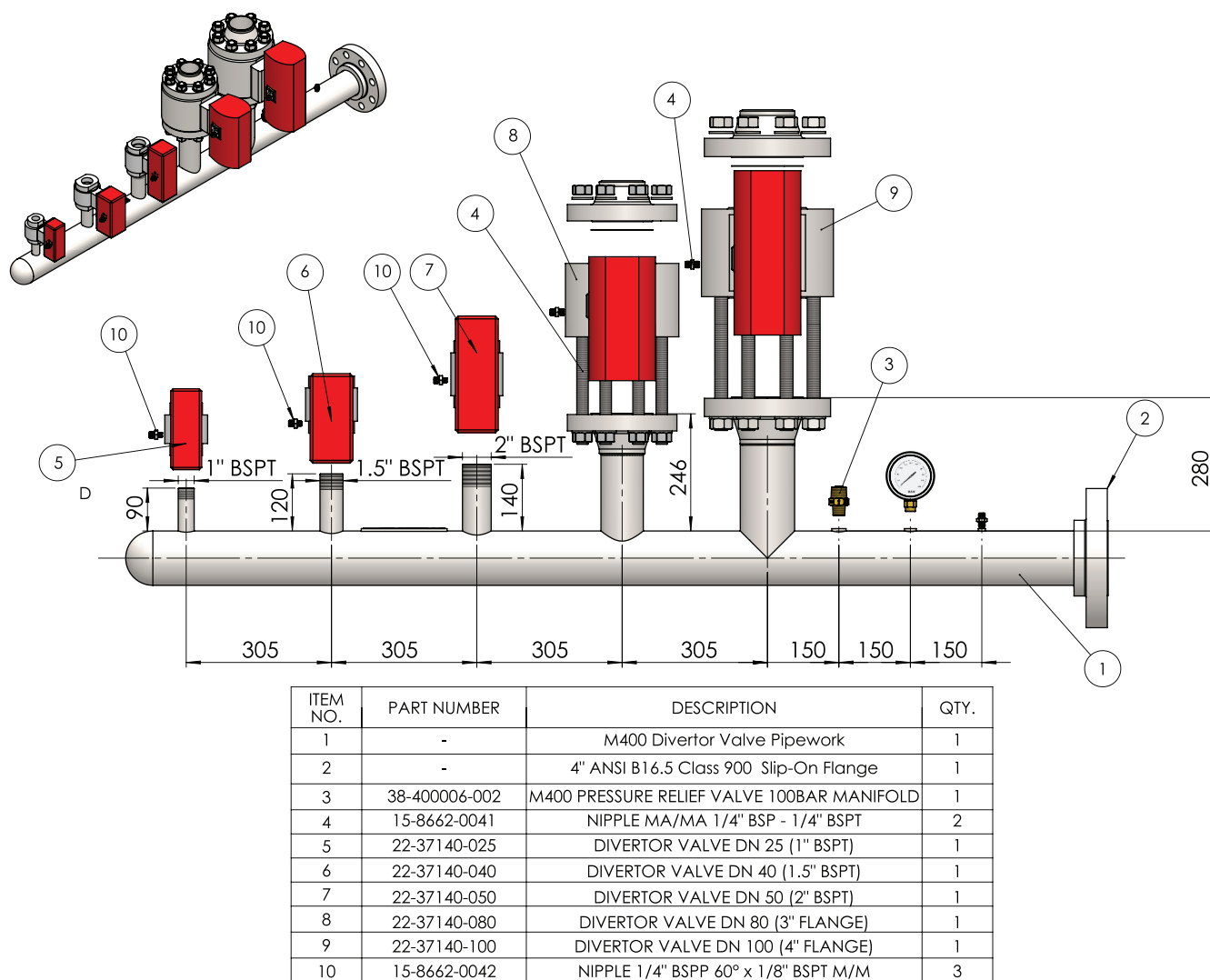


Figure 3-3. Typical Distribution Manifold Design

### 3-16.1 Back-Plate Manifold for Selector Valves

The solenoid valves with manual override used for controlling the opening of the Selector valves are supplied as part of a back-plate manifold which holds the required numbers of solenoid valves. The back-plate manifold receives pressure from the discharge manifold via a pressure regulator reducing the supplied pressure to approx. 8 bar.

**Note:** The solenoid on the back-plate manifold leading to the hazard being protected by the discharge must be continuously powered during the system discharge.

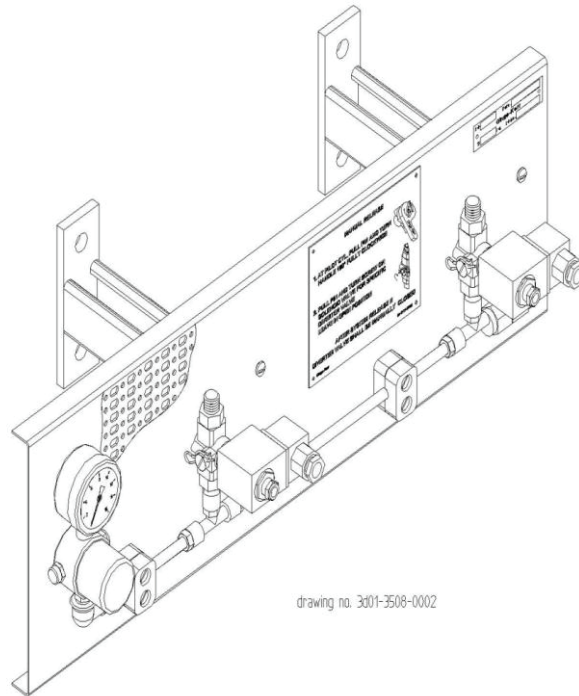


Figure 3-4. Back-Plate Manifold Arrangement

### 3-17 SELECTING NUMBER OF NOZZLES

A range of nozzles, 1/2" to 1 1/2", with orifices from 3mm to 26mm can be provided. Nozzles have a 180° or 360° discharge pattern. Nozzles can be installed pendant or upright.

The number of nozzles, their size and their location shall be such that:

- The desired design concentration is achieved in all parts of the protected enclosure within the specified discharge time
- The discharge will not unduly splash flammable liquids or create dust clouds that could extend the fire.
- The discharge will not create an explosion or harm personnel occupying the enclosure.
- The discharge will not adversely affect the contents or integrity of the enclosure.

Evaluate the height of the nozzles with regard to where the fire may start, ensuring the minimum and maximum height requirements are met.

When selecting the number of nozzles required, the following factors may affect the distribution of the discharged agent and shall always be taken into account:

- The shape of the enclosure including the area and volume of any raised floor, suspended ceiling or installed equipment (chimney effect).
- The location and shape of any obstructions
- The location of pressure relief openings
- Any architectural considerations (i.e. installation in a warehouse may allow for 1 1/2" nozzles whereas an office environment would require a number of smaller nozzles).

In hazards with a suspended ceiling, consideration shall be given to having nozzles in the ceiling void performing a simultaneous discharge in order to equalize the pressure during discharge. This reduces the risk of unnecessary damage to ceiling tiles and such. Nozzles in ceiling voids can be installed upright directly from a tee or elbow from the branch pipe.

Also, nozzles in room voids shall be installed in such a way that the jets from the nozzles do not damage the ceiling tiles during discharge (i.e. the nozzles shall be positioned vertically with the discharge holes free of the ceiling tiles and/or escutcheon plates). For lightweight ceiling tiles, it is a requirement to securely anchor all tiles within 4.9' (1.5 m) of each discharge nozzle.

In hazards with a raised floor (not gas tight) consideration shall be given for having nozzles installed in the floor void to perform a simultaneously discharge in order to equalize the pressure and achieve the extinguishing concentration below the floor.

In hazards such as server rooms, requirements to the release and equipment shut down sequence may be needed as well as number of nozzles installed sufficient for providing the design concentration between rows of server cabinets.

### 3-17.1 Nozzle Coverage

The maximum area coverage of the installed nozzle is 1250 sq ft (116 sq m).

In enclosures higher than 16.0' (4.88m), nozzles may need to be positioned using a two tiered nozzle arrangement. The nozzles can be mounted in the upright or pendant position.

### 3-17.2 Nozzle Selection and Placement

Use the Kidde Fire Systems Natura IGS Flow Calculation design software to determine the required orifice area and nozzle size. There are two Natura IGS system nozzle configurations:

- The 360° nozzle provides a full 360° discharge pattern.
- The 180° nozzle provides a 180° discharge pattern designed for placement adjacent to the side walls of the hazard.

The maximum orifice area to pipe area ratio must conform to the following:

- The ratio between the nozzle orifice area for a 360° nozzle at the given node and the pipe cross sectional area for the pipe segment preceding that nozzle is 0.85, or 85%.
- The ratio between the nozzle orifice area for a 180° nozzle at the given node and the pipe cross sectional area for the pipe segment preceding that nozzle is 0.85, or 85%. Due to geometric constraints and the need to keep a sharp-edged orifice, in sizes up to and including 3/4 in NPT (19 mm), the 180° sidewall nozzle has a lower ratio of orifice area to feed pipe area. This value is different for each size nozzle through 3/4 in (19 mm) NPT.

The minimum orifice area to pipe area ratio must conform to the following:

- The ratio between the nozzle orifice area for a 360° nozzle at the given node and the pipe cross sectional area for the pipe segment preceding that nozzle is 0.20, or 20%.
- The ratio between the nozzle orifice area for a 180° nozzle at the given node and the pipe cross sectional area for the pipe segment preceding that nozzle is 0.20, or 20%.

Nozzles are available in nominal pipe sizes of 1/2 in, 3/4 in, 1 in, and 1-1/2 in (13mm, 19mm, 26mm, and 38mm). Nozzles are available in NPT or BSP fittings.

3-17.2.1 Nozzle Placement

There are certain coverage and height limitations which must be observed with each nozzle configuration to ensure proper agent distribution.

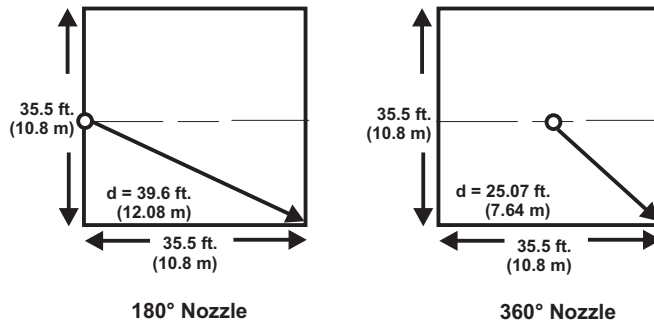


Figure 3-5. Nozzle Placement and Coverage

- **Orientation**-Nozzles must be mounted perpendicular to the ceiling or subfloor surface and oriented with the orifices radiating outward from the pipe network. Pendant or upright mounting of the nozzle is acceptable.

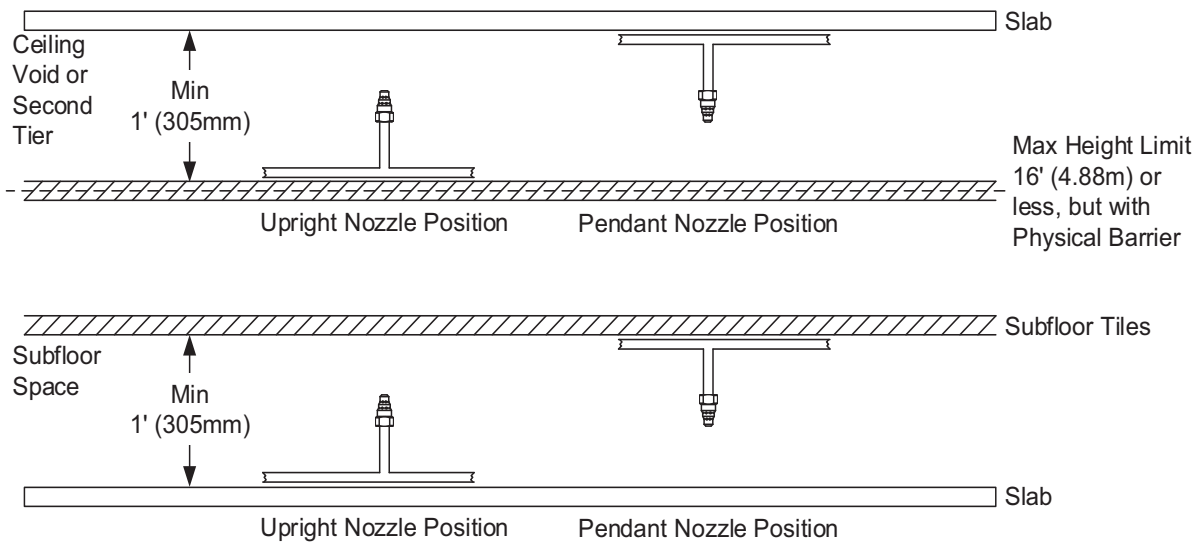


Figure 3-6. Nozzle Orientation

- **Ceiling Clearance**-Nozzles must be installed so that the orifices are located 6 to 12 in (152 to 305 mm) below the ceiling. In enclosures using the minimum ceiling height (1 ft), the nozzles must be installed so that the orifices are located 6 in +/- 2 in (152 +/- 51 mm) below the ceiling.
- **Maximum Height**-The maximum protected height for a single row of nozzles is 16.0 ft (4.88m). Nozzles may be tiered to accommodate enclosures with ceiling heights greater than 16.0 feet (4.88 m), but no greater than 32 ft (9.8 m).
- **Minimum Ceiling Height**-The minimum ceiling height for UL Listed/FM Approved systems is 12 in (305 mm). Systems designed for enclosures 6 to 12 in (152 mm to 305 mm) are acceptable, but not UL Listed or FM Approved. Follow reduced coverage guidelines on page page 3-23.
- **180° Nozzles**-180° nozzles must be located 6 +/- 2 inches (152 mm +/- 51 mm) from a wall, with the orifices directed away from the wall. The nozzle shall be located as close to the center of the wall as possible, but at least 1/3 of the way along the wall. 180° nozzles have a maximum coverage area defined as a square that can be inscribed in a semicircle of distance 39.8 ft (12.1 m, diagonal of a rectangle 17.8 ft x 35.6 ft). Refer to Figure 3-5 for further information. 180° nozzles may be used in a back-to-back configuration. The nozzles should be placed 1 to 2 ft (0.3 m to 0.6 m) apart.

- **360° Nozzles**-360° nozzles must be located as close to the center of the enclosure as possible. 360° nozzles have a maximum coverage area defined as any square that can be inscribed in a circle of radius 25.2 ft (7.7 m, diagonal of a square 17.8 ft x 17.8 ft). Refer to Figure 3-5 for further information.
- **Multiple Nozzles**-Nozzles whose discharge patterns will intersect must be placed at least 10 ft (3.3 m) apart to assure adequate agent distribution.
- **Reduced Coverage Area**-Consideration should be given to reducing nozzle spacing when obstructions that would impede the uniform distribution of the agent throughout the area are present. Nozzle coverage area must be reduced to 25 ft x 25 ft for enclosure heights six to twelve inches (7.5 m x 7.5 m for heights 0.15 to 0.3 meters).

Limits on Nozzle Conditions:

- **Minimum average nozzle pressure**-The minimum nozzle pressure required to effectively distribute the agent and mix the agent into the air of the enclosure being protected varies by agent type.

Agent	Minimum Nozzle Pressure
IG-100	15.2 bar (221 psi)
IG-541	15.0 bar (218 psi)
IG-55	16.5 bar (239 psi)
IG-01	30.8 bar (447 psi)

- **Maximum pressure variance**-The maximum pressure variance between nozzles is 10.9 bar (147.0 psig).
- **Maximum arrival imbalance**-The maximum arrival imbalance between nozzles is 2.4 seconds.

Maximum Elevation Differences in Pipe Runs:

There are no limits on the Maximum Elevation Differences in Pipe Runs.

### 3-17.3 Tee Split Limitations

The following table outlines the tee split limitations:

Table 3-16. Tee Split Limitations

Tee Style	Orientation	Maximum Split	Minimum Split
Bull Tee	Standard	50:50	10:90
Side Tee	Standard	50:50	10:90
	Vertical	50:50	10:90

### 3-17.4 Pipe Sizing

The following table may be used as an estimating guide for sizing distribution piping. This table is intended for use as a guide only. Use the Kidde Fire Systems Natura IGS Flow Calculation design software for the final design.

Table 3-17. Pipe Size Estimating Table

Nominal Pipe Size (inches)	Flow Rate (lb./sec.)		Flow Rate (kg/s)	
	Minimum Design	Max. Nom. Design	Minimum Design	Max. Nom. Design
1/4 in	0.06	0.32	0.03	0.15
3/8 in	0.11	0.59	0.05	0.27
1/2 in	0.17	0.94	0.08	0.43
3/4 in	0.3	1.7	0.14	0.77
1 in	0.5	2.83	0.23	1.28
1-1/4 in	0.9	5.03	0.41	2.28
1-1/2 in	1.24	6.96	0.56	3.16
2 in	2.1	11.76	0.95	5.34
2-1/2 in	3.05	17.09	1.38	7.75
3 in	4.81	26.98	2.18	12.24
4 in	8.52	47.77	3.86	21.67
5 in	13.7	76.82	6.22	34.85
6 in	20.16	113.04	9.15	51.28

### 3-17.5 Temperature Limitations

#### 3-17.5.1 Operating/Storage Temperature Range

The Natura IGS system equipment listed herein is designed to operate within the range of -4° to 130°F (-20° to 54°C). The Kidde Fire Systems Natura IGS Flow Calculation design software assumes a temperature of 20°C (68°F).

#### 3-17.5.2 Storage Temperature

Natura IGS system equipment is suitable for storage from -4° to 130°F (-20° to 54°C).

### 3-17.6 Cylinder Actuation Limitations

The following table lists how many cylinders can be actuation from one release unit or discharge delay:

Table 3-18. Maximum Number of Cylinders that can Be Actuated per Actuation Device

Actuation Method	Maximum Number of Cylinders	
	80L	140L
Release Unit	62	54
Discharge Delay	44	39

### 3-17.7 Pressure Actuation Limitations

The following sections list the limitations on the various pressure activated accessories of the Natura IGS system:

Table 3-19. Nitrogen Pilot Cylinder Actuation Cylinder, Driver and Ancillary Limits

Detail	108 cu. in.	1040 cu. in.
Cylinder Part Number	85-877690-001	85-101040-001
Discharge Delay Capability	Yes	No
Siren Driver Capability	Yes	Yes
Number of 80L Agent Cylinders	44	N/A
Number of 140L Agent Cylinders	39	N/A
Number of Siren Drivers	2	3
Length of Actuation Pipe to First Agent Cylinder in feet	75	75
Length of Actuation Pipe to Siren Driver(s) in feet	20	90
Siren Driver: Number of Sirens	1	4
Siren Driver: Length of Siren Piping in feet	90	500
Discharge Delay in seconds	34/61	N/A

#### 3-17.7.1 Pressure Trip Limitations

For pressure trip P/N 81-874290-000, the minimum operating pressure required is 50 PSI.

The maximum load on the retaining ring is 100 pounds (45.3 kg).

#### 3-17.7.2 Pressure Operated Sirens

Pressure Operated Sirens (N<sub>2</sub> operated) are used to provide an audible alarm prior to the start of and during discharge. The siren cannot be driven by the same cylinder as a pneumatic discharge delay. A union should be installed at each siren connection, and a dirt trap shall be installed after the last siren. The total length of 1/2-inch (DN15) pipe between the cylinders and the sirens cannot exceed 250 ft. (76 m).

The N<sub>2</sub> pressure operated siren (P/N 90-981574-001) consumes approximately 0.5 to 0.9 lb. (0.23 to 0.5 kg) of nitrogen per minute. Each siren driver cylinder can operate one or more sirens. Table 3-20 indicates the number of sirens that can be installed on a line from any one siren driver; the total length of actuation pipe that can be used must not exceed the limits shown in this table.

Table 3-20. Siren Driver Cylinder Actuation Limits

Siren Cylinder Size	Siren Part Number	Number of Sirens per Siren Driver	Maximum Length of 1/4 in. Sch. 80 Pipe	Maximum Length of 1/4 in. Sch. 40 Pipe	Maximum Length of 5/16 in. x 0.032 in. Wall Tubing
108 cu. in.	90-981574-001	1	90 ft.	90 ft.	90 ft.
1040 cu. in.	90-981574-001	4	500 ft.	500 ft.	500 ft.

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# CHAPTER 4

## INSTALLATION

### 4-1 GENERAL EQUIPMENT INSTALLATION

This section contains installation instructions for Kidde Fire Systems Natura™ Inert Gas System (Natura IGS system) using IG-100, IG-541, IG-55, or IG-01 inert-gas agent (herein refer to collectively as the “agent”). Equipment must be installed to facilitate proper inspection, testing, manual operation, recharging and any other required maintenance as may be necessary.



**Equipment must not be subject to severe weather conditions or mechanical, chemical, or other damage that could render the equipment inoperative. Equipment must be installed in accordance with NFPA Standard 2001, BS EN 15004, or ISO 14520, current editions, this manual, and applicable national Standards.**



**The Natura IGS system cylinder and valve assemblies must be handled, installed and serviced in accordance with the instructions contained in this chapter and Compressed Gas Association (CGA) pamphlets C-1, C-6 and P-1. CGA pamphlets may be obtained from the Compressed Gas Association website: <http://www.cganet.com>. Failure to follow these instructions can cause Natura IGS system cylinders to violently discharge, resulting in severe injury, death and/or property destruction. For further advice or training information contact Kidde Fire Systems.**

#### 4-1.1 Personal Safety

Installing a Natura IGS system requires the use of personal protection equipment (PPE). The PPE should as a minimum include:

- Safety Toe Shoes, Helmet, Safety Glasses, and Hearing Protection
- Lifting Devices
- Cylinder Trolley

When welding, use appropriate PPE including welders mask, welder’s gloves, protection plate(s) and fire extinguisher(s).

#### 4-1.2 General Installation Requirements

Installation of a Natura IGS system shall:

- Comply with local and regional standards
- Be conducted according to accepted practices
- Be performed in accordance with the approved installation drawings
- Be performed in accordance with the instructions and information contained in this manual

#### 4-1.3 Electrical Clearance

Maintain at least the minimum required clearance from energized electrical equipment when installing all system components. If the designed insulation level is not available and where nominal voltage is used for the design criteria, use the highest minimum clearance listed for this group.

**Note:** Consult the local applicable standards for the required minimum electrical clearance. Where there is a risk of static electrical build up in the pipe network, ensure such pipe work is earth grounded/bounded according to local standards.

### 4-2 INSTALLATION PROCESS

When installing, follow this general process:

1. Install all system piping, including selector valves if applicable.
2. Pressurize the pipe network per local applicable standards. Blow out any debris in the piping once done.
3. Install the nozzles and traps.
4. Install the cylinder manifold. If applicable, install the back-plate manifold as well.
5. Install discharge hoses to the manifold.
6. Install the cylinder racking components.
7. Secure the cylinders to the racking system.
8. Connect pilot actuation line and discharge hoses.
9. Install the release unit and secondary cylinder gauge assemblies.

**Note:** Do not install the pilot line actuation hose from release unit to rear of valve, this should be performed during commissioning.

10. Install a compatible detection and control systems per manufacturer's instructions.
11. Commission the system.

### 4-3 TECHNICAL DESCRIPTION

Items to be supplied locally (excluded from normal scope of supply) include bolts for supports, distribution pipes and fittings as well as supports for pipe installation.

The agent cylinder bank must be installed and assembled as indicated on the relevant drawings. For details of individual components please refer to the relevant datasheet and/or installation instruction.

The system generally consists of the following main components:

- Distribution manifold arrangement with manifold check valves
- Agent cylinders with valves
- Solenoid release units with pressure gauge and switch
- Secondary cylinder pressure gauge with switch
- Discharge hoses
- Actuation hoses with quick-connect fittings
- Discharge nozzles

The solenoid actuator valve and the contact gauges for secondary cylinders are connected to the fire release and control panel either directly or via a junction box.

The contact gauge on the release unit and all secondary cylinders are joined together using "quick connect" cable joints, the lead from the primary cylinder is then wired into a junction box which in turn is wired to the control panel.

### 4-4 FUNCTIONAL DESCRIPTION

The agent cylinder valve is kept closed by the cylinder pressure and will remain open once operated until the cylinder is almost empty or pressure is removed from the pilot actuation line.

The system can be released in the following ways:

- Automatic release: By a signal from a compatible fire alarm & control panel, initiated by detectors installed in the protected area or a manual pull station tied into the applicable circuit on the panel.
- Manual release: In the unlikely event of a complete electrical failure to the system, actuation may be accomplished by operating the manual actuator on the primary cylinder valve's release unit. For multiple area systems, open the appropriate 2-way solenoid valve on the back-plate manifold manually before operating the release unit. For more information, see Chapter 5.

### 4-4.1 System Overview

The cylinders, stored in a bank, are individually connected to the manifold assembly. The connection is made with high-pressure hoses and a manifold check valve, one for each cylinder. The manifold check valves allow for removal of one or more cylinders from the manifold without having a significant loss of agent into the storage area should the remaining cylinders be discharged.

The system can be released electronically by a control panel sending a signal to the release unit.

**Note:** Release unit solenoids must be continuously powered during system discharge.

The system can be released manually by removing the locking pin and turning the wheel of the primary cylinder manual release unit in the direction of the arrow (clockwise).

Each cylinders can be equipped with a pressure gauge for low pressure monitoring. The "primary" cylinder will include a solenoid valve release unit. The pressure from the "primary" cylinder is channeled to valves on the secondary cylinders, releasing their content. During a discharge, the cylinders in the cylinder bank will be released almost simultaneously.

**Note:** Kidde Fire Systems recommends that the release unit be installed on the left most cylinder if possible.

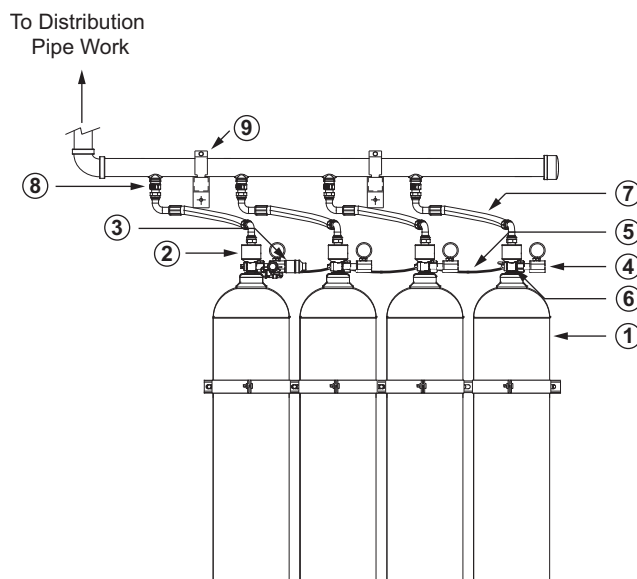


Figure 4-1. Single Area Cylinder Bank Arrangement

Table 4-1. Single Area Cylinder Bank Arrangement Components

Item	Description	Part Number
1	Agent Cylinder	38-42XXX1-XXX
2	Valve	
3	Release Unit	38-400001-00X
4	Secondary Cylinder Gauge Assembly	38-400005-00X
5	Actuation Hose	38-4011X0-X00
6	Pilot Line Bleed Valve (on back side)	38-400007-001
7	Discharge Hose	38-400330-410
8	3/4" BSP Manifold Check Valve	38-400002-002
9	Manifold Bracket Clamp	01-8143-0000

### 4-4.2 Selector Valve System

In selector valve systems, the agent may be distributed to various hazards from a common cylinder bank, non-simultaneously. Only one hazard can be protected at a time. Therefore, it is recommended that a reserve bank of cylinders is maintained so that continuous fire suppression is available in the event of a discharge. The number of cylinders released per hazard is controlled by using a solenoid release unit for each "primary" cylinder in the bank. By only energizing certain "primary" cylinders, the amount of agent released can be limited to the amount needed for the given hazard.

A low-pressure back-plate manifold incorporating low-pressure 2 way solenoid valves controls the pressure directed to the selector valves. Each solenoid valve controls a specific selector valve, with each selector valve allowing access to one hazard.

**Note:** The solenoid on the back-plate manifold leading to the hazard being protected by the discharge must be continuously powered during the system discharge.

The back-plate manifold receives pressure from the discharge manifold. The pressure is reduced to 8 bar by a pressure-reducing valve.

The fire alarm and control panel will simultaneously energize the high-pressure release solenoid valve on the primary cylinders in the bank and the associated low-pressure solenoid valve on the back-plate manifold for the area where a fire is detected.

For safety reasons, selector valves are supplied as dual action. The selector valves shall be closed in the normal standby position and only open during a discharge. The selector valve needs to be closed manually after the discharge and before resetting the system with a new set of cylinders. The selector valves are not self-resetting.

In Figure 4-2, there are two release units. The Hazard 1 release unit would fire 3 cylinders. The Hazard 2 release unit would only fire 2 cylinders. If a third Hazard required all 5 cylinders, both release units would need to activate.

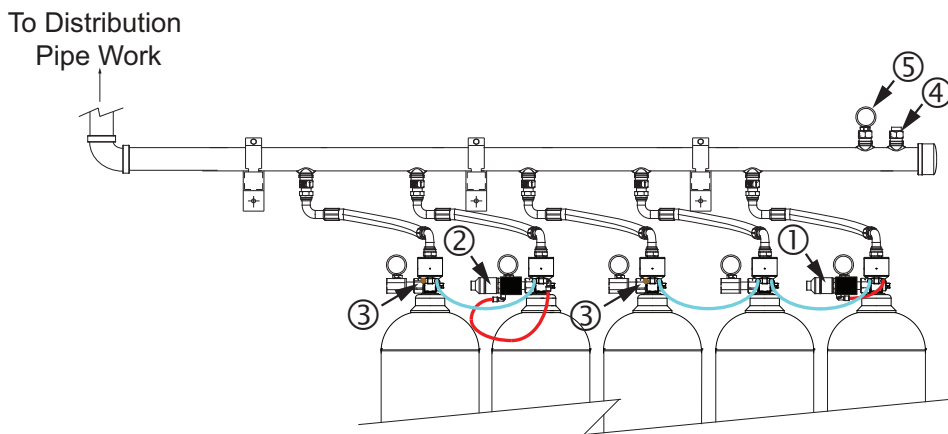


Figure 4-2. Typical Pilot Line on Selector Valve System (Rear View)

Table 4-2. Components for Typical Pilot Line

Item	Description
1	Hazard 1 Release Unit
2	Hazard 2 Release Unit
3	Pilot Line Bleed Valve
4	Manifold Safety Device
5	Manifold Pressure Gauge

Figure 4-3 shows the Distribution manifold in a selector valve system including the selector valves and back-plate manifold. Not all release units are shown in the image.

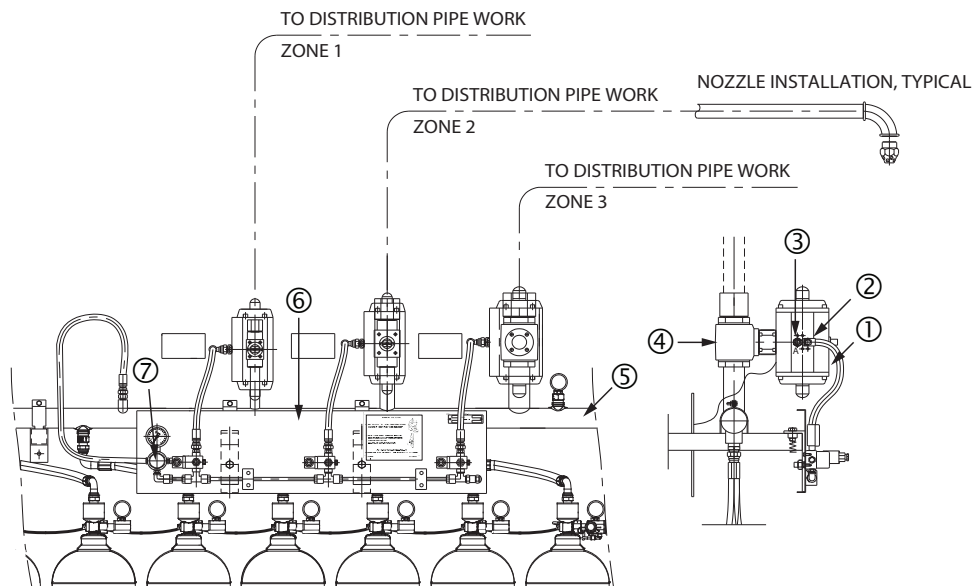


Figure 4-3. Typical Detailed Cylinder Bank Selector Valve System

Table 4-3. Selector Valve System Cylinder Bank Arrangement Components

Item	Description
1	Selector Valve Actuator
2	Connection for 1/4" Hi-flex hose
3	Actuator Vent Outlet
4	Selector Valve
5	Discharge Manifold
6	Back-plate Manifold
7	Pressure Reducing Valve

### 4-4.3 Systems Using Discharge Delays

Discharge delays prevent a system from discharging until a specified time has expired. Discharge delay systems use nitrogen from a nitrogen pilot cylinder for activation of the cylinder valves. Use an electric control head to open the valve on the pilot cylinder. The nitrogen then travels to the discharge delay. The discharge delay prevents the nitrogen from pressurizing the activation line until after the delay has expired. The discharge delay can be bypassed by using a manual lever operated control head on the discharge delay. Figure 4-4 illustrates a system with a discharge delay.

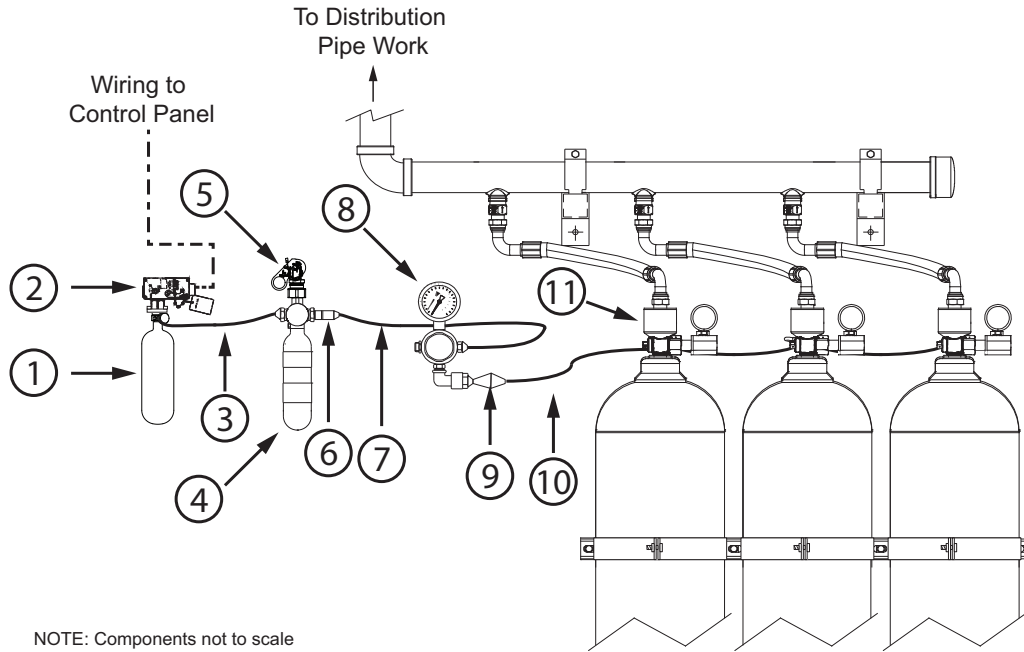


Figure 4-4. System with Discharge Delay

Table 4-4. Discharge Delay System Components

Number	Description	Part Number
1	108 cu. in. Nitrogen Pilot Cylinder	06-129773-001
2	Electric Control Head Kit with Control Head Monitor (CHM not pictured)	85-890181-000
3	30" Actuation Hose	WK-264986-000
4	Nitrogen Discharge Delay Kit	34 sec.: 38-401140-030 61 sec.: 38-401140-060
5	Lever Operated Control Head	WK-870652-000
6	3/4" NPS to BSP Adapter	Included in Nitrogen Discharge Delay Kit
7	Back-Plate Manifold Hose	Included in Nitrogen Discharge Delay Kit
8	Pressure Regulator	01-6017-0000
9	BSP to Quick Connect Adapter	Included in Nitrogen Discharge Delay Kit
10	Pilot Line Actuation Hose	38-401110-X00 or 38-401130-X00
11	1st Cylinder with Secondary Gauge	Varies

## 4-5 CYLINDER BANK INSTALLATION

Before the cylinder installation begins, it is strongly recommended that door(s) to the cylinder storage room are secured in the OPEN position. Use signs and warning tape to restrict access to the area. No other tasks should be performed while installing the cylinders.

The cylinders and associated equipment shall be placed and installed according to the project specific cylinder bank assembly layout.

### 4-5.1 Typical Floor Load

Ensure the floor can support the total load of the cylinders. Use these table to calculate the floor load of the cylinder bank.

Table 4-5. Approximate Weight per Foot of 80.0 Liter Cylinders

Number of Rows	IG-100		IG-541		IG-55		IG-01	
	Weight (lb)		Weight (lb)		Weight (lb)		Weight (lb)	
	200 bar	300 bar	200 bar	300 bar	200 bar	300 bar	200 bar	300 bar
Single row	244	257	256	274	254	272	266	290
Double row	487	515	511	549	508	545	531	580
Triple row	731	772	766	824	762	817	795	870

Table 4-6. Approximate Weight per Foot of 140.0 Liter Cylinders

Number of Rows	IG-100	IG-541	IG-55	IG-01
	Weight (lb)	Weight (lb)	Weight (lb)	Weight (lb)
Single Row	486	516	513	543
Double Row	973	1032	1025	1086
Triple Row	1459	1548	1538	1629

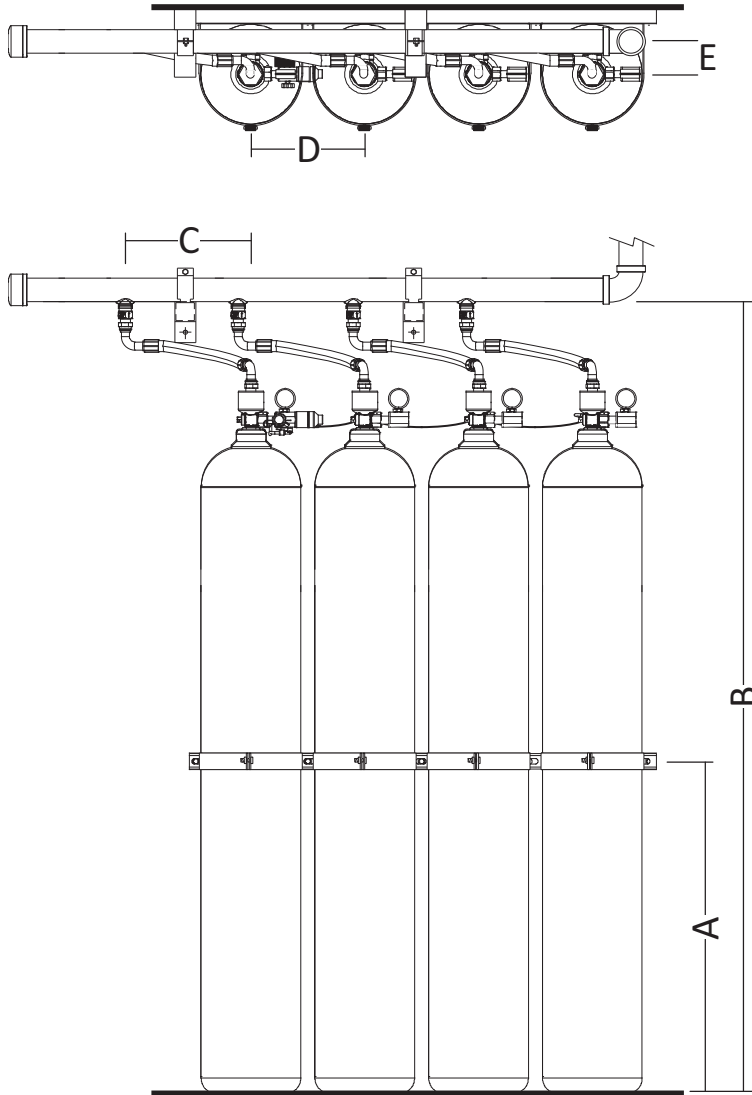
**Note:** When cylinders banks are installed on top of subfloors, additional supports under the subfloor may be required.

## 4-5.2 Racking Install Diagrams

**Note:** The racking components can be configured using the Natura IGS Cylinder Racking Configuration Calculator which can be downloaded from the Kidde Fire Systems distributor extranet.

Use the following diagrams when planning out the install.

### 4-5.2.1 Clamp Racking Layouts



**Note:**

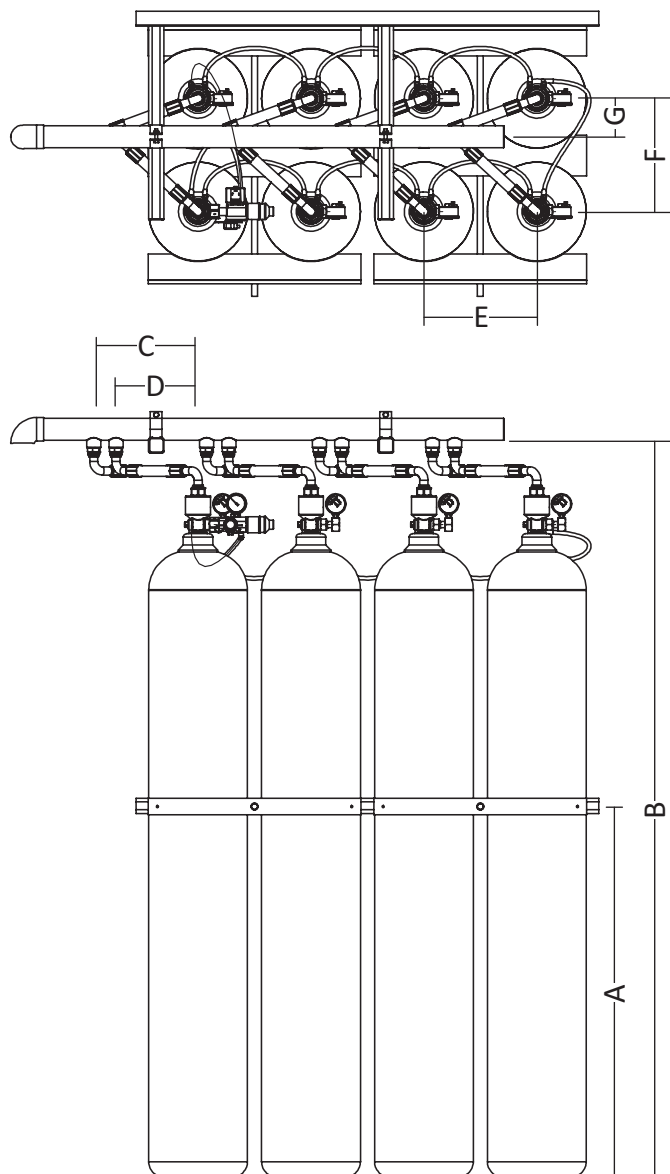
- Manifolds can be offset Front or rear of cylinder center
- Manifolds can be offset to the left (as illustrated) or to the right of the cylinders.

Figure 4-5. Single Row Racking System with Clamps

Table 4-7. Dimensions for Racking Systems with Clamps

Cylinder Size	Dimension in inches (mm)				
	Floor to Clamping Bar	Floor to Bottom of Manifold	Center Cylinder to Manifold Check Valve	Cylinder Centers (Side to Side)	Center of Cylinder to Manifold Centre Offset (Minimum)
	A	B	C	D	E
80 L	43.3 (1100)	78.7 (2000)	14.4 (365)	12.0 (305)	3.9 (100)
140 L	43.3 (1100)	80.5 (2045)	17.9 (455)	15.6 (395)	3.9 (100)

### 4-5.2.2 2 Row Wooden Racking Layouts



**Note:**

- Manifolds can be offset to the left (as illustrated) or to the right of the cylinders.

Figure 4-6. Dual Row Racking System with Wooden Bracketing

Table 4-8. Dimensions for Racking Systems with Wooden Bracketing

Cylinder Size	Dimension in inches (mm)						
	Floor to Clamping Bar	Floor to Bottom of Manifold	Center Rear Cylinder to Manifold Check Valve	Center Front Cylinder to Manifold Check Valve	Cylinder Centers (Side to Side)	Cylinder Centers (Front to Back)	Center of Cylinders (front and rear) to Manifold Centre Offset
	A	B	C	D	E	F	G
80 L	43.3 (1100)	78.7 (2000)	14.4 (365)	12.0 (305)	12.0 (305)	12.2 (310)	6.1 (155)
140 L	43.3 (1100)	80.5 (2045)	17.9 (455)	15.6 (395)	15.6 (395)	15.7 (400)	7.9 (200)

**4-5.2.3 Distance Pipe Installation**

In systems where there is an odd number of cylinders, use a distance pipe (80L P/N 03-8331-0000, 140L P/N 03-8331-0140) to ensure the lone cylinder is held properly in the wooden bracket. The distance pipe is a sheath that goes over the clamping bolt.

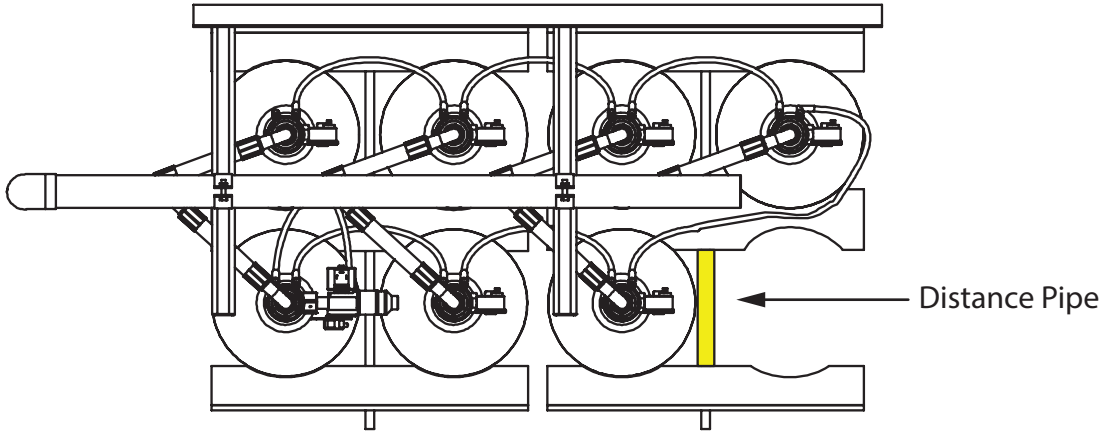


Figure 4-7. Installed Distance Pipe

4-5.2.4 Manifold Installation

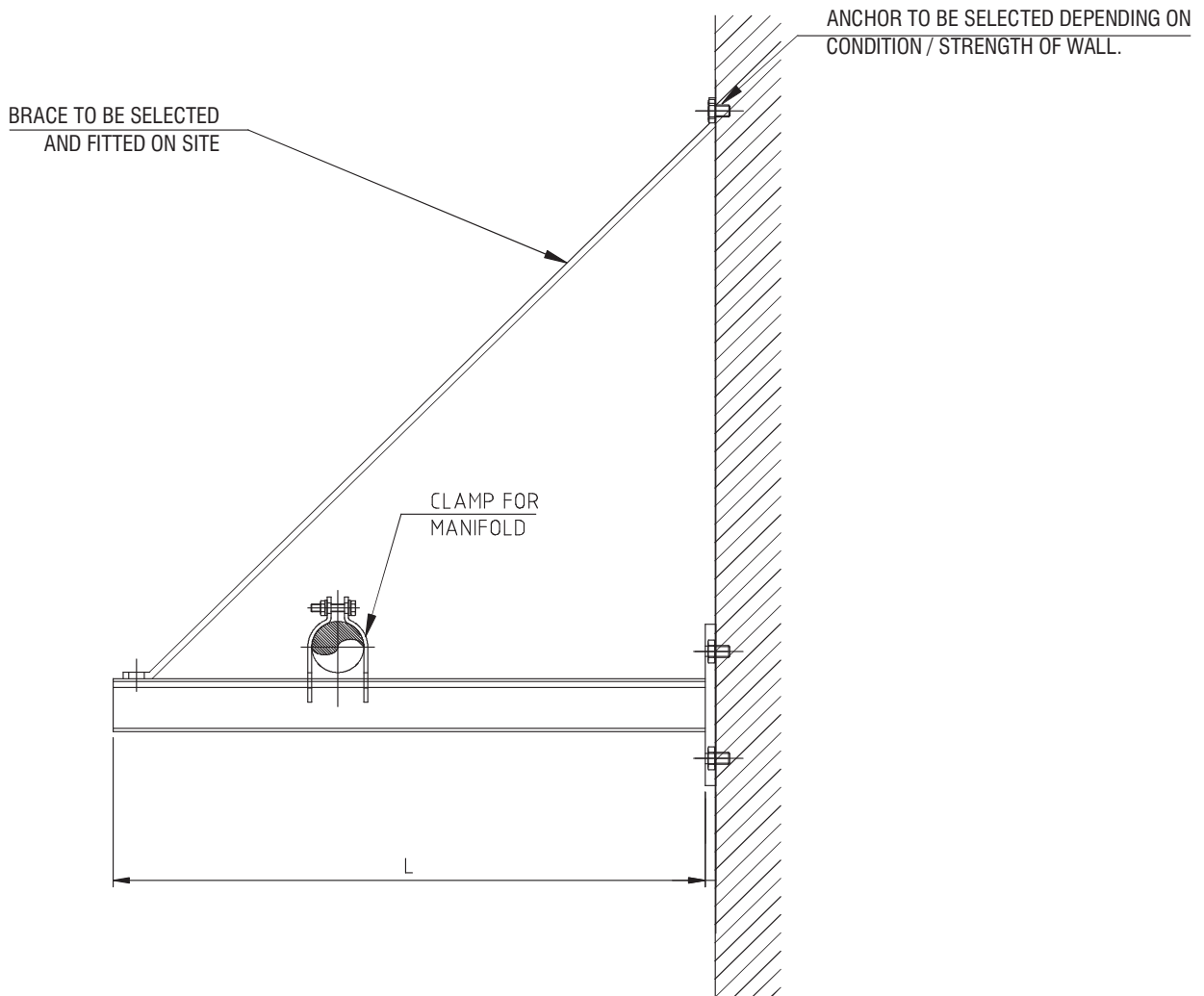


Figure 4-8. Manifold Installation

Table 4-9. Manifold Installation Details

Type No.	L	Weight	Used For		Max. Load (kgs)
			80 L	140 L	
01-8160-0200	200	~ 1.0 kg	1 - Row	N/A	540
01-8160-0250	250	~ 1.5 kg	N/A	1 - Row	432
01-8160-0520	520	~ 2.0 kg	2 - Rows	N/A	210
01-8160-0600	600	~ 2.5 kg	N/A	2 - Rows	*180
01-8160-0830	830	~ 3.0 kg	3 - Rows	N/A	*130
01-8160-1000	1000	~ 4.0 kg	N/A	3 - Rows	*108

\*Brace required for installation.

4-5.2.5 Cylinder and Valve Installation Diagrams

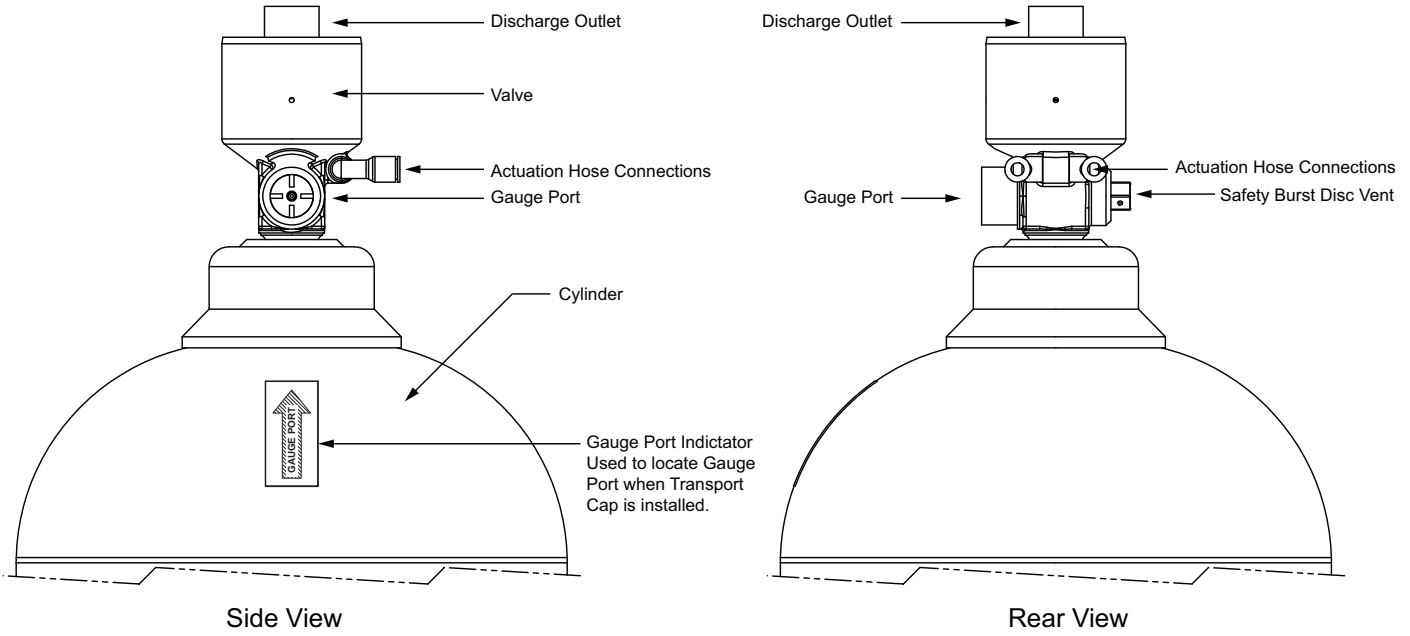


Figure 4-9. Cylinder Components

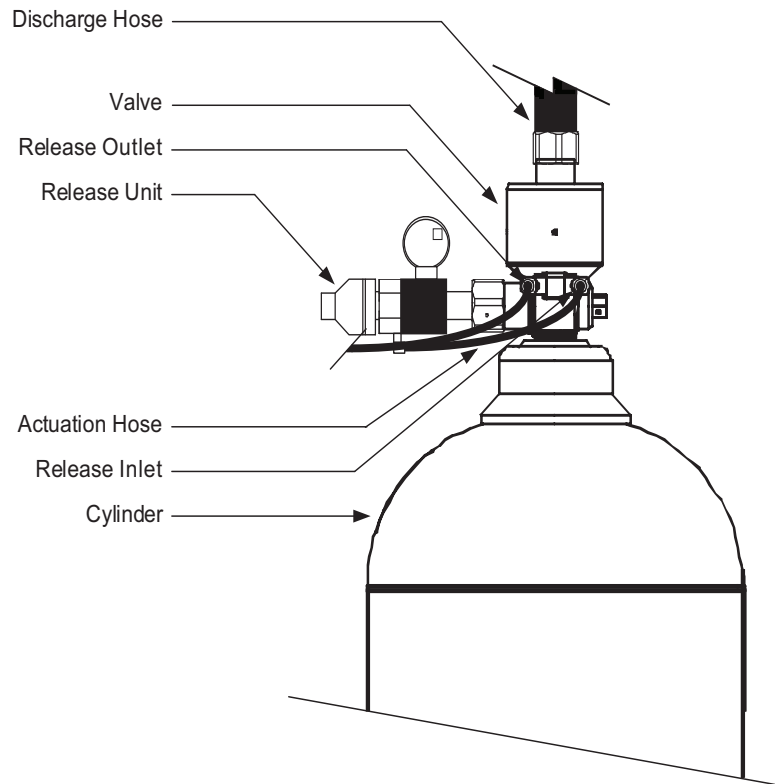


Figure 4-10. Typical Primary Cylinder/Valve Assembly (Rear View)

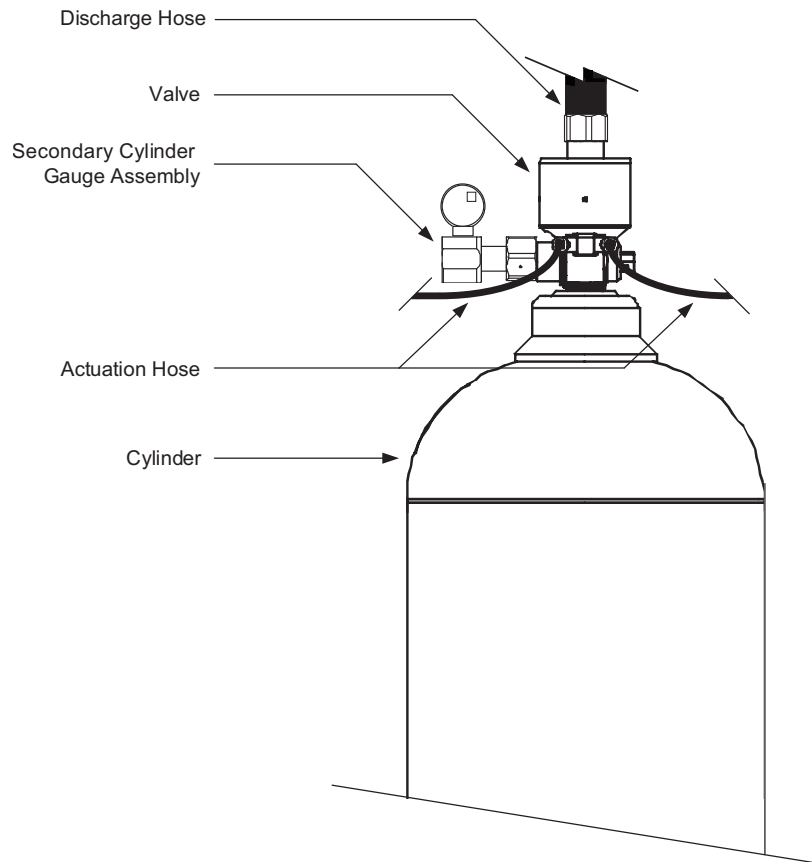


Figure 4-11. Typical Secondary Cylinder/Valve Assembly (Rear View)

## 4-6 CYLINDER BANK ASSEMBLY

### 4-6.1 Securing the Manifold

Before measuring the placement of the manifold brackets, check the cylinder height(s) to ensure accuracy to the design plan. Install manifold supports in such a way to allow for vertical adjustment if necessary. Follow this procedure to secure the manifold:

1. Use 1/2" expansion bolts (or equivalent) with washer or similar to secure the channel iron/Unistrut<sup>®</sup> to a wall or solid structure. On steel structures, The channel iron/Unistrut could be fixed by welding.
2. Tighten bolts in accordance with the manufacturer's recommendation for the selected fixing and the strength of the wall.
3. Ensure that the brackets are horizontal, level, and at the same height as indicated on the cylinder bank assembly drawing.
4. Fix the manifold loosely to the channel iron/Unistrut by using the pipe clamps (pipe clamps are not to be tightened at this stage, as adjustment of the manifold may be required when cylinders are in place).
5. Install distribution pipe work, see Section 4-8.

### 4-6.2 Manifold Safety Device

Wherever there are closed sections of pipe, install a manifold safety device. This device prevents any unlikely overpressure within the pipe.

**Note:** The manifold safety device may be vented to atmosphere or connected to the downstream pipe work (after any selector valves if applicable) to prevent accidental exposure to the agent in quantities that may exceed exposure limits within the cylinder storage room.

- Locate the venting for the manifold safety device in an area where the agent can be safely discharged without exposing personnel.
- Ensure that the maximum allowable working pressure of the closed section of pipe is equal to or greater than the maximum operating pressure of the manifold safety device, which is 1450 psi (100 bar) for part number 38-400006-002.
- The device must be installed upstream of any selector or lockout valve (if applicable).

Figure 4-12 shows an example of an installed manifold safety device. In this example, the manifold safety device's 3/4" NPT fitting is connected to a reducer. The reducer is connected to a Tee pipe which is also connected to the manifold via a BSP to NPT adapter. The other side of the Tee pipe connects to the extended manifold, selector valve, lockout valve or other system piping.

**Note:** When installing, attach the wrench to the body of the manifold safety device. Do not tighten or loosen the retaining nut containing the safety burst disc.

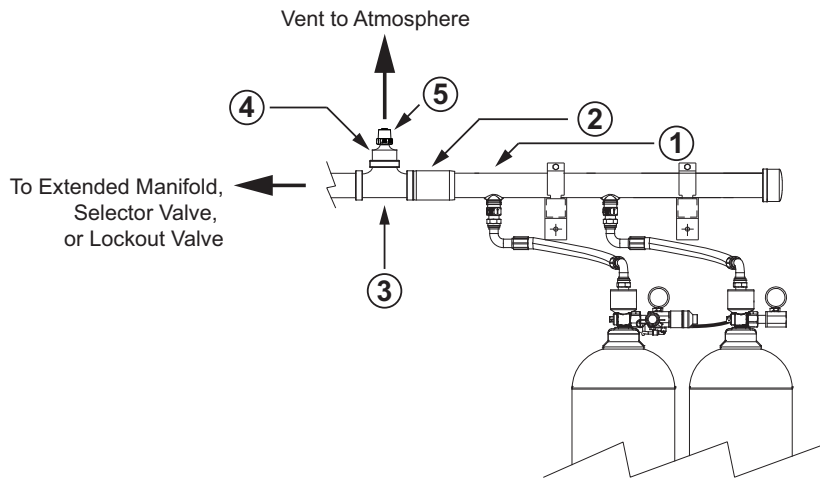


Figure 4-12. Manifold Safety Device Installation Example

Table 4-10. Components for Manifold Safety Device Installation Example

Item	Description
1	Manifold
2	2" BSP to NPT Adapter
3	NPT Tee Pipe
4	2" to 3/4" NPT Reducer
5	Manifold Safety Device

### 4-6.3 Install Discharge Hoses to Manifold Check Valves

After installing the manifold, install the discharge hoses to the manifold check valves.

### 4-6.4 Securing Single-Row Cylinders

Follow this procedure to secure the cylinders in a single row (see Figure 4-5):

**Note:** The installation of the manifold and the pipe work within the cylinder storage area/room must be completed before cylinders are moved into the cylinder storage area/room.

1. Use 1/2" expansion bolts (or equivalent) with washer or similar to secure the channel iron/Unistrut supplied to a wall or solid structure. On steel structures, The channel iron/Unistrut could be fixed by welding.
2. Tighten bolts in accordance with the manufacturer's recommendation for the selected fixing and the strength of the wall.
3. Install all sections of channel iron/Unistrut horizontally and at the same height from the floor.
4. For single row, secure cylinders using the single row bracket, P/N 01-8131-1000 for 140 L cylinders and P/N 01-8131-0000 for 80L cylinders.

### 4-6.5 Securing Multi-Row Cylinders

Follow this procedure to secure the cylinders in a multi-row setup (see Figure 4-6):

**Note:** The installation of the manifold and the pipe work within the cylinder storage area/room must be completed before cylinders are moved into the cylinder storage area/room.

1. Use 1/2" expansion bolts (or equivalent) with washer or similar to secure the channel iron/Unistrut supplied to a wall or solid structure. On steel structures, The channel iron/Unistrut could be fixed by welding.
2. Tighten bolts in accordance with the manufacturer's recommendation for the selected insert and the strength of the wall.
3. Install all sections of channel iron/Unistrut horizontally and at the same height from the floor.
4. Fit clamping bolts into the channel iron.

**Note:** If using bolt and nuts made from AISI 316 stainless steel, apply silicone spray or "Molykote™ lacquer" to the male threads before assembly.

5. If using Unistrut profiles, apply counter nut, washer, and plate nut on the bolt. Fit the bolt into the profile, then tighten the nut loosely against the washer. Use a wooden spacer as a template for exact location of bolts and fix by tightening the nut against the washer. Apply max torque 7.4-11.1 ft lbf (10 – 15 N-m).
6. Fit the rear wooden spacer on the clamping bolts.
7. Place the back row of cylinders in position.
8. Fit wooden spacer on the clamping bolts (double row only).
9. Place next row of cylinders in position. If necessary repeat Step 8 and 9 for 3 row systems.

**Use caution when installing the cylinders into place.**

**The high pressure cylinder valve is capable of producing high discharge thrust from the valve outlet if not handled properly. Remember that pressurized cylinders are extremely hazardous. Always ensure the Safety Transport cap is fitted before any movement of the cylinder. Failure to do so can result in serious bodily injury, death, and property damage.**



10. Fit clamping bar on cylinder bracket as appropriate. Tighten nuts on clamping bolts lightly at this stage (adjustment of cylinders may be required during hose installation). Do not use the clamping bolt as a means of pressing the cylinder into the bracket.

### 4-6.6 Positioning Cylinders

For ease of positioning the cylinder, the gauge port is marked by a label on the shoulder of the cylinder.

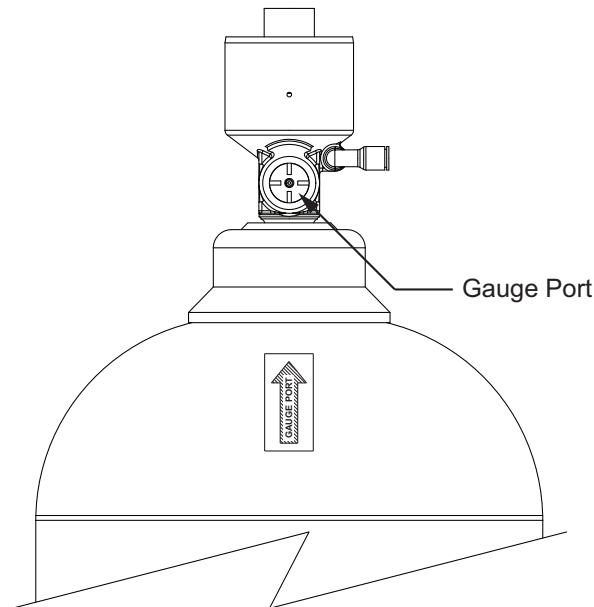


Figure 4-13. Cylinder Valve Gauge Port

Follow this procedure to install the cylinders after all discharge hoses have been connected to manifold check valves and the cylinders secured in their brackets:

1. Tighten the nuts on the clamping bolts, securing the cylinders. Use M24 & M20 fixed spanners and torque to 40 – 45 Nm.

**Note:** Do not use the clamping bolt as a means of pressing the cylinder into the bracket.

2. Install a protecting nut on the free thread end, tightening slightly.
3. Remove the transport cap from the cylinder. Store the cap in a convenient place for future use.
4. Ensure that the gauge port is pointing to the right.
5. Install the “quick connect” pilot hoses as indicated on the bank assembly drawing, except for the actuation hoses from release units to the corresponding primary cylinder actuation inlets. This last hose is installed during commissioning.
6. Install the Pilot Line Bleed Valve to the pilot line on the last cylinder.
7. Tighten the pipe clamps for the distribution manifold. Use an 3/4” or equivalent fixed spanner, torque: 14.75-18.5 ft lb (20-25 N-m).



**Cylinders not connected to the manifold must have anti-recoil safety caps on the discharge outlet.**

### 4-6.6.1 Installing Back-Plate Manifold for Selector Valve Systems



**When installing selector valves, ensure that there is enough clearance to open and close the selector valve using the handle. Also ensure that the handle is kept with the selector valve in case of emergency.**

Follow these steps to install the back-plate manifold for systems which uses selector valves:

1. Mount the back-plate manifold for the selector valves on the brackets holding the discharge manifold in the location specified on the cylinder bank assembly drawing. Use the supplied M12 bolts and nuts, tightening appropriately.
2. Connect the pilot hose from the solenoid valves on the back-plate manifold to the inlet on the selector valves as indicated on the cylinder bank drawing. Apply a torque of 14.75-18.5 ft lb (20 – 25 N-m).
3. Connect the pilot hose from the pressure regulator on the back-plate manifold to the outlet on the discharge manifold. Apply a torque of 14.75-18.5 ft lb (20 – 25 N-m).

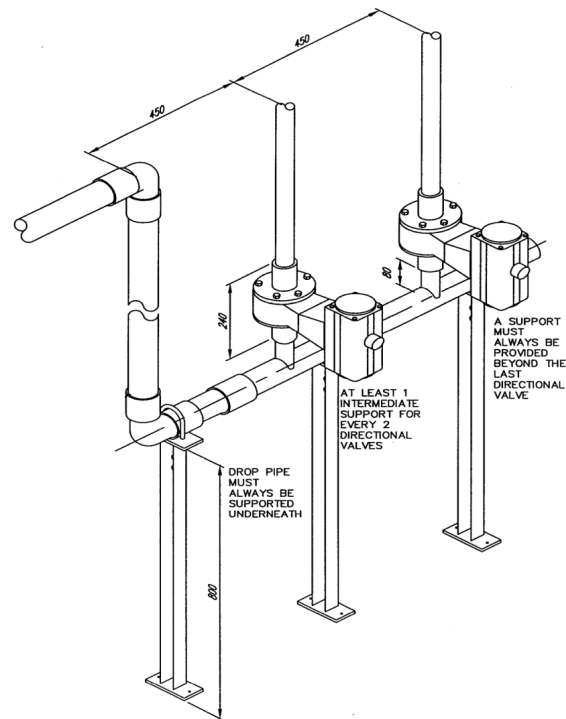


Figure 4-14. Selector Valve Installation

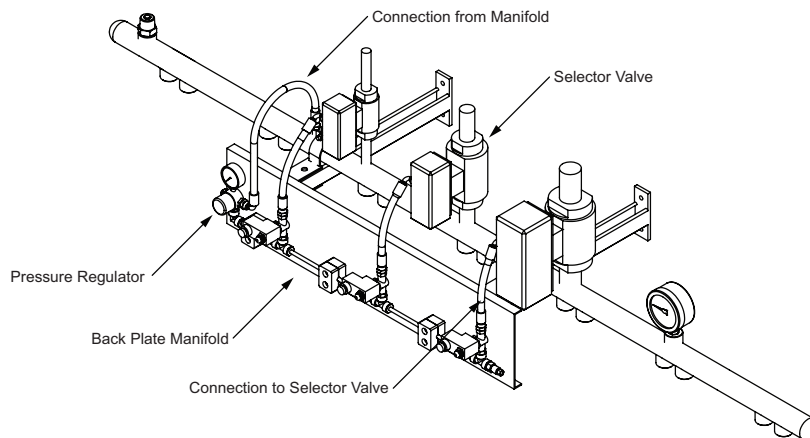


Figure 4-15. Back Plate Manifold Installation

### 4-6.7 Installing Secondary Cylinder Gauge Assembly

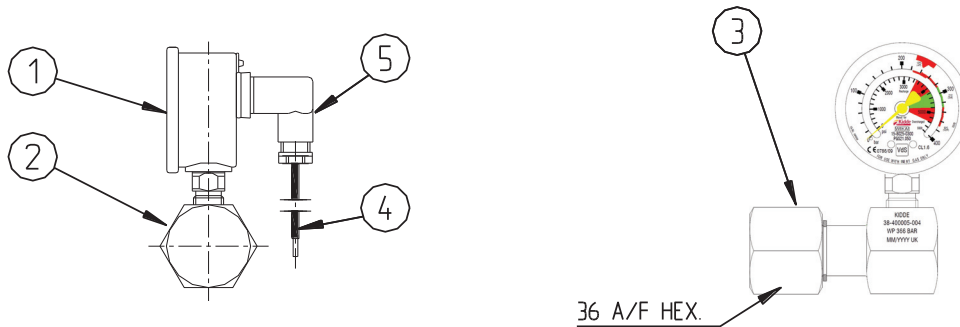
Follow these steps to install the secondary cylinder gauge assembly:

1. Make sure the O-ring in the connecting swivel of the secondary cylinder gauge assembly is in place and properly lubricated. If lubrication is missing, use silicone spray (Würth Art no: 0893221 or similar).
2. Installing secondary cylinder gauge assemblies as indicated on the bank assembly drawing. Apply a torque of  $33.2 \pm 0.75$  ft lbf ( $45 \pm 1$  N-m). A counter hold may be required.
3. Leak test all connections on the secondary cylinder gauge assembly by means of an ammonium-free leak detection liquid or spray, ensuring that there is no leakage.



**Do not spray leak test liquid on the valve shield or anti-recoil cap. This area must remain free of moisture at all times.**

**Note:** The pre-assembled unit shall not be tampered with, as any adjustment to components pre-fitted to the connector block will lead to a leak.



Key:

- (1) Contact Pressure Gauge
- (2) Connection Block
- (3) Connecting Swivel
- (4) Two Core Cable with Quick Connect Cable Joiner
- (5) Connector for Contact Gauge

Figure 4-16. Contacts for Pressure Gauge

## 4-6.8 Installing Release Units

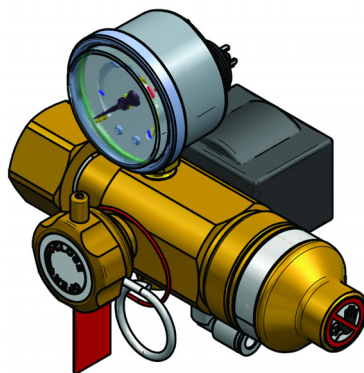


Figure 4-17. Release Unit

Release units should be installed on the front row, left most cylinder whenever possible. This provides some protection under the manifold and provides easy access for manual discharge. When connecting multiple cylinders using actuation hoses, use the following:

Table 4-11. Actuation Hose Usage

Connection Type	Actuation Hose Used
<b>80 Liter Cylinders</b>	
Release Unit to Cylinder Valve	38-401110-500
Interconnecting Valves in the same row (in line valve to valve)	
Interconnecting Valves in different rows (in between cylinder rows)	38-401130-600
<b>140 Liter Cylinders</b>	
Release Unit to Cylinder Valve	38-401110-500
Interconnecting Valves in the same row (in line valve to valve)	38-401110-600
Interconnecting Valves in different rows (in between cylinder rows)	38-401130-700

Install the release units on the primary cylinders in the locations specified on the cylinder bank assembly drawings using the following procedure:

**Note:** The release unit seals against the cylinder valve with an O-ring. Ensure the inlet port is free from dirt or other impurities.

1. Make sure the O-ring in the connecting swivel of the release unit is in place and properly lubricated. If lubrication is missing, use silicone spray (Würth Art no: 0893221 or similar).



**Only the O-ring should be lubricated. Excessive lubricant in the valve port will enter into the solenoid valve itself when pressurized and may jeopardize the performance.**

2. Install the release unit on the cylinder valve and tighten swivel nut by hand until pressure is indicated on the gauge.



**Do not tamper with the release unit. Any adjustment to components pre-fitted to the connector block will lead to a leak. After the release unit is pressurized, do not adjust the alignment as this may reset the Schrader valve in the cylinder valve causing it to discharge or not seal properly.**

3. Secure the connecting swivel of the release unit by the use of an M36 A/F fixed wrench. Apply a torque of  $44.25 \pm 0.75$  ft lb ( $60 \pm 1$  N-m) on the unit. A counter hold may be required during tightening.

## Installation

4. Leak test all connections on the release unit by means of ammonium-free leak detection liquid or spray, ensuring that there is no leakage (see Section 4-6.10).



**Do not spray leak test liquid on the valve shield or anti-recoil cap. This area must remain free of moisture at all times.**

5. Connect the actuation hose to the release unit but not to the cylinder valve at this stage. Make sure to push the actuation hose in fully.



**Ensure the actuation hose is fully inserted into the release unit. There should be a gap of no more than 1/4" (6 mm) between the end of the Quick Connect on the actuation hose and the shoulder of the release unit Quick Connect.**



Figure 4-18. Actuation Hose Install

**Note:** The installation of the actuation hose to the cylinder valve inlet should only be performed by the commissioning engineer, see the last step of Section 4-24.

6. For multi cylinder systems, use an actuation hose to connect the actuation outlet of each valve to the actuation inlet of the next valve in line. Make sure to push the actuation hose in fully. (For outlet and inlet locations, see Figure 4-9, Figure 4-10, and Figure 4-11.)



**Ensure the actuation hose is fully inserted into the inlet or outlet. There should be a gap of no more than 1/4" (6 mm) between the end of the Quick Connect on the actuation hose and the shoulder of the Quick Connect on the valve.**

7. After installing all actuation hoses, install a Pilot Line Bleed Valve (P/N 38-400007-001) on the open actuation port of the last cylinder in the system.

**Note:** In the case of systems with more than one release unit, one Pilot Line Bleed Valve is required per release unit. The bleed valve is installed on the open actuation port of the last cylinder controlled by that release unit.

If installing a multi-row cylinder bank, when the first row has been installed then connect up the cables between each pressure gauge via the quick connect cable joiners. This will permit easy access to the contact gauges and solenoid valve(s) on the cylinders in the inner row.

**Never attach the release unit to the cylinder valves until the cylinders are secured in brackets or racking. Under no circumstances is the release unit to remain attached to the cylinder valve after removal of the cylinder from service, handling, storage, or during shipment. Failure to follow these instructions could result in serious bodily injury, death, or property damage.**



### 4-6.8.1 Aligning the Release Unit after Pressurization

The construction of the release units allows for alignment/adjustment by hand until the swivel is tightened. After the swivel is tightened, do not attempt further alignment or adjustment.

### 4-6.9 Locations for Leak Testing the Valve and Cylinder

**Note:** As the system relies on pressure from the cylinders to operate, all permanently pressurized connections (or those under pressure during a discharge, including the cylinder valves) must be checked for leakage during the installation. This check includes actuation and outlet port valve, the gauge connection port on the release unit or cylinder secondary gauge, and the various parts fitted into the contact gauge unit(s) and the pilot hoses.

Any leakage from the pressure bearing parts may jeopardize the operation of the system. It is therefore mandatory that the checkpoints listed hereafter are completed and that the specified torques are applied to the connections.

Apply an ammonium free leak detection liquid in order to verify that no leaks are present.

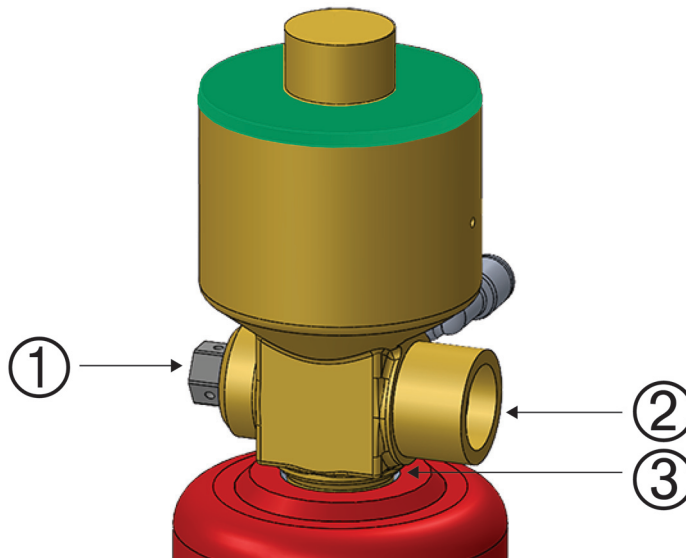


Figure 4-19. Valve Leak Points

Table 4-12. Valve Leak Points

Point	Description
1	Burst Disc Port
2	Actuation Schrader
3	Valve-Cylinder Connection



**Do not spray leak test liquid on the valve shield or anti-recoil cap. This area must remain free of moisture at all times.**

Should a leak be found, then fit the safety transport cap and return the cylinder to Kidde Fire Systems for refurbishment or replacement of valve and refilling.

### 4-6.10 Locations for Leak Testing the Release Unit

The arrows on the sketch below indicate locations where to apply ammonium-free leak detection liquid or spray in order to verify that there are no leaks. Should a leak be found on the release unit, the unit shall be removed from service and replaced with a working unit.

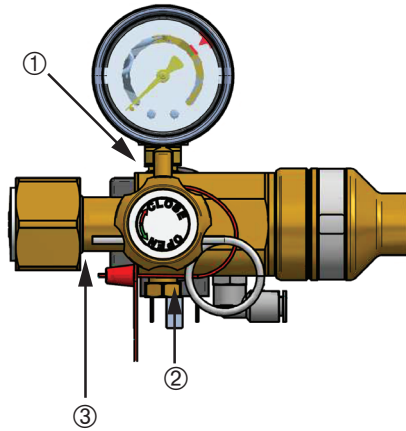


Figure 4-20. Release Unit Leak Test Locations

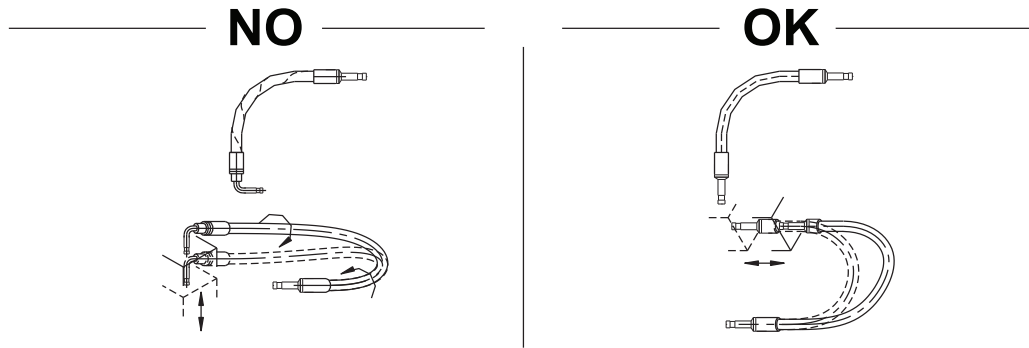
### 4-6.11 Venting Pressure from the Manifold Safety Burst Discs

In the event that the manifold safety burst disc ruptures, some installations may require a method of venting agent to a location outside the cylinder storage room.

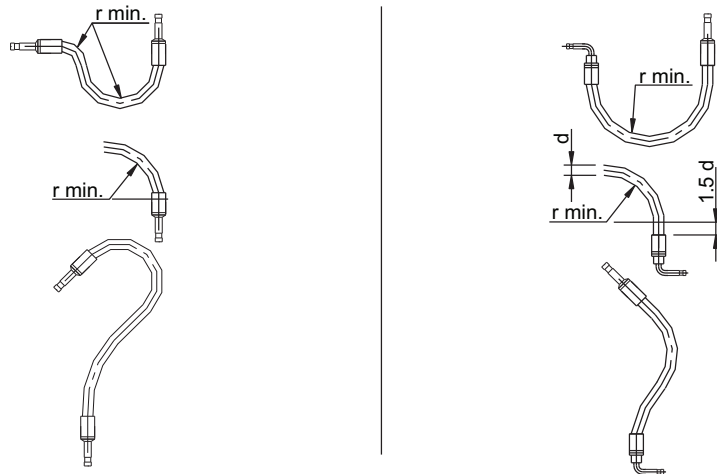
The outlet shall be installed in such a manner as to prevent the discharge from creating a hazard to personnel nearby the release. The vent outlet shall be located at an elevation greater than 6.6 feet (2m) above the ground level, pointing away from any locations likely to be occupied. Use of a nozzle to diffuse the discharge should be considered. The outlet shall be protected against ingress of dust, dirt, water and any contaminants that could disrupt the release.

### 4-7 INSTALLATION OF HOSES

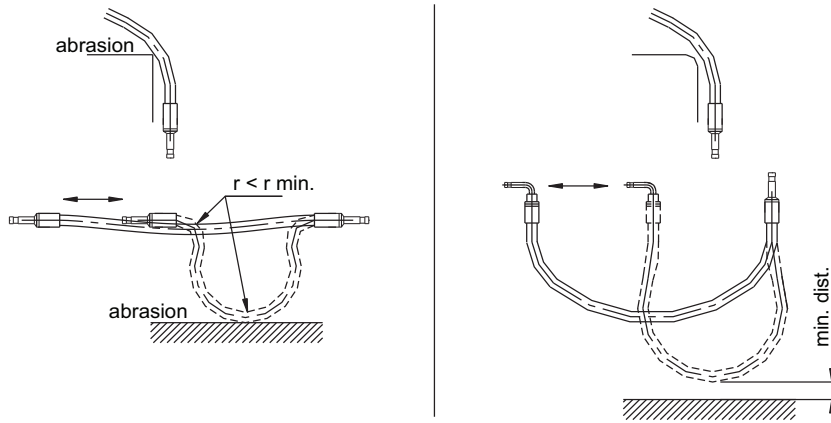
Ensure that hoses are correctly installed and do not exceed the maximum bend radius.



Do not twist the hose when installing as this can lead to damage or incorrect installation.



Do not bend the hose closer than 1.5 times the hose diameter(d) to the ferrule.



Avoid contact with objects that can cause abrasion or damage. On moving applications, pay particular attention to avoid tensile stress or abrasion.

Figure 4-21. Hose Installation

Table 4-13. Minimum Hose Bend Radius

Hose	Minimum Bend Radius
Stainless Steel Actuation Hose	2.99" (76mm)
Discharge Hose	9.6" (240mm)
Back-Plate Manifold Rubber Hose	3.9" (100mm)

### 4-8 DISTRIBUTION PIPE & FITTINGS

Piping should be installed in accordance with good pipe fitting practices. Care should be taken to avoid the potential for restrictions being caused by foreign material, faulty fabrication, or improper installation.

The piping system should be securely supported with due allowance made for agent thrust forces and thermal expansion or contraction. Piping should not be subjected to mechanical, chemical, vibrational, or other damage. Where there is an explosion risk, the piping should be attached to those supports which have been identified as being the least likely to be dislodged.

Open ended pipe sections, selector valves, nozzle ports etc. should be protected against ingress of impurities until the installation is completed.

Although agent piping systems are not subjected to continuous pressurization, ensure that the type of pipe installed can withstand the maximum stress at the maximum storage temperature at the site.

The selected pipe schedule shall always be in accordance with the project specification and accepted by the authorities having jurisdiction.

Lay pipes in such a manner that accumulation of water within the pipe or pipe section is avoided with a slope towards the nozzles. In cases where this isn't possible, provide drain facilities to the pipe sections.

#### 4-8.1 Pipe

Piping must be of noncombustible material having physical and chemical characteristics, such that its integrity under stress can be predicted with reliability. The computer flow program has only been verified for the specific types and schedule of pipe and fittings covered in this manual. There is a risk that the system may not supply the required quantity of agent in unbalanced systems when other pipe types and fittings are used.

#### 4-8.2 Ferrous Piping

Use black steel or galvanized pipe in accordance with Table 4-14, Table 4-15 and Table 4-16.



**Pipe supplied as dual stenciled A-120/A-53 Class F meets the requirements of Class F furnace welded pipe ASTM A-53. Ordinary cast-iron pipe, steel pipe conforming to ASTM A-120, or nonmetallic pipe must not be used.**

**Note:** A shaded cell indicates the pipe size is allowed.

Table 4-14. Allowable Pipe Grade and Size for Use with Natura IGS System Manifold to Selector valves for Sch 40 THDF Per FSSA

NPS Pipe size	Grade					
	A-106C	A-106B A-53B	A-53B ERW	A-106A A-53A	A-53A ERW	A-53F Furnace
1/4						
3/8						
1/2						
3/4						
1						
1-1/4						
1-1/2						
2						
2-1/2						
3						
4						

Table 4-15. Allowable Pipe Grade and Size for Use with Natura IGS System Manifold to Selector valves for Sch. 40 Rolled Groove Fittings

NPS Pipe size	Grade					
	A-106C	A-106B A-53B	A-53B ERW	A-106A A-53A	A-53A ERW	A-53F Furnace
1/4						
3/8						
1/2						
3/4						
1						
1-1/4						
1-1/2						
2						
2-1/2						
3						
4						

Table 4-16. Allowable Pipe Grade and Size for Use with Natura IGS System Manifold to Selector valves for Sch. 80 Threaded Fitting

NPS Pipe size	Grade					
	A-106C	A-106B A-53B	A-53B ERW	A-106A A-53A	A-53A ERW	A-53F Furnace
1/4						
3/8						
1/2						
3/4						
1						
1-1/4						
1-1/2						
2						
2-1/2						
3						
4						

**4-8.3 Fittings**

Fittings shall conform to the requirements of NFPA 2001, 2022 Edition, Sections 5.2.2. Class 150 and cast iron fittings must not be used. Class 400 lb malleable or ductile iron fittings in sizes 3-inch and smaller, or 1000 lb ductile iron or forged steel fittings in sizes greater than 3-inch are to be used. Class 400 flanged joints are acceptable for use in all sizes. Alternately, forged steel fittings can be used.

**Note:** Systems installed in Europe should not use malleable fittings unless approved by the local AHJ.

Pipe size reductions shall be through concentric reducers. Where pipe size reductions occur at flow splits, reducers shall be downstream of the tee.

Fittings of any type shall be a minimum of 10 nominal pipe diameters of length upstream of the entrance to the tee.

Fittings shall be used with a working pressure of not less than 70 bar i.e. EN 10241 (Seamless with test pressure of 150 bar) or BS 3799 (3000 lb) forged steel.



**The calculation software has only been verified for use with the piping, inside pipe diameter and fittings specified in this manual. When unspecified piping and fittings are used for unbalanced systems, there is a risk that the system will not supply the required quantity of agent.**

## 4-8.4 Support of Pipes/Manifolds

### 4-8.4.1 Pipe Spans

The distance between supports should not exceed the distances stated in Table 4-17.

Supports shall be fastened to an adequate structural member by the use of suitable anchors, expansion anchors, plugs, or similar means. Anchors and fastening bolts shall be selected in accordance with the anticipated loads and the dimension of the hole in the relevant bracket.

Table 4-17. Pipe Support Distances

Nominal Pipe Diameter (in)	Max. Span (ft)	Max. Free End (ft)
1/2	4.50	2.50
3/4	5.50	3.00
1	6.50	3.50
1-1/4	7.50	4.00
1-1/2	8.50	4.25
2	11.00	5.50
2-1/2	11.25	5.50
3	12.00	6.00
4	14.00	6.50
5	15.50	6.50
6	17.50	6.50

### 4-8.4.2 Nozzle Supports

Adequate support shall be provided for nozzles and their reactive forces; in no case shall the distance from last support be greater than as follows:

- Nominal pipe diameter of  $\leq 1''$ , Max distance  $\leq 4''$
- Nominal pipe diameter  $> 1''$ , Max  $\leq 10''$

4-8.4.3 Support Details

HANG SUPPORTS TO STEEL BEAM, TYPE A A

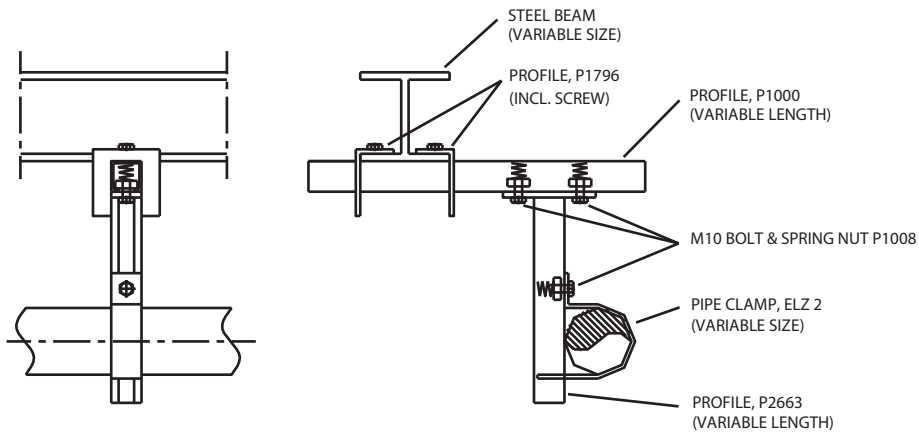


Figure 4-22. Pipe Support Details Type A

HANG SUPPORTS TO STEEL BEAM, TYPE B B

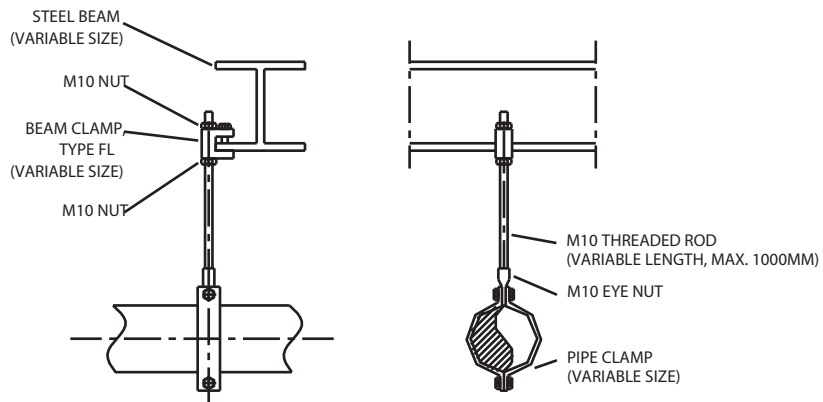


Figure 4-23. Pipe Support Details Type B

HANG SUPPORTS, TYPE C C

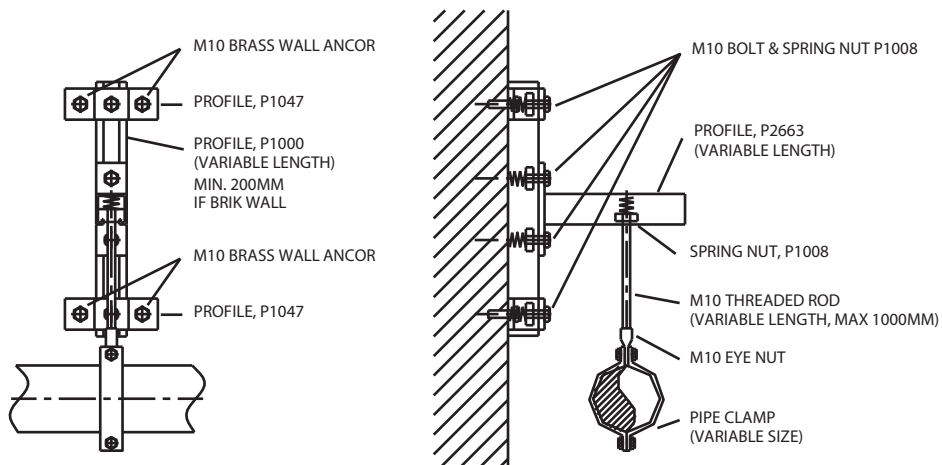


Figure 4-24. Pipe Support Details Type C

HANG SUPPORTS, TYPE **D**

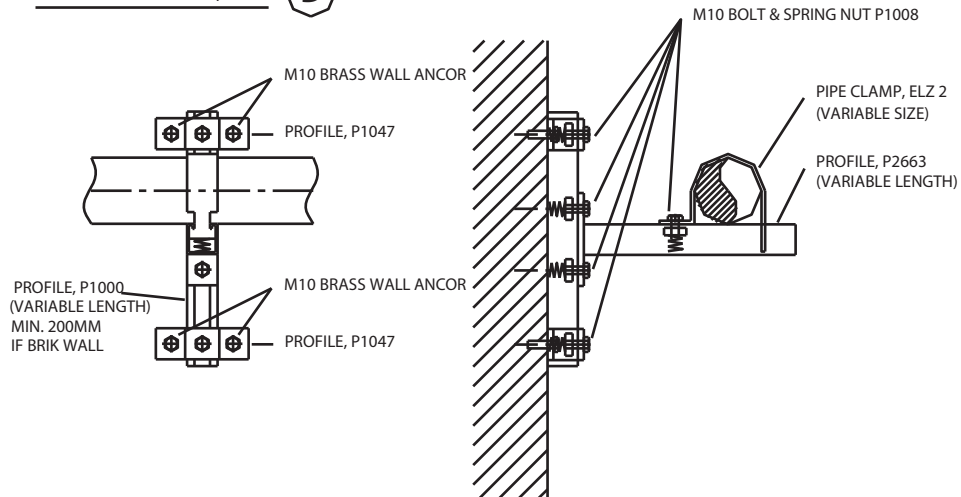


Figure 4-25. Pipe Support Details Type D

FLOOR/WALL SUPPORTS, TYPE **E**

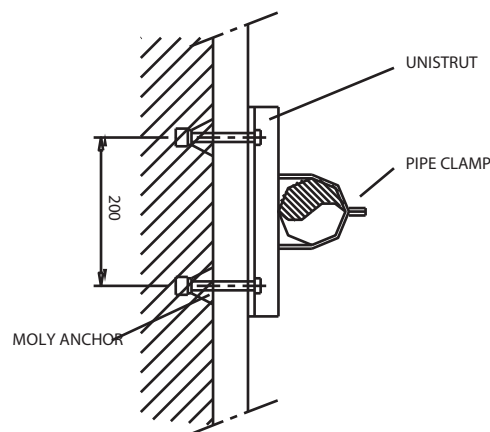


Figure 4-26. Pipe Support Details Type E

WALL PENETRATION, TYPICAL

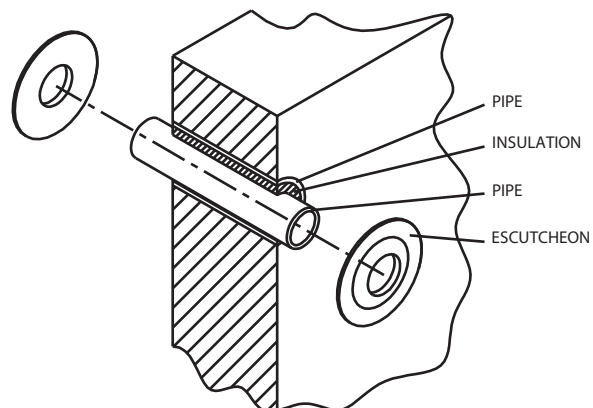
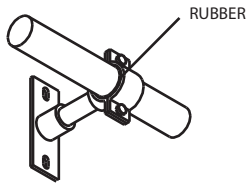
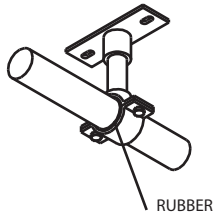


Figure 4-27. Pipe Support Typical Wall Penetration

SUPPORT, WALL



SUPPORT, CEILING



SUPPORT DETAIL

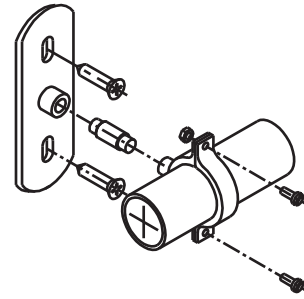
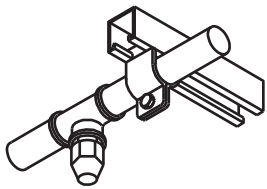
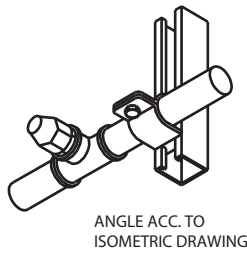


Figure 4-28. Support Details

NOZZLE, CEILING



NOZZLE, WALL



THREADED NOZZLES TYPICAL

NOZZLE DETAILS

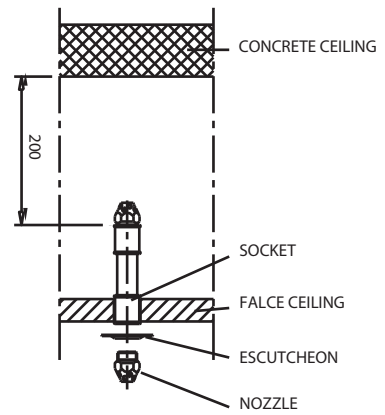


Figure 4-29. Nozzle Details

## 4-8.5 Installation of Pipes

### 4-8.5.1 Cutting

The required length of pipe is measured and marked on the pipe. The pipe is cut at 90° with a cutting machine. After cutting, the pipe end shall be reamed and all burrs removed and all cutting oil shall be removed from both inside and outside of the pipe.

### 4-8.5.2 NPT/BSPT – Threading

Threads on all pipe and fittings must be tapered threads conforming to ANSI Specification B-20.1. or ISO 7-1.

Threads shall be cut to the full cutting length as specified in Table 4-18 and Table 4-19 using a pipe-threading machine. After threading, the pipe shall be cleaned to remove excess cutting oil and any other particulates.

Table 4-18. NPT Thread Length

Pipe Diameter	Length of NPT-Thread		Effective Length of NPT-Thread		Free Length of NPT-Thread	
	mm	Inches	mm	Inches	mm	Inches
1/2"	14.5	0.570	13.56	0.533	0.94	0.037
3/4"	16.0	0.629	13.86	0.545	2.14	0.084
1"	19.0	0.748	17.34	0.682	1.66	0.065
1 1/4"	20.5	0.807	17.95	0.706	2.55	0.100
1 1/2"	20.5	0.807	18.38	0.723	2.12	0.083
2"	22.0	0.866	19.20	0.755	2.80	0.110
2 1/2"	31.0	1.220	29.00	1.141	3.00	0.118
3"	33.5	1.319	30.48	1.200	3.02	0.118

Table 4-19. BSPT Thread Length

Pipe Diameter	Length of BSPT-Thread		Effective Length of BSPT-Thread		Free Length of BSPT-Thread	
	mm	Inches	mm	Inches	mm	Inches
1/2"	14.5	0.570	13.0	0.511	1.50 mm	0.059
3/4"	16.0	0.629	15.0	0.590	1.00 mm	0.039
1"	19.0	0.748	17.0	0.669	2.00 mm	0.078
1 1/4"	20.5	0.807	19.0	0.748	1.50 mm	0.059
1 1/2"	20.5	0.807	19.0	0.748	1.50 mm	0.059
2"	22.0	0.866	20.0	0.787	2.00 mm	0.078
2 1/2"	31.0	1.220	27.0	1.062	4.00 mm	0.157
3"	33.5	1.319	30.0	1.181	3.50 mm	0.137

After the thread has been cut it is recommended that the crest and root of the thread is truncated (shortened) a minimum of  $0.033 \times p$  (pitch of thread) in order to ease adherence of the packing material.

**Note:** When assembling NPT and BSPT threads, a distance between the two parts will always be visible.

### 4-8.5.3 Grooved Joining

Rolled grooved joining may be used for Natura IGS systems. If such fittings are to be used then the supplier must be consulted to verify maximum working pressure.

### 4-8.5.4 Installation of Pipes

Pipe and fittings must be installed in strict accordance with the system drawings and good pipe fitting practices. The piping between the cylinder and the nozzles must be the shortest route possible, with a minimum of fittings. Any deviations in the routing or number of fittings must be approved by the design engineer before installation.

Piping must be reamed free of burrs and ridges after cutting, welding or threading. All threaded joints must conform to ANSI B1-20-1 or ISO/IEC Guide 7 as appropriate. Joint compound or thread tape must be applied only to the male threads of the joint, excluding the first two threads. Welding must be in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. Each pipe section must be swabbed clean internally, using a non-flammable organic solvent.

All piping must be blown clear with dry nitrogen or compressed air before installing the discharge nozzles.

The piping must be securely braced to account for discharge reaction forces and thermal expansion/contraction. Care must be taken to ensure the piping is not subjected to vibration, mechanical or chemical damage. All hangers must be UL Listed, must conform to general industry standards for pipe hangers and conform to ANSI B-31.1. Refer to ANSI B-31.1 for additional bracing requirements.

Dirt traps at least 2-inches (50 mm) in length must be installed at the end of each pipe run.

Care shall be taken that the pipe ends extend into fittings sufficiently.

Pipe runs shall, unless otherwise specified, be horizontal/vertical. Pipes in areas where condensation may be expected may be laid (sloped) in such a manner that avoidance of accumulation of water within the pipe or pipe section is prevented. In cases where sloping is not possible, the pipe sections shall be provided with drain facilities.



**Should site conditions demand major alterations to the pipe layout, notification shall be given to the design engineer on a marked up copy of the relevant drawings for updating and preparation of new 'as-built' flow calculations. The design engineer will evaluate the new pipe runs and determine whether modifications to the design are needed.**

**The design engineer shall approve the new pipe run before installing of the pipes.**

### 4-8.5.5 Threaded Pipe Assemblies

For pipe thread fittings sealed using a metal-to-metal connection, the metal of the male and female fittings deforms during installation to create this seal. As a result, pipe thread connections tend to leak after a connection is made and then disassembled and re-assembled. If the connection leaks after re-assembly, you may need to replace one or more of the fittings. Continuing to tighten the connection will not necessarily eliminate the leak and can easily result in a split fitting or port.

1. Inspect port and fitting to ensure that both are free of contaminants and excessive burrs and nicks.
2. Apply a stripe of an anaerobic liquid pipe sealant around the male threads leaving the first two threads uncovered. If no liquid sealant is available, wrap Teflon™ tape 2-1/2 turns in a clockwise direction, viewed from the pipe end, leaving the first two threads uncovered (only use tape suitable for gas applications).



**Teflon tape and some pipe sealants are destructive to pneumatic components. Always use extreme caution and follow manufacturer's recommendations for proper application of any sealant in order to prevent contamination.**

3. Screw hand-tight into the port.
4. Wrench tighten the fitting. When installing elbows or tees, consider final orientation position as to not require excessive tightening to fit properly. A properly assembled fittings total thread engagement should be 3.5 to 6 turns.

### 4-9 TEST OF PIPEWORK

Each nozzle location or the last nozzle location on each branch should be blanked off, pressurized, and blown through using either an air compressor (dry air) or dry nitrogen.

### 4-10 NOZZLE INSTALLATION

After the system piping has been leak tested and blown free of debris, install the discharge nozzles in strict accordance with the approved installation drawings and good pipe fitting practices. Orient the nozzles as shown on drawings. Make certain the correct nozzle type, part number, and orifice size are installed in the proper locations. Ensure that the nozzles are securely tightened to the piping.



**Ensure that each applicable nozzle type, part number, and orifice code is matched to the appropriate location for each node. Failure to do so could compromise of the system ability to suppress a fire.**

An agent discharge nozzle consists of the following items:

- Project Specific Orifice Plate
- Nozzle Body
- Orifice Securing Ring

Nozzles have a female taper thread; (NPT or BSPT) or as specified in the project documentation. The orifice diameter is identified on the hexagon of the nozzle.

Care shall be taken that the nozzles are complete (orifice plate inserted and secured) and that no damage to the thread has occurred.

**Note:** Dirt traps at least 2-inches (51 mm) in length, consisting of a barrel nipple and blanking cap must be installed at the end of each pipe run that has a nozzle.

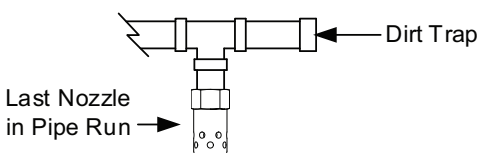


Figure 4-30. Nozzle with Dirt Trap

### 4-11 PRESSURE TESTING OF PIPEWORK

It is recommended that the pressure testing is performed prior to the cylinder bank assembly. Once installation of the open ended pipe work is complete, all nozzle connections shall be plugged. and the pipe shall be pressure tested in accordance with national standards. Manifolds and other closed section pipe work, such as selector valves, are pressure tested by Kidde Fire Systems.

#### 4-11.1 Precautions

Pneumatic testing involves the hazard of energy stored in compressed gas. Particular care must therefore be taken to minimize the chance of failure of brittle components during a pneumatic test.

Use dry compressed air or the agent for pressure testing. All due precautions shall be taken to prevent injury to personnel while the pipes are under pressure. Always maintain a safe distance from the pipe work. Evacuate all areas affected both prior to and during the pressure test. Conduct the pressure test from outside the room containing the pipe work.

The compressed air or agent pressure must be applied slowly through a pressure regulator. When a pressure of approximately 3 bar is attained, a preliminary check shall be made, including examination of joints and fittings.

#### 4-11.2 Pressure Testing Using Gas

Follow this procedure to pressure test the pipework:

1. Disconnect the pipe downstream of the manifold and fit the distribution pipe inlet with a test valve which incorporates a hose connection to the pressure testing equipment (union/flanged connection to be supplied locally).

If no union/flanged connection has been installed one of the manifold check valve connections may be used or connect compressor with longer hose to one of the nozzle locations (with nozzle removed) and remaining nozzle locations blanked off, before pressurizing to 3 bar ensure discharge hoses are disconnected from cylinder valves.

2. Disconnect all discharge hoses from the manifold.
3. Connect the pressure testing equipment to the test valve or manifold check valve (3/4" BSP).
4. Slowly apply compressed air or nitrogen through a pressure regulator. When a pressure of 3 bar is attained, make a preliminary check, including examination of joints and fittings. After the inspection, check for pressure loss of no more than 20% (0.6 bar) in 10 minutes.

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## 4-12 SIGNS AND LABELING

### 4-12.1 Storage Room

All doors to the system storage room shall be marked with a sign with the following text (in the local language):

“CAUTION!

Inert Gas Cylinder Storage Room

Before entering ensure doors are secured in the OPEN position”

**Note:** Where practicable the access to storage room and route for moving cylinders to the storage room should have access restricted during installation, this can be achieved using cones coupled with red and white warning flash tape.

### 4-12.2 Cylinder

Each cylinder shall be labeled with the following:

- Agent Instruction label: This label shall be attached on the front of the cylinders and at same height. The purpose of the label is to provide filling information, transport/safety information, inspection information and general precautions to be taken during reinstallation of the cylinder.
- Agency Label: Label listing the approving agencies.
- Gauge Port Label: Located on the cylinder shoulder and shows the location of the port for the release unit or secondary cylinder gauge. Use this to help align cylinders without needing to remove the safety transport cap.

### 4-12.3 Selector Valves

Each selector valve shall be provided with a sign or label clearly stating the name of the associated protected space to which the valve shall direct the agent.

### 4-12.4 Protected Enclosure

#### 4-12.4.1 Access Doors

Doors leading to and from the protected area to be fitted with appropriate signs (P/N 85-909300-001 and 85-909300-002), or signs in local language with same text that comply with associated National Standards.

All doors from an area protected by a gaseous extinguishing system should open outwards and be fitted with automatic door closing devices.

### 4-12.5 Warning Alarms

Audible and visual alarms to be provided within the protected space, such alarms shall continue to operate after discharge until all appropriate action has been taken.

#### 4-12.5.1 Pressure Relief Vents

Relief vent openings (except at high level) to display warning sign, “Vent for Inert Gas - Keep Clear” (P/N 01-2172-0200).

## 4-13 ELECTRICAL INSTALLATION

The cable routing plan shall include all electrical components including detailed loop information and the cable quality to be used, such as; mm sq, rating IEC, braiding, twisted cores, required material and color of the outer sheath, bending radius, max. distance between supports/strapping, 90° crossing etc.

Also the cable routing plan shall include notes regarding maximum distances allowed for parallel runs, minimum distances between control and power cables (normally 500 mm), and separate cable ways/trays to be used etc.

### 4-13.1 Release Unit/Secondary Cylinder Gauge Assembly Wiring

**Note:** Release unit solenoids must be continuously powered during system discharge.

Connect the release unit/secondary cylinder gauge assembly as indicated on the electrical wiring diagram and terminate in the allocated terminals in the control panel/junction box.

The release units are wired separately. The secondary cylinder gauge assembly should be connected in a single loop configuration (between cylinders) using the quick connect cable joiners provided.

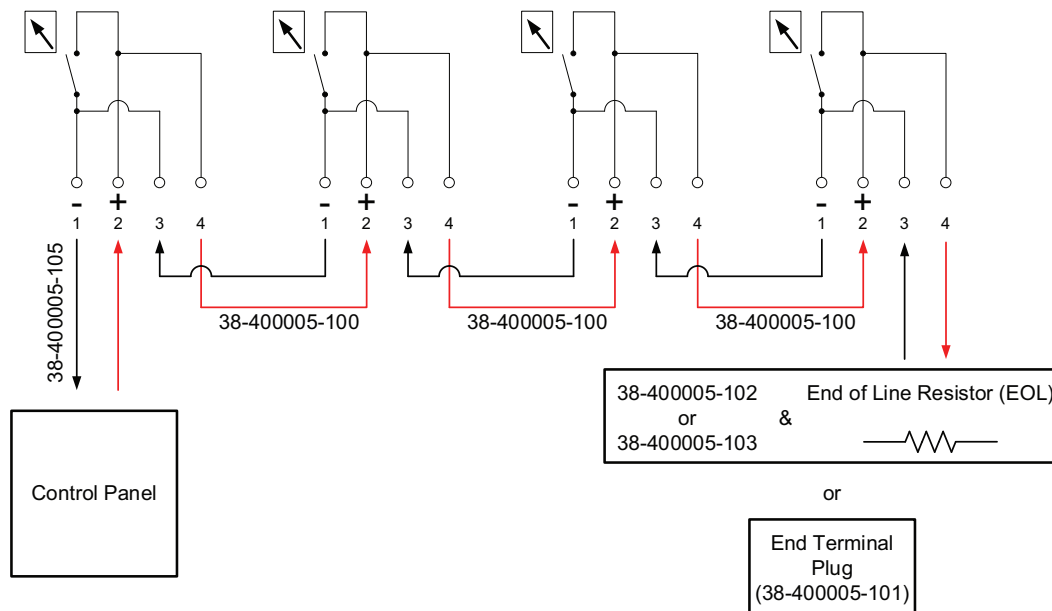


Figure 4-31. Quick Connect Wiring Example

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## 4-13.2 Solenoid Valve, Release And Selection

In order to avoid accidental release of the system, it is recommended that the solenoid release units only be fitted to the cylinder valve after the control panel has been finally commissioned and found to operate as intended.

**Note:** Never attempt to relocate the solenoid valve from its mechanical position; twisting or turning the solenoid valve will result in a leak.

Cable(s) between the control panel and the cylinder bank should, at a minimum, be one pair cable 17 AWG (1.0 mm<sup>2</sup>) in accordance with IEC 331/332 or in accordance with the requirements for the control installation.

Max. cable length of 246' in order to limit power loss, max. 5% power from the panel to the coil.

It is recommended that each cable/core between the release and control panel and the cylinder bank has a cable identification number in accordance with the wiring diagram or otherwise agreed.

It is recommended that each core has an identification number corresponding to the terminal number into which it is terminated.

Minimum recommended bending radius for 20 AWG (0.5 mm<sup>2</sup>) single pair cable: 3.15" (80 mm) (should always be verified against the manufacturer recommendations).

Cables should be secured to cable trays (or an alternative solid construction element) with cable strips or other suitable means (according to normal practice)

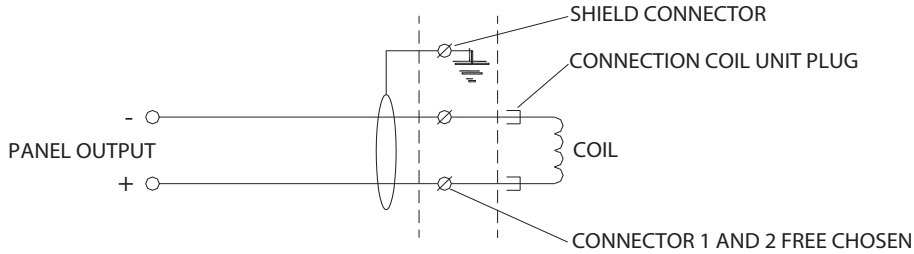
Junction boxes supplied by others recommended having terminals suitable for up to 14 AWG (2.5 mm<sup>2</sup>).

Junction boxes should be provided with an identification tag number in accordance with the system-wiring diagram or as otherwise agreed.

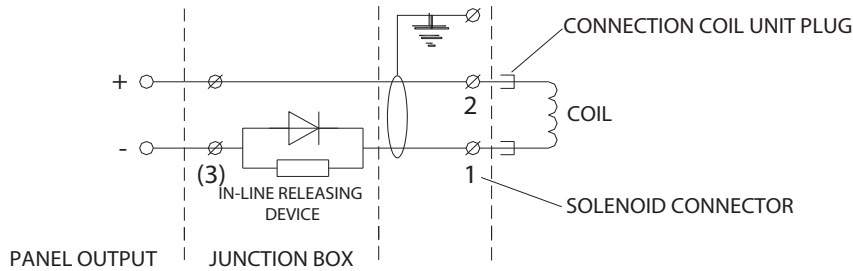
4-14 TYPICAL WIRING DETAILS

SOLENOID CONNECTION

24V DC SOLENOID CONNECTION TO NON POWER LIMITED RELEASE CIRCUITS:



24V DC SOLENOID CONNECTION TO REVERSIBLE VOLTAGE MONITORING OUTPUTS, GK TYPE 3010-1010



OTHER EOL VALUES POSSIBLE, REFER TO PANEL SPECIFICATIONS. IN-LINE RELEASING DEVICES TO BE POSITIONED CLOSE TO COIL.

NOTE: A MAINTENANCE BYPASS SWITCH MUST BE USED ON EACH AGENT RELEASE CIRCUIT

Figure 4-32. Typical Wiring Details

**Note:** For more details, refer to the control panel manuals.

**4-15 PRESSURE OPERATED SWITCHES**

Pressure operated switches must be connected to the pilot piping or discharge manifolds as shown in Figure 4-33 and Figure 4-34. The preferred mounting position is upright. Both the standard and explosion-proof pressure switches have 1/2-inch NPT pressure inlets to connect to the piping. The electrical connections are through 1/2-inch conduit knockouts for the pressure operated switch (P/N 81-486536-000) or 1-inch NPT fittings for the hazardous location pressure switch (P/N 81-981332-000). The minimum operating pressure required is 50 PSI.

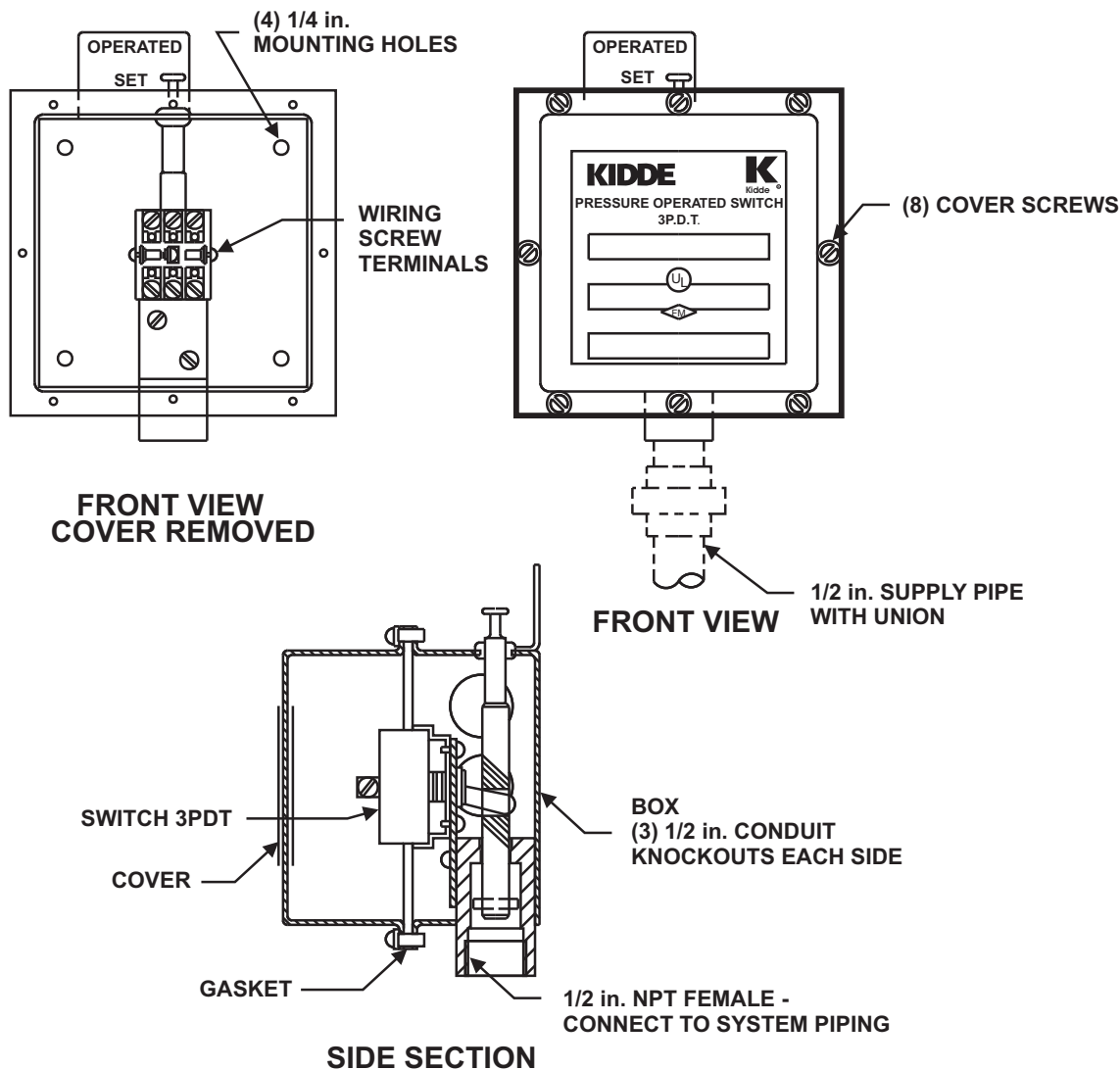


Figure 4-33. Pressure-Operated Switches

1 in. NPT FEMALE BOTH ENDS  
FOR ELECTRIC CONNECTION.  
SWITCH SUPPLIED WITH (2)  
1 in. NPT PIPE PLUGS

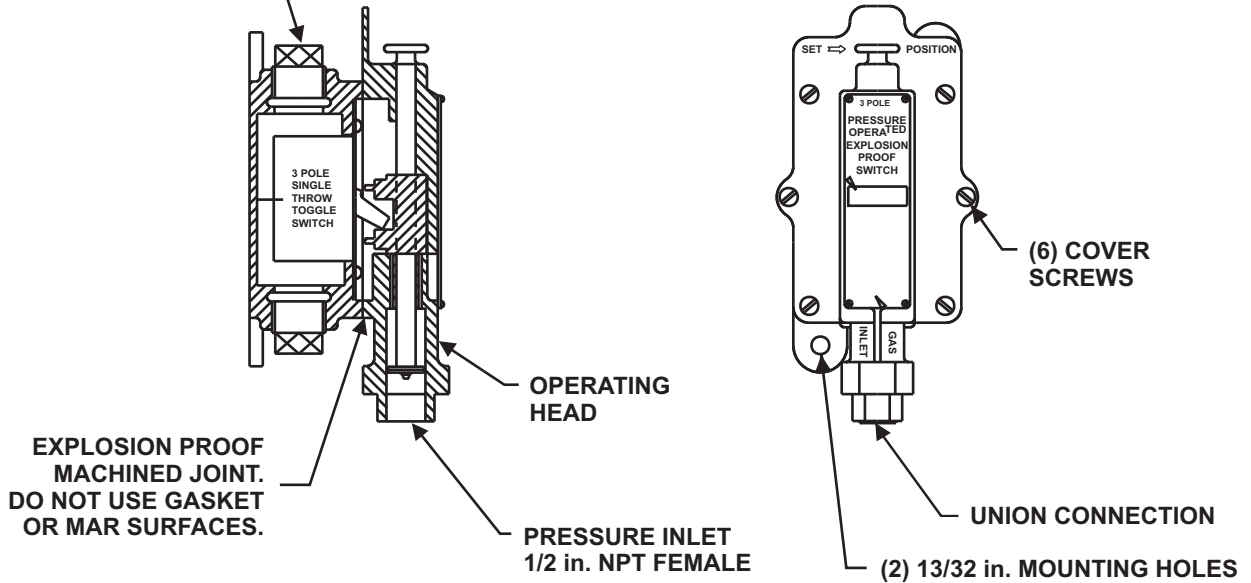


Figure 4-34. Pressure Operated Switches, Hazardous Location

#### 4-16 PRESSURE OPERATED TRIP

Install the pressure operated trip as shown in Figure 4-35. Connect the trip to the discharge piping with 1/2-inch schedule 40 pipe. The minimum operating pressure required is 50 PSI. The maximum load on the retaining ring is 100 pounds.

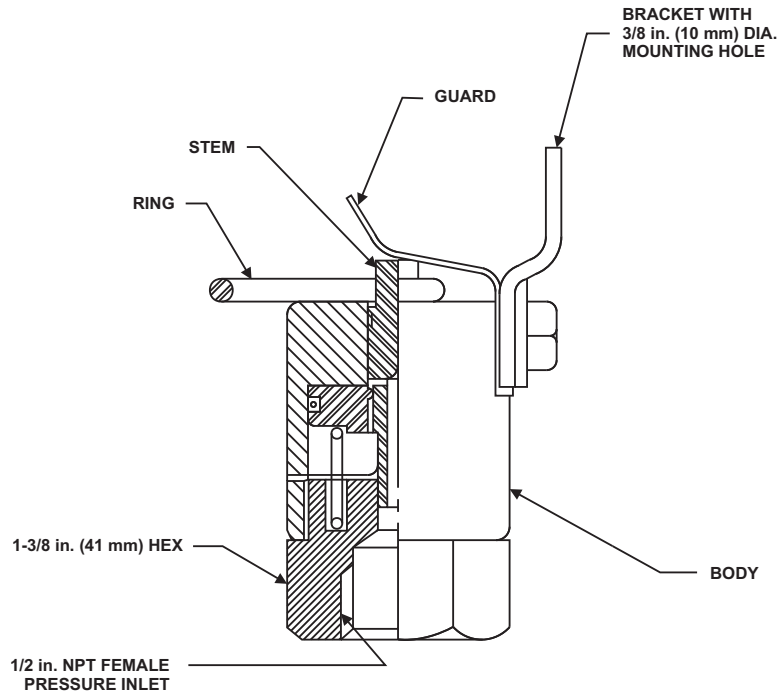


Figure 4-35. Pressure Operated Trip

## 4-17 NITROGEN PILOT CYLINDER ACCESSORIES INSTALLATION

Use the nitrogen pilot cylinders to drive either nitrogen time delays or sirens.

### 4-17.1 Installation of Nitrogen Pilot Cylinder, P/N 85-877690-001 and Mounting Bracket, P/N WK-877845-000

Follow these instructions to install the 108 cu.in. Nitrogen pilot cylinder:

1. Locate the nitrogen cylinder mounting bracket in an area where the cylinder valve assembly and control head will be protected from inclement weather by a suitable total or partial enclosure, preferably adjacent to the agent storage cylinders.
2. Install the mounting bracket clamps and hardware. Install the nitrogen cylinder in position in a mounting bracket; tighten sufficiently to hold the cylinder in place while allowing the cylinder enough free play to be rotated.
3. Turn the cylinder until the discharge outlet is in the desired position. The nitrogen cylinder must be positioned so that control head is readily accessible during manual operation.
4. Securely tighten the mounting bracket clamps and hardware.
5. Attach the adapter (P/N WK-699205-010) and connect the nitrogen lines.

### 4-17.2 Nitrogen Pilot Cylinder Installation, 1040 cu. in. P/N 85-101040-001



**Nitrogen cylinders must not be moved unless the discharge and control heads are removed and protection caps installed. Failure to follow these instructions could result in inadvertent discharge, injury, death or property damage.**

The nitrogen pilot cylinders must be located as close to the hazard area as possible. The storage location must be protected from the elements and maintained at a temperature between 32°F (0°C) and 130°F (54°C). External heating and/or cooling may be required to maintain this temperature range. Cylinders should be raised at least 2 in. (50 mm) from the floor using a suitable bracket or blocks if the area is regularly washed down or is subject to environmental wetting.

Single cylinders should be installed using two straps, P/N WK-270014-000, installed at the heights shown in Figure 4-36. See Table 4-20 for strap dimensions.

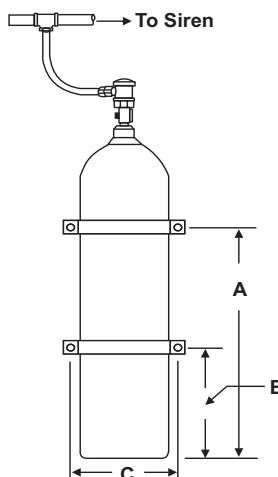


Figure 4-36. Typical 1040 cu. in. Nitrogen Pilot Cylinder Strap Installation  
Table 4-20. 1040 cu. in. Nitrogen Pilot Cylinder Strap Installation Dimensions

Part Number	Description	A		B		C	
		in.	mm	in.	mm	in.	mm
85-101040-000	1040 cu. in.	21 to 22	533 to 559	6 to 8	152 to 203	10.4	264

## Installation

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Before connecting cylinders into the siren pipework, tighten straps until there is clearance enough to allow the cylinders to be rotated in place if required. Tighten fully when all components are correctly positioned.

1040 cu. in. cylinders being installed as siren drivers, should have the add-on label P/N 06-231866-518 (siren driver) affixed to the area at the center of the cylinder label (rectangle with the dotted line) to indicate the function of the unit.

**Note:** The label is supplied with the unit.

### 4-17.2.1 Installation of Flexible Discharge Hose, P/N WK-251821-000 or WK-264986-000

Connect the discharge hose to the piping or manifold as shown on the system drawings. Apply Teflon tape or pipe jointing compound to the male threads. Ensure that the manifold or system piping is at the correct height and the cylinder is correctly positioned such that the hose, when installed, will not be kinked or flattened when installed.



**Discharge hoses must always be connected to the system piping and to the discharge heads before attaching the discharge heads to the cylinder valves, in order to prevent injury in the event of an inadvertent discharge.**

### 4-17.2.2 Installation Of Discharge Head, P/N WK-872450-000

Attach the discharge head to the flexible discharge hose. The hose must be already attached to the system piping. Do not connect discharge head(s) to the pilot cylinder valve(s) until all flex hoses and discharge heads are installed on a common manifold. Install the discharge head to the pilot cylinder valve as follows:

1. Remove protective cap from the cylinder valve and ensure that the sealing surfaces are clean.
2. Verify that the discharge head o-rings are correctly seated in their grooves in the swivel nut. O-rings must be free of dirt and other contaminants. The o-rings are lightly lubricated at the factory and should not require further lubrication.
3. Ensure that the pilot orifice, located between the inner and outer o-ring seals, is unobstructed,
4. Install the discharge head on the cylinder valve and tighten securely.

### 4-17.3 Installation of Control Heads to Pilot Cylinders

- Electric to N<sub>2</sub> 1040 cu. in. pilot cylinder (Type "I" Valve)
- Electric to N<sub>2</sub> 108 cu. in. pilot cylinder
- Lever/Pressure Operated to N<sub>2</sub> pilot cylinder

**For field wiring installation applicable to ATEX and IECEx certification the following specific conditions of use apply:**

- **The flameproof joints of the equipment are not intended to be repaired. Consult the manufacturer if repair of the flameproof joints is necessary.**
- **A suitably certified conduit sealing device must be installed at the threaded entry and connected to a certified Ex d or Ex e rated terminal box.**

**For US and Canada Explosion proof installations, seal all conduits within 18 inches from the end of the component.**



### 4-17.3.1 Installation of Electric Control Heads to N<sub>2</sub> 1040 cu. in. Pilot Cylinder



The placement supervision signal is not a substitute for ensuring proper interlock of the actuator plunger to the pilot check assembly. Make sure the control head is properly seated.

When installed on the nitrogen pilot cylinder, the Control Head Monitor is not completely snug against the valve, allowing for easier attachment of the conduit.



Before installing a control head on a pilot cylinder valve, ensure the control head is in the SET position (that is, the actuating pin is in the fully retracted or SET position). Failure to position the control head in the SET position will result in accidental discharge and possible personal injury when the control head is installed on the siren valve.

1. Remove the protection cap from the nitrogen pilot cylinder actuation port. Ensure the control head is in SET position (The actuating pin is in the fully retracted or SET position).
2. Insert the Control Head Monitor between the control head and the cylinder actuation port.

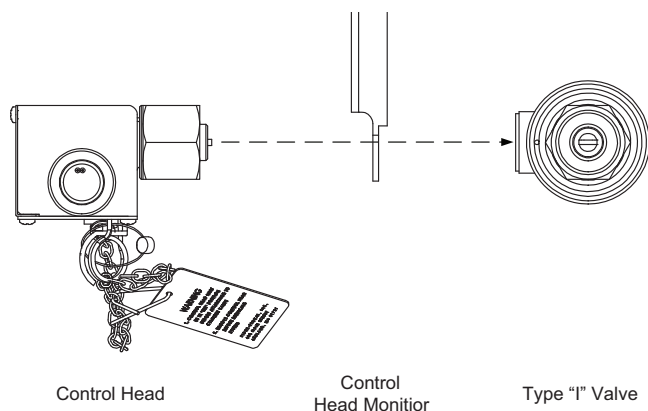


Figure 4-37. Control Head and Placements Supervision Component Installation to Type "I" Valve, Top View

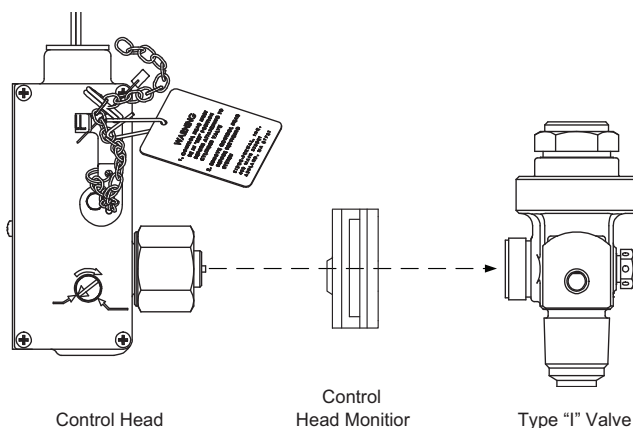


Figure 4-38. Control Head and Placements Supervision Component Installation to Type "I" Valve, Side View

3. Install the electric control head on the cylinder actuation port. Tighten the swivel nut.

**Note:** When installed, the Control Head Monitor does not sit completely snug against the valve. This play allows for easier attachment of conduit to the component.

4. Make all electrical connections.

### 4-17.3.2 Installation of Electric Control Head to 108 cu. in. Nitrogen Pilot Cylinder



The placement supervision signal is not a substitute for ensuring the proper interlock of the actuator plunger to the pilot check assembly. Make sure the control head is properly seated.

**IMPORTANT:** Do not use a control head monitor, (herein referred to as “CHM”), with a round front on a Nitrogen Pilot cylinder with non-ATEX Supervisory Pressure Switch (P/N: 06-129773-001, -002, -003, and -004). In this case, use a CHM with a flat front manufactured after October 2019 (Date code: 10-19), to avoid interference with supervisory pressure switch.

Follow these steps to install a Nitrogen pilot cylinder:

1. Install mounting bracket clamps and hardware.
2. Install the nitrogen pilot cylinder in the mounting bracket, ensuring the gauge is forward facing. Tighten the clamps sufficiently to hold the cylinder in place while allowing the cylinder enough free play to rotate.

**Note:** If the discharge port is too close to a wall or obstruction, install the N<sub>2</sub> pilot cylinder bracket using a spacer such as a Unistrut<sup>®</sup> channel setup as shown in Figure 4-39. One section of Unistrut may not create enough space. Ensure the spacer is structurally sound and can support the weight of the components.

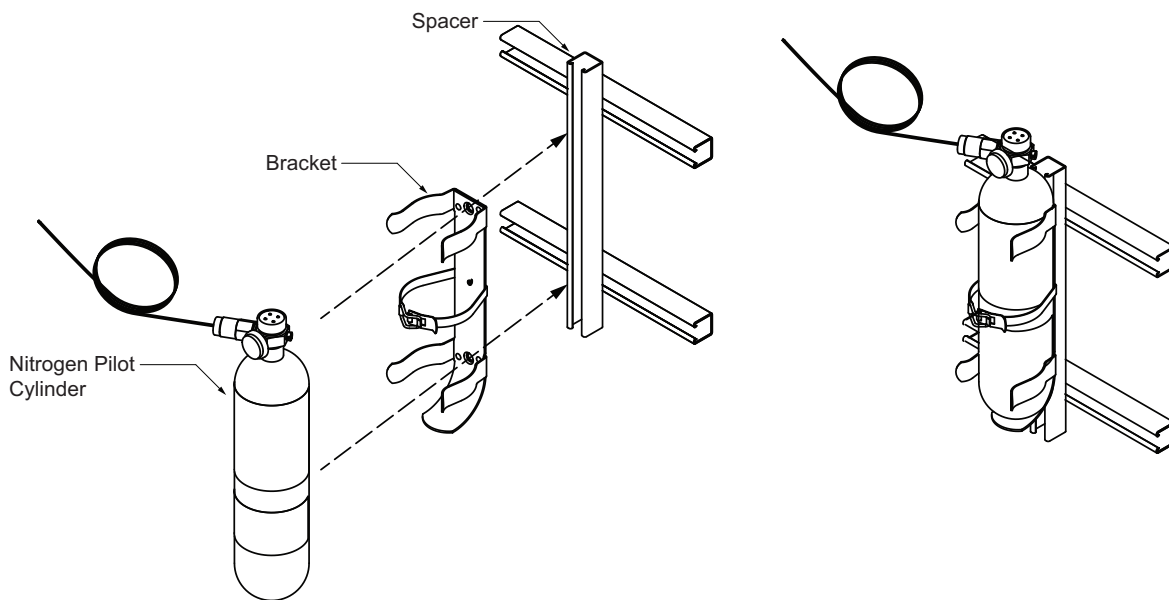


Figure 4-39. Nitrogen Pilot Cylinder with Bracket and Spacer

3. Turn the cylinder until the cylinder valve discharge outlet is in the desired position.
- Note:** The cylinder must be positioned so that the gauge is accessible and the control head is readily accessible during manual operation. Additionally, the CHM should face opposite any supervisory pressure switch and should not rest against the pressure gauge.
4. Securely tighten mounting bracket clamps and hardware.
  5. Remove the protective cap from the cylinder valve actuation port.
  6. Insert the CHM between the control head and the cylinder valve actuation port as shown in Figure 4-40 and Figure 4-41. Make sure the safety burst disc outlet port lines up and sits in the slot on the underside of the CHM.

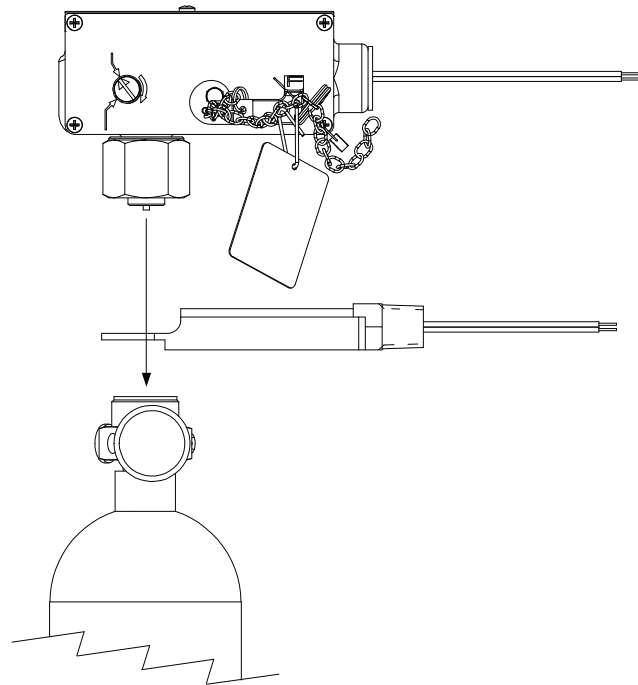


Figure 4-40. Installation Side View

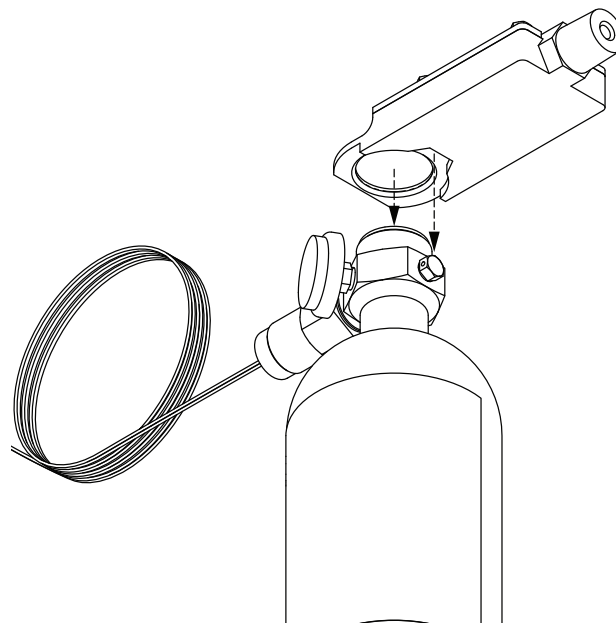


Figure 4-41. Installation Isometric View

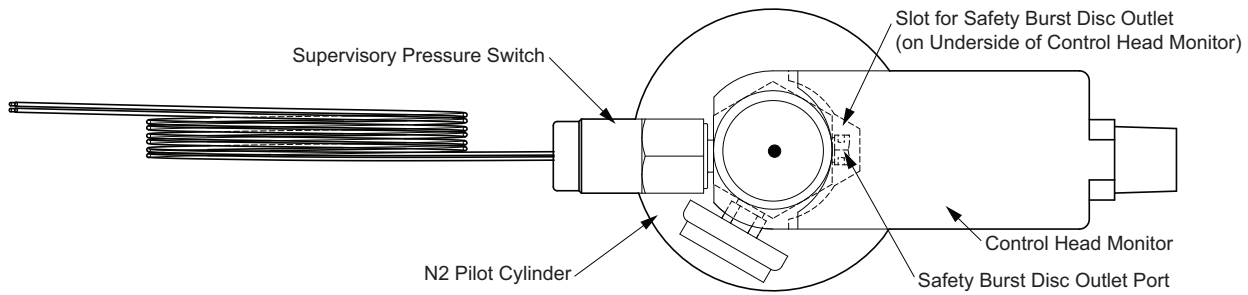


Figure 4-42. Control Head Monitor and Pilot Cylinder, Top View, no Control Head Shown

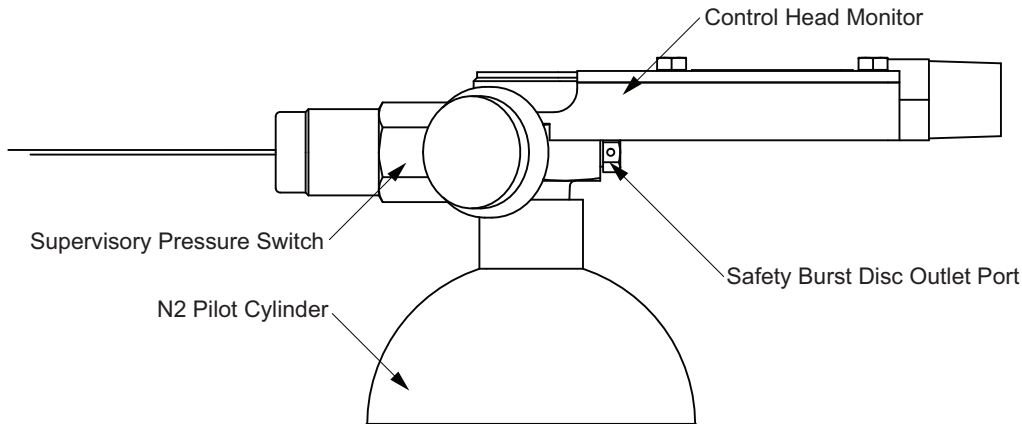


Figure 4-43. Control Head Monitor and Pilot Cylinder, Side View

**Note:** Position the CHM so that the main body is opposite the supervisory switch (see Figure 4-43) For additional confirmation of proper positioning, the underside of the CHM's body has a slot that sits above the safety disc on the valve (see Figure 4-42 and Figure 4-43).



**Ensure the control head is in the SET position (that is, the actuating pin is in the fully retracted or SET position) before attaching the control head to the cylinder valve. Also, ensure the safety pin is installed and secured. If the control head is not in the SET position, agent will accidentally discharge.**

7. Attached the control head to the nitrogen pilot cylinder valve body by hand threading the swivel nut onto the mating threads of the valve. Hand thread the swivel as far as possible.
8. Using the two available flats of the valve body, hold the valve body while using a wrench on the flats of the swivel nut to secure the control head. Tighten the control head swivel nut until the nut is tight and the control head body does not swivel further. Tighten the swivel nut to approximate 55-60 ft-lbs of torque.
9. Attach necessary adapter and connect the nitrogen pilot lines.

**IMPORTANT:** The CHM body should not be held down tight by the swivel nut of the control head. Some play or movement of the CHM body is acceptable, and the CHM should not touch the supervisory pressure switch or the gauge.

### 4-17.3.3 Installation of Lever or Lever/Pressure Operated Control Head



**Ensure that pilot line is non-pressurized and the actuating pins are in the retracted (SET) position. Failure to follow this procedure will cause the pilot cylinder to discharge accidentally when the control head is installed on the cylinder valve.**

1. Ensure control head is in the SET position with the safety pull pin and seal wire intact.
2. Remove the protection cap from the cylinder valve actuation port.
3. Install the lever/pressure operated control head using a suitable wrench. Tighten securely to a torque of 55ft-lb.
4. Connect the actuation line to the pressure port using the appropriate adapter.



**When attaching the Lever or Lever/Pressure operated control head to the valve, the swivel nut must be tightened to a torque of 55ft-lb. Failure to tighten the swivel nut may result in leakage during actuation.**

### 4-17.4 Installation of Discharge Delay, P/Ns 81-871072-001 and 81-871072-002

**Note:** Discharge Delay P/N 81-871072-001 is included in the kit P/N 38-401140-030. Discharge Delay P/N 81-871072-002 is included in kit P/N 38-401140-060. Both kits include the corresponding delay and the necessary adapters for connecting to the system.

The discharge delay must be installed in the pilot line, as shown on the system drawings. The discharge delay must be securely mounted to a structural member by securing the attached pipework (use channel mount pipe clamp or equivalent with a load rating equal to or greater than 400 lb.). Make certain the inlet and outlet ports are properly oriented and the arrow is in the direction of flow. Both ports have 3/4 in. NPT fittings for connection to the pipe. A lever operated control head must be installed on each discharge delay. Operation of the control head will override the timing cycle. Make certain the control heads are installed in their "SET" or non-operated position.

**Note:** The discharge delay units are factory set to give the nominal rating minus zero, plus 20% per NFPA 2001 latest edition and UL-2166. The nominal ratings are indicated in Table 4-21. The actual delay achieved in service is dependent on the ambient conditions.

Table 4-21. Nitrogen Discharge Delay Rating

Part Number	Cylinder	Nominal Rating (seconds)
81-871072-001	108 cu. in.	34
81-871072-002	108 cu. in.	61

**4-17.4.1 Connecting Discharge Delay to the Pressure Regulator and Cylinder Valve**

Follow these steps when connecting the discharge delay to the pressure regulator and valve.

1. After installing the discharge delay, connect the 3/4" male NPT x 1/4" NPT female bushing adapter to the outlet on the discharge delay.
2. Screw the 1/4" BSPP male x NPT male adapter into the bushing adapter.
3. Connect the adapter to the back-plate manifold hose (P/N 01-3273-1200).

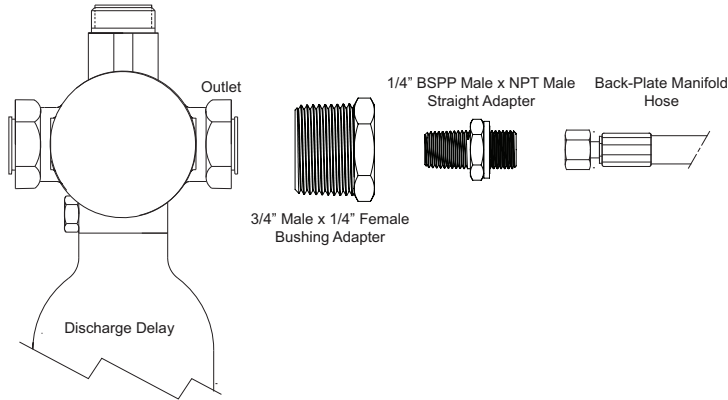


Figure 4-44. Discharge Delay Outlet Adapters and Hose

4. Mount the Pressure Regulator and connect the back-plate manifold hose to the inlet on the pressure regulator.
5. Insert the copper washer into the 1/4" BSPP female end of the 1/4" BSPP female x NPT male straight adapter.

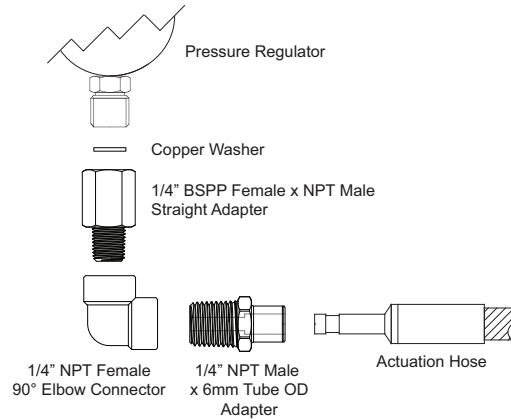


Figure 4-45. Pressure Regulator Outlet Adapters and Hose

6. Screw the 1/4" BSPP female end of the 1/4" BSPP female x NPT male straight adapter onto the outlet of the pressure regulator.
7. Connect the 1/4" NPT female 90° elbow connector to the male end of the 1/4" BSPP female x NPT male straight adapter.
8. Screw the threaded male end of the 1/4" NPT male x 6mm Tube OD adapter into the 90° elbow connector.
9. Connect an actuation hose (P/N 38-401110-X00 or 38-401130-X00) into the tube end of the 1/4" NPT male x 6mm Tube OD adapter. Make sure to push the actuation hose in fully.



**Ensure the actuation hose is fully inserted into the release unit. There should be a gap of no more than 1/4" (6 mm) between the end of the Quick Connect on the actuation hose and the shoulder of the release unit Quick Connect.**

10. Do not connect the actuation hose the cylinder valve at this time. That should be performed during final commissioning.

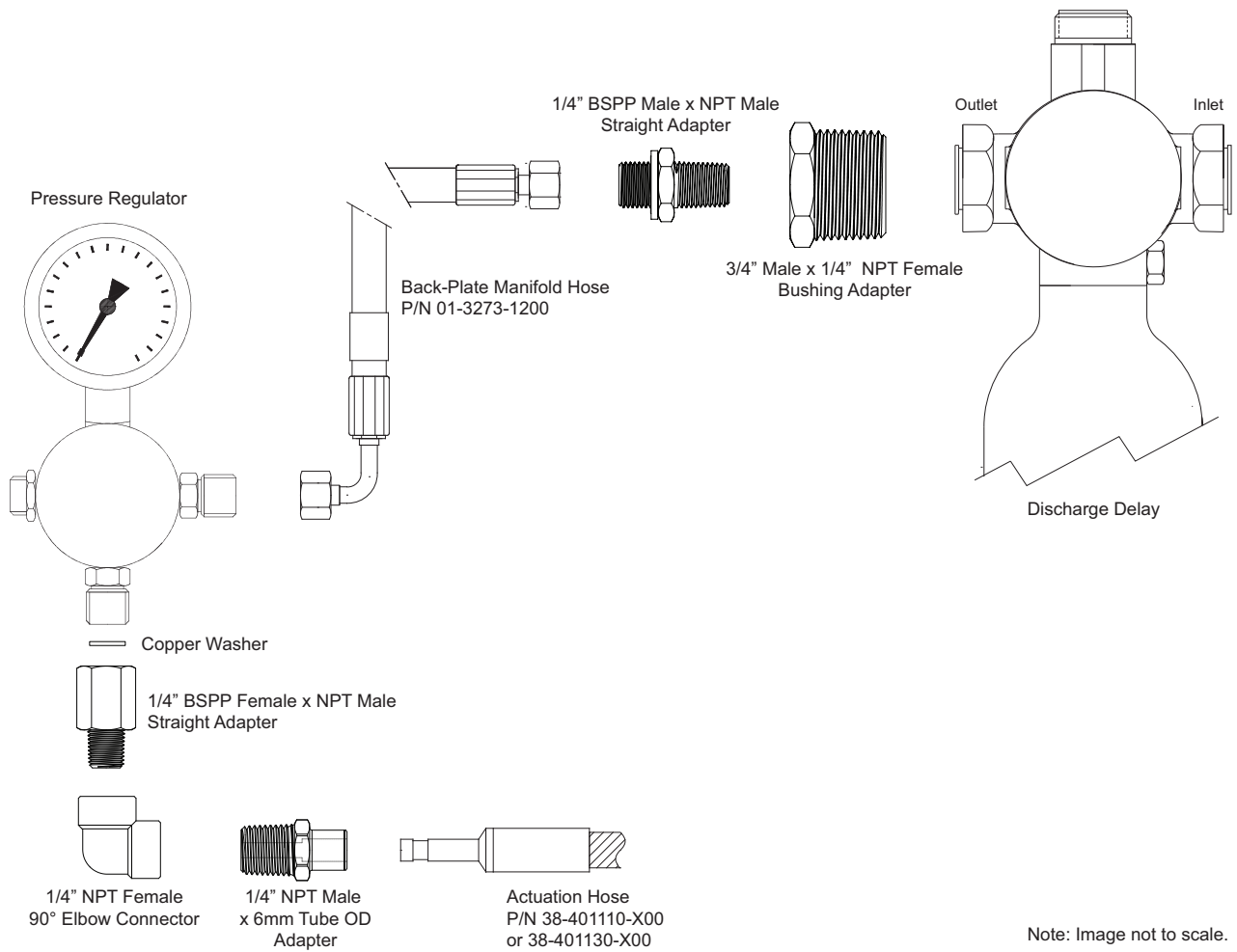


Figure 4-46. Discharge Delay and Pressure Regulator with Adapters and Hoses

**4-17.5 Pressure Operated Siren**

The pressure operated siren shall be located in accordance with the installation plan. Connect the siren in accordance with requirements corresponding to the siren driver cylinder noted in Table 4-22:

Table 4-22. Siren Driver Cylinder Actuation Limits

Pilot Cylinder Size	Siren Part Number	Number of Sirens per Pilot Cylinder	Maximum Length of 1/4 in. Sch. 80 Pipe	Maximum Length of 1/4 in. Sch. 40 Pipe	Maximum Length of 5/16 in. x 0.032 in. Wall Tubing
108 cu. in.	90-981574-001	1	90 ft.	90 ft.	90 ft.
1040 cu. in.	90-981574-001	4	500 ft.	500 ft.	500 ft.

- Never connect a pipe supplying the agent to the pressure operated siren.
- The siren supply line shall start from a dedicated siren driver cylinder, which is separate from the agent cylinder and separate from the pilot cylinder driving the discharge delay.
- Typically located inside the protected space.
- Install a dirt trap and union as shown in Figure 4-47.

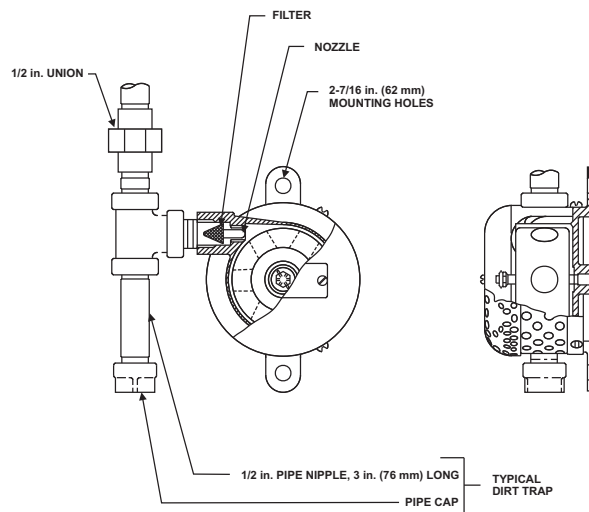


Figure 4-47. Pressure Operated Siren

### 4-17.5.1 Sample Siren Setups

The following show possible examples for operating the siren.

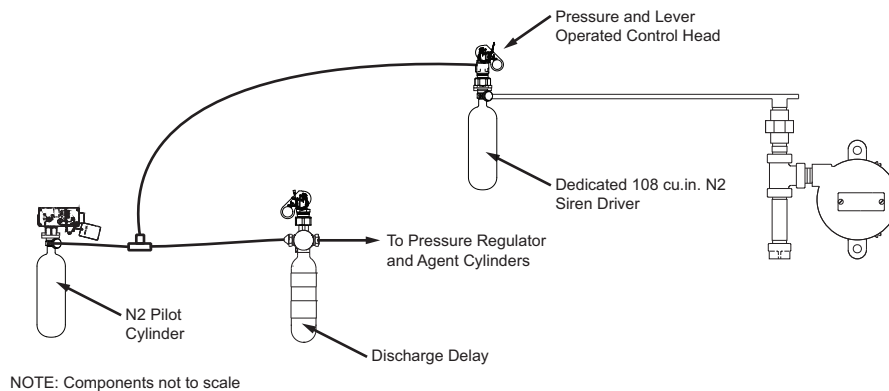


Figure 4-48. Single Siren with Pneumatic Activation

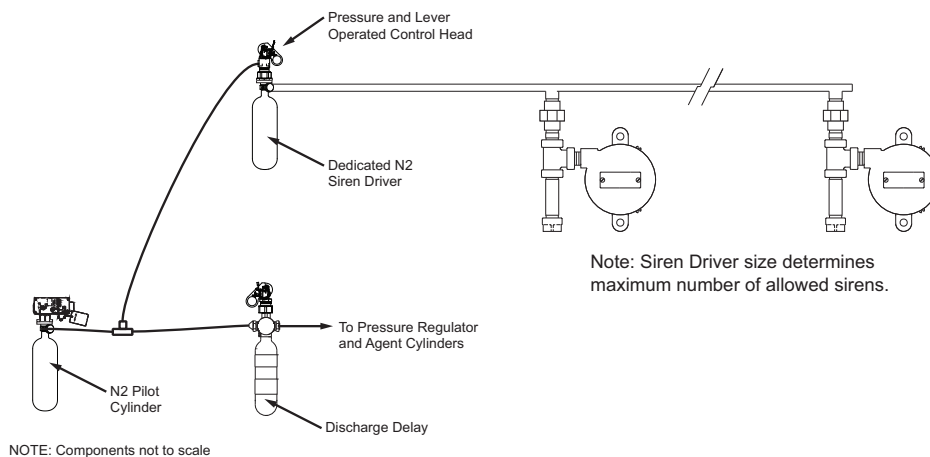


Figure 4-49. Multiple Siren with Pneumatic Activation

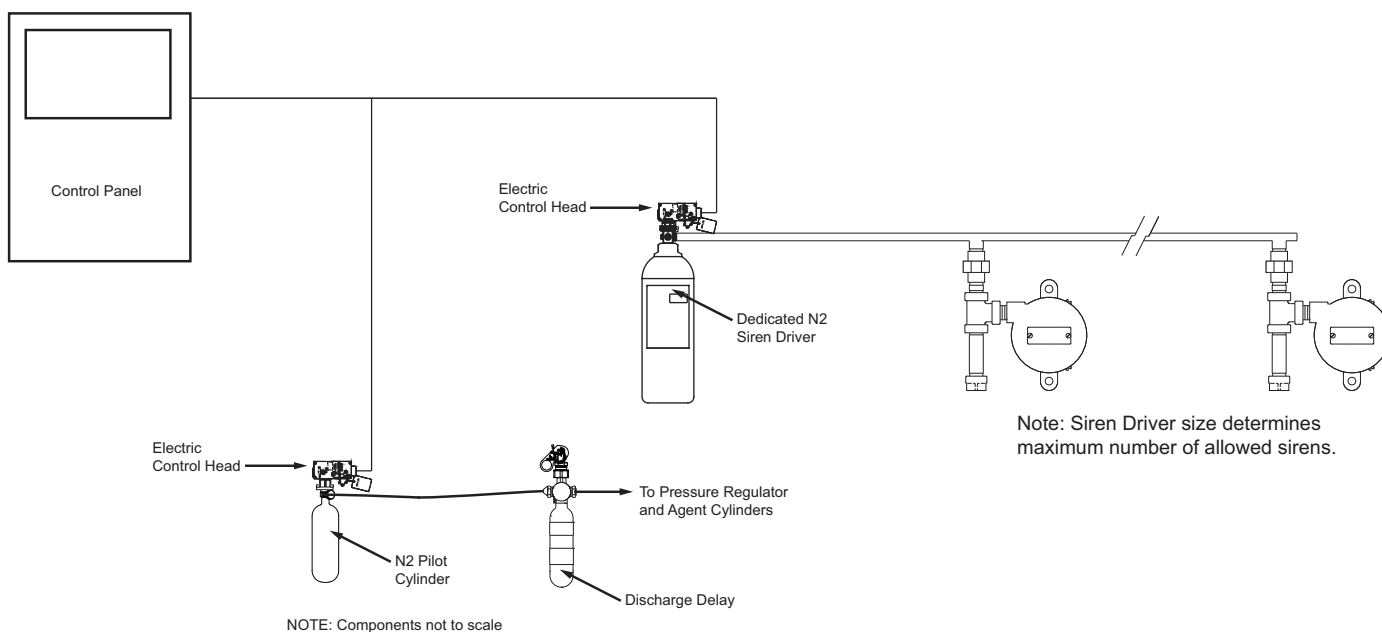


Figure 4-50. Siren with Electric Control Head Activation

### 4-18 INSTALLATION OF PRESSURE TRIP, P/N 81-874290-000

Install the pressure trip on the discharge manifold or piping in the horizontal position as shown on the system drawings. Connect the trip to the piping with 1/2-inch Schedule 40 pipe. The minimum operating pressure required is 50 psig (3.45 bar). The maximum allowable load to be attached to the retaining ring is 100 lb (45.3 kg).

### 4-19 INSTALLATION OF DISCHARGE INDICATOR, P/N 81-875553-000

The discharge indicator must be installed on the discharge manifold, either in a vertical or horizontal position. The indicator has a 3/4-inch (19 mm) NPT male connection. Make certain the indicator stem is in the normal position.

### 4-20 ODORIZER

When used, odorizer assemblies should be located immediately downstream of each selector valve. For systems protecting a single hazard, a single odorizer assembly can be located immediately downstream of the discharge manifold.

Odorizer assemblies must be attached to the discharge piping in the upright position. The odorizer assembly requires approximately 9" of clearance. Odorizer assemblies connect to a 3/4" NPT fitting.

1. Install the 3/4" NPT fitting where the odorizer assembly will be located.
2. Screw the odorizer assembly to the 3/4" NPT fitting.



**To prevent damaging the odorizer assembly during testing, it is recommended that the odorizer assembly not be installed until after system testing of the discharge piping is complete. For periodic maintenance after the system has been installed and in use, remove the odorizer assembly and replace with a temporary plug prior to any testing of the discharge piping.**

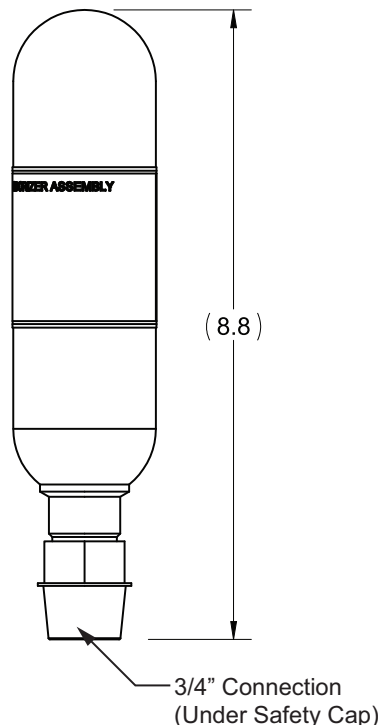


Figure 4-51. Odorizer Installation

## 4-21 SELECTOR VALVES

**Note:** Valves can be installed horizontally or vertically.

Kidde Fire Systems recommends installing union fittings before and after the valves to facilitate future service work.

### 4-21.1 1-inch, 1 1/2-inch, and 2-inch Selector Valves

Install the 1-inch, 1 1/2-inch, and 2-inch selector valves by following the steps listed below:

1. Inspect the valves to verify the threads are not damaged.
2. If needed, use the BSPT to NPT adapters (P/N 01-3711-3000, 01-3711-4000, and 01-3711-5000) to adapt the BSPT piping on the valve to standard NPT piping.
3. Apply Teflon tape or pipe sealant to the piping male threads.



**Do not drip sealant into the internal part of the valve.**

4. Ensure the piping is properly supported with pipe hangers prior to installing the valves.
5. Use high pressure air, nitrogen, or CO<sub>2</sub> to verify the valves allow flow in the direction shown by the arrow on the valve body.



**All valves must be installed with the arrow on the valve body pointing in the direction of flow.**

### 4-21.2 3 and 4 inch Selector Valves

Install the 3 and 4 inch Selector valves by following the steps listed below:

1. Inspect the gaskets and valve assemblies for damage.
2. Weld the flange connections to the piping in accordance with the ASME B31 Boiler & Pressure Vessel Code.
3. Align the valve body with the flanges, insert gaskets between the valve body and each flange and insert the bolts through the bolt holes.
4. Tighten the hex nuts.
  - a. Valves can be installed horizontally or vertically.
  - b. All valves must be checked to ensure installation in the proper flow direction.
  - c. Ensure the piping is properly supported with pipe hangers prior to installing the valves.
5. Use high pressure air, nitrogen, or CO<sub>2</sub> to verify the valves allow flow in the direction shown by the arrow on the valve body.



**All valves must be installed with the arrow on the valve body pointing in the direction of flow.**

## 4-22 LOCKOUT VALVES

**Note:** Lockout valves are required when the agent concentration is at or above the LOAEL. The lockout valve with limit switch must be installed in the discharge pipe network, downstream of all cylinders, check valves, and selector valves. All valves must be easily accessible. Lockout valves can be installed in either the vertical or horizontal position using good pipe fitting practices. Place two to three wraps of Teflon tape on male threads of pipe. A union is recommended before and after the valve to facilitate future service work. If needed, use the BSPT to NPT adapters (P/N 01-3711-3000 and 01-3711-5000) to adapt the BSPT piping on the valve to standard NPT piping for the 1" and 2" lock out valves. For Larger valves, Weld the flange connections to the piping in accordance with the ASME B31 Boiler & Pressure Vessel Code. The valve should be locked in the "open" position using a padlock. All valves must be electrically supervised.

Figure 4-52 shows the lockout valve wiring diagram when the ball valve is in the fully open position.

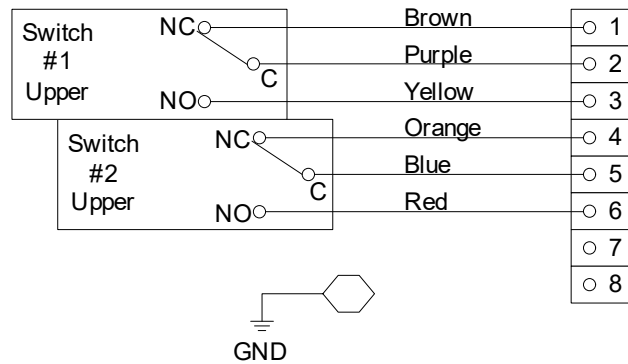


Figure 4-52. Wiring Diagram for Lockout Valve when Ball Valve is in Fully Open Position

### 4-23 MAIN TO RESERVE TRANSFER SWITCH

The main to reserve transfer switch is used in the system to toggle the connection between the electrical release units installed on the main or reserve cylinders. For electrical wiring with a single electrical release unit, refer to Figure 4-53 and for two electrical release units, refer to Figure 4-54. The transfer switch is generally installed at the cylinder bank.

However, should the cylinder banks be installed within the risk, then the main and reserve switch must be installed outside. For EU applications the switch will be of a key type and the key to be kept adjacent to the switch within an emergency "break-glass" key holder

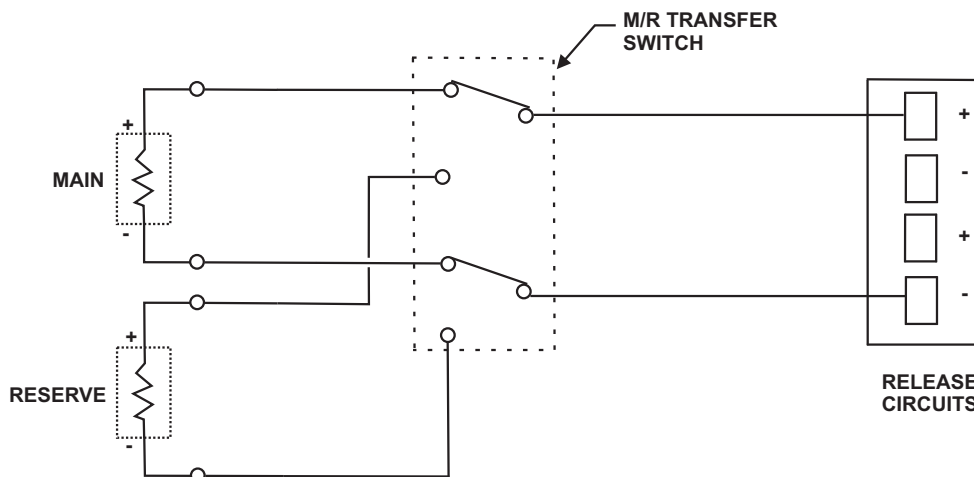


Figure 4-53. Wiring Diagram with Single Solenoid (Main and Reserve)

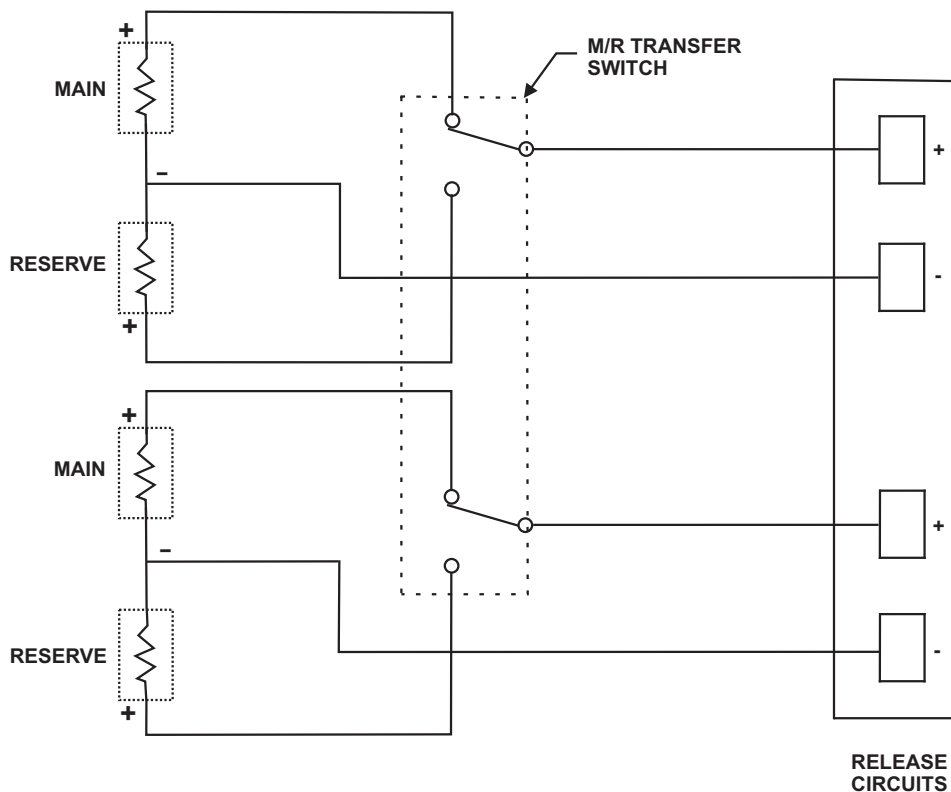


Figure 4-54. Wiring Diagram with Dual Solenoid (Main and Reserve)

### 4-24 POST-INSTALLATION PROCEDURES

After installing the Natura IGS system, perform these inspections and tests:

1. Verify that the cylinders of correct size and pressure are installed in accordance with installation drawings.
  2. Verify that the cylinder brackets and straps are properly installed and all fittings are tight.
  3. The piping distribution system must be inspected for compliance with the system drawings, NFPA 2001, latest edition or BS EN ISO 14520, design limitations within this manual and the hydraulic calculations associated with each independent piping and nozzle configuration.
  4. Check that the discharge manifold, discharge piping and actuation piping are securely braced. Ensure all fittings are tight and securely fastened to prevent agent leakage and hazardous movement during discharge. The means of pipe size reduction and installation position of the tees must be checked for conformance to the design requirements.
  5. The piping distribution system during installation must be cleaned, blown free of foreign material and inspected internally to ensure that oil or particulate matter will not soil the hazard area or reduce the nozzle orifice area and affect agent distribution.
  6. System piping should be pressure tested in accordance with the requirements of NFPA 2001, latest edition or BS EN ISO 14520 as appropriate.
  7. Ensure that all types of check valves are installed in the proper location as indicated on the installation drawings and that the equipment is installed with the arrow pointing in the direction of flow.
  8. Verify the nozzles are installed in the correct locations and have the correct part numbers and orifice sizes as indicated on installation drawings and calculation output. Ensure discharge nozzles are properly oriented. Check the nozzle orifices for any obstructions.
  9. The discharge nozzles, piping and mounting brackets must be installed such that they will not cause injury to personnel. The agent must not be discharged at head height or below where people in a normal work area could be injured by the discharge. The agent must not directly impinge on any loose objects or shelves, cabinet tops or similar surfaces where loose objects could be propelled by the discharge.
  10. For systems with a main/reserve capability, the MAIN/RESERVE switch must be clearly identified and properly installed outside the hazard area where it is readily accessible.
  11. Manual release units must also be clearly identified and properly installed where they are readily accessible. All manual release units that activate Natura IGS systems should be properly identified as to their purpose. Particular care should be taken when multiple release units exist on the same bank of containers. These release units should be clearly identified as to the risk with which they are associated.
  12. Install any remaining actuation hoses and perform the release unit test outlined in Paragraph 6-6.6 on all cylinders equipped with release units.
  13. Perform the electric control head test outlined in Paragraph 6-6.7 on all siren and time delay driver cylinders equipped with electric control heads
  14. Perform the pressure switch test outlined in Paragraph Paragraph 6-6.5 for all pressure switches installed.
- Note:** All acceptance testing shall be in accordance with NFPA 2001, latest edition or BS EN ISO 14520 current edition as appropriate.
15. Making the system live after all system checks by installing the actuation hoses from release units or pressure regulator to the corresponding primary cylinder actuation inlets then test the Pilot Line.



**Ensure the actuation hose is fully inserted into the release unit. There should be a gap of no more than 1/4" (6 mm) between the end of the Quick Connect on the actuation hose and the shoulder of the release unit Quick Connect.**

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### 4-24.1 Pilot Line Test

After installation, check the complete pilot line arrangement for integrity. Perform this check as follows:

1. Place the control panel in manual mode.
2. Ensure the discharge hoses are **not** connected to the top of each cylinder valve and the anti-recoil caps are in place.
3. Operate the system manually either by manual electric release at the control panel or by the manual release on the release unit.
4. Make sure that the pins are now protruding out from the top of the anti-recoil caps on top of each cylinder valve.
5. Leak test all connections on the pilot line.
6. Reset manual release unit by turning lever to close position, insert pin, and fix new anti-tamper seal, or reset manual release at control panel.
7. De-pressurise pilot line via the Pilot Line Bleed Valve on the last cylinder valve.
8. Make sure the pins have fully retracted on the top of each anti-recoil cap.
9. Remove the anti-recoil caps from the top of each cylinder valve.
10. Connect the discharge hoses, torque to 29.5 ft-lb (40 Nm).
11. Place control panel back to automatic mode.

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# CHAPTER 5

## OPERATION

### 5-1 INTRODUCTION

This chapter describes the operation of the Kidde Fire Systems Natura™ Inert Gas System (Natura IGS system) using IG-100, IG-541, IG-55, or IG-01 inert-gas agent (herein refer to collectively as the “agent”).

### 5-2 SYSTEM CONTROLS AND INDICATORS

#### 5-2.1 General

Compressed gaseous agent is held in the cylinder by a discharge valve. When the discharge valve is actuated by a release unit, the compressed gas escapes through the discharge port of the valve and is directed through the distribution piping to the nozzles. The nozzles provide the proper flow rate and distribution of the agent.

#### 5-2.2 Operating Procedures

##### 5-2.2.1 Automatic Operation

When a system is operated automatically by means of a detection and control system, everyone must evacuate the hazard area promptly upon hearing the pre-discharge alarm. Make sure no one enters the hazard area. Call the fire department immediately.

##### 5-2.2.2 Local Manual Operation (Single Area)

Manual control is not part of normal system actuation and should only be used in an emergency as a last resort. Ensure the hazard area is evacuated and emergency services are being called.

1. Proceed to appropriate Natura IGS system cylinder for the hazard.
2. Remove the safety pull pin from the cylinder release unit. This will also break the tamper seal.
3. Operate the manual release knob in the direction indicated by the arrow on the unit.

**Note:** Allow no one to enter the hazard area. Call the fire department immediately.

##### 5-2.2.3 Local Manual Operation (Multi Area System)

Manual control of selector valves is not part of normal system actuation and should only be used in an emergency. Ensure the hazard area is evacuated and emergency services are being called:

1. Proceed to appropriate Natura IGS system selector valve for the hazard.
2. Attach the handle to the selector valve, and turn the valve open.
1. Proceed to appropriate Natura IGS system primary cylinder release unit for the hazard.
2. Remove the safety pull pin from the cylinder release unit. This will also break the tamper seal.
3. Operate the manual release knob in the direction indicated by the arrow on the unit.

**Note:** Allow no one to enter the hazard area. Call the fire department immediately.

### 5-2.3 Post-Fire Operation

After a Natura IGS system discharge, qualified fire suppression system maintenance personnel must perform post-fire maintenance as directed in Chapter 7 of this manual. Observe all warnings, especially those pertaining to the length of elapsed time before entering the hazard area.



**Do not enter a hazard area with an open flame or lighted smoking materials. Flammable vapors may cause reignition or explosion. Ensure the fire is completely extinguished before ventilating the area. Ventilate the area thoroughly before permitting anyone to enter the hazard area, or use a self-contained breathing apparatus.**

### 5-3 MAIN AND RESERVE SYSTEMS



**The following procedures can be applied only when the reserve system has not been discharged.**

After operating the "main" system as described above, place the "reserve" system in standby mode as follows:

1. Reset all manually operated release units, pressure operated trips, discharge indicators, manual operation stations, and pressure operated switches. Ensure that the control panel and all detectors are reset.
2. If the system uses selector valves, manually close the valves.
3. Proceed to the main/reserve transfer switch. Set the transfer switch to the RESERVE position.
4. Ensure panel is not in trouble mode after setting switch to RESERVE.
5. Immediately contact a Kidde Fire Systems distributor for service.

### 5-4 LOCKOUT VALVES

If applicable, it is recommended to lock-out the Natura IGS system when performing maintenance on the system or there is need to perform work that could cause false alarms and a discharge. Use the following steps to lockout the system:

1. Unlock the valve and place it in the Closed position.
2. Lock the valve.
3. Verify that a Trouble indicator appears on the control unit.
4. When maintenance or test is complete, unlock the valve and place it in the Open position.
5. Lock the valve.
6. Verify the Trouble indicator is clear on the control unit.

### 5-5 CYLINDER RECHARGE

Recharge all Natura IGS system cylinders and nitrogen pilot cylinders immediately after use. Return all cylinders to a Kidde Fire Systems Distributor or other qualified refill agency.

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# CHAPTER 6

## MAINTENANCE

### 6-1 INTRODUCTION

This chapter contains maintenance instructions for the Kidde Fire Systems Natura™ Inert Gas System (Natura IGS system) using IG-100, IG-541, IG-55, or IG-01 inert-gas agent (herein refer to collectively as the “agent”). These procedures must be performed in accordance with regulations.

Be aware of the following:

- Natura IGS systems must be serviced by trained, authorized Kidde Fire Systems distributors only.
- Any environmental or operating condition that causes shorting or grounding of system components can cause system malfunctions or actual discharge.
- Before commencing service isolate the system by removing release units, control heads, and isolating electronically at the panel.

#### 6-1.1 Agent Storage Cylinders

Agent storage cylinders are pressurized vessels containing the agent pressurized to 300 bar at 15°C (4351 psig at 59°F) or 200 bar at 15°C (2901 psig at 59°F). This pressure causes considerable thrust if the discharge valve is actuated, thus, the safety transport cap supplied with the cylinder must be installed when handling or storing the cylinder, or whenever it is not securely fastened down. The safety transport cap prevents objects from striking the burst disc, and reduces and redirects the thrust if the cylinder is accidentally discharged.

Handle the cylinder carefully to prevent damaging the gauge and other attached fixtures. The cylinder must not be subjected to temperatures above 130°F (54°C) nor be exposed to direct sunlight, or the pressure relief device may operate, releasing the agent.

**6-2 MAINTENANCE PROCEDURES**



**Natura IGS system cylinders and components must be handled, installed, inspected and serviced only by qualified and trained personnel in accordance with the instructions contained in this manual. (For further advice or training details contact Kidde Fire Systems.)**

**Before performing these maintenance procedures, refer to the Safety Data Sheets in Appendix B of this manual and "Safe Cylinder Handling Procedures" on page iii.**

A program of systematic maintenance is essential for continuous, proper operation of all Natura IGS systems. Follow a periodic maintenance schedule as outlined in Table 6-1 and Table 6-2. Additionally, maintain an inspection log for ready reference. As a minimum, record the following in the log:

- Inspection interval
- The inspection procedure performed
- Maintenance performed, if any, as a result of inspection
- The name of inspector performing the task

If areas of rust or corrosion are found during the inspection of cylinders then record on report that cylinders should be sent to a Kidde Fire Systems authorized fill station for proper examination and, if necessary, hydrostatic testing.

**6-3 PREVENTATIVE MAINTENANCE SCHEDULE**

Instruct all system owners to perform preventative maintenance at outline in Table 6-1.

Table 6-1. Owner Preventive Maintenance Schedule

Schedule	Requirement	Paragraph
Weekly	Inspect Natura IGS system cylinder and check the cylinder pressures	Section 6-4.1
	Check nitrogen pilot cylinder pressures	Section 6-4.2
	Perform hazard and enclosure inspection	Section 6-4.3
	Perform pipework and controls inspection	Section 6-4.4
Monthly	Perform Weekly Inspection as outlined in Section 6-4 and the following additional tasks:	
	Perform General Inspection	Section 6-5.1
	Inspect Hazard Access	Section 6-5.2
	Inspect Hoses	Section 6-5.3
	Inspect Release Units and Secondary Gauges	Section 6-5.4
	Inspect Cylinder and Valve Assembly	Section 6-5.5
	Inspect Electric Control Heads	Section 6-5.6

As an Authorized Kidde Fire Systems Natura IGS systems Distributor, perform preventative maintenance per Table 6-2.

Table 6-2. Authorized Kidde Fire Systems Distributor Maintenance Schedule

<b>Schedule</b>	<b>Requirement</b>	<b>Paragraph</b>
Semi-Annual	Perform Monthly inspection as outlined in Section 6-5 and the following additional tasks:	
	Inspect the protected room	Section 6-6.1
	Check distribution pipework and nozzles	Section 6-6.2
	Check lockout valves	Section 6-6.3
	Check actuators on selector valves	Section 6-6.4
	Test pressure switches	Section 6-6.5
	Test release units	Section 6-6.6
	Test Nitrogen Pilot Control Heads (if applicable)	Section 6-6.7
	Inspect Flexible Hoses	Section 6-6.8
Verify Odorizer Assembly	Section 6-6.9	
Annual	Perform Semi-Annual inspection as outlined in Section 6-6 and the following additional tasks:	
	Check Natura IGS System Cylinder Pressure Gauges	Section 6-7.1
Every 2 Years	Perform Annual inspection as outlined in Section 6-7 and the following additional tasks:	
	Blow out distribution piping	Section 6-8.1
Every 5 Years (CFR)	Perform 2 year Inspection as outlined in Section 6-8 and the following additional tasks:	
	Agent cylinder hydrostatic pressure test and/or inspection	Section 6-9.1
	Nitrogen pilot cylinder hydrostatic pressure test and/or inspection	Section 7-6.1
	Flexible hose hydrostatic pressure test and inspection	Section 6-9.2
Every 10 Years (EU)	Perform 2 year Inspection as outlined in Section 6-8 and the following additional tasks:	
	Agent cylinder hydrostatic pressure test	Section 6-10.1
	Nitrogen pilot cylinder hydrostatic pressure test	Section 7-6.1

**6-4 WEEKLY**

**6-4.1 Check Natura IGS System Cylinder Pressure**

Check the Natura IGS system cylinder pressure gauges for proper operating pressure (refer to Section 1-5). If the pressure gauge indicates a pressure loss (adjusted for temperature) of more than 5%, it shall be refilled or replaced by an authorized Kidde Fire Systems Distributor. Remove and recharge the cylinder as instructed in Section 7-5. Cylinders should have a pressure of either 300 bar at 15 °C (4351 psig at 59 °F) or 200 bar at 15 °C (2901 psig at 59 °F) depending on the pressure specified on the label.

**6-4.2 Check Nitrogen Pilot Cylinder Pressure**

If used, check the nitrogen pilot cylinder pressure gauge for proper operating pressure. If there is a pressure loss (adjusted for temperature) of more than 10%, recharge with nitrogen to 1800 psig @ 70 °F (124 bar @ 21 °C) by an authorized Kidde Fire Systems Distributor.

**6-4.3 Hazard and Enclosure Inspection**

Visually inspect the hazard and the integrity of the enclosure for changes which may affect the performance of the system as per the requirements of BS EN 14520-1 or NFPA 2001.

**6-4.4 Pipework and Controls Inspection**

Visually inspect the pipework for damage and that all operating controls and components are properly set and undamaged.

**6-5 MONTHLY**

In addition to performing the weekly inspection (see Section 6-4), perform the following procedures every month:

**6-5.1 Perform General Inspection**

Make a general inspection survey of all cylinders and equipment for damaged or missing parts. If the equipment requires replacement, refer to Paragraph 6-11.3.

**6-5.1.1 Inspect Discharge Nozzles**

Inspect discharge nozzles for dirt and physical damage. Replace damaged nozzles. If nozzles are dirty or clogged, refer to Paragraph 6-11.1.



**Painting or coating nozzles is prohibited. A part number is located on each nozzle. Nozzles must be replaced by nozzles of the same part number. Nozzles must never be interchanged since random interchanging of nozzles could adversely affect proper agent distribution and concentration within a hazard area.**

**6-5.1.2 Inspect Pull Stations**

Inspect all manual pull stations for cracks, broken or cracked glass plate, dirt or distortion. Inspect the station for signs of physical damage. Replace damaged glass. Replace the station if damaged. If necessary, clean as directed in Paragraph 6-11.1.

**6-5.1.3 Inspect Pressure Switches**

Inspect pressure switches for deformations, cracks, dirt or other damage. Replace the switch if damaged. If necessary, clean the switch as directed in Paragraph 6-11.1.

**6-5.1.4 Personnel**

Check that all personnel who may have to operate the system are properly trained and authorized to do so. All new employees must be instructed in its use.

## 6-5.2 Inspect Hazard Access

Ensure access to hazard areas, manual pull stations, discharge nozzles, and cylinders are unobstructed and nothing obstructs the operation of the equipment or distribution of agent.

## 6-5.3 Inspect Hoses

Inspect actuation and discharge hoses for loose fittings, damaged threads, cracks, distortion, cuts, dirt, and frayed wire braid. Tighten loose fittings and replace hoses with stripped threads or other damage. If necessary, clean parts as directed in Paragraph 6-11.1. Inspect the adapters, couplings and tees at the Natura IGS system cylinder pilot outlets for tightness. Tighten couplings if necessary. Replace any damaged parts. If applicable, check any pilot line actuation or discharge hoses in a similar manner.

## 6-5.4 Inspect Release Units and Secondary Gauge Assemblies

Inspect the Natura IGS system cylinder release units and secondary gauge assemblies for physical damage, deterioration, corrosion, distortion, cracks, dirt and loose couplings. Tighten loose couplings. Replace if damaged. Check the release unit's or secondary gauge assembly's electrical line for wear and damage, and if necessary replace. If necessary, clean as directed in Paragraph 6-11.1.

Check the pressure on the gauges. If the gauge pressure is not normal 300 bar at 15°C (4351 psig at 59°F) or 200 bar at 15°C (2901 psig at 59°F) depending on the pressure specified on the label, remove and recharge the cylinder as instructed in Paragraph 6-12.

**Note:** The supervisory pressure switch on the gauge is designed to change the contact state when the pressure falls below 160 bar (2320 psi) for 200 bar (2900 psi) cylinders and 240 bar (3480 psi) for 300 bar (4350 psi) cylinders.



**Before removing the release unit, all pressure must be relieved from the actuation lines. Pressure can be relieved from unvented actuation tubing by loosening the fitting on the release unit slightly and allowing the line to bleed out completely. Failure to perform this action can result in damage to the release unit.**

## 6-5.5 Inspect Cylinder and Valve Assembly

Inspect the Natura IGS system cylinder and valve assembly for leakage and physical damage such as cracks, dents, distortion and worn parts. Check the burst disc for damage. If the burst disc is damaged or needs to be replaced, return the cylinder. If damaged parts are found on the Natura IGS system cylinder/valve assembly, replace the entire assembly. If necessary, clean the cylinder and associated parts as directed in Paragraph 6-11.1.

## 6-5.6 Inspect Electric Control Heads on Nitrogen Pilot Cylinders

If applicable, inspect the Natura IGS system nitrogen pilot cylinder electric control heads for damage, corrosion, and dirt. Check the control heads' flexible electrical line for wear and damage. Check the control head for loose coupling and tighten if necessary. Check that the indicator is in the SET position, the pull pin is installed in the manual lever, and the seal wire is intact. Replace the control head if damaged. If necessary, clean as directed in Paragraph 6-11.1.

### 6-5.6.1 Inspect Brackets, Straps, Cradles and Mounting Hardware

Inspect the Natura IGS system cylinder brackets, straps, cradles, and mounting hardware for loose, damaged, or broken parts. Check the cylinder brackets, straps, and associated parts for corrosion, oil, grease, and grime. Tighten any loose hardware. Replace damaged parts. If necessary, clean as directed in Paragraph 6-11.1.

## **6-6 SEMI-ANNUAL INSPECTION PROCEDURE**

In addition to performing the monthly inspection (see Section 6-5), perform the following procedures semi-annually:

### **6-6.1 Protected Room**

Inspect the protected room thoroughly to determine if any changes to the volume, new penetrations, leakage rate etc. have occurred which could adversely affect extinguishing performance of the system and/or require additional pressure relief openings to be installed.

Operation of pressure relief devices together with unobstructed flow to free air shall be verified.

Where the integrity inspection reveals changes to the enclosure for which the system originally was designed that could result in failure to maintain the extinguishing concentration, they shall be corrected or the system redesigned to provide the appropriate degree of protection.

Should additional equipment have been introduced resulting in a higher required concentration, pressure relief openings may have to be increased.

### **6-6.2 Distribution Pipe Work and Nozzles**

All pipe work and nozzles should be visually inspected for any signs of damage, deterioration or obstruction. Nozzles should be checked for any signs of blockage and cleaned out if appropriate. Any paint or lacquer shall be removed.

### **6-6.3 System Lockout Valve (if Fitted)**

The ball valve should be manually operated and the operation of the micro-switch (if fitted) observed.

1. Signal to be initiated on control panel.
2. Replace the micro-switch if found to be defective.

### **6-6.4 Actuator on Selector Valve**

1. Operate the valve manually by the use of the emergency handle. The handle should move freely when opening and closing the valve.

2. Close the selector valve and store the emergency handle in a convenient place

Should for any reason the unit fail to operate as intended or should there be any doubt about the opening/closing of the valve, contact Kidde Fire Systems.

Never attempt to modify the actuator assembly (i.e. never open the actuator).

### **6-6.5 Test Discharge Pressure Switches**

Discharge pressure switches must be tested semi-annually for proper operation.

1. Contact the appropriate personnel and obtain authorization for a shutdown.
2. Ensure that the hazard area operations controlled by the pressure switch are operative.
3. Manually operate the switch by pulling up on the plunger and verify that the hazard area operations controlled by the pressure switch shut down.
4. Return the pressure switch to the SET position.
5. Reactivate all systems that were shut down by the pressure switch (such as power, ventilation systems and compressors).

## 6-6.6 Test Release Units

Release units must be tested semi-annually for proper operation. This test can be performed without fully discharging the Natura IGS system agent cylinders. In systems with multiple release units, test one release unit at a time before proceeding to the next, as follows:

**Note:** Do not remove the solenoid on the release unit when testing release units.

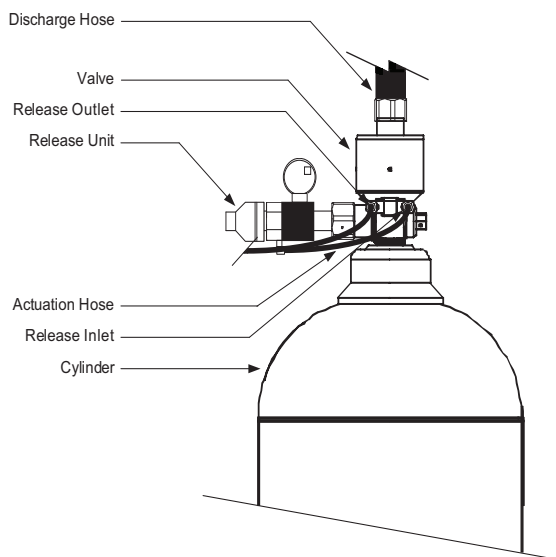


Figure 6-1. Typical Primary Cylinder/Valve Assembly (Rear View)

1. Remove the actuation line connecting the primary cylinder with the release unit to the next secondary cylinder. This is the actuation line installed in the release outlet.

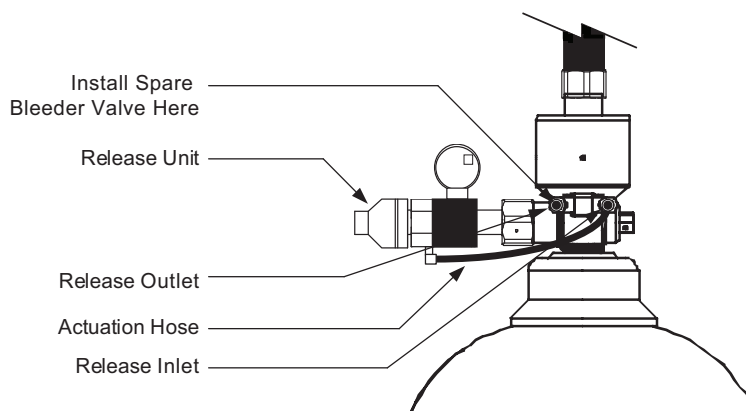


Figure 6-2. Spare Pilot Line Bleed Valve Location

2. Install a spare Pilot Line Bleed Valve in the release outlet from where the actuation hose was removed. Make sure to push the bleed valve in fully.
3. Disconnect the actuation hose from the release unit to the valve at the release inlet.
4. Disconnect the Discharge hose from the discharge outlet on the valve. Immediately install the anti-recoil cap on the valve's discharge outlet.
5. Reconnect the actuation hose from the release unit to the valve at the release inlet. Make sure to push the actuation hose in fully.
6. Operate the Natura IGS system electrically. This can be accomplished by actuation of the Natura IGS system at the system control panel or by manual operation of an electric pull station.

7. Ensure the release unit operated by seeing if the pin on the anti-recoil cap popped up. If the release unit did not operate, check the circuit for electric continuity to the release unit and repeat the test. If necessary, replace the damaged release unit. Repeat the test if the release unit was replaced.
8. Return the unit to service by first ensuring the release unit is de-energized. Next, disconnect the actuation hose from the release unit to the valve at the release inlet.
9. Remove the anti-recoil cap and reinstall the discharge hose to the discharge outlet. Remove the spare Pilot Line Bleed Valve from the release outlet.
10. Reconnect all actuation hoses. Make sure to push the actuation hose in fully.

### 6-6.7 Control Head Test for Nitrogen Pilot Cylinders

All control heads used on nitrogen pilot cylinders must be tested on a semi-annual basis.

**Note:** Not all systems use a nitrogen pilot cylinder.

#### 6-6.7.1 Electric Control Head Test for Nitrogen Pilot Cylinders

Electric control heads must be tested semi-annually for proper operation. This test can be performed without discharging the Natura IGS system nitrogen pilot cylinders. Test one hazard area at a time before proceeding to the next, as follows:



**All control heads must be removed from the Natura IGS system nitrogen pilot cylinders prior to testing to prevent accidental cylinder discharge.**

1. Remove all electric control heads and control head monitors from all Natura IGS system nitrogen pilot cylinders serving the hazard area being tested. Let the electric control heads hang freely, but securely, from the flexible electric conduit connections.
2. Check the control panel to see that the Control Head Monitor reports a supervision alarm to the panel.
3. Operate the Natura IGS system electrically. This can be accomplished by actuation of the Natura IGS system at the system control panel or by manual operation of an electric pull station.
4. Ensure applicable (per programming) electric control heads have operated, that is, the indicator on the electric control head has moved to the RELEASED position. If any control heads have not operated, check the circuit for electric continuity to these particular heads and repeat the test. Replace all damaged heads. Repeat the test if any control heads have been replaced.



**Electric control heads must be reset manually before reconnecting to the pilot cylinder valves.**

5. Observe the instructions on the caution label attached to each electric control head. Replace any damaged heads that fail to reset properly before reconnecting to pilot cylinders. Re-Install the Control Head Monitor between the control head and corresponding valve. Re-attach all electric control heads to the threaded port on the pilot cylinder valve. Tighten the swivel nut securely. Make certain each electric control head is in SET position before reconnecting to cylinders. Failure to follow this procedure will result in accidental Natura IGS system discharge.

### 6-6.7.2 Lever Operated Control Head Test for Nitrogen Pilot Cylinders

Lever Operated control heads must be tested semi-annually for proper operation. This test can be performed without discharging the Natura IGS system nitrogen pilot cylinders. Test one hazard area at a time before proceeding to the next, as follows:



**All control heads must be removed from the Natura IGS system nitrogen pilot cylinders prior to testing to prevent accidental cylinder discharge.**

1. Remove all lever operated control heads from all Natura IGS system nitrogen pilot cylinders serving the hazard area being tested.
2. Operate the lever operated control heads and ensure the pin protrudes from the bottom of the control head after moving the lever to the open position. Replace all damaged heads. Repeat the test if any control heads have been replaced.



**Lever Operated control heads must be reset manually before reconnecting to the pilot cylinder valves.**

3. Make certain each control head is in SET position before reconnecting to cylinders. Failure to follow this procedure will result in accidental Natura IGS system discharge. Reinstall the double-pull pin and a new taper seal in each Lever Operated control head. Reattach all Lever Operated control heads to the threaded port on the pilot cylinder valve. Tighten the swivel nut securely.

### 6-6.7.3 Lever/Pressure Operated Control Head Test for Nitrogen Pilot Cylinders

Lever/Pressure Operated control heads must be tested semi-annually for proper operation. This test can be performed without discharging the Natura IGS system nitrogen pilot cylinders. Test one hazard area at a time before proceeding to the next, as follows:



**All control heads must be removed from the Natura IGS system nitrogen pilot cylinders prior to testing to prevent accidental cylinder discharge.**

1. Remove all lever/pressure operated control heads from all Natura IGS system nitrogen pilot cylinders serving the hazard area being tested.
2. Disconnect the lever/pressure operated control head from the incoming pressure line.
3. Operate the lever on the control heads and ensure the pin protrudes from the bottom of the control head after moving the lever to the open position. Replace all damaged heads. Repeat the test if any control heads have been replaced.
4. Reset the lever and pin.
5. Connect the lever/pressure operated control head to a spare nitrogen pressure supply capable of providing 1800 psi of nitrogen. Supply pressure to the control head and verify the pin protrudes from the bottom of the control head.
6. Vent the pressure and reset the control head.



**The Lever on the Lever/Pressure Operated control heads must be reset manually and the pressure must be vented before reconnecting to the pilot cylinder valves.**

7. Make certain each control head is in SET position before reconnecting to cylinders. Failure to follow this procedure will result in accidental Natura IGS system discharge. Reinstall the double-pull pin and a new taper seal in each control head. Reattach all the control heads to the threaded port on the pilot cylinder valve. Tighten the swivel nut securely.

### 6-6.8 Inspect Flexible Hoses

In accordance with NFPA 2001 latest edition, all system hoses shall be examined annually for damage. If the visual examination shows any deficiencies, replace the hose.

### 6-6.9 Verify Odorizer Assembly

Verify the odorizer assembly as follows:

1. Remove the odorizer assembly.
2. Check to make sure the burst disc is intact.
3. Reattach the odorizer assembly. If the burst disc has ruptured, replace the odorizer.

## 6-7 ANNUAL INSPECTION PROCEDURE

In addition to performing the semi-annual inspection (see Section 6-6) which includes monthly and weekly inspection tasks, perform the following procedures annually:

### 6-7.1 Check Natura IGS System Cylinder Pressure Gauges

Per NFPA 2001 latest edition, where container pressure gauges are used for fire suppression systems, the gauges shall be compared to a separate calibrated device annually. Check the Natura IGS system agent cylinder pressure gauges against a separate calibrated pressure gauge to ensure the Natura IGS system gauges are accurate. If the Natura IGS system gauges are not accurate, replace the release unit or secondary gauge assembly. This applies to agent cylinder gauges only.

## 6-8 INSPECTION PROCEDURES-2 YEAR

In addition to performing the semi-annual inspection (see Section 6-6), perform the following procedures every 2 years:

### 6-8.1 Distribution Piping Blow Out

Before blowing out the system, notify all necessary personnel, then remove pipe caps from the ends of the distribution piping to allow any foreign matter to blow clear. In addition, remove any Manifold Safety Devices. Blow out all distribution piping with dry air or CO<sub>2</sub> to make sure there are no obstructions.



**Do not use water or oxygen to blow out pipe lines. The use of oxygen is especially dangerous as the possible presence of even a minute quantity of oil may cause an explosion.**

1. Remove all release units from the agent cylinders. Disconnect all control heads from pilot cylinders.
2. Remove all pipe caps on dirt traps from distribution piping to allow any foreign matter to blow clear.
3. Remove all Manifold Safety Devices.



**Do not disconnect release units from flexible hose(s). Discharge of the system will cause flexible hose, without release units attached, to flail violently, resulting in possible equipment damage and severe bodily injury to personnel.**

4. Discharge test cylinder into system manifold. Use of CO<sub>2</sub> or dry air is acceptable. Discharge duration is to be of sufficient length to insure that all piping is blown clear.
5. Reinstall all pipe caps and Manifold Safety Devices as required.
6. Reconnect all release units to agent cylinder valves.

## 6-9 INSPECTION PROCEDURES- 5 YEAR (CFR)

In addition to performing the 2 year inspection (see Section 6-8), for cylinders subject to the Code of Federal Regulations (CFR) perform the following procedures every 5 years:

### 6-9.1 Inspection and Retest Procedures for Natura IGS System UN Specification Cylinders

A cylinder that is damaged or corroded should be emptied, retested and restamped in accordance with CFR Title 49, Section 180.207.

All Natura IGS system cylinders are designed, fabricated, and factory tested at 450 BAR (6527 psig) in compliance with UN 9809-2 specifications as stamped on each cylinder.

Two sets of regulations will apply to periodic inspection and test procedures depending on the following:

Cylinder State	Hydrostatic Test Required*	See Section
Cylinder Continuously in Service without a Discharge	No	Section 6-9.1.1
Discharge Cylinders	Yes	Section 6-9.1.2
Charged Cylinders Requiring Transport	Yes	Section 6-9.1.3

\*Test is required if more than five years have elapsed since the last test date stamped on the cylinder.

#### 6-9.1.1 Cylinders Continuously in Service Without Discharge

These cylinders are governed by NFPA 2001, 2022 latest edition regulations. Cylinders in continuous service without discharge require a complete external visual inspection every five years in accordance with Compressed Gas Association Pamphlet C-6, Section 3 except that the cylinders need not be emptied or stamped while under pressure. Record date of inspection on record tag attached to each cylinder. Where the visual inspection shows damage or corrosion, the cylinder shall be emptied, retested and restamped in accordance with CFR Title 49, Section 180.207.

#### 6-9.1.2 Discharged Cylinders

Per NFPA 2001, discharged cylinders must not be charged if more than five years have elapsed since the last test date stamped on the cylinder. The cylinders must be retested and restamped in accordance with CFR Title 49, Section 180.207. before charging.

#### 6-9.1.3 Charged Cylinders Needing to be Transported

Per NFPA 2001, cylinders that are charged and need to be transported, must not be shipped if more than five years have elapsed since the last test date stamped on the cylinder. The cylinders must be retested and restamped in accordance with DOT Code of Federal Regulations (CFR) Title 49, Section 180.213.

### 6-9.2 Inspection and Retest Procedures for Flexible Hoses

Regardless of condition, hoses must be hydrostatically tested every 5 years and replaced if necessary.

**6-10 INSPECTION PROCEDURES- 10 YEAR (EU)**

In addition to performing the 2 year inspection (see Section 6-8), for EU approved cylinders perform the following procedures every 10 years:

**6-10.1 Retest Procedures for TPED Specification EU Cylinders**

Where the visual inspection shows evidence of damage or corrosion, the cylinder shall be emptied, re-tested and re-stamped in accordance with BS EN ISO 1968 latest edition.



**Cylinder assemblies must be returned with all valve and discharge protection caps in place. These shall be attached immediately after disconnection from pipework. Failure to do so may result in damage to equipment and cause severe bodily injury.**



**These guidelines only apply to cylinders containing the agent.**

Natura IGS system cylinders up to 140 liters are manufactured to TPED/ADR/84/ 527/EEC.

**6-10.1.1 Cylinders Continuously in Service without Discharge**

These cylinders are governed by the Transportable Pressure Equipment Directive (2010/35/EU). Cylinders in continuous service without discharge require a periodic inspection in accordance with BS EN ISO 1968 latest edition. Record date of inspection on record tag attached to each cylinder. Where the visual inspection shows evidence of damage or corrosion, the cylinder shall be emptied, re-tested and re-stamped in accordance with BS EN ISO 1968 latest edition.

**6-10.1.2 Discharged Cylinders or Charged Cylinders that are Transported**

These cylinders are governed by the United Nations (UN) ADR and the European Union's (EU) Transportation of Pressure Equipment Directive (2010/35/EU). In the case of shipment of charged cylinders, other shipping regulations may also apply. In either case, cylinders in continuous service without discharge require a periodic inspection in accordance with BS EN ISO 1968 latest edition. Record date of inspection on record tag attached to each cylinder. Where the visual inspection shows evidence of damage or corrosion, the cylinder shall be emptied, re-tested and re-stamped in accordance with BS EN ISO 1968 latest edition.

**6-10.1.3 Retest**

Cylinders used with in Natura IGS system are required to be hydrostatically re-tested and re-stamped in accordance with BS EN ISO 1968 latest edition prior to recharge and shipment. It is company policy that at the time of hydrostatic testing that valves are replaced with new.

Table 6-3. Retest Schedule EU Specification Cylinders

Inspection Method	TPED/ADR/84/527/EEC		TPED/TRG330/ADR	
	First Retest Due	Subsequent Retest Due	First Retest Due	Subsequent Retest Due
Fully hydrostatic test including determination of cylinder expansion	10 years	10 years	10 years	10 years
External visual inspection per BS EN ISO 14520 requirement	6 months	6 months	6 months	6 months

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## **6-11 SERVICE**

### **6-11.1 Cleaning**

Remove dirt from metallic parts using a lint-free cloth with dry cleaning solvent. Dry parts with a clean, dry, lint-free cloth, or air blow dry. Wipe non-metallic parts with a clean, dry lint-free cloth. Remove corrosion with a light abrasive cloth.

### **6-11.2 Nozzle Service**

Service nozzles after use as follows:

1. Clean the outside of the nozzles with a rag or soft brush.
2. Examine the discharge orifices for damage or blockage. If the nozzles appear to be obstructed, unscrew the nozzles and clean by immersing them in cleaning solvent. Dry thoroughly with lint-free cloth. Replace damaged nozzles. Nozzles must be replaced with the same part number in the same location. See Paragraph 3-17.2.1 for the correct nozzle placement and orientation.

### **6-11.3 Repairs**

Replace all damaged parts found during inspection. Replacement procedures for Natura IGS system cylinders are provided below. For other system components, refer to the installation drawings and Natura IGS system assembly drawings for guidance.

Natura IGS system cylinders must be recharged or replaced when the cylinder pressure gauge indicates there is a loss of pressure (adjusted for temperature) of more than 5% or, immediately after discharge. Initial pressure of the cylinder is 300 bar at 15°C (4351 psig at 59°F) or 200 bar at 15°C (2901 psig at 59°F) depending on cylinder starting pressure.

## 6-12 REMOVING A NATURA IGS SYSTEM CYLINDER

Remove a Natura IGS system cylinder as follows:



**Do not disconnect the flexible discharge hose prior to removing release units from the Natura IGS system cylinders. Before replacing a Natura IGS system cylinder within a cylinder bank, ensure that the actuation line is completely vented of all pressure.**

1. Remove all release units and secondary cylinder gauge assemblies from cylinder and electrically isolate at the control panel.
2. Remove all discharge hoses from the cylinder/valve assembly.
3. Immediately install the anti-recoil caps to the top of cylinder valves and tighten to 18.5 ft-lbs torque.
4. Disconnect electrical cabling for low pressure monitoring at the quick connect cable joiner.
5. Remove all "quick connect" pilot line hoses and end of line Pilot Line Bleed Valve.
6. Install safety transport cap over the top of each valve and ensure they are fully fitted, if experiencing difficulty when fitting then remove and clean threads on inside of transport cap with a wire brush then fit.
7. Remove cylinders one at a time using appropriate cylinder trolley and follow safe cylinder handling procedures.



**To prevent injury, all cylinders must have safety caps installed immediately on the outlet ports when discharge hoses are disconnected.**

### 6-12.1 Reinstalling a Natura IGS System Cylinder

Reinstall following procedure as described in Section 6-12 in reverse order.

# CHAPTER 7

## POST-DISCHARGE MAINTENANCE

### 7-1 INTRODUCTION



**The information contained in this Chapter, Post Discharge Maintenance, is for limited distribution to Kidde Fire Systems approved Fill Stations only.**

Follow these procedures after the system has been activated and the Kidde Fire Systems Natura™ Inert Gas System (Natura IGS system) using IG-100, IG-541, IG-55, or IG-01 inert-gas agent (herein refer to collectively as the “agent”) has been discharged.

### 7-2 AFTER SYSTEM DISCHARGE

After a discharge, the system shall be returned into operational mode as soon as possible. The cylinder bank shall only be dismantled, reassembled, and its operation verified by trained technicians.

#### 7-2.1 Cylinder Replacement



**Safety is the primary concern. Never assume that a cylinder is empty. Treat all Natura IGS system agent cylinders as if they are fully charged. The Natura IGS system cylinder valve is capable of producing dangerously high discharge forces from the valve outlet if not handled properly.**

**Remember that pressurized cylinders are extremely hazardous. Always fit the anti-recoil cap and transport safety cap before any movement of the cylinder and always use appropriate cylinder trolley or similar. Failure to do so can result in serious bodily injury, death and property damage.**

When a Natura IGS system cylinder has been used (or the indicated pressure is less than 190 bar or lower for 200 bar systems or 285 bar or lower for 300 bar systems at a reference temperature of 15°C) it should be refilled immediately to the operating pressure at 15°C.

**Note:** Gauge accuracy is Class 1.6, i.e. a variation of 1.6% of the maximum scale value is permitted.

Before commencing cylinder replacement, it is strongly recommended that door(s) to the cylinder storage room are secured in the OPEN position. Use signs in combination with barrier tape to restrict access to the route used for moving cylinders and to the cylinder storage area/room.

No other tasks should be performed simultaneously i.e. only personnel involved in the cylinder replacement should be present.

Install replacement cylinders following Section 6-12 in reverse order.

When all cylinders are out of the room and secured for transport, contact Kidde Fire Systems for a recommended filling station/supplier.

**Note:** A Natura IGS system cylinder can weigh approximately 320 lbs depending on the agent stored within the cylinder. Always take precautions to prevent personnel injuries. Treat all dismantled parts with great care to avoid damage.

### 7-3 RE-INSTALLING RELEASE UNITS

Follow this procedure when re-installing the release unit:

**Note:** When reinstalling the release unit, the O-ring must be replaced.

1. If the release unit was operated manually or the tamper seal was removed, install a new tamper seal.
2. Remove the old O-ring in the connecting swivel and replace it with one of the O-rings included in the rebuild kit, P/N: 38-400001-010. Make sure the O-ring is properly lubricated before installation. If lubrication is missing, use silicone spray (Würth Art no: 0893221 or similar).



**Only the O-ring should be lubricated. Excessive lubricant in the valve port will enter into the valve itself when pressurized and may jeopardize the performance.**

**Used O-rings that are removed are to be deliberately cut and discarded to prevent inadvertent use.**

3. Install the release unit on the cylinder valve and tighten swivel nut by hand until pressure is indicated on the gauge.



**Do not tamper with the release unit. Any adjustment to components pre-fitted to the connector block will lead to a leak. After the release unit is pressurized, do not adjust the alignment as this may reset the shredder valve in the cylinder valve causing it to discharge or not seal properly.**

4. Secure the connecting swivel of the release unit by the use of an M36 A/F fixed wrench. Apply a torque of  $44.25 \pm 0.75$  ft lb ( $60 \pm 1$  N-m) on the unit. A counter hold may be required during tightening.
5. Leak test all connections on the release unit by means of ammonium-free leak detection liquid or spray, ensuring that there is no leakage
6. Connect the actuation hose to the release unit, then to the cylinder valve. Make sure to push the actuation hose in fully.



**Ensure the actuation hose is fully inserted into the release unit. There should be a gap of no more than 1/4" (6 mm) between the end of the Quick Connect on the actuation hose and the shoulder of the release unit Quick Connect.**



Figure 7-1. Actuation Hose Install



**Never attach the release units to the cylinder valves until the cylinders are secured in brackets or racking. Under no circumstances is the release unit to remain attached to the cylinder valve after removal from service, handling, storage, or during shipment. Failure to follow these instructions could result in serious bodily injury, death, or property damage.**

## 7-4 RE-INSTALLING SECONDARY CYLINDER GAUGE ASSEMBLIES

Follow this procedure when re-installing the secondary cylinder gauge assembly:

**Note:** Secondary Cylinder Gauge Assemblies must be replaced as a whole unit. There are no individual serviceable parts on the unit apart from the connector O-ring. When reinstalling the secondary cylinder gauge assembly, the O-ring must be replaced.

1. Remove the old O-ring in the connecting swivel and replace it with one of the O-rings included in the rebuild kit, P/N: 38-400001-010. Make sure the O-ring is properly lubricated before installation. If lubrication is missing, use silicone spray (Würth Art no: 0893221 or similar).



**Only the O-ring should be lubricated. Excessive lubricant in the valve port will enter into the valve itself when pressurized and may jeopardize the performance.**

2. Installing secondary cylinder gauge assemblies, applying a torque of  $45 \pm 1\text{Nm}$  ( $33.2 \text{ ft/lbs} \pm 0.73 \text{ ft/lbs}$ ). A counter hold may be required.
3. Leak test all connections on the secondary cylinder gauge assembly by means of ammonium-free leak detection liquid or spray, ensuring that there is no leakage.

**Note:** The pre-assembled unit shall not be tampered with, as any adjustment to components pre-fitted to the connector block will lead to a leak.

## 7-5 RECHARGING NATURA IGS SYSTEM CYLINDERS

After a fire, contact Kidde Fire Systems or authorized distributor for service replacements or refilling of cylinders.

## 7-6 NITROGEN PILOT CYLINDER SERVICE AND MAINTENANCE



**Any area in which nitrogen is used or stored must be properly ventilated. A person working in an area where air has become enriched with nitrogen can become unconscious without sensing the lack of oxygen. Remove the victim to fresh air. Administer artificial respiration if necessary and summon a physician.**

### 7-6.1 Nitrogen Pilot Cylinder Hydrostatic Pressure Test

A hydrostatic test must be performed in accordance with DOT Regulatory Compliance Guide, 49 CFR 180.209.

Nitrogen Pilot cylinders shall not be recharged and shipped without hydrostatic test if more than five years has elapsed from the date of the last test.

Nitrogen Pilot cylinders continuously in service without discharging can be retained in service for a maximum of five years from the date of the last hydrostatic test. At the end of five years the cylinder shall be visually inspected per CGA pamphlet C-6.

Cylinders must also be hydrostatic pressure tested immediately if the cylinder shows evidence of distortion, cracking, corrosion or mechanical or fire damage.

## 7-6.2 Pilot Cylinder Removal



**When removing a pressurized cylinder due to pressure loss, the control head must be in the SET position with the safety pull pin installed. A control head in the released position will cause the remaining contents of cylinder to discharge which may result in property damage and bodily injury.**

Replace the Pilot cylinder when expended or when loss of pressure occurs, as follows:

1. Remove the control head from the Pilot cylinder valve.
2. Immediately install the protection cap on the Pilot cylinder actuation port.
3. For the 108 cu. in. cylinder, remove the flexible actuation hose or tubing and adapter (P/N WK-699205-010) from the cylinder valve outlet. For the 1040 cu. in cylinder, Remove discharge head from cylinder valve.
4. Remove the clamps and hardware that secure the Pilot cylinder to the mounting bracket.

### 7-6.3 Nitrogen Pilot Cylinder Recharge

**Note:** This procedure is for Pilot cylinders only.

Nitrogen Pilot cylinders must be recharged when the cylinder pressure gauge indicates pressure is 10% below normal (1800 PSIG at 70°F [124 bar @ 21°C] as adjusted for temperature as shown in Figure 7-2) or immediately after discharge. Nitrogen used for charging must comply with Federal Specification BB-N-411C, Grade A, Type 1. Copies of this specification may be obtained from: <http://global.ihs.com/>



**Before recharging, cylinder must be firmly secured by chains, clamps or other devices to an immovable object such as a wall, structural I-beam or permanently mounted holding rack.**

Recharge Pilot cylinders as follows:

1. Remove the protection cap from the cylinder valve actuation port.
2. Install the nitrogen cylinder recharge adapter (P/N WK-933537-000) to the cylinder valve actuation port and plug valve outlet port with 1/8 in. NPT pipe plug.

**Note:** The pressure gauge attached to the extinguishing system is not to be used to determine when the intended charging pressure has been reached. A pressure regulator is to be used per UL-2166.

3. Connect the nitrogen recharging supply hose to the adapter. Tighten securely.
4. Open the nitrogen recharging control valve slowly until full nitrogen flow is obtained.
5. Monitor the recharging supply pressure gauge. Close the charging control valve when the gauge indicates proper cylinder pressure (1800 PSIG @ 70°F [124 bar @ 21°C]) or until the mass of nitrogen reaches the number referenced in Table 6-9.

Table 7-1. Nitrogen Fill Weights

Part Number	Description	Net Fill Weight (lb.) Nominal
85-877690-001	108 cu. in. nitrogen cylinder	0.52
85-101040-001	1040 cu. in. nitrogen cylinder	5.70

6. Allow the cylinder to cool to ambient temperature and recheck nitrogen cylinder indicated pressure.
7. Open valve and add additional nitrogen as needed to obtain full cylinder charge at ambient temperature (1800 PSIG @ 70°F [124 bar @ 21°C]).
8. Close the valve and remove the supply hose and charging adapter from the nitrogen Pilot cylinder.
9. Check the nitrogen cylinder valve for leakage using a soap solution. Bubbles appearing in the soap solution indicate leakage and shall be cause for rejection of cylinder.
10. After the leak test is completed, thoroughly clean and dry the cylinder valve.
11. Ensure the cylinder valve control head port is clean and dry.
12. Immediately install the protective cap to the actuation port of the cylinder valve.
13. Install the charged cylinder as directed in Section 4-17.

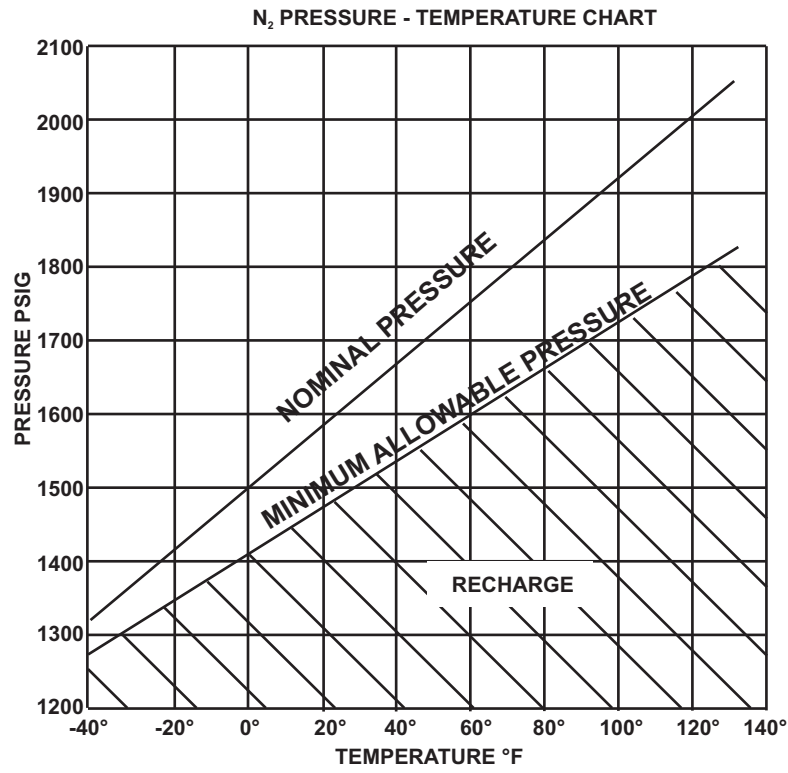


Figure 7-2. Nitrogen Temperature vs. Pressure Data

## 7-6.4 Nitrogen Cylinder I-Valve Inspection and Services

Inspect and service the Nitrogen I-Valve used on the 1040 cu. in. Nitrogen Pilot cylinder as follows:

**Note:** After every discharge, certain components in the I-Valve assembly will have to be serviced and inspected before recharging the Cylinder/Valve Assembly. Part numbers for items which may require replacement are listed in Table 7-2.

### 7-6.4.1 Valve Disassembly

**Note:** Refer to Figure 7-3 and Table 7-2.



**Before disassembly of valve, relieve all pressure from the cylinder. Contents under pressure can cause personal injury or property damage.**

1. Remove valve seat (P/N WK-202490-000).
2. Remove copper sealing gasket (P/N WK-326420-000).
3. Remove main check assembly and spring (P/Ns WK-800760-000 and WK-326410-000).
4. Remove sleeve retainer, brass sleeve and pilot check assembly (P/Ns WK-202804-000, WK-202805-000 and WK-923066-000 respectively).

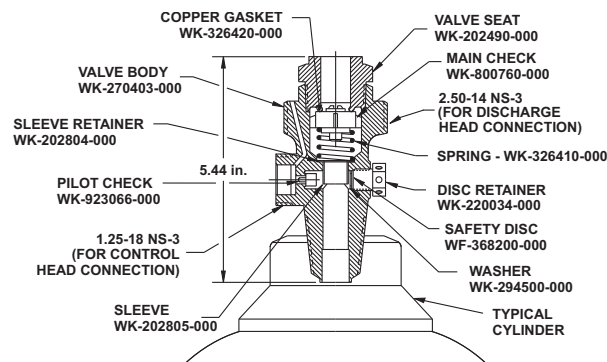


Figure 7-3. 5/8-inch I-Valve for Nitrogen Driver

Table 7-2. I-Valve Components

Part Number	Description	Qty.
WK-923066-000	Pilot Check Assembly	1
WK-202805-000	Brass Sleeve	1
WK-202804-000	Sleeve Retainer	1
WK-326410-000	Spring	1
WK-800760-000	Main Check Assembly-5/8" I-Valve	1
WK-326420-000	Copper Gasket	1
WK-202490-000	Valve Seat	1
WF-368200-000	Safety Disc (white)	1
WK-294500-000	Washer	1

**7-6.4.2 Nitrogen Cylinder I-Valve Assembly**

After each part has been thoroughly inspected, assemble the valve in the following order:

1. Install the new pilot check assembly.
2. Install the brass sleeve.
3. Install the sleeve retainer.
4. Install the spring.

**Note:** The main check assembly is installed with the rubber seat facing up. The copper sealing gasket **MUST** be replaced when the valve seat is removed. Refer to Figure 7-3.

5. Install the new main check assembly.
6. Install the new copper gasket (rounded side up). Apply a lubricant to the gasket before replacing.
7. Install the valve seat. Torque to 150 ± 15 ft·lb. (203 ± 20 N-m).

**7-6.4.3 Safety Disc Replacement**

1. Remove the safety disc retainer, along with the safety disc and safety disc washer from the valve body.
2. Assemble the safety disc washer, the new safety disc (paint side out) and the new safety disc retainer to the valve body. Refer to Table 7-3 for torque values.



**Never install any type disc other than the specified compliment for the cylinder. Installing the incorrect disc could result in violent rupture of the cylinder causing serious personal injury.**

**When replacing the safety on the valve, all three components must be replaced. Use kit, part number 81-004706-500.**

Table 7-3. Safety Disc Replacements for the I-Valve

<b>Nitrogen Cylinder</b>	<b>Safety Disc and Washer P/N</b>	<b>Safety Disc Retainer Nut P/N</b>	<b>Torque Value</b>	<b>PSIG @ 70°F</b>
85-101040-000	81-902048-000 (white)	WK-220034-000	350 + 35 in. lb. (475.0 + 47.5)	2900-3250

**7-6.4.4 Plain Nut Discharge Head Inspection and Service**

**Note:** After every discharge, certain components in the Plain Nut Discharge Head assembly must be inspected and serviced before recommissioning the Nitrogen Driver cylinder. Part numbers for the items which may require replacement are listed in Table 7-4.

1. Lubricate packing O-ring (P/N WF-209180-000) and reinstall top cap. Tighten to 25 to 50 ft. lb. (35 to 70 N-m).
2. Replace inner and outer packing O-ring (P/N WK-242466-000 and WK-242467-000 respectively) located concentrically on the bottom of the discharge head body.
3. Apply lubricant to both O-rings prior to attaching to I-valve (refer to Table 7-5 for lubricant recommendations).

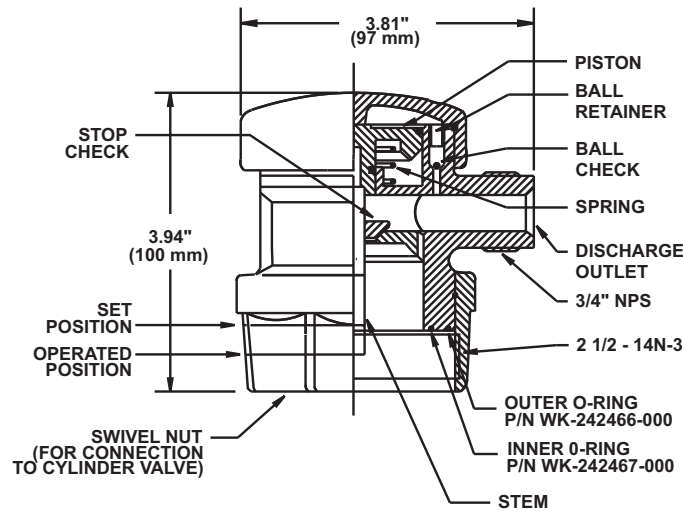


Figure 7-4. Plain Nut Discharge Head

Table 7-4. Discharge Head Replacement Part Numbers

Part Number	Description	Qty.
WK-242466-000	Outer Packing O-ring	1
WK-242467-000	Inner Packing O-ring	1

Table 7-5. Recommended Lubricants

Other Materials	Description
Lubricant	Parker Seal Co. Super-O-Lube or equivalent

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# CHAPTER 8

## PARTS LIST

### 8-1 INTRODUCTION AND PARTS LIST

The tables below, and on the following pages, provides a complete list of the Kidde Fire Systems Natura™ Inert Gas System (Natura IGS system) using IG-100, IG-541, IG-55, or IG-01 inert-gas agent (herein refer to collectively as the “agent”) parts and associated system equipment. The Natura IGS System equipment can be ordered as complete assemblies or as individual items. In most situations, when ordering a system, it will be easier and more cost effective to order by assembly part numbers.

**Note:** Please ensure when designing systems, ordering parts, or installing that the cylinder sizes match the manifolds, racking components, and other equipment. Using the incorrect size may cause issues with the design or installation of the system.

- Section 8-2, Agent and Cylinder Part Number
- Section 8-3, Release Units
- Section 8-4, Secondary Cylinder Gauge Assemblies
- Section 8-5, Quick Connect Cables
- Section 8-6, Discharge Accessories
- Section 8-7, Selector Valves
- Section 8-8, Lockout Valves
- Section 8-9, Discharge Nozzles
- Section 8-10, Discharge Delay, Siren, and Associated Accessories
- Section 8-11, Fill Adapters
- Section 8-12, Manifold Equipment
- Section 8-13, Cylinder Racking Kits

**8-2 AGENT AND CYLINDER PART NUMBER**

The following tables list the part numbers for the various agent and cylinder combinations for the Natura IGS system. The part number for each cylinder shows the agent, cylinder size, fill temperature, fill pressure, and brand.

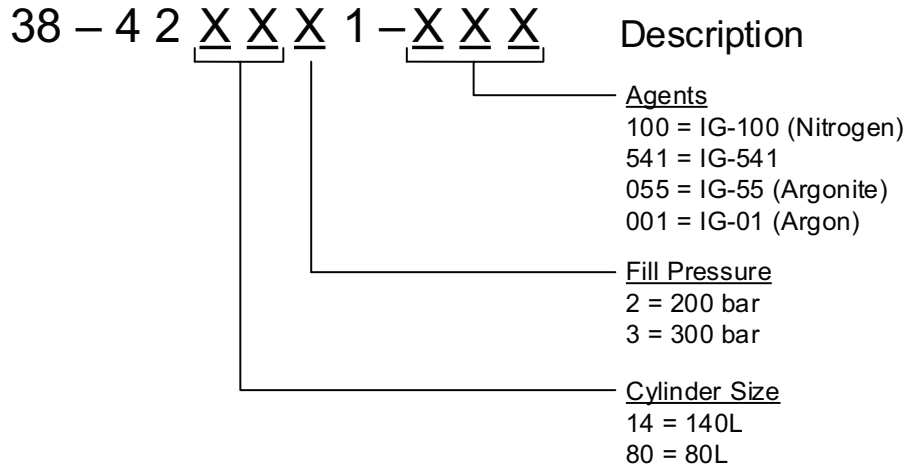


Figure 8-1. Natura IGS System Agent and Cylinder Part Number Breakdown

Table 8-1. Natura IGS System Factory Filled Cylinders

Description	Part Number
Kidde Fire Systems Factory Filled Cylinders with IG-100	
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-100 to 200 bar	38-428021-100
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-100 to 300 bar	38-428031-100
Kidde Fire Systems Factory Filled 140L Cylinder filled with IG-100 to 300 bar	38-421431-100
Kidde Fire Systems Factory Filled Cylinders with IG-541	
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-541 to 200 bar	38-428021-541
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-541 to 300 bar	38-428031-541
Kidde Fire Systems Factory Filled 140L Cylinder filled with IG-541 to 300 bar	38-421431-541
Kidde Fire Systems Factory Filled Cylinders with IG-55	
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-55 to 200 bar	38-428021-055
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-55 to 300 bar	38-428031-055
Kidde Fire Systems Factory Filled 140L Cylinder filled with IG-55 to 300 bar	38-421431-055
Kidde Fire Systems Factory Filled Cylinders with IG-01	
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-01 to 200 bar	38-428021-001
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-01 to 300 bar	38-428031-001
Kidde Fire Systems Factory Filled 140L Cylinder filled with IG-01 to 300 bar	38-421431-001

Table 8-2. Natura IGS System First Fill Eligible Cylinders

Description	Part Number
Kidde Fire Systems First Fill Eligible Cylinders with IG-100	
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-100 to 200 bar	38-428022-100
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-100 to 300 bar	38-428032-100
Kidde Fire Systems First Fill Eligible 140L Cylinder filled with IG-100 to 300 bar	38-421431-100
Kidde Fire Systems First Fill Eligible Cylinders with IG-541	
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-541 to 200 bar	38-428022-541
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-541 to 300 bar	38-428032-541
Kidde Fire Systems First Fill Eligible 140L Cylinder filled with IG541 to 300 bar	38-421431-541
Kidde Fire Systems First Fill Eligible Cylinders with IG-55	
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-55 to 200 bar	38-428022-055
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-55 to 300 bar	38-428032-055
Kidde Fire Systems First Fill Eligible 140L Cylinder filled with IG-55 to 300 bar	38-421431-055
Kidde Fire Systems First Fill Eligible Cylinders with IG-01	
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-01 to 200 bar	38-428022-001
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-01 to 300 bar	38-428032-001
Kidde Fire Systems First Fill Eligible 140L Cylinder filled with IG01 to 300 bar	38-421431-001

Table 8-3. Natura IGS System Cylinder Spare Parts

Description	Part Number
Anti-recoil Safety Cap, with Actuation Test Pin	38-400011-001
Transport Cap for 80L Cylinders	15-9604-0011
Transport Cap for 140L Cylinders	15-9604-0014

### 8-3 RELEASE UNITS

Table 8-4. Natura IGS System Release Unit Part Numbers

Description	Part Number
Release Unit	
Release Unit 400 Series - 200 bar, Manual / Electric, N.O. Gauge	38-400001-001
Release Unit 400 Series - 300 bar, Manual / Electric, N.O. Gauge	38-400001-003
Release Unit Service Kit, includes: <ul style="list-style-type: none"> <li>• 1 x Pin</li> <li>• 1 x Seal</li> <li>• 10 x O-rings pack*</li> </ul>	38-400001-010
*O-rings also fit Secondary Cylinder Gauge Assemblies and Fill Adapters	

### 8-4 SECONDARY CYLINDER GAUGE ASSEMBLIES

Table 8-5. Natura IGS System Secondary Cylinder Gauge Part Numbers

Description	Part Number
Secondary Cylinder Gauge Assembly - 200 bar, N.O.	38-400005-001
Secondary Cylinder Gauge Assembly - 300 bar, N.O.	38-400005-003

### 8-5 QUICK CONNECT CABLES

Table 8-6. Natura IGS System Quick Connect Cable Part Numbers

Description	Part Number
L Plug x 2 Cable, Dual Core 0.013" x 11.8" (0.34mm x 300mm) x Quick Connects (Male & Female)	38-400005-100
Gauge Signal Line - Quick Connect (MALE) Connector with 3m Fly lead (Dual Core Cable)	38-400005-102
Quick Connect (Male) x Dual Core 0.013" x 39.4" (0.34mm x 1000mm) Fly-Lead	38-400005-103
Quick Connect (Female) x Dual Core 0.013" x 39.4" (0.34mm x 1000mm) Fly-Lead	38-400005-105

**8-6 DISCHARGE ACCESSORIES**

Table 8-7. Natura IGS System Discharge Accessories Part Numbers

Description	Part Number
19.68" Actuation Hose with Quick Connect Fitting, Straight to Straight	38-401110-500
23.62" Actuation Hose with Quick Connect Fitting, Straight to Straight	38-401110-600
23.62" Actuation Hose with Quick Connect Fitting, Straight to 90°	38-401130-600
27.56" Actuation Hose with Quick Connect Fitting, Straight to 90°	38-401130-700
Discharge Hose 3/4" Dia., 16.1" (410 mm) Length, 90° to 90° Coupling	38-400330-410
Discharge Hose 3/4" Dia., 20.1" (510 mm) Length, 90° to 90° Coupling	38-400330-510
Manifold Check Valve 3/4", BSP	38-400002-002
Manifold Safety Device, BSP	38-400006-002
Pilot Line Bleed Valve (for last cylinder)	38-400007-001
Discharge Indicator	81-967082-000
Caution Label - Entrance	85-909300-001
Caution Label - Exit	85-909300-002
Caution Sign - Vent Keep Clear	01-2172-0200
Caution Sign - Entrance Inert System (BS Compliant)	K4076-2
Caution Sign - Manual Actuation Point (BS Compliant)	K4076-1
Caution Sign - Evacuate on Alarm Sound (BS Compliant)	01-2173-0200
Pressure Switch, 3 Pole Double Throw	81-486536-000
Pressure Switch, 3 Pole Single Throw (Ex. Proof)	81-981332-000
Pressure Trip	81-874290-000
Main-to-Reserve Transfer Switch	85-802398-001
Name Plate - Main	WK-310330-000
Name Plate - Reserve	WK-310340-000
Odorizer Assembly, Black	81-897600-001

**8-7 SELECTOR VALVES**

Table 8-8. Natura IGS System Selector Valve Part Numbers

Description	Part Number
1" Selector Valve, DN 25, 8-10 bar Actuator	22-37140-025
1 1/2" Selector Valve, DN 40, 8-10 bar Actuator	22-37140-040
2" Selector Valve, DN 50, 8-10 bar Actuator	22-37140-050
3" Selector Valve, Flange DN 80, 8-10 bar Actuator	22-37140-080
4" Selector Valve, Flange DN 100, 8-10 bar Actuator	22-37140-100
Back-Plate Manifold - 2 Area, Selector Valve Control, 8 bar	01-3508-0002
Back-Plate Manifold - 3 Area, Selector Valve Control, 8 bar	01-3508-0003
Back-Plate Manifold - 4 Area, Selector Valve Control, 8 bar	01-3508-0004
Back-Plate Manifold - 5 Area, Selector Valve Control, 8 bar	01-3508-0005
Back-Plate Manifold Hose	01-3273-1200
1" BSPT (M) to NPT (F) Adapter (2 required per valve, entry/exit)	01-3711-3000
1 1/2" BSPT (M) to NPT (F) Adapter (2 required per valve, entry/exit)	01-3711-4000
2" BSPT (M) to NPT (F) Adapter (2 required per valve, entry/exit)	01-3711-5000
Nipple 1/4" BSPP 60° x 1/4" BSPT M/M, Hose Adapter for For 1", 1 1/2" and 2" Selector Valves	15-8662-0042
Nipple 1/4" BSPP 60° x 1/8" BSPT M/M, Hose Adapter for For 3" and 4" Selector Valves	15-8662-0041
Pressure Regulator - 300 bar to 8 bar	01-6017-0000
Back-Plate Manifold Spare Solenoid	38-350800-001

**8-8 LOCKOUT VALVES**

Table 8-9. Natura IGS System Lockout Valve Part Numbers

Description	Part Number
Valve, 1" NPT Lockout (Isolation)	38-409830-005
Valve, 2" NPT Lockout (Isolation)	38-409830-007
Valve, 3" NPT Lockout (Isolation)	38-409830-009
Valve, 4" NPT Lockout (Isolation)	38-409830-010

## 8-9 DISCHARGE NOZZLES



**Only listed Natura IGS system nozzles are to be used on the Kidde Fire Systems Inert Gas Systems. Failure to comply with this WARNING can result in unpredictable agent distribution.**

**Note:** For the full listed NPT nozzles with corresponding orifice areas, see Table 8-11 and Table 8-13. For the full listed BSP nozzles with corresponding orifice areas, see Table 8-12 and Table 8-14.

Table 8-10. Natura IGS System Nozzle Part Numbers

Description	Part Number
NPT Nozzles	
Nozzle Assembly, 1/2" NPT, 360°	38-407100-XXX
Nozzle Assembly, 3/4" NPT, 360°	38-407200-XXX
Nozzle Assembly, 1" NPT, 360°	38-407300-XXX
Nozzle Assembly, 1-1/2" NPT, 360°	38-407400-XXX
Nozzle Assembly, 1/2" NPT, 180°	38-407500-XXX
Nozzle Assembly, 3/4" NPT, 180°	38-407600-XXX
Nozzle Assembly, 1" NPT, 180°	38-407700-XXX
Nozzle Assembly, 1-1/2" NPT, 180°	38-407800-XXX
BSP Nozzles	
Nozzle Assembly, 1/2" BSP, 360°	38-417100-XXX
Nozzle Assembly, 3/4" BSP, 360°	38-417200-XXX
Nozzle Assembly, 1" BSP, 360°	38-417300-XXX
Nozzle Assembly, 1-1/2" BSP, 360°	38-417400-XXX
Nozzle Assembly, 1/2" BSP, 180°	38-417500-XXX
Nozzle Assembly, 3/4" BSP, 180°	38-417600-XXX
Nozzle Assembly, 1" BSP, 180°	38-417700-XXX
Nozzle Assembly, 1-1/2" BSP, 180°	38-417800-XXX

**8-9.1 Listed 360 Degree Nozzles**

The Natura IGS system offers the 360 degree nozzle in brass for both NPT and BSP piping.

Table 8-11. Natura IGS System Listed 360 Degree NPT Nozzles

Orifice Diameter (mm)	Area		Nominal Thread Diameter			
	mm <sup>2</sup>	in. <sup>2</sup>	0.5"	0.75"	1.00"	1.50"
2	3.1416	0.0049	38-407100-020			
2.5	4.9087	0.0076	38-407100-025			
3	7.0686	0.0110	38-407100-030			
3.5	9.6211	0.0149	38-407100-035			
4	12.5664	0.0195	38-407100-040			
4.5	15.9043	0.0247	38-407100-045			
5	19.6350	0.0304	38-407100-050			
5.5	23.7583	0.0368	38-407100-055			
6	28.2743	0.0438	38-407100-060			
6.5	33.1831	0.0514	38-407100-065			
7	38.4845	0.0597	38-407100-070	38-407200-070		
7.5	44.1786	0.0685	38-407100-075	38-407200-075		
8	50.2655	0.0779	38-407100-080	38-407200-080		
8.5	56.7450	0.0880	38-407100-085	38-407200-085		
9	63.6173	0.0986	38-407100-090	38-407200-090		
9.5	70.8822	0.1099	38-407100-095	38-407200-095		
10	78.5398	0.1217	38-407100-100	38-407200-100	38-407300-100	
10.5	86.5901	0.1342		38-407200-105	38-407300-105	
11	95.0332	0.1473		38-407200-110	38-407300-110	
11.5	103.8689	0.1610		38-407200-115	38-407300-115	
12	113.0973	0.1753		38-407200-120	38-407300-120	
12.5	122.7185	0.1902		38-407200-125	38-407300-125	
13	132.7323	0.2057		38-407200-130	38-407300-130	
13.5	143.1388	0.2219		38-407200-135	38-407300-135	
14	153.9380	0.2386		38-407200-140	38-407300-140	38-407400-140
14.5	165.1300	0.2560			38-407300-145	38-407400-145
15	176.7146	0.2739			38-407300-150	38-407400-150
15.5	188.6919	0.2925			38-407300-155	38-407400-155
16	201.0619	0.3116			38-407300-160	38-407400-160
16.5	213.8246	0.3314			38-407300-165	38-407400-165
17	226.9801	0.3518			38-407300-170	38-407400-170
17.5	240.5282	0.3728			38-407300-175	38-407400-175
18	254.4690	0.3944			38-407300-180	38-407400-180
18.5	268.8025	0.4166				38-407400-185
19	283.5287	0.4395				38-407400-190

Table 8-11. Natura IGS System Listed 360 Degree NPT Nozzles (Continued)

Orifice Diameter (mm)	Area		Nominal Thread Diameter			
	mm <sup>2</sup>	in. <sup>2</sup>	0.5"	0.75"	1.00"	1.50"
19.5	298.6477	0.4629				38-407400-195
20	314.1593	0.4869				38-407400-200
20.5	330.0636	0.5116				38-407400-205
21	346.3606	0.5369				38-407400-210
21.5	363.0503	0.5627				38-407400-215
22	380.1327	0.5892				38-407400-220
22.5	397.6078	0.6163				38-407400-225
23	415.4756	0.6440				38-407400-230
23.5	433.7361	0.6723				38-407400-235
24	452.3893	0.7012				38-407400-240
24.5	471.4352	0.7307				38-407400-245
25	490.8739	0.7609				38-407400-250
25.5	510.7052	0.7916				38-407400-255
26	530.9292	0.8229				38-407400-260

Table 8-12. Natura IGS System Listed 360 Degree BSP Nozzles

Orifice Diameter (mm)	Area		Nominal Thread Diameter			
	mm <sup>2</sup>	in. <sup>2</sup>	0.5"	0.75"	1.00"	1.50"
3	7.0686	0.0110	38-417100-030			
3.5	9.6211	0.0149	38-417100-035			
4	12.5664	0.0195	38-417100-040			
4.5	15.9043	0.0247	38-417100-045			
5	19.6350	0.0304	38-417100-050			
5.5	23.7583	0.0368	38-417100-055			
6	28.2743	0.0438	38-417100-060			
6.5	33.1831	0.0514	38-417100-065			
7	38.4845	0.0597	38-417100-070	38-417200-070		
7.5	44.1786	0.0685	38-417100-075	38-417200-075		
8	50.2655	0.0779	38-417100-080	38-417200-080		
8.5	56.7450	0.0880	38-417100-085	38-417200-085		
9	63.6173	0.0986	38-417100-090	38-417200-090		
9.5	70.8822	0.1099	38-417100-095	38-417200-095		
10	78.5398	0.1217	38-417100-100	38-417200-100	38-417300-100	
10.5	86.5901	0.1342		38-417200-105	38-417300-105	
11	95.0332	0.1473		38-417200-110	38-417300-110	
11.5	103.8689	0.1610		38-417200-115	38-417300-115	

**Parts List**

Table 8-12. Natura IGS System Listed 360 Degree BSP Nozzles (Continued)

Orifice Diameter (mm)	Area		Nominal Thread Diameter			
	mm <sup>2</sup>	in. <sup>2</sup>	0.5"	0.75"	1.00"	1.50"
12	113.0973	0.1753		38-417200-120	38-417300-120	
12.5	122.7185	0.1902		38-417200-125	38-417300-125	
13	132.7323	0.2057		38-417200-130	38-417300-130	
13.5	143.1388	0.2219		38-417200-135	38-417300-135	
14	153.9380	0.2386		38-417200-140	38-417300-140	38-417400-140
14.5	165.1300	0.2560			38-417300-145	38-417400-145
15	176.7146	0.2739			38-417300-150	38-417400-150
15.5	188.6919	0.2925			38-417300-155	38-417400-155
16	201.0619	0.3116			38-417300-160	38-417400-160
16.5	213.8246	0.3314			38-417300-165	38-417400-165
17	226.9801	0.3518			38-417300-170	38-417400-170
17.5	240.5282	0.3728			38-417300-175	38-417400-175
18	254.4690	0.3944			38-417300-180	38-417400-180
18.5	268.8025	0.4166				38-417400-185
19	283.5287	0.4395				38-417400-190
19.5	298.6477	0.4629				38-417400-195
20	314.1593	0.4869				38-417400-200
20.5	330.0636	0.5116				38-417400-205
21	346.3606	0.5369				38-417400-210
21.5	363.0503	0.5627				38-417400-215
22	380.1327	0.5892				38-417400-220
22.5	397.6078	0.6163				38-417400-225
23	415.4756	0.6440				38-417400-230
23.5	433.7361	0.6723				38-417400-235
24	452.3893	0.7012				38-417400-240
24.5	471.4352	0.7307				38-417400-245
25	490.8739	0.7609				38-417400-250
25.5	510.7052	0.7916				38-417400-255
26	530.9292	0.8229				38-417400-260

## 8-9.2 Listed 180 Degree Nozzles

The Natura IGS system offers the 180 degree nozzle in brass for both NPT and BSP piping.

Table 8-13. Natura IGS System Listed 180 NPT Degree Nozzles

Orifice Diameter (mm)	Area		Nominal Thread Diameter			
	mm <sup>2</sup>	in. <sup>2</sup>	0.5"	0.75"	1.00"	1.50"
2	3.1416	0.0049	38-407500-020			
2.5	4.9087	0.0076	38-407500-025			
3	7.0686	0.0110	38-407500-030			
3.5	9.6211	0.0149	38-407500-035			
4	12.5664	0.0195	38-407500-040			
4.5	15.9043	0.0247	38-407500-045			
5	19.6350	0.0304	38-407500-050			
5.5	23.7583	0.0368	38-407500-055			
6	28.2743	0.0438	38-407500-060			
6.5	33.1831	0.0514	38-407500-065			
7	38.4845	0.0597	38-407500-070	38-407600-070		
7.5	44.1786	0.0685	38-407500-075	38-407600-075		
8	50.2655	0.0779	38-407500-080	38-407600-080		
8.5	56.7450	0.0880	38-407500-085	38-407600-085		
9	63.6173	0.0986	38-407500-090	38-407600-090		
9.5	70.8822	0.1099	38-407500-095	38-407600-095		
10	78.5398	0.1217	38-407500-100	38-407600-100	38-407700-100	
10.5	86.5901	0.1342		38-407600-105	38-407700-105	
11	95.0332	0.1473		38-407600-110	38-407700-110	
11.5	103.8689	0.1610		38-407600-115	38-407700-115	
12	113.0973	0.1753		38-407600-120	38-407700-120	
12.5	122.7185	0.1902		38-407600-125	38-407700-125	
13	132.7323	0.2057		38-407600-130	38-407700-130	
13.5	143.1388	0.2219		38-407600-135	38-407700-135	
14	153.9380	0.2386		38-407600-140	38-407700-140	38-407800-140
14.5	165.1300	0.2560			38-407700-145	38-407800-145
15	176.7146	0.2739			38-407700-150	38-407800-150
15.5	188.6919	0.2925			38-407700-155	38-407800-155
16	201.0619	0.3116			38-407700-160	38-407800-160
16.5	213.8246	0.3314			38-407700-165	38-407800-165
17	226.9801	0.3518			38-407700-170	38-407800-170
17.5	240.5282	0.3728			38-407700-175	38-407800-175
18	254.4690	0.3944			38-407700-180	38-407800-180
18.5	268.8025	0.4166				38-407800-185
19	283.5287	0.4395				38-407800-190

**Parts List**

Table 8-13. Natura IGS System Listed 180 NPT Degree Nozzles (Continued)

Orifice Diameter (mm)	Area		Nominal Thread Diameter			
	mm <sup>2</sup>	in. <sup>2</sup>	0.5"	0.75"	1.00"	1.50"
19.5	298.6477	0.4629				38-407800-195
20	314.1593	0.4869				38-407800-200
20.5	330.0636	0.5116				38-407800-205
21	346.3606	0.5369				38-407800-210
21.5	363.0503	0.5627				38-407800-215
22	380.1327	0.5892				38-407800-220
22.5	397.6078	0.6163				38-407800-225
23	415.4756	0.6440				38-407800-230
23.5	433.7361	0.6723				38-407800-235
24	452.3893	0.7012				38-407800-240
24.5	471.4352	0.7307				38-407800-245
25	490.8739	0.7609				38-407800-250
25.5	510.7052	0.7916				38-407800-255
26	530.9292	0.8229				38-407800-260

Table 8-14. Natura IGS System Listed 180 BSP Degree Nozzles

Orifice Diameter (mm)	Area		Nominal Thread Diameter			
	mm <sup>2</sup>	in. <sup>2</sup>	0.5"	0.75"	1.00"	1.50"
3	7.0686	0.0110	38-417500-030			
3.5	9.6211	0.0149	38-417500-035			
4	12.5664	0.0195	38-417500-040			
4.5	15.9043	0.0247	38-417500-045			
5	19.6350	0.0304	38-417500-050			
5.5	23.7583	0.0368	38-417500-055			
6	28.2743	0.0438	38-417500-060			
6.5	33.1831	0.0514	38-417500-065			
7	38.4845	0.0597	38-417500-070	38-417600-070		
7.5	44.1786	0.0685	38-417500-075	38-417600-075		
8	50.2655	0.0779	38-417500-080	38-417600-080		
8.5	56.7450	0.0880	38-417500-085	38-417600-085		
9	63.6173	0.0986	38-417500-090	38-417600-090		
9.5	70.8822	0.1099	38-417500-095	38-417600-095		
10	78.5398	0.1217	38-417500-100	38-417600-100	38-417700-100	
10.5	86.5901	0.1342		38-417600-105	38-417700-105	
11	95.0332	0.1473		38-417600-110	38-417700-110	
11.5	103.8689	0.1610		38-417600-115	38-417700-115	

Table 8-14. Natura IGS System Listed 180 BSP Degree Nozzles (Continued)

Orifice Diameter (mm)	Area		Nominal Thread Diameter			
	mm <sup>2</sup>	in. <sup>2</sup>	0.5"	0.75"	1.00"	1.50"
12	113.0973	0.1753		38-417600-120	38-417700-120	
12.5	122.7185	0.1902		38-417600-125	38-417700-125	
13	132.7323	0.2057		38-417600-130	38-417700-130	
13.5	143.1388	0.2219		38-417600-135	38-417700-135	
14	153.9380	0.2386		38-417600-140	38-417700-140	38-417800-140
14.5	165.1300	0.2560			38-417700-145	38-417800-145
15	176.7146	0.2739			38-417700-150	38-417800-150
15.5	188.6919	0.2925			38-417700-155	38-417800-155
16	201.0619	0.3116			38-417700-160	38-417800-160
16.5	213.8246	0.3314			38-417700-165	38-417800-165
17	226.9801	0.3518			38-417700-170	38-417800-170
17.5	240.5282	0.3728			38-417700-175	38-417800-175
18	254.4690	0.3944			38-417700-180	38-417800-180
18.5	268.8025	0.4166				38-417800-185
19	283.5287	0.4395				38-417800-190
19.5	298.6477	0.4629				38-417800-195
20	314.1593	0.4869				38-417800-200
20.5	330.0636	0.5116				38-417800-205
21	346.3606	0.5369				38-417800-210
21.5	363.0503	0.5627				38-417800-215
22	380.1327	0.5892				38-417800-220
22.5	397.6078	0.6163				38-417800-225
23	415.4756	0.6440				38-417800-230
23.5	433.7361	0.6723				38-417800-235
24	452.3893	0.7012				38-417800-240
24.5	471.4352	0.7307				38-417800-245
25	490.8739	0.7609				38-417800-250
25.5	510.7052	0.7916				38-417800-255
26	530.9292	0.8229				38-417800-260

**8-10 DISCHARGE DELAY, SIREN, AND ASSOCIATED ACCESSORIES**

Table 8-15. Natura IGS System Discharge Delay, Siren, and Associated Accessories Part Numbers

Description	Part Number
Nitrogen Pilot Cylinder, 108 cu. in. (1.77 L) with Supervisory Pressure Switch, Normally Open Under Pressure	85-877690-001
1040 cu. in. Nitrogen Pilot Cylinder w/pressure switch	85-101040-001
30 Second Nitrogen Discharge Delay Kit which includes: <ul style="list-style-type: none"> <li>• Nitrogen Discharge Delay for use with 108 cu. in. Pilot Cylinder (P/N 81-871072-001)</li> <li>• 3/4" Male x 1/4" NPT Female Bushing Adapter</li> <li>• 1/4" BSPP Male x NPT Male Straight Adapter</li> <li>• 1/4" BSPP Female x NPT Male Straight Adapter</li> <li>• 1/3" NPT Female 90° Elbow Connector</li> <li>• 1/4" NPT Male x 6mm Tube OD Adapter</li> <li>• Back-Plate Manifold Hose (P/N 01-3273-1200)</li> </ul>	38-401140-030
60 Second Nitrogen Discharge Delay Kit which includes: <ul style="list-style-type: none"> <li>• Nitrogen Discharge Delay for use with 108 cu. in. Pilot Cylinder (P/N 81-871072-002)</li> <li>• 3/4" Male x 1/4" NPT Female Bushing Adapter</li> <li>• 1/4" BSPP Male x NPT Male Straight Adapter</li> <li>• 1/4" BSPP Female x NPT Male Straight Adapter</li> <li>• 1/3" NPT Female 90° Elbow Connector</li> <li>• 1/4" NPT Male x 6mm Tube OD Adapter</li> <li>• Back-Plate Manifold Hose (P/N 01-3273-1200)</li> </ul>	38-401140-060
Siren, Nitrogen Pressure Operated	90-981574-001
Male Connector, 5/16" Flare x 1/8" NPT	WK-699205-010
Mounting Bracket, Nitrogen Pilot Cylinder 108 cu. in.	WK-877845-000
Actuation Hose, 30"	WK-264986-000
Cylinder Strap, Nitrogen Pilot Cylinder 1040 cu. in.	WK-270014-000
Discharge Head, Plain Nut	WK-872450-000
Flexible Hose, 3/4" Outlet	WK-251821-000
Electric Control Head, 24 VDC Kit with Control Head Monitor	85-890181-200
Lever Operated Control Head	WK-870652-000
Lever/Pressure Operated Control Head	82-878751-000
Control Head Monitor, with Hazloc Assembly (as spare)	85-100000-100

**8-11 FILL ADAPTERS**

Table 8-16. Natura IGS System Fill Adapter Part Numbers

Description	Part Number
Filling Adapter Assembly	38-406000-001
O-Ring for Filling Adapter	38-406000-003
Nitrogen Cylinder Recharge Adapter	WK-933537-000
O-Ring for Nitrogen Cylinder Recharge Adapter (P/N WK-933537-000)	WK-197008-000

**8-12 MANIFOLD EQUIPMENT**

Table 8-17. Natura IGS System Manifold Equipment Part Numbers

Description	Part Number
80L, 2 Stub 1 Row 2" Manifold BSP, with 2 manifold check valves	38-351000-004
80L, 3 Stub 1 Row 2" Manifold BSP, with 3 manifold check valves	38-351000-005
80L, 4 Stub 1 Row 2" Manifold BSP, with 4 manifold check valves	38-351000-006
80L, 5 Stub 1 Row 2" Manifold BSP, with 5 manifold check valves	38-351000-007
80L, 6 Stub 1 Row 2" Manifold BSP, with 6 manifold check valves	38-351000-008
80L, 4 Stub 2 Row 2" Manifold BSP, with 4 manifold check valves	38-351000-009
80L, 6 Stub 2 Row 2" Manifold BSP, with 6 manifold check valves	38-351000-010
80L, 8 Stub 2 Row 2" Manifold BSP, with 8 manifold check valves	38-351000-011
140L, 2 Stub 1 Row 2" Manifold BSP, with 2 manifold check valves	38-351140-004
140L, 3 Stub 1 Row 2" Manifold BSP, with 3 manifold check valves	38-351140-005
140L, 4 Stub 1 Row 2" Manifold BSP, with 4 manifold check valves	38-351140-006
140L, 5 Stub 1 Row 2" Manifold BSP, with 5 manifold check valves	38-351140-007
140L, 6 Stub 1 Row 2" Manifold BSP, with 6 manifold check valves	38-351140-008
140L, 4 Stub 2 Row 2" Manifold BSP, with 4 manifold check valves	38-351140-009
140L, 6 Stub 2 Row 2" Manifold BSP, with 6 manifold check valves	38-351140-010
140L, 8 Stub 2 Row 2" Manifold BSP, with 8 manifold check valves	38-351140-011
2" BSP Manifold Coupling	38-400020-100
2" BSP Manifold End Cap	38-400020-101
3/4" BSP Manifold End Cap For 14mm Check Valve	38-400020-102
2" Adapter, BSPT (F) to NPT (F)	38-351000-001
Bracket for 80L Cylinder Manifold 1 Row 200mm (includes 2" Clamp)	01-8160-0200
Bracket for 80L Cylinder Manifold 2 Row 520mm (includes 2" Clamp)	01-8160-0520
Bracket for 80L Cylinder Manifold 3 Row 830mm (includes 2" Clamp)	01-8160-0830
Bracket for 140L Cylinder Manifold 1 Row 250mm (includes 2" Clamp)	01-8160-0250
Bracket for 140L Cylinder Manifold 2 Row 600mm (includes 2" Clamp)	01-8160-0600
Bracket for 140L Cylinder Manifold 3 Row 1000mm (includes 2" Clamp)	01-8160-1000
2" Pipe Clamp $\phi$ 58.7 - $\phi$ 63.5 mm	01-8143-0000

**8-13 CYLINDER RACKING KITS**

Table 8-18. Natura IGS System Cylinder Accessories Parts List

<b>Description</b>	<b>Part Number</b>
Unistrut Cylinder Wall Bracket - 400mm	01-8121-1000
Unistrut Cylinder Wall Bracket - 440mm	01-8121-1400
Unistrut Cylinder Wall Bracket - 650mm	01-8122-1000
Unistrut Cylinder Wall Bracket - 950mm	01-8123-1000
Unistrut Cylinder Wall Bracket - 1250mm	01-8124-1000
Unistrut Cylinder Wall Bracket - 1550mm	01-8125-1000
Unistrut Cylinder Wall Bracket - 1850mm	01-8126-1000
Clamping Bar 1 x 2 for 80L Cylinder (Front)	03-8266-0000
Clamping Bar 1 x 3 for 80L Cylinder (Front)	03-8267-0000
Clamping Bar 1 x 2 for 140L Cylinder (Front)	03-8366-0000
Clamping Bar 1 x 3 for 140L Cylinder (Front)	03-8367-0000
Wooden Spacer 1 x 2 for 80L Cylinder (Rear)	03-8162-0000
Wooden Spacer 1 x 3 for 80L Cylinder (Rear)	03-8163-0000
Wooden Spacer 1 x 2 for 140L Cylinder (Rear)	03-8462-0000
Wooden Spacer 1 x 3 for 140L Cylinder (Rear)	03-8463-0000
Wooden Spacer 2 x 2 for 80L Cylinder (Center)	03-8164-0000
Wooden Spacer 2 x 3 for 80L Cylinder (Center)	03-8165-0000
Wooden Spacer 2 x 2 for 140L Cylinder (Center)	03-8464-0000
Wooden Spacer 2 x 3 for 140L Cylinder (Center)	03-8465-0000
Single Clamp for 80L Cylinder, Galvanized Steel	01-8131-0000
Single Clamp for 140L Cylinder, Galvanized Steel	01-8131-1000
Clamping Bolt, 2 Row, 80L - 715mm Long	01-8337-0200
Clamping Bolt, 3 Row, 80L - 1030mm Long	01-8337-0300
Clamping Bolt, 2 Row, 140L - 895mm Long	01-8437-0200
End Cover, White PVC 34 X 40 mm	01-8131-0002
Distance Pipe 3/4" + Washers 80L	03-8331-0000
Distance Pipe 3/4" + Washers 140L	03-8331-0140

# APPENDIX A

## REFILL INFORMATION

This appendix provides instructions for refilling cylinders of inert gas agents used in Kidde Fire Systems Natura™ Inert Gas System (Natura IGS system) with IG-100, IG-541, IG-55, or IG-01 inert-gas agent (herein refer to collectively as the “Agent”) and includes the following:

- Description of required charging equipment
- Charging process
- Leak test procedure

The procedures and instructions included herein are a basic guide and are intended to be performed by qualified personnel, trained in the handling, service, maintenance, filling and testing of Natura IGS for both 300 and 200 bar cylinders with the corresponding agents.

A robust Quality Management System is expected to control the procedure and documents for the refilling process such that it is ensured that the cylinders receive the correct quantity, quality, and composition of gas and that the leak integrity is ensured.

**Note:** Only the cylinders listed in Table A-2 and Table A-3 are eligible for refilling.

### A-1 AGENT PRESSURE VERSE TEMPERATURE FORMULAS

See the individual Agent sections in Chapter 1 for the corresponding graphs.

Table A-1. Agent Pressure Verse Temperature Formulas

Agent	Temp. Unit	200 bar	300 bar
IG-100	°F	$P = 0.555(t) + 167.2$	$P = 0.894(t) + 247.1$
	°C	$P = 0.999(t) + 185.0$	$P = 1.809(t) + 272.8$
IG-541	°F	$P = 0.616(t) + 163.6$	$P = 1.019(t) + 239.7$
	°C	$P = 1.809(t) + 272.8$	$P = 1.835(t) + 272.4$
IG-55	°F	$P = 0.575(t) + 166.0$	$P = 0.943(t) + 244.2$
	°C	$P = 1.035(t) + 184.4$	$P = 1.697(t) + 274.4$
IG-01	°F	$P = 0.600(t) + 164.5$	$P = 1.005(t) + 240.6$
	°C	$P = 1.080(t) + 183.7$	$P = 1.809(t) + 272.8$

P= Pressure  
t = Measured Temperature

### A-2 QUALITY RESPONSIBILITY REQUIREMENTS

It is the responsibility of the refill site to maintain the necessary quality control for component materials, manufacturing methods and finished components. It is understood that the refill site must have a continuing program of employee training, equipment maintenance and other quality assurance practices, which keep the product in conformance. Under abnormal conditions, additional examination, inspection, or other steps will be required to ensure product conformance.

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## A-3 CALIBRATION OF TESTING AND MEASURING EQUIPMENT

The refill site shall maintain a program to assure that testing and measuring equipment used in production and/or inspection is kept clean, is maintained in good working order, and in calibration.

Measuring devices and production aids, such as micrometers, calipers, steel scales, and gauges must be subjected to a formal calibration program. Accordingly, for these devices the refill site is to maintain surveillance over these devices and replace or adjust any equipment, which is found to be inaccurate.

Gauges, scales, torque wrenches, flow measuring devices, or other instruments used to conduct quality tests shall be calibrated as follows:

- Calibration must occur at least once per year
- Calibration must occur whenever the gauge has been subjected to physical abuse such as might result from it being dropped or struck with an object
- Calibration must occur any time when the accuracy of the gauge appears questionable.

Gauges shall be calibrated against a standard traceable to a National Standard. The refill site shall maintain certification of this calibration until the next succeeding certification is provided and shall have the certification readily available for review as required.

### A-3.1 Designation of Batches

The manufacturer or fill site shall start a new batch with each change in run, material used, or manufacturing methods. A new batch shall be established every week of production. Each batch shall be identified with the batch designation. The refill site shall maintain records for each batch. The number of samples indicated in the production tests is for one batch only. An equal number of samples shall be provided for each additional batch to be tested.

The agent shall be traceable as FM Approved through batch numbers and/or agent manufactures quality reports as applicable.

## A-4 CHARGING EQUIPMENT

This section describes the required charging equipment and specifies the cylinder assemblies compatible with the Natura IGS system.

### A-4.1 Cylinder and Valve Assemblies

The various agents are stored in steel cylinders as a gas. The steel cylinders are capped with a valve assembly. The cylinder valve assembly is equipped with a safety burst disc in compliance with DOT or TPED requirements.

In addition, each cylinder and valve assembly is provided with a anti-recoil cap and a transport cap/shroud which is a safety feature to prevent uncontrolled, accidental discharge.



**The anti-recoil cap must be installed on the discharge outlet whenever a charged cylinder/valve assembly is not connected to the system piping. Failure to install the anti-recoil cap could result in violent movement of the container in the event of inadvertent actuation. Failure to follow these instructions could cause death, personal injury and/or property damage.**

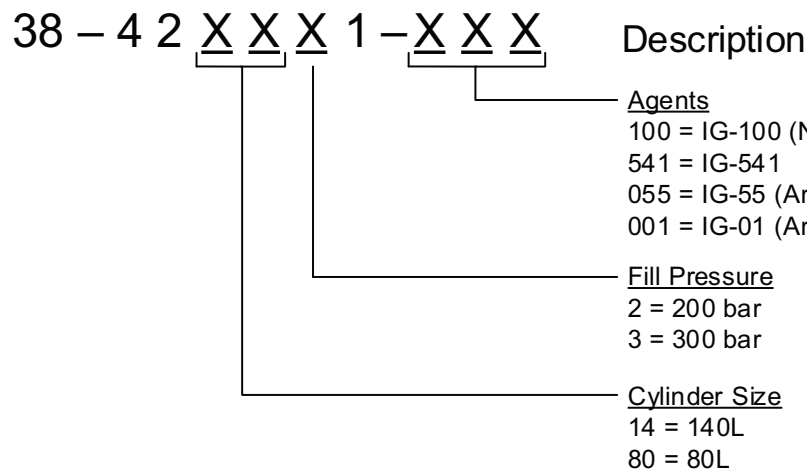


Figure A-1. Factory Filled Natura IGS System Agent and Cylinder Part Number Breakdown

Table A-2. Natura IGS System Factory Filled Cylinder Part Numbers

Description	Part Number
Kidde Fire Systems Factory Filled Cylinders with IG-01	
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-01 to 200 bar	38-428021-001
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-01 to 300 bar	38-428031-001
Kidde Fire Systems Branded 140L Cylinder filled with IG01 to 300 bar	38-421431-001
Kidde Fire Systems Factory Filled Cylinders with IG-100	
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-100 to 200 bar	38-428021-100
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-100 to 300 bar	38-428031-100
Kidde Fire Systems Branded 140L Cylinder filled with IG-100 to 300 bar	38-421431-100
Kidde Fire Systems Factory Filled Cylinders with IG-55	
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-55 to 200 bar	38-428021-055
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-55 to 300 bar	38-428031-055
Kidde Fire Systems Branded 140L Cylinder filled with IG-55 to 300 bar	38-421431-055
Kidde Fire Systems Factory Filled Cylinders with IG-541	
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-541 to 200 bar	38-428021-541
Kidde Fire Systems Factory Filled 80L Cylinder filled with IG-541 to 300 bar	38-428031-541
Kidde Fire Systems Branded 140L Cylinder filled with IG541 to 300 bar	38-421431-541

Table A-3. Natura IGS System First Fill Eligible Cylinder Part Numbers

Description	Part Number
Kidde Fire Systems First Fill Eligible Cylinders with IG-01	
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-01 to 200 bar	38-428022-001
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-01 to 300 bar	38-428032-001
Kidde Fire Systems Branded 140L Cylinder filled with IG01 to 300 bar	38-421432-001
Kidde Fire Systems First Fill Eligible Cylinders with IG-100	
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-100 to 200 bar	38-428022-100
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-100 to 300 bar	38-428032-100
Kidde Fire Systems Branded 140L Cylinder filled with IG-100 to 300 bar	38-421432-100
Kidde Fire Systems First Fill Eligible Cylinders with IG-55	
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-55 to 200 bar	38-428022-055
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-55 to 300 bar	38-428032-055
Kidde Fire Systems Branded 140L Cylinder filled with IG-55 to 300 bar	38-421432-055
Kidde Fire Systems First Fill Eligible Cylinders with IG-541	
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-541 to 200 bar	38-428022-541
Kidde Fire Systems First Fill Eligible 80L Cylinder filled with IG-541 to 300 bar	38-428032-541
Kidde Fire Systems Branded 140L Cylinder filled with IG541 to 300 bar	38-421432-541

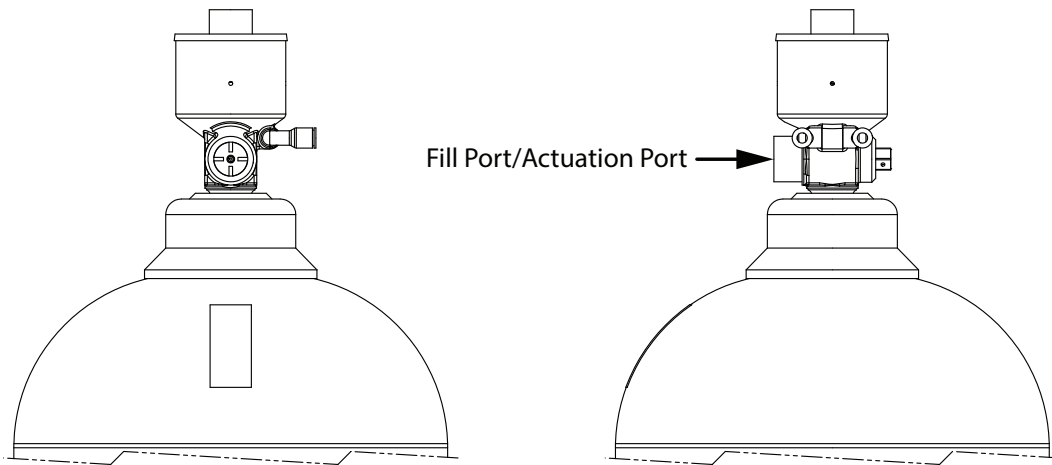
## A-4.2 Natura IGS Cylinder Valve, P/N 38-40000-001

The Natura IGS cylinder valve is a pneumatically operated valve.

The valve is designed and suitable for use in fire extinguishing systems having a storage pressure at 15°C up to 300 bar. The valve is based on a force (pressure) balance mechanism whereby the cylinder pressure is used to keep the valve closed until actuation. The valve is operated pneumatically by applying pressure to the actuation port. A minimum pressure of 8 bar is required to actuate the valve.



**Valves must be replaced after each discharge.**



Note: Fill Adapter must be used when filling.

Figure A-2. Natura IGS System Cylinder and Valve Assembly

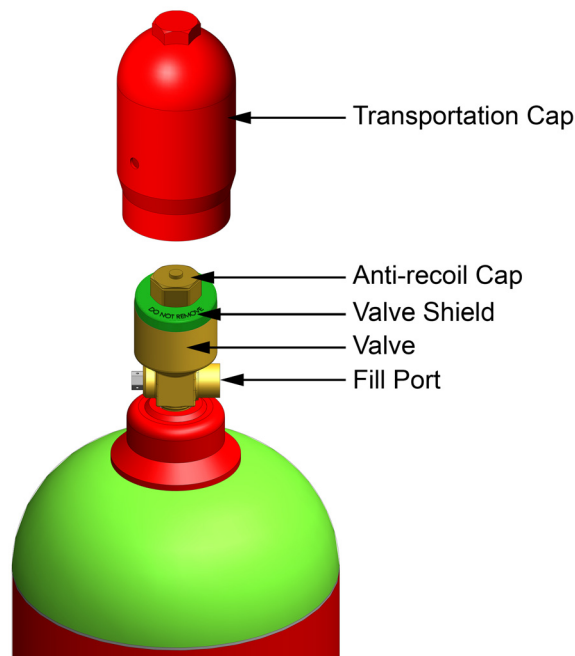


Figure A-3. Natura IGS System Cylinder and Valve Assembly Component Locations

### A-4.3 Fill Adapters, P/N 38-406000-001

The fill adapter should be tightened onto the valve with a torque of 25Nm. When the adapter is in position the shaft with the 17mm hex should be turned clockwise 1.5 revolutions in order to depress the Schrader in the valve port. It is necessary to counter hold the adapter when turning the 17mm hex shaft during operation.

Table A-4. Natura IGS System Fill Adapter Part Numbers

Description	Part Number
Filling Adapter Assembly, CGA 580	38-406000-001
O-Ring for Filling Adapter (P/N 38-406000-001)	38-406000-003

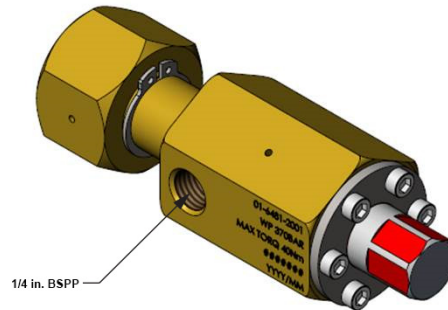


Figure A-4. Fill Adapter, P/N 38-406000-001 for Natura IGS System Cylinder Valve

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## A-5 FILLING PROCESS

The filling process for Natura IGS cylinder and valve assemblies may use pressure or weight as the means of controlling the quantity of the agent filled.



**During the filling process, take care not to exceed the pressure or temperature limitation of the system. Adjust the filling ratio in such a way that the temperature within the cylinder never exceeds 50°C, nor let the pressure exceed the reference pressure.**

When filling, use the following process:

1. Perform a pre-filling inspection of the cylinder and valve assembly. See Section A-5.1.
2. Fill the cylinder and valve assembly, see Section A-5.3.
3. Record all necessary information as specified in Section A-5.4.
4. Leak test the cylinder and valve assembly as specified in Section A-6.

### A-5.1 Pre-filling Inspection

Cylinders must meet the following before being refilled:

- Cylinders shall have been pressure tested as accepted by local authorities.
- Topcoat colors shall be in accordance with requirements of the country.
- The surface treatment, coating, shall be intact.
- Damaged topcoat shall be repaired according to paint specification using compatible paint in the same color (RAL code).
- Cylinders shall have stamping as required by the authorities having jurisdiction
- Size of cylinder to be filled shall be in accordance with the filling order.
- Filled cylinder to be provided with transport/filling label indicating the content and the pressure.

#### A-5.1.1 Cylinder/Valve Replacement

Follow these steps to replace the valve on the cylinder.



**Valves must be replaced after each discharge.**

**Safety is the primary concern. Never assume that a cylinder is empty. Treat all Natura IGS cylinders as if they are fully charged. The Natura IGS cylinder valve is capable of producing dangerously high discharge forces from the valve outlet if not handled properly.**



**Remember that pressurized cylinders are extremely hazardous. Always fit the transport safety cap before any movement of the cylinder and always use appropriate cylinder trolley or similar. Failure to do so can result in serious bodily injury, death and property damage.**

1. Secure the cylinder and ensure the cylinder has been discharged of Agent contents.
2. Remove the old valve.
3. Ensure there is no tread tape left on the cylinder neck. Make sure the cylinder is clean and dry inside.

4. Wrap the valve's 25E EN 629-1 thread with 10-12 rounds of PTFE sealing tape; Quality: Grade L according to BS 7786 or PTFE-Paktape 0.057 mm. Apply the tape in a clockwise direction on the tapered thread in an even pattern, starting 2 mm from the start of the thread and ending approximately 2 mm from end of the thread.
5. Screw the valve into an empty, clean and dry cylinder.
6. Apply a torque of be between 147.5 ft-lbs and 162.3 ft-lbs (200 Nm and 220 Nm) (DS/EN-ISO 13341) to the valve to ensure proper installation.
7. Remove excess tape material after the valve has been screwed into the cylinder.

## A-5.2 Using the Fill Adapter

Follow this procedure to use the Fill Adapter:

1. Ensure that the pin in the fill adapter is fully reset.
2. Screw the Fill Adapter to the pressure gauge port of the valve.
3. Connect the filling rig to the fill port on the fill adapter.



**Do not install a tapered threaded fitting such as 1/4 in. BSPT or 1/4 in. NPT into this fill port. The fill port is threaded female 1/4 in. BSPP, and a corresponding male 1/4 in. BSPP must be used to connect to the fill port on the adapter.**

**Failure to do so could damage the fill adapter, filling line, or cause possible injury if a line disconnects during the fill process.**

4. Turn the knob on the end of the Fill Adapter clockwise approximately 1 turn to engage the Schrader valve on the fill port.
5. Fill the cylinder.
6. Turn the knob on the end of the Fill Adapter counter-clockwise approximately 1 turn to disengage the Schrader valve and bleed the Fill Line. If the line does not fully bleed then the check-pin is still engaged. Rotate the knob another 1/4 turn and repeat the Fill Line bleed.
7. Disconnect the fill rig from the Fill Adapter.
8. Once the Fill Line has bled off any pressure, unscrew the Fill Adapter from the pressure gauge port.

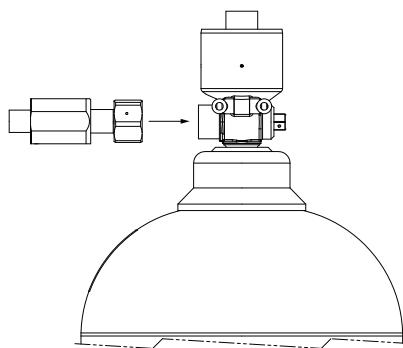


Figure A-5. Fill Adapter Installation

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### A-5.3 Filling Cylinder and Valve Assemblies

**Note:** The cylinder valve anti-recoil cap is only to be removed at the end of the fill process if the indicator pin is protruding from the top of the cap. If the pin is protruding then remove the cap fully to reset pin and check that the O-ring has not deformed. Fit anti-recoil cap then fit the transport cap.

The refill site shall provide suitable precautions to prevent contamination of the agent when it is transferred from its shipping or storage container into the Natura IGS cylinder and valve assemblies. Suitable precautions include but are not limited to:

- Purging the fill line before it is connected to each cylinder and valve assembly
- Using a fill line fitted with a quick disconnect type fitting at the end connected to the cylinder and valve assembly.

**Note:** If the fill line is not kept pressurized up to the quick disconnect type fitting, the line needs to be purged prior to being used in the fill process.

- Installing a moisture meter or indicator in the fill line between the agent shipping or storage container and the cylinder and valve assembly to monitor the agent.

The filling process may use pressure or weight as the means to control the quantity of the various gases that make up each agent. During the filling process, do not exceed the pressure or temperature limitation of the system. The filling ratio shall be adjusted in such a way that the temperature within the cylinder never exceeds 50°C, nor shall the pressure exceed the reference pressure. The filled quantity/pressure shall be maintained strictly in accordance with the specific requirements.

#### A-5.3.1 Filling by Pressure

Natura IGSs use cylinder pressures, at a filling reference temperature of 15°C, of 200 bar and 300 bar. When filling is complete, verify the final filling pressure(s). See the individual Pressure vs Temperature relations for each agent presented in Chapter 1.

For IG-541, the component gases must be filled in a specific order, CO<sub>2</sub>, then Nitrogen, then Argon. For IG-55, the fill order should be Nitrogen, then Argon, but this can be reversed. Use Table A-6 when pressurizing the cylinder with Argon first.

The filling may be initiated by using either of the two gases. See relations below.

**Note:** Allow a resting period of 30 minutes between filling each gas and prior to reaching the final fill pressure in order to let the cylinders cool down.

---

### A-5.3.1.1 Partial Pressure Fill Information



**Procedures must be in place at the fill site to ensure contamination does not occur.**

The pressures of each component agent gases required to fill a cylinders at 15°C are shown in Table A-5.

**Note:** Table A-5 assumes a fill order of CO<sub>2</sub>, then Nitrogen, then Argon. Filling in a different order requires different partial pressure valves not listed here.

Table A-5. Agent Partial Pressure (in bar) required to Fill Cylinders at 15 °C

Agent	Nominal Pressure.	CO <sub>2</sub>	Nitrogen	Argon
IG-55	300 bar	N/A	143-149	300
	200 bar	N/A	100-104	200
IG-01	300 bar	N/A	N/A	300
	200 bar	N/A	N/A	200
IG-100	300 bar	N/A	300	N/A
	200 bar	N/A	200	N/A
IG-541	300 bar	24	180	300
	200 bar	16	120	200

Table A-6. IG-55 Partial Pressure (in bar) required to Fill Cylinders at 15 °C if Filling Argon First

Agent	Nominal Pressure.	Argon	Nitrogen
IG-55	300 bar	128-133	300
	200 bar	91-95	200

### A-5.3.2 Filling by Weight



**Procedures must be in place at the fill site to ensure contamination does not occur.**

When filling the agents by weight, administer each component gas per Table A-7 in order to achieve the required agent pressure at 15°C.

**Note:** The net volume of the cylinder shall be used for calculating the required quantity of the individual gases.

When the filling is complete, verify the final filling pressure(s). See the individual Pressure vs Temperature relations for each agent presented in Chapter 1.

If additional gas is required to bring the cylinder up to the required pressure, use the agent or in the case of IG-55 or IG-541 use Nitrogen.

**Note:** Allow a resting period of 30 minutes between filling each gas and prior to reaching the final fill pressure in order to let the cylinders cool down.

#### A-5.3.2.1 Weight Relations for each Agent in kg/l

The weight of agent gases required to fill an agent cylinders at 15°C are shown in Table A-7.

Table A-7. Gas Weight required to Fill Agent Cylinders at 15 °C

Agent	Nominal Pressure.	Temp., °C	CO <sub>2</sub> , kg/l	Nitrogen, kg/l	Argon, kg/l	Final Weight, kg/l
IG-55	300 bar	15	None	0.165 – 0.171	0.226 – 0.236	0.397 – 0.401
	200 bar	15	None	0.117 – 0.122	0.160 – 0.167	0.282 – 0.285
IG-01	300 bar	15	None	None	0.504	0.504
	200 bar	15	None	None	0.353	0.353
IG-100	300 bar	15	None	0.312	None	0.312
	200 bar	15	None	0.225	None	0.225
IG-541	300 bar	15	0.043	0.182	0.199	0.424
	200 bar	15	0.029	0.121	0.133	0.283

#### A-5.3.3 Fill Tolerance per Agent

Agent	Nominal Pressure.	Temp., °C	Minimum Fill Pressure (bar)	Maximum Fill Pressure (bar)
IG-55	300 bar	15	294	303
	200 bar	15	196	202
IG-01	300 bar	15	294	303
	200 bar	15	196	202
IG-100	300 bar	15	294	303
	200 bar	15	196	202
IG-541	300 bar	15	294	303
	200 bar	15	196	202

### A-5.3.4 Principle of Filling - Flow Path

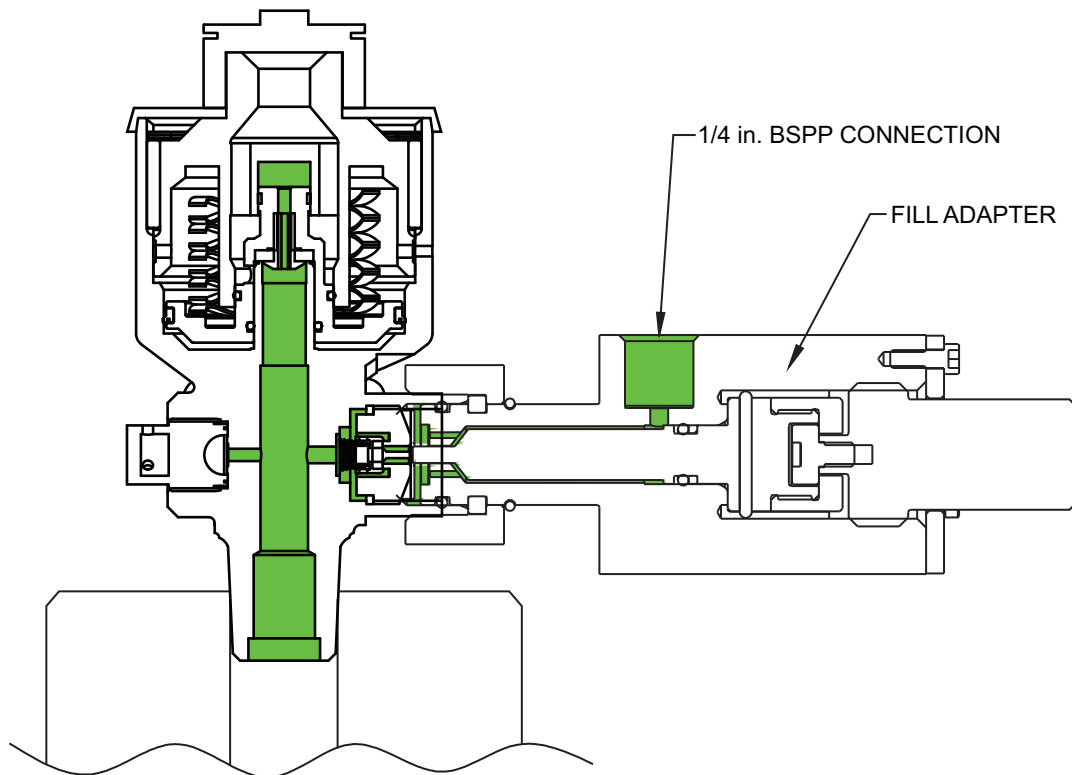


Figure A-6. Natura IGS Fill Adapter and Cylinder Valve Showing the Pressure (Green) Path during Filling  
The Natura IGS cylinder valve can only be filled through the fill/gauge port as shown in Figure A-6. The filling can be carried out using the fill adapter 38-406000-001, which is detailed in Section 2-9.



**Do not install a tapered threaded fitting such as 1/4" BSPT or 1/4" NPT into this port. The adapter must be 1/4" BSPP male at the fill adapter end and can be any thread on the opposing end that suits the filler needs to mate with the supply gas connection.**

---

## **A-5.4 Required Records**

Per agency requirements, the filling site shall keep comprehensive records for at least five years from the date of filling, to provide the capability to:

- Assure that materials of acceptable quality are used
- Enable further testing of samples
- Allow for the immediate tracing of the cause of any non-conformance and take the necessary corrective action to eliminate the non-conformance.

Records shall include the identification of parts, sub-assemblies, or completed extinguishing system units, test(s) conducted, date tested, number of samples tested, and the results (actual date). The records shall be retained for 12 months and shall be readily available for review by agency representative.

At a minimum, the following information must be recorded for each fill:

- Unique agent storage container serial number
- Order number and customer (may be recorded at a later date as long as it is traceable)
- Fill date
- Employee name
- Empty container assembly weight
- Ambient temp
- Agent temp
- Agent fill weight and/or pressurization level, as applicable
- Filled agent container assembly weight
- Leak test results
- Valve Manufacture Date/Batch Code

## A-5.5 Checklist for Filling Operation



**All pressurized cylinders can be extremely hazardous. Cylinder valves are capable of producing a high discharge thrust from the valve outlet when opened.**

Table A-8. Filling Checklist

Step	Description	Checked	Comments
1.	Ensure that the cylinder(s) to be filled are in good condition and secured / caged as described in detail in the Foreword.		
2.	List the cylinder serial number on the filling list.		
3.	Ensure that the Teflon tape on the cylinder thread on the valve is intact before the valve is screwed into the cylinder. Torque 200 - 220 Nm.		
4.	Remove the plastic protection cap from the filling port and fit fill adapter and tighten hex 1.5 turns.		
5.	Fill the selected first gas through the filling pump or pressure transfer equipment to the required quantity, pressure, or weight. Check the individual quantities:  If filling by pressure, check pressures against charts in Chapter 1.		
6.	Fill the second gas through the filling pump or pressure transfer equipment to the required final pressure.		
7.	When filling is completed, fully unscrew the hex nut on fill adapter, vent the fill line, then remove fill adapter.  Check the agent pressure against the charts in Chapter 1, when temperature is equalized.		
8.	Leak test all connection ports: Burst disc, gauge port, actuation port, valve connection to cylinder, vent hole.  <b>Note:</b> Check pressure indicator pin on anti-recoil cap is fully retracted, do not spray leak detection fluid with the cap off.  No leaks shall be accepted from any port.		
9.	Refit thread protection cap on fill port.		
10.	Fit cylinder with transport cap.		
11.	Secure cylinder in transport cage or on pallets.		
12.	Issue filling list.		
13.	Issue letter of conformity to the procurer with gas analysis report for each batch filled.		
14.	Ship to Receiver/Site as agreed.		

## A-6 LEAK TESTING

This section provides instructions for leak testing cylinders of inert gas agents used in the Natura IGS system. Each cylinder and valve assembly must be leak tested prior to affixing any Agency label. Leak tests can be accomplished using a leak detection fluid.



**Clamp the agent cylinder securely in place. The clamping device and supports must be capable of withstanding a thrust force of 126 KG-force. This approximates the thrust force generated from the agent cylinder valve outlet on a full, wide open discharge.**

### A-6.1 Leak Detection Fluid Procedure

Applied an ammonium free leak detection liquid in order to verify that no leaks are present. Should a leak be identified the cylinder should be returned to Kidde Fire Systems for investigation.

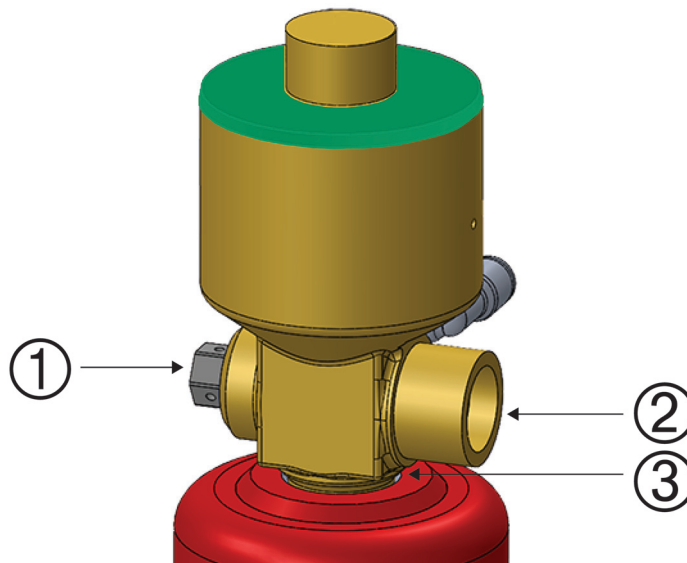


Figure A-7. Valve Leak Points

Table A-9. Valve Leak Points

Point	Description
1	Burst Disc Port
2	Actuation Schrader
3	Valve-Cylinder Connection



**Do not spray leak test liquid on the valve shield or anti-recoil cap. This area must remain free of moisture at all times.**



---

# **APPENDIX B**

## **SAFETY DATA SHEETS**

---

**1. IDENTIFICATION**

---

<b>Product Name</b>	Argon
<b>Recommended use of the chemical and restrictions on use</b>	
<b>Identified uses</b>	Fire Extinguishing Agent
<b>Restrictions on use</b>	Consult applicable fire protection codes
<b>Company Identification</b>	Kidde-Fenwal, Inc. 400 Main Street Ashland, MA 01721 USA
<b>Customer Information Number</b>	(508) 881-2000
<b>Emergency Telephone Number</b>	
<b>CHEMTREC Number</b>	(800) 424-9300 (703) 527-3887 (International)
<b>Issue Date</b>	July 21, 2017
<b>Supersedes Date</b>	This is the first issue.

*Safety Data Sheet prepared in accordance with OSHA's Hazard Communication Standard (29 CFR 1910.1200) and the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)*

---

**2. HAZARD IDENTIFICATION**

---

**Hazard Classification**

Gas under pressure – compressed gas  
Simple Asphyxiant

**Label Elements**

Hazard Symbols



Signal Word: Warning

**Hazard Statements**

Contents under pressure; may explode if heated.  
May displace oxygen and cause rapid suffocation.

**Precautionary Statements****Prevention**

Do not enter confined space unless adequately ventilated.  
In case of inadequate ventilation wear respiratory protection.

**Response**

None

**Storage**

Keep container tightly closed.  
Protect from sunlight and store in well-ventilated place.

---

**2. HAZARD IDENTIFICATION**

---

**Disposal**

None

**Other Hazards**

Avoid direct inhalation of undiluted gas. Can cause suffocation by reducing oxygen available for breathing. Breathing very high concentrations can cause dizziness, shortness of breath, unconsciousness or asphyxiation.

**Specific Concentration Limits**

The values listed below represent the percentages of ingredients of unknown toxicity.

Acute oral toxicity	0%
Acute dermal toxicity	0%
Acute inhalation toxicity	0%
Acute aquatic toxicity	100%

---

**3. COMPOSITION/INFORMATION ON INGREDIENTS**

---

This product is a substance.

<b>Component</b>	<b>CAS Number</b>	<b>Concentration</b>
Argon	7440-37-1	>99.5%

---

**4. FIRST- AID MEASURES**

---

**Description of necessary first-aid measures****Eyes**

No specific measures.

**Skin**

No specific measures.

**Ingestion**

Ingestion is not considered a potential route of exposure.

**Inhalation**

Remove from exposure. If there is difficulty in breathing, give oxygen. Obtain medical attention immediately.

**Most important symptoms/effects, acute and delayed**

Aside from the information found under Description of necessary first aid measures (above) and Indication of immediate medical attention and special treatment needed, no additional symptoms and effects are anticipated.

**Indication of immediate medical attention and special treatment needed****Notes to Physicians**

Treat symptomatically.

---

**5. FIRE - FIGHTING MEASURES**

---

**Suitable Extinguishing Media**

Argon is used as an extinguishing agent and therefore is not a problem when trying to control a blaze. Use extinguishing agent appropriate to other materials involved. Keep containers and surroundings cool with water spray as containers may rupture or burst in the heat of a fire.

---

**5. FIRE - FIGHTING MEASURES**

---

**Specific hazards arising from the chemical**

Containers may explode in heat of fire.

**Special Protective Actions for Fire-Fighters**

Wear full protective clothing and self-contained breathing apparatus as appropriate for specific fire conditions.

---

**6. ACCIDENTAL RELEASE MEASURES**

---

**Personal precautions, protective equipment and emergency procedures**

Remove leaking cylinder to a safe place. Ventilate the area. Leaks inside confined spaces may cause suffocation as oxygen is displaced and should not be entered without a self-contained breathing apparatus.

**Environmental Precautions**

None - Material is a normal atmospheric gas.

**Methods and materials for containment and cleaning up**

None

---

**7. HANDLING AND STORAGE**

---

**Precautions for safe handling**

Containers should be properly stored and secured to prevent falling or being knocked over. Do not drag, slide or roll containers. Do not drop containers or permit them to strike against each other. Never apply flame or localized heat directly to any part of the containers.

**Conditions for safe storage**

Store away from sources of heat or ignition. Storage area should be: - cool - dry - well ventilated - under cover - out of direct sunlight

---

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

---

**Control parameters**

Exposure limits are listed below, if they exist.

**Argon**

None

**Appropriate engineering controls**

Use with adequate ventilation (natural or mechanical), especially in a confined space.

**Individual protection measures**

**Respiratory Protection**

Not normally required. In oxygen deficient atmospheres, use a self contained breathing apparatus, as an air purifying respirator will not provide protection.

**Skin Protection**

Use leather or sturdy work gloves when handling cylinders.

**Eye/Face Protection**

Chemical goggles or safety glasses with side shields.

---

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

---

**Body Protection**

Normal work wear.

---

**9. PHYSICAL AND CHEMICAL PROPERTIES**

---

**Appearance**

<b>Physical State</b>	Compressed gas
<b>Color</b>	Colorless
<b>Odor</b>	None
<b>Odor Threshold</b>	Not applicable
<b>pH</b>	Not applicable
<b>Relative Gas Density</b>	1.38
<b>Boiling Range/Point (°C)</b>	-185.9
<b>Melting Point (°C)</b>	-189
<b>Flash Point (PMCC) (°C/F)</b>	Not flammable
<b>Vapor Pressure</b>	No data available
<b>Evaporation Rate (BuAc=1)</b>	Not applicable
<b>Solubility in Water</b>	61 mg/l
<b>Vapor Density (Air = 1)</b>	No data available
<b>VOC (%)</b>	Not applicable
<b>Partition coefficient (n-octanol/water)</b>	No data available
<b>Viscosity</b>	Not applicable
<b>Auto-ignition Temperature</b>	Not applicable
<b>Decomposition Temperature</b>	Not applicable
<b>Upper explosive limit</b>	Not applicable
<b>Lower explosive limit</b>	Not applicable
<b>Flammability (solid, gas)</b>	Not flammable

---

**10. STABILITY AND REACTIVITY**

---

**Reactivity**

Containers may rupture or explode if exposed to heat.

**Chemical Stability**

Stable under normal conditions.

**Possibility of hazardous reactions**

Hazardous polymerization will not occur.

**Conditions to Avoid**

None known

**Incompatible Materials**

None known

**Hazardous Decomposition Products**

None

---

**11. TOXICOLOGICAL INFORMATION**

---

**Acute Toxicity**

Simple asphyxiant.

**Specific Target Organ Toxicity (STOT) – single exposure**

Exposure to argon gas at high concentrations can cause suffocation by reducing oxygen available for breathing. Breathing very high concentrations can cause dizziness, shortness of breath, unconsciousness or asphyxiation.

**Specific Target Organ Toxicity (STOT) – repeat exposure**

No data available.

**Serious Eye damage/Irritation**

No data available.

**Skin Corrosion/Irritation**

No data available.

**Respiratory or Skin Sensitization**

No data available.

**Carcinogenicity**

Not considered carcinogenic by NTP, IARC, and OSHA.

**Germ Cell Mutagenicity**

No data available.

**Reproductive Toxicity**

No data available.

**Aspiration Hazard**

Not an aspiration hazard.

---

**12. ECOLOGICAL INFORMATION**

---

**Ecotoxicity**

No data available

**Mobility in soil**

Argon occurs naturally in the atmosphere.

**Persistence/Degradability**

Argon occurs naturally in the atmosphere.

**Bioaccumulative Potential**

Argon occurs naturally in the atmosphere.

**Other adverse effects**

No relevant studies identified.

---

**13. DISPOSAL CONSIDERATIONS**

---

**Disposal Methods**

Dispose of container in accordance with all applicable local and national regulations. Do not cut, puncture or weld on or near to the container. If spilled, contents will vaporize to the atmosphere.

---

**14. TRANSPORT INFORMATION**

---

Safety Data Sheet information is intended to address a specific material and not various forms or states of containment.

**Pressurized Containers****DOT CFR 172.101 Data**

<b>UN Proper Shipping Name</b>	Argon, compressed, (2.2), UN1006
<b>UN Class</b>	Argon, compressed (2.2)
<b>UN Number</b>	UN1006
<b>UN Packaging Group</b>	Not applicable
<b>Classification for AIR Transportation (IATA)</b>	Consult current IATA Regulations prior to shipping by air.
<b>Classification for Water Transport IMDG</b>	Consult current IMDG Regulations prior to shipping by water.

This section is believed to be accurate at the time of preparation. It is not intended to be a complete statement or summary of the applicable laws, rules, or hazardous material regulations, and is subject to change. Users have the responsibility to confirm compliance with all laws, rules, and hazardous material regulations in effect at the time of shipping.

---

**15. REGULATORY INFORMATION**

---

**United States TSCA Inventory**

All components of this product are in compliance with the inventory listing requirements of the US Toxic Substance Control Act (TSCA) Chemical Substance Inventory.

**Canada DSL Inventory**

All ingredients in this product have been verified for inclusion on the Domestic Substance List (DSL).

**SARA Title III Sect. 311/312 Categorization**

Pressure Hazard

**SARA Title III Sect. 313**

This product does not contain any chemicals listed in Section 313 at or above de minimis concentrations.

---

**16. OTHER INFORMATION**

---

**NFPA Ratings**

NFPA Code for Health - 0

NFPA Code for Flammability - 0

NFPA Code for Reactivity - 0

NFPA Code for Special Hazards - None

---

**16. OTHER INFORMATION**

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**Legend**

ACGIH: American Conference of Governmental Industrial Hygienists

CAS: Chemical Abstracts Service

IARC: International Agency for Research on Cancer

LCLo: Lethal concentration low

N/A: Denotes no applicable information found or available

NTP: National Toxicology Program

OSHA: Occupational Safety and Health Administration

PEL: Permissible Exposure Limit

SDS: Safety Data Sheet

STEL: Short Term Exposure Limit

TLV: Threshold Limit Value

Revision Date: July 21, 2017

Replaces: This is the first issue.

Changes made: NA

**Information Source and References**

This SDS is prepared by Hazard Communication Specialists based on information provided by internal company references.

**Prepared By:** EnviroNet LLC.

The information and recommendations presented in this SDS are based on sources believed to be accurate. Kidde-Fenwal Inc. assumes no liability for the accuracy or completeness of this information. It is the user's responsibility to determine the suitability of the material for their particular purposes. In particular, we make NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, with respect to such information, and we assume no liability resulting from its use. Users should ensure that any use or disposal of the material is in accordance with applicable Federal, State, and local laws and regulations.

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**1. IDENTIFICATION**

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<b>Product Name</b>	Argonite®
<b>Other Names</b>	IG-55
<b>Recommended use of the chemical and restrictions on use</b>	
<b>Identified uses</b>	Fire Extinguishing Agent and Expellant
<b>Restrictions on use</b>	Consult applicable fire protection codes
<b>Company Identification</b>	Kidde-Fenwal, Inc. 400 Main Street Ashland, MA 01721 USA
<b>Customer Information Number</b>	(508) 881-2000
<b>Emergency Telephone Number</b>	
<b>CHEMTREC Number</b>	(800) 424-9300 (703) 527-3887 (International)
<b>Issue Date</b>	October 1, 2015
<b>Supersedes Date</b>	April 10, 2015

*Safety Data Sheet prepared in accordance with OSHA's Hazard Communication Standard (29 CFR 1910.1200) and the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)*

---

**2. HAZARD IDENTIFICATION**

---

**Hazard Classification**

Gas under pressure – compressed gas  
Simple Asphyxiant

**Label Elements**

Hazard Symbols



Signal Word: Warning

**Hazard Statements**

Contents under pressure; may explode if heated.  
May displace oxygen and cause rapid suffocation.

**Precautionary Statements****Prevention**

Do not enter confined space unless adequately ventilated.  
In case of inadequate ventilation wear respiratory protection.

---

**2. HAZARD IDENTIFICATION**

---

**Response**

None

**Storage**

Keep container tightly closed.

Protect from sunlight and store in well-ventilated place.

**Disposal**

None

**Other Hazards**

Avoid direct inhalation of undiluted gas. Can cause suffocation by reducing oxygen available for breathing. Breathing very high concentrations can cause dizziness, shortness of breath, unconsciousness or asphyxiation.

**Specific Concentration Limits**

The values listed below represent the percentages of ingredients of unknown toxicity.

Acute oral toxicity	0%
Acute dermal toxicity	0%
Acute inhalation toxicity	0%
Acute aquatic toxicity	100%

---

**3. COMPOSITION/INFORMATION ON INGREDIENTS**

---

**Synonyms:** IG-55

This product is a mixture.

<b>Component</b>	<b>CAS Number</b>	<b>Concentration</b>
Nitrogen	7727-37-9	50-52%
Argon	7440-37-1	48-50%

---

**4. FIRST- AID MEASURES**

---

**Description of necessary first-aid measures****Eyes**

No specific measures.

**Skin**

No specific measures.

**Ingestion**

Ingestion is not considered a potential route of exposure.

**Inhalation**

Remove from exposure. If there is difficulty in breathing, give oxygen. Obtain medical attention immediately.

**Most important symptoms/effects, acute and delayed**

Aside from the information found under Description of necessary first aid measures (above) and Indication of immediate medical attention and special treatment needed, no additional symptoms and effects are anticipated.

---

**4. FIRST- AID MEASURES**

---

**Indication of immediate medical attention and special treatment needed**

**Notes to Physicians**

Treat symptomatically.

---

**5. FIRE - FIGHTING MEASURES**

---

**Suitable Extinguishing Media**

Argonite® is used as an extinguishing agent and therefore is not a problem when trying to control a blaze. Use extinguishing agent appropriate to other materials involved. Keep containers and surroundings cool with water spray as containers may rupture or burst in the heat of a fire.

**Specific hazards arising from the chemical**

Containers may explode in heat of fire.

**Special Protective Actions for Fire-Fighters**

Wear full protective clothing and self-contained breathing apparatus as appropriate for specific fire conditions.

---

**6. ACCIDENTAL RELEASE MEASURES**

---

**Personal precautions, protective equipment and emergency procedures**

Remove leaking cylinder to a safe place. Ventilate the area. Leaks inside confined spaces may cause suffocation as oxygen is displaced and should not be entered without a self-contained breathing apparatus.

**Environmental Precautions**

None - Material is a normal atmospheric gas.

**Methods and materials for containment and cleaning up**

None

---

**7. HANDLING AND STORAGE**

---

**Precautions for safe handling**

Containers should be properly stored and secured to prevent falling or being knocked over. Do not drag, slide or roll containers. Do not drop containers or permit them to strike against each other. Never apply flame or localized heat directly to any part of the containers.

**Conditions for safe storage**

Store away from sources of heat or ignition. Storage area should be: - cool - dry - well ventilated - under cover - out of direct sunlight

---

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

---

**Control parameters**

Exposure limits are listed below, if they exist.

---

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

---

**Nitrogen**

None established

**Argon**

None

**Appropriate engineering controls**

Use with adequate ventilation (natural or mechanical), especially in a confined space.

**Individual protection measures****Respiratory Protection**

Not normally required. In oxygen deficient atmospheres, use a self contained breathing apparatus, as an air purifying respirator will not provide protection.

**Skin Protection**

Use leather or sturdy work gloves when handling cylinders.

**Eye/Face Protection**

Chemical goggles or safety glasses with side shields.

**Body Protection**

Normal work wear.

---

**9. PHYSICAL AND CHEMICAL PROPERTIES**

---

**Appearance****Physical State**

Compressed gas

**Color**

Colorless

**Odor**

None

**Odor Threshold**

Not applicable

**pH**

Not applicable

**Gas Density**0.088 lb/ft<sup>3</sup> at 70°F (1.41 kg/m<sup>3</sup> at 21°C), at 1 atm pressure**Boiling Range/Point (°C/F)**

-190.1/-310.18

**Melting Point (°C/F)**

No data available

**Flash Point (PMCC) (°C/F)**

Not flammable

**Vapor Pressure**

No data available

**Evaporation Rate (BuAc=1)**

Not applicable

**Solubility in Water**

Negligible

**Vapor Density (Air = 1)**

1.17

**VOC (%)**

Not applicable

**Partition coefficient (n-octanol/water)**

No data available

**Viscosity**

Not applicable

**Auto-ignition Temperature**

Not applicable

**Decomposition Temperature**

Not applicable

**Upper explosive limit**

Not applicable

**Lower explosive limit**

Not applicable

**Flammability (solid, gas)**

Not flammable

---

**10. STABILITY AND REACTIVITY**

---

**Reactivity**

Containers may rupture or explode if exposed to heat.

**Chemical Stability**

Stable under normal conditions.

**Possibility of hazardous reactions**

Hazardous polymerization will not occur.

**Conditions to Avoid**

None known

**Incompatible Materials**

None known

**Hazardous Decomposition Products**

None

---

**11. TOXICOLOGICAL INFORMATION**

---

**Acute Toxicity**

Simple asphyxiant.

**Specific Target Organ Toxicity (STOT) – single exposure**

Exposure to Argonite gas at high concentrations can cause suffocation by reducing oxygen available for breathing. Breathing very high concentrations can cause dizziness, shortness of breath, unconsciousness or asphyxiation.

**Specific Target Organ Toxicity (STOT) – repeat exposure**

No data available.

**Serious Eye damage/Irritation**

No data available.

**Skin Corrosion/Irritation**

No data available.

**Respiratory or Skin Sensitization**

No data available.

**Carcinogenicity**

Not considered carcinogenic by NTP, IARC, and OSHA.

**Germ Cell Mutagenicity**

No data available.

**Reproductive Toxicity**

No data available.

---

**11. TOXICOLOGICAL INFORMATION**

---

**Aspiration Hazard**

Not an aspiration hazard.

---

**12. ECOLOGICAL INFORMATION**

---

**Ecotoxicity**

No data available

**Mobility in soil**

Nitrogen and argon occur naturally in the atmosphere.

**Persistence/Degradability**

Nitrogen and argon occur naturally in the atmosphere.

**Bioaccumulative Potential**

Nitrogen and argon occur naturally in the atmosphere.

**Other adverse effects**

No relevant studies identified.

---

**13. DISPOSAL CONSIDERATIONS**

---

**Disposal Methods**

Dispose of container in accordance with all applicable local and national regulations. Do not cut, puncture or weld on or near to the container. If spilled, contents will vaporize to the atmosphere.

---

**14. TRANSPORT INFORMATION**

---

Safety Data Sheet information is intended to address a specific material and not various forms or states of containment.

**Pressurized Containers****DOT CFR 172.101 Data**

Compressed Gas, n.o.s., (50% Argon, 50% Nitrogen), (2.2), UN1956

**UN Proper Shipping Name**

Compressed Gas, n.o.s., (50% Argon, 50% Nitrogen) (2.2)

**UN Class****UN Number**

UN1956

**UN Packaging Group**

Not applicable

**Classification for AIR**

Consult current IATA Regulations prior to shipping by air.

**Transportation (IATA)****Classification for Water**

Consult current IMDG Regulations prior to shipping by water.

**Transport IMDG**

This section is believed to be accurate at the time of preparation. It is not intended to be a complete statement or summary of the applicable laws, rules, or hazardous material regulations, and is subject to change. Users have the responsibility to confirm compliance with all laws, rules, and hazardous material regulations in effect at the time of shipping.

---

**15. REGULATORY INFORMATION**

---

**United States TSCA Inventory**

All components of this product are in compliance with the inventory listing requirements of the US Toxic Substance Control Act (TSCA) Chemical Substance Inventory.

**Canada DSL Inventory**

All ingredients in this product have been verified for inclusion on the Domestic Substance List (DSL).

**SARA Title III Sect. 311/312 Categorization**

Pressure Hazard

**SARA Title III Sect. 313**

This product does not contain any chemicals listed in Section 313 at or above de minimis concentrations.

---

**16. OTHER INFORMATION**

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**NFPA Ratings**

NFPA Code for Health - 0

NFPA Code for Flammability - 0

NFPA Code for Reactivity - 0

NFPA Code for Special Hazards – None

**HMIS Ratings**

HMIS Code for Health - 0

HMIS Code for Flammability - 0

HMIS Code for Physical Hazard - 0

HMIS Code for Personal Protection - See Section 8

\*Chronic

**Legend**

ACGIH: American Conference of Governmental Industrial Hygienists

CAS: Chemical Abstracts Service

IARC: International Agency for Research on Cancer

LCLo: Lethal concentration low

N/A: Denotes no applicable information found or available

NTP: National Toxicology Program

OSHA: Occupational Safety and Health Administration

PEL: Permissible Exposure Limit

SDS: Safety Data Sheet

STEL: Short Term Exposure Limit

TLV: Threshold Limit Value

Revision Date: October 1, 2015

Replaces: April 10, 2015

Changes made: Update to Section 14.

**Information Source and References**

This SDS is prepared by Hazard Communication Specialists based on information provided by internal company references.

**Prepared By:** EnviroNet LLC.

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**16. OTHER INFORMATION**

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The information and recommendations presented in this SDS are based on sources believed to be accurate. Kidde-Fenwal Inc. assumes no liability for the accuracy or completeness of this information. It is the user's responsibility to determine the suitability of the material for their particular purposes. In particular, we make **NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED**, with respect to such information, and we assume no liability resulting from its use. Users should ensure that any use or disposal of the material is in accordance with applicable Federal, State, and local laws and regulations.

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---

**1. IDENTIFICATION**

---

<b>Product Name</b>	Nitrogen (Fire Extinguishing Agent)
<b>Other Names</b>	N <sub>2</sub>
<b>Recommended use of the chemical and restrictions on use</b>	
<b>Identified uses</b>	Fire Extinguishing Agent
<b>Restrictions on use</b>	Consult applicable fire protection codes
<b>Company Identification</b>	Kidde-Fenwal, Inc. 400 Main Street Ashland, MA 01721 USA
<b>Customer Information Number</b>	(508) 881-2000
<b>Emergency Telephone Number</b>	
<b>Chemtrec Number</b>	(800) 424-9300 (703) 527-3887 (International)
<b>Issue Date</b>	March 25, 2019
<b>Supersedes Date</b>	This is the first issue.

*Safety Data Sheet prepared in accordance with OSHA's Hazard Communication Standard (29 CFR 1910.1200) and the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)*

---

**2. HAZARD IDENTIFICATION**

---

**Hazard Classification**  
Gas under pressure – compressed gas  
Simple Asphyxiant

**Label Elements**  
Hazard Symbols



Signal Word: Warning

**Hazard Statements**  
Contents under pressure; may explode if heated.  
May displace oxygen and cause rapid suffocation.

**Precautionary Statements**

**Prevention**  
Do not enter confined space unless adequately ventilated.  
In case of inadequate ventilation wear respiratory protection.

**Response**  
None

**Storage**  
Keep container tightly closed.  
Protect from sunlight and store in well-ventilated place.

---

**2. HAZARD IDENTIFICATION**

---

**Disposal**

None

**Other Hazards**

Avoid direct inhalation of undiluted gas. Can cause suffocation by reducing oxygen available for breathing. Breathing very high concentrations can cause dizziness, shortness of breath, unconsciousness or asphyxiation.

**Specific Concentration Limits**

The values listed below represent the percentages of ingredients of unknown toxicity.

Acute oral toxicity	0%
Acute dermal toxicity	0%
Acute inhalation toxicity	0%
Acute aquatic toxicity	100%

---

**3. COMPOSITION/INFORMATION ON INGREDIENTS**

---

This product is a substance.

<b>Component</b>	<b>CAS Number</b>	<b>Concentration</b>
Nitrogen	7727-37-9	≥99.7%

---

**4. FIRST- AID MEASURES**

---

**Description of necessary first-aid measures****Eyes**

No specific measures.

**Skin**

No specific measures.

**Ingestion**

Ingestion is not considered a potential route of exposure.

**Inhalation**

Remove from exposure. If there is difficulty in breathing, give oxygen. Obtain medical attention immediately.

**Most important symptoms/effects, acute and delayed**

Aside from the information found under Description of necessary first aid measures (above) and Indication of immediate medical attention and special treatment needed, no additional symptoms and effects are anticipated.

**Indication of immediate medical attention and special treatment needed****Notes to Physicians**

Treat symptomatically.

---

**5. FIRE - FIGHTING MEASURES**

---

**Suitable Extinguishing Media**

All known extinguishing media can be used. Use extinguishing media appropriate for containers in the area.

---

**5. FIRE - FIGHTING MEASURES**

---

**Specific hazards arising from the chemical**

Containers may explode in heat of fire.

**Special Protective Actions for Fire-Fighters**

Wear full protective clothing and self-contained breathing apparatus as appropriate for specific fire conditions.

---

**6. ACCIDENTAL RELEASE MEASURES**

---

**Personal precautions, protective equipment and emergency procedures**

Remove leaking cylinder to a safe place. Ventilate the area. Leaks inside confined spaces may cause suffocation as oxygen is displaced and should not be entered without a self-contained breathing apparatus.

**Environmental Precautions**

None - Material is a normal atmospheric gas.

**Methods and materials for containment and cleaning up**

None

---

**7. HANDLING AND STORAGE**

---

**Precautions for safe handling**

Containers should be properly stored and secured to prevent falling or being knocked over. Do not drag, slide or roll containers. Do not drop containers or permit them to strike against each other. Never apply flame or localized heat directly to any part of the containers.

**Conditions for safe storage**

Store away from sources of heat or ignition. Storage area should be: - cool - dry - well ventilated - under cover - out of direct sunlight

---

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

---

**Control parameters**

Exposure limits are listed below, if they exist.

**Nitrogen**

None established

**Appropriate engineering controls**

Use with adequate ventilation (natural or mechanical), especially in a confined space.

**Individual protection measures**

**Respiratory Protection**

Not normally required. In oxygen deficient atmospheres, use a self-contained breathing apparatus, as an air purifying respirator will not provide protection.

**Skin Protection**

Use leather or sturdy work gloves when handling cylinders.

**Eye/Face Protection**

Chemical goggles or safety glasses with side shields.

---

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

---

**Body Protection**

Normal work wear.

---

**9. PHYSICAL AND CHEMICAL PROPERTIES**

---

**Appearance****Physical State**

Compressed gas

**Color**

Colorless

**Odor**

None

**Odor Threshold**

No data available

**pH**

Not applicable

**Gas Density**0.075 lb/ft<sup>3</sup> @70°F as vapor**Boiling Range/Point (°C/F)**

-196°C/-321 °F

**Melting Point (°C/F)**

-210°C/-346 °F

**Flash Point (PMCC) (°C/F)**

Not flammable

**Vapor Pressure**

No data available

**Evaporation Rate (BuAc=1)**

Not applicable

**Solubility in Water**

20 mg/l

**Vapor Density (Air = 1)**

0.97

**VOC (%)**

Not applicable

**Partition coefficient (n-octanol/water)**

No data available

**Viscosity**

Not applicable

**Auto-ignition Temperature**

No data available

**Decomposition Temperature**

No data available

**Upper explosive limit**

Not explosive

**Lower explosive limit**

Not explosive

**Flammability (solid, gas)**

Not flammable

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**10. STABILITY AND REACTIVITY**

---

**Reactivity**

Containers may rupture or explode if exposed to heat.

**Chemical Stability**

Stable under normal conditions.

**Possibility of hazardous reactions**

Hazardous polymerization will not occur.

**Conditions to Avoid**

Extremely high temperatures

**Incompatible Materials**

None known

**Hazardous Decomposition Products**

None

---

**11. TOXICOLOGICAL INFORMATION**

---

**Acute Toxicity**

Simple asphyxiant.

**Specific Target Organ Toxicity (STOT) – single exposure**

Exposure to nitrogen gas at high concentrations can cause suffocation by reducing oxygen available for breathing. Breathing very high concentrations can cause dizziness, shortness of breath, unconsciousness or asphyxiation.

**Specific Target Organ Toxicity (STOT) – repeat exposure**

No data available.

**Serious Eye damage/Irritation**

No data available.

**Skin Corrosion/Irritation**

No data available.

**Respiratory or Skin Sensitization**

No data available.

**Carcinogenicity**

Not considered carcinogenic by NTP, IARC, and OSHA.

**Germ Cell Mutagenicity**

No data available.

**Reproductive Toxicity**

No data available.

**Aspiration Hazard**

Not an aspiration hazard.

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**12. ECOLOGICAL INFORMATION**

---

**Ecotoxicity**

No data available

**Mobility in soil**

Nitrogen occurs naturally in the atmosphere.

**Persistence/Degradability**

Nitrogen occurs naturally in the atmosphere.

**Bioaccumulative Potential**

Nitrogen occurs naturally in the atmosphere.

**Other adverse effects**

No relevant studies identified.

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**13. DISPOSAL CONSIDERATIONS**

---

**Disposal Methods**

Dispose of container in accordance with all applicable local and national regulations. Do not cut, puncture or weld on or near to the container. If spilled, contents will vaporize to the atmosphere.

---

**14. TRANSPORT INFORMATION**

---

Safety Data Sheet information is intended to address a specific material and not various forms or states of containment.

<b>DOT CFR 172.101 Data</b>	Nitrogen, compressed, 2.2, UN1066
<b>UN Proper Shipping Name</b>	Nitrogen, compressed
<b>UN Class</b>	(2.2)
<b>UN Number</b>	UN1066
<b>UN Packaging Group</b>	Not Applicable
<b>Classification for AIR Transportation (IATA)</b>	Consult current IATA Regulations prior to shipping by air.
<b>Classification for Water Transport IMDG</b>	Consult current IMDG Regulations prior to shipping by water.

This section is believed to be accurate at the time of preparation. It is not intended to be a complete statement or summary of the applicable laws, rules, or hazardous material regulations, and is subject to change. Users have the responsibility to confirm compliance with all laws, rules, and hazardous material regulations in effect at the time of shipping.

---

**15. REGULATORY INFORMATION**

---

**United States TSCA Inventory**

All components of this product are in compliance with the inventory listing requirements of the US Toxic Substance Control Act (TSCA) Chemical Substance Inventory.

**Canada DSL Inventory**

All ingredients in this product have been verified for inclusion on the Domestic Substance List (DSL).

**SARA Title III Sect. 311/312 Categorization**

Pressure Hazard

**SARA Title III Sect. 313**

This product does not contain any chemicals listed in Section 313 at or above de minimis concentrations.

---

**16. OTHER INFORMATION**

---

**NFPA Ratings**

NFPA Code for Health - 0

NFPA Code for Flammability - 0

NFPA Code for Reactivity - 0

NFPA Code for Special Hazards – None

---

**16. OTHER INFORMATION**

---

**Legend**

ACGIH: American Conference of Governmental Industrial Hygienists

CAS: Chemical Abstracts Service

IARC: International Agency for Research on Cancer

LCLo: Lethal concentration low

N/A: Denotes no applicable information found or available

NTP: National Toxicology Program

OSHA: Occupational Safety and Health Administration

PEL: Permissible Exposure Limit

SDS: Safety Data Sheet

STEL: Short Term Exposure Limit

TLV: Threshold Limit Value

Revision Date: March 25, 2019

Replaces: This is the first issue.

Changes made: Not applicable

**Information Source and References**

This SDS is prepared by Hazard Communication Specialists based on information provided by internal company references.

**Prepared By:** EnviroNet LLC.

The information and recommendations presented in this SDS are based on sources believed to be accurate. Kidde-Fenwal, Inc. assumes no liability for the accuracy or completeness of this information. It is the user's responsibility to determine the suitability of the material for their particular purposes. In particular, we make **NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED**, with respect to such information, and we assume no liability resulting from its use. Users should ensure that any use or disposal of the material is in accordance with applicable Federal, State, and local laws and regulations.

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**1. IDENTIFICATION**

---

<b>Product Name</b>	IG-541
<b>Recommended use of the chemical and restrictions on use</b>	
<b>Identified uses</b>	Fire Extinguishing Agent
<b>Restrictions on use</b>	Consult applicable fire protection codes
<b>Company Identification</b>	Kidde-Fenwal, Inc. 400 Main Street Ashland, MA 01721 USA
<b>Customer Information Number</b>	(508) 881-2000
<b>Emergency Telephone Number</b>	
<b>CHEMTREC Number</b>	(800) 424-9300 (703) 527-3887 (International)
<b>Issue Date</b>	July 28, 2017
<b>Supersedes Date</b>	This is the first issue.

*Safety Data Sheet prepared in accordance with OSHA's Hazard Communication Standard (29 CFR 1910.1200) and the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)*

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**2. HAZARD IDENTIFICATION**

---

**Hazard Classification**

Gas under pressure – compressed gas  
Simple Asphyxiant

**Label Elements**

Hazard Symbols



Signal Word: Warning

**Hazard Statements**

Contents under pressure; may explode if heated.  
May displace oxygen and cause rapid suffocation.

**Precautionary Statements****Prevention**

Do not enter confined space unless adequately ventilated.  
In case of inadequate ventilation wear respiratory protection.

**Response**

None

**Storage**

Keep container tightly closed.  
Protect from sunlight and store in well-ventilated place.

---

**2. HAZARD IDENTIFICATION**

---

**Disposal**

None

**Other Hazards**

Avoid direct inhalation of undiluted gas. Can cause suffocation by reducing oxygen available for breathing. Breathing very high concentrations can cause dizziness, shortness of breath, unconsciousness or asphyxiation.

**Specific Concentration Limits**

The values listed below represent the percentages of ingredients of unknown toxicity.

Acute oral toxicity	0%
Acute dermal toxicity	0%
Acute inhalation toxicity	0%
Acute aquatic toxicity	100%

---

**3. COMPOSITION/INFORMATION ON INGREDIENTS**

---

This product is a mixture.

<b>Component</b>	<b>CAS Number</b>	<b>Concentration</b>
Nitrogen	7727-37-9	52%
Argon	7440-37-1	40%
Carbon Dioxide	124-38-9	8%

---

**4. FIRST- AID MEASURES**

---

**Description of necessary first-aid measures****Eyes**

No specific measures.

**Skin**

No specific measures.

**Ingestion**

Ingestion is not considered a potential route of exposure.

**Inhalation**

Remove from exposure. If there is difficulty in breathing, give oxygen. Obtain medical attention immediately.

**Most important symptoms/effects, acute and delayed**

Aside from the information found under Description of necessary first aid measures (above) and Indication of immediate medical attention and special treatment needed, no additional symptoms and effects are anticipated.

**Indication of immediate medical attention and special treatment needed****Notes to Physicians**

Treat symptomatically.

---

**5. FIRE - FIGHTING MEASURES**

---

**Suitable Extinguishing Media**

This product is used as an extinguishing agent and therefore is not a problem when trying to control a blaze. Use extinguishing agent appropriate to other materials involved. Keep containers and surroundings cool with water spray as containers may rupture or burst in the heat of a fire.

**Specific hazards arising from the chemical**

Containers may explode in heat of fire.

**Special Protective Actions for Fire-Fighters**

Wear full protective clothing and self-contained breathing apparatus as appropriate for specific fire conditions.

---

**6. ACCIDENTAL RELEASE MEASURES**

---

**Personal precautions, protective equipment and emergency procedures**

Remove leaking cylinder to a safe place. Ventilate the area. Leaks inside confined spaces may cause suffocation as oxygen is displaced and should not be entered without a self-contained breathing apparatus.

**Environmental Precautions**

None - Material is a normal atmospheric gas.

**Methods and materials for containment and cleaning up**

None

---

**7. HANDLING AND STORAGE**

---

**Precautions for safe handling**

Containers should be properly stored and secured to prevent falling or being knocked over. Do not drag, slide or roll containers. Do not drop containers or permit them to strike against each other. Never apply flame or localized heat directly to any part of the containers.

**Conditions for safe storage**

Store away from sources of heat or ignition. Storage area should be: - cool - dry - well ventilated - under cover - out of direct sunlight

---

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

---

**Control parameters**

Exposure limits are listed below, if they exist.

**Carbon Dioxide**

ACGIH TLV: 5000 ppm (9000 mg/m<sup>3</sup>) STEL: 30,000 ppm (54,000 mg/m<sup>3</sup>)

OSHA PEL: 5000 ppm (9000 mg/m<sup>3</sup>)

**Appropriate engineering controls**

Use with adequate ventilation (natural or mechanical), especially in a confined space.

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

**Individual protection measures**

**Respiratory Protection**

Not normally required. In oxygen deficient atmospheres, use a self contained breathing apparatus, as an air purifying respirator will not provide protection.

**Skin Protection**

Use leather or sturdy work gloves when handling cylinders.

**Eye/Face Protection**

Chemical goggles or safety glasses with side shields.

**Body Protection**

Normal work wear.

**9. PHYSICAL AND CHEMICAL PROPERTIES**

**Appearance**

<b>Physical State</b>	Compressed gas
<b>Color</b>	Colorless
<b>Odor</b>	None
<b>Odor Threshold</b>	Not applicable
<b>pH</b>	Not applicable
<b>Relative Gas Density</b>	Heavier than air.
<b>Boiling Range/Point (°C)</b>	Not applicable
<b>Melting Point (°C)</b>	Not applicable
<b>Flash Point (PMCC) (°C/F)</b>	Not applicable
<b>Vapor Pressure</b>	No data available
<b>Evaporation Rate (BuAc=1)</b>	Not applicable
<b>Solubility in Water</b>	No data available
<b>Vapor Density (Air = 1)</b>	No data available
<b>VOC (%)</b>	Not applicable
<b>Partition coefficient (n-octanol/water)</b>	No data available
<b>Viscosity</b>	Not applicable
<b>Auto-ignition Temperature</b>	Not applicable
<b>Decomposition Temperature</b>	Not applicable
<b>Upper explosive limit</b>	Not applicable
<b>Lower explosive limit</b>	Not applicable
<b>Flammability (solid, gas)</b>	Not flammable

**10. STABILITY AND REACTIVITY**

**Reactivity**

Containers may rupture or explode if exposed to heat.

**Chemical Stability**

Stable under normal conditions.

**Possibility of hazardous reactions**

Hazardous polymerization will not occur.

**Conditions to Avoid**

None known

---

**10. STABILITY AND REACTIVITY**

---

**Incompatible Materials**

None known

**Hazardous Decomposition Products**

None

---

**11. TOXICOLOGICAL INFORMATION**

---

**Acute Toxicity**

Simple asphyxiant.

**Specific Target Organ Toxicity (STOT) – single exposure**

Exposure to argon, nitrogen and carbon dioxide gases at high concentrations can cause suffocation by reducing oxygen available for breathing. Breathing very high concentrations can cause dizziness, shortness of breath, unconsciousness or asphyxiation.

**Specific Target Organ Toxicity (STOT) – repeat exposure**

No data available.

**Serious Eye damage/Irritation**

No data available.

**Skin Corrosion/Irritation**

No data available.

**Respiratory or Skin Sensitization**

No data available.

**Carcinogenicity**

Not considered carcinogenic by NTP, IARC, and OSHA.

**Germ Cell Mutagenicity**

No data available.

**Reproductive Toxicity**

No data available.

**Aspiration Hazard**

Not an aspiration hazard.

---

**12. ECOLOGICAL INFORMATION**

---

**Ecotoxicity**

No data available

**Mobility in soil**

Argon, nitrogen and carbon dioxide occur naturally in the atmosphere.

**Persistence/Degradability**

Argon, nitrogen and carbon dioxide occur naturally in the atmosphere.

---

**12. ECOLOGICAL INFORMATION**

---

**Bioaccumulative Potential**

Argon, nitrogen and carbon dioxide occur naturally in the atmosphere.

**Other adverse effects**

No relevant studies identified.

---

**13. DISPOSAL CONSIDERATIONS**

---

**Disposal Methods**

Dispose of container in accordance with all applicable local and national regulations. Do not cut, puncture or weld on or near to the container. If spilled, contents will vaporize to the atmosphere.

---

**14. TRANSPORT INFORMATION**

---

Safety Data Sheet information is intended to address a specific material and not various forms or states of containment.

**Pressurized Containers****DOT CFR 172.101 Data**

Compressed Gas, n.o.s., (Nitrogen, Argon, Carbon Dioxide), (2.2), UN1956

**UN Proper Shipping Name**

Compressed Gas, n.o.s., (Nitrogen, Argon, Carbon Dioxide) (2.2)

**UN Class****UN Number**

UN1956

**UN Packaging Group**

Not applicable

**Classification for AIR**

Consult current IATA Regulations prior to shipping by air.

**Transportation (IATA)****Classification for Water**

Consult current IMDG Regulations prior to shipping by water.

**Transport IMDG**

This section is believed to be accurate at the time of preparation. It is not intended to be a complete statement or summary of the applicable laws, rules, or hazardous material regulations, and is subject to change. Users have the responsibility to confirm compliance with all laws, rules, and hazardous material regulations in effect at the time of shipping.

---

**15. REGULATORY INFORMATION**

---

**United States TSCA Inventory**

All components of this product are in compliance with the inventory listing requirements of the US Toxic Substance Control Act (TSCA) Chemical Substance Inventory.

**Canada DSL Inventory**

All ingredients in this product have been verified for inclusion on the Domestic Substance List (DSL).

**SARA Title III Sect. 311/312 Categorization**

Pressure Hazard

**SARA Title III Sect. 313**

This product does not contain any chemicals listed in Section 313 at or above de minimis concentrations.

---

**16. OTHER INFORMATION**

---

**NFPA Ratings**

NFPA Code for Health - 0  
NFPA Code for Flammability - 0  
NFPA Code for Reactivity - 0  
NFPA Code for Special Hazards – None

**Legend**

ACGIH: American Conference of Governmental Industrial Hygienists  
CAS: Chemical Abstracts Service  
IARC: International Agency for Research on Cancer  
LCLo: Lethal concentration low  
N/A: Denotes no applicable information found or available  
NTP: National Toxicology Program  
OSHA: Occupational Safety and Health Administration  
PEL: Permissible Exposure Limit  
SDS: Safety Data Sheet  
STEL: Short Term Exposure Limit  
TLV: Threshold Limit Value

Revision Date: July 28, 2017  
Replaces: This is the first issue.  
Changes made: NA

**Information Source and References**

This SDS is prepared by Hazard Communication Specialists based on information provided by internal company references.

**Prepared By:** EnviroNet LLC.

The information and recommendations presented in this SDS are based on sources believed to be accurate. Kidde-Fenwal Inc. assumes no liability for the accuracy or completeness of this information. It is the user's responsibility to determine the suitability of the material for their particular purposes. In particular, we make **NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED**, with respect to such information, and we assume no liability resulting from its use. Users should ensure that any use or disposal of the material is in accordance with applicable Federal, State, and local laws and regulations.

---

**1. IDENTIFICATION**

---

<b>Product Name</b>	Odorizer
<b>Recommended use of the chemical and restrictions on use</b>	
<b>Identified uses</b>	Odorizing agent
<b>Restrictions on use</b>	For use in fire suppression systems only
<b>Company Identification</b>	Kidde-Fenwal, Inc. 400 Main Street Ashland, MA 01721 USA
<b>Customer Information Number</b>	(508) 881-2000
<b>Emergency Telephone Number</b>	
<b>CHEMTREC Number</b>	(800) 424-9300 (703) 527-3887 (International)
<b>Issue Date</b>	October 15, 2019
<b>Supersedes Date</b>	This is the first issue.

*Safety Data Sheet prepared in accordance with OSHA's Hazard Communication Standard (29 CFR 1910.1200, the Canadian Hazardous Products Regulations (HPR) and the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)*

---

**2. HAZARD IDENTIFICATION**

---

**Hazard Classification**

Flammable Liquid - Category 2  
Acute Toxicity (Oral) - Category 3  
Acute Toxicity (Dermal) - Category 3  
Acute Toxicity (Inhalation) - Category 3  
Serious eye damage/eye irritation: Category 1  
Specific Target Organ Toxicity (STOT) Single Exposure - Category 1

**Label Elements**

Hazard Symbols



Signal Word: Danger

**Hazard Statements**

Highly flammable liquid and vapor.  
Toxic if swallowed.  
Toxic in contact with skin.  
Toxic if inhaled.  
Causes serious eye damage.  
Causes damage to organs (optic nerve, central nervous system).

---

**2. HAZARD IDENTIFICATION**

---

**Precautionary Statements****Prevention**

Keep away from heat/sparks/open flames/hot surfaces – no smoking.

Keep container tightly closed.

Use explosion proof equipment.

Take precautionary measures against static discharge.

Use only non-sparking tools.

Wash hands thoroughly after handling.

Wear protective gloves, protective clothing, eye protection and face protection.

Do not eat drink or smoke when using this product.

Avoid breathing mists, vapors or spray.

Use only outdoors or in a well-ventilated area.

**Response**

If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center or doctor.

If inhaled: Remove to fresh air and keep comfortable for breathing. Call a poison center or doctor.

If on skin (or hair): Take off immediately all contaminated clothing. Wash with plenty of water. Call a poison center or doctor if you feel unwell. Take off immediately all contaminated clothing and wash it before reuse.

If swallowed: Immediately call a poison center or doctor/physician. Rinse mouth.

In case of fire: Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

If exposed: Call a poison center or doctor.

**Storage**

Store in a well-ventilated place.

Keep cool.

Store locked up.

Keep container tightly closed.

**Disposal**

Dispose of contents/container in accordance with local regulation.

**Other Hazards**

None

**Specific Concentration Limits**

The values listed below represent the percentages of ingredients of unknown toxicity.

Acute oral toxicity 0%

Acute dermal toxicity 0%

Acute inhalation toxicity 0%

Acute aquatic toxicity 0%

---

**3. COMPOSITION/INFORMATION ON INGREDIENTS**

---

This product is a mixture.

<b>Component</b>	<b>CAS Number</b>	<b>Concentration*</b>
Methyl Salicylate	119-36-8	45 – 70%
Methanol	67-56-1	30 – 60%

\*Exact concentration withheld as trade secret.

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**4. FIRST- AID MEASURES**

---

**Description of necessary first-aid measures**

**Eyes**

Immediately flood the eye with plenty of water for at least 15 minutes, holding the eye open. Obtain medical attention.

**Skin**

Wash skin thoroughly with soap and water. Obtain medical attention if irritation persists.

**Ingestion**

Dilute by drinking large quantities of water and obtain medical attention.

**Inhalation**

Move victim to fresh air. Obtain medical attention immediately for any breathing difficulty.

**Most important symptoms/effects, acute and delayed**

Aside from the information found under Description of necessary first aid measures (above) and Indication of immediate medical attention and special treatment needed, no additional symptoms and effects are anticipated.

**Indication of immediate medical attention and special treatment needed**

**Notes to Physicians**

Treat symptomatically. Consult standard literature for treatment details.

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**5. FIRE - FIGHTING MEASURES**

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**Suitable Extinguishing Media**

Use foam, dry chemical or carbon dioxide. Use water spray for surroundings and containers. Be aware of the possibility of re-ignition

**Specific hazards arising from the chemical**

Vapors can travel a considerable distance to a source of ignition and flashback. Flashback can occur if air temperature exceeds flash point. Be aware of possibility of re-ignition.

**Special Protective Actions for Fire-Fighters**

Wear full protective clothing and self-contained breathing apparatus as appropriate for specific fire conditions.

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**6. ACCIDENTAL RELEASE MEASURES**

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**Personal precautions, protective equipment and emergency procedures**

Wear appropriate protective clothing. Prevent skin and eye contact. Remove leaking container to a safe place. Ventilate the area.

**Environmental Precautions**

Prevent large quantities of the material from entering drains or watercourses.

**Methods and materials for containment and cleaning up**

Contain and absorb using appropriate inert material and transfer into suitable containers for recovery or disposal. Eliminate all sources of ignition.

**7. HANDLING AND STORAGE**

**Precautions for safe handling**

Wear appropriate protective clothing. Prevent skin and eye contact. Do not eat or drink while handling this material.

**Conditions for safe storage**

Store in original container tightly closed. Storage area should be: - cool - dry - well ventilated - under cover - out of direct sunlight

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

**Control parameters**

Exposure limits are listed below, if they exist.

**Methyl Salicylate**

None assigned.

**Methanol**

ACGIH: 200 ppm (262 mg/m<sup>3</sup>) 8h TWA; 250ppm (328 mg/m<sup>3</sup>) 15-minute STEL. Danger of cutaneous absorption.

OSHA: 200ppm (260 mg/m<sup>3</sup>) 8h TWA.

**Appropriate engineering controls**

Engineering methods to prevent or control exposure are preferred. Methods include process or personnel enclosure, mechanical ventilation (dilution and local exhaust), and control of process conditions. Use only with adequate ventilation.

**Individual protection measures**

**Respiratory Protection**

Wear respiratory protection if there is a risk of exposure to high vapor concentrations or aerosols. The specific respirator selected must be based on the airborne concentration found in the workplace and must not exceed the working limits of the respirator.

**Skin Protection**

Chemical resistant gloves

**Eye/Face Protection**

Chemical goggles or safety glasses with side shields.

**Body Protection**

Normal work wear.

**9. PHYSICAL AND CHEMICAL PROPERTIES**

**Appearance**

	<b>Physical State</b>	Liquid
	<b>Color</b>	Water white
<b>Odor</b>		Oil of wintergreen
<b>Odor Threshold</b>		No data available
<b>pH</b>		No data available
<b>Specific Gravity</b>		0.986
<b>Boiling Range/Point (°C/F)</b>		>64°C/>147°F
<b>Melting Point (°C/F)</b>		No data available
<b>Flash Point (TCC) (°C/F)</b>		16.7°C/62°F
<b>Vapor Pressure</b>		97.0 mm of Hg @ 20°C

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**9. PHYSICAL AND CHEMICAL PROPERTIES**

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<b>Evaporation Rate (BuAc=1)</b>	No data available
<b>Solubility in Water</b>	Appreciable
<b>Vapor Density (Air = 1)</b>	1.1
<b>VOC (g/l)</b>	396
<b>Partition coefficient (n-octanol/water)</b>	No data available
<b>Viscosity</b>	No data available
<b>Auto-ignition Temperature</b>	463°C/867°F
<b>Decomposition Temperature</b>	No data available
<b>Upper explosive limit</b>	No data available
<b>Lower explosive limit</b>	No data available
<b>Flammability (solid, gas)</b>	Not applicable

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**10. STABILITY AND REACTIVITY**

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**Reactivity**

Stable under normal conditions.

**Chemical Stability**

Stable under normal conditions.

**Possibility of hazardous reactions**

Hazardous polymerization will not occur.

**Conditions to Avoid**

Exposure to direct sunlight - contact with incompatible materials - heat, sparks, flames - high temperatures - sources of ignition

**Incompatible Materials**

Reacts violently with strong oxidants and strong bases causing fire and explosion hazard.

**Hazardous Decomposition Products**

Oxides of carbon

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**11. TOXICOLOGICAL INFORMATION**

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**Acute Toxicity**Methyl Salicylate

Oral LD50 (Rat) 887 mg/kg

Dermal LD50 (Rabbit) >2000mg/kg

Inhalation LC50 (Rat) >4.96 mg/l

Methanol

LD 50 Oral >50 and < 300 mg/kg (based on ECHA classification of Category 3)

LD 50 Dermal >200 and < 1000 mg/kg (based on ECHA classification of Category 3)

LC50 Inhalation >2.0 and < 10.0 mg/l (based on ECHA classification of Category 3)

**Specific Target Organ Toxicity (STOT) – single exposure**

Methanol: Causes damage to organs (optic nerve, central nervous system) (ECHA classification at concentrations >10%)

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**11. TOXICOLOGICAL INFORMATION**

---

**Specific Target Organ Toxicity (STOT) – repeat exposure**

No relevant studies identified.

**Serious Eye damage/Irritation**

Methyl Salicylate: Causes serious eye damage.

**Skin Corrosion/Irritation**

No relevant studies identified.

**Respiratory or Skin Sensitization**

No relevant studies identified.

**Carcinogenicity**

Not considered carcinogenic by NTP, IARC, and OSHA.

**Germ Cell Mutagenicity**

No relevant studies identified.

**Reproductive Toxicity**

Methanol: Some teratogenic and fetotoxic effects were observed in animal studies but are inconclusive.

**Aspiration Hazard**

Not an aspiration hazard.

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**12. ECOLOGICAL INFORMATION**

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**Ecotoxicity**

No relevant studies identified.

**Mobility in soil**

No relevant studies identified.

**Persistence/Degradability**

No relevant studies identified.

**Bioaccumulative Potential**

No relevant studies identified.

**Other adverse effects**

No relevant studies identified.

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**13. DISPOSAL CONSIDERATIONS**

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**Disposal Methods**

Dispose of container in accordance with all applicable local and national regulations.

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**14. TRANSPORT INFORMATION**

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Contact supplier for transport information.

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**15. REGULATORY INFORMATION**

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**United States TSCA Inventory**

This product contains ingredients that are listed on or exempt from listing on the EPA Toxic Substance Control Act Chemical Substance Inventory.

**Canada DSL Inventory**

All ingredients in this product are listed on the Domestic Substance List (DSL) or the Non-Domestic Substance List (NDSL) or are exempt from listing.

**SARA Title III Sect. 311/312 Categorization**

Serious eye damage, Specific Target Organ Toxicity – single exposure, Flammable liquid, Acute toxicity

**SARA Title III Sect. 313**

This product contains the following chemicals listed in Section 313 at or above de minimis concentrations:  
Methanol

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**16. OTHER INFORMATION**

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**NFPA Ratings**

NFPA Code for Health - 3

NFPA Code for Flammability - 4

NFPA Code for Reactivity - 0

NFPA Code for Special Hazards - None

**Legend**

ACGIH: American Conference of Governmental Industrial Hygienists

CAS#: Chemical Abstracts Service Number

EC50: Effect Concentration 50%

IARC: International Agency for Research on Cancer

LC50: Lethal Concentration 50%

LD50: Lethal Dose 50%

N/A: Denotes no applicable information found or available

OSHA: Occupational Safety and Health Administration

PEL: Permissible Exposure Limit

STEL: Short Term Exposure Limit

TLV: Threshold Limit Value

TSCA: Toxic Substance Control Act

Revision Date: October 15, 2019

Replaces: This is the first issue.

Changes made: Not applicable.

**Information Source and References**

This SDS is prepared by Hazard Communication Specialists based on information provided by internal company references.

**Prepared By:**

EnviroNet LLC.

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**16. OTHER INFORMATION**

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The information and recommendations presented in this SDS are based on sources believed to be accurate. CaptiveAire Systems, Inc. assumes no liability for the accuracy or completeness of this information. It is the user's responsibility to determine the suitability of the material for their particular purposes. In particular, we make **NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED**, with respect to such information, and we assume no liability resulting from its use. Users should ensure that any use or disposal of the material is in accordance with applicable Federal, State, and local laws and regulations.

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**SAFETY DATA SHEET**

This Safety Data Sheet conforms to ANSI Z400.5, and to the format requirements and the International Chemical Safety Cards of the Global Harmonizing System.

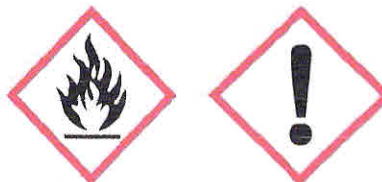
THIS SDS COMPLIES WITH 29 CFR 1910.1200 (HAZARD COMMUNICATION STANDARD)

IMPORTANT: Read this SDS before handling & disposing of this product.

Pass this information on to employees, customers, & users of this product.

**SECTION 1. IDENTIFICATION OF THE SUBSTANCE OR MIXTURE AND OF THE SUPPLIER**

PRODUCT IDENTITY: ODORIZER FLUID 00-920933-001  
COMPANY IDENTITY: Astro Chemicals, Inc.  
COMPANY ADDRESS: 126 Memorial Drive  
COMPANY CITY: Springfield, MA 01104  
COMPANY PHONE: 1-413-781-7240  
EMERGENCY PHONES: CHEMTREC: 1-800-424-9300 (USA)  
CANUTEC: 1-613-996-6666 (CANADA)



**SECTION 2. HAZARDS IDENTIFICATION**

**DANGER!!**

**EXPOSURE PREVENTION: AVOID EXPOSURE OF ADOLESCENTS, CHILDREN!**

**HAZARD STATEMENTS:**

H100s = General, H200s = Physical, H300s = Health, H400s = Environmental

- H225 Highly flammable liquid and vapor.
- H301 Toxic if swallowed.
- H311 Toxic in contact with skin.
- H315 Causes skin irritation.
- H318 Causes serious eye damage.
- H331 Toxic if inhaled.
- H335 May cause respiratory irritation.
- H370 Causes damage to organs.

**PRECAUTIONARY STATEMENTS:**

P100s = General, P200s = Prevention, P300s = Response, P400s = Storage, P500s = Disposal

- P210 Keep away from heat/sparks/open flames/hot surfaces - No smoking.
- P262 Do not get in eyes, on skin, or on clothing.
- P280 Wear protective gloves/protective clothing/eye protection/face protection.
- P309+311 If exposed or you feel unwell: Call a POISON CENTER or doctor/physician.
- P404 Store in a closed container.

**SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS**

MATERIAL	CAS#	EINECS#	WT %
Methyl Salicylate	119-36-8	-	59 - 61
Methanol	67-56-1	200-659-6	39 - 41

TRACE COMPONENTS: Trace ingredients (if any) are present in < 1% concentration, (< 0.1% for potential carcinogens, reproductive toxins, respiratory tract mutagens, and sensitizers). None of the trace ingredients contribute significant additional hazards at the concentrations that may be present in this product. All pertinent hazard information has been provided in this document, per the requirements of the Federal Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalents, and Canadian Hazardous Materials Identification System Standard (CPR 4).

**SEE SECTIONS 8, 11 & 12 FOR TOXICOLOGICAL INFORMATION.**

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#### SECTION 4. FIRST AID MEASURES

##### GENERAL ADVICE:

First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists, refer to Section 8 for specific personal protective equipment.

##### EYE CONTACT:

If this product enters the eyes, open eyes while under gently running water. Use sufficient force to open eyelids. "Roll" eyes to expose more surface. Minimum flushing is for 15 minutes. Seek immediate medical attention.

##### SKIN CONTACT:

If the product contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove contaminated clothing, taking care not to contaminate eyes. If skin becomes irritated and irritation persists, medical attention may be necessary. Wash contaminated clothing before reuse, discard contaminated shoes.

##### INHALATION:

After high vapor exposure, remove to fresh air. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. Keep person warm and at rest. breathing is difficult, give oxygen. If breathing has stopped, trained personnel should immediately begin artificial respiration. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. If the heart has stopped, trained personnel should immediately begin cardiopulmonary resuscitation (CPR). Seek immediate medical attention. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

##### SWALLOWING:

Do not induce vomiting. GET MEDICAL ATTENTION IMMEDIATELY. If person is fully conscious give 1 cup or 8 ounces of water. If medical advice is delayed and if an adult has swallowed several ounces of chemical, then give 3-4 ounces (1/3-1/2 cup) (90-120 ml) of hard liquor such as 80 proof whiskey. For children, give proportionally less liquor at a dose of 0.3 ounce (1 1/2 tsp) (8 ml) liquor for each 10 pounds of body weight, or 2 ml per kg body weight (for example: 1.2 ounce (2 1/3 tablespoon) for a 40 pound child or 36 ml for an 18 kg child).

##### NOTES TO PHYSICIAN:

In cases where several ounces (60 - 100 ml) have been ingested, consider the use of ethanol and hemodialysis in the treatment. Consult standard literature for details of treatment. If ethanol is used, a therapeutically effective blood concentration in the range of 100 - 150 mg/dl may be achieved by a rapid loading dose followed by a continuous intravenous infusion. Consult standard literature for details of treatment. 4-Methyl pyrazole (Antizol TM) is an effective blocker of alcohol dehydrogenase and should be used in the treatment of ethylene glycol, di- or triethylene glycol, ethylene glycol butyl ether, or methanol intoxication if available. Fomepizol protocol (Brent, J. et al, New England Journal of Medicine, Feb 8, 2001, 344:6, p. 424-9): loading dose 15 mg/kg intravenously, follow by bolus dose of 10 mg/kg every 12 hours; after 48 hours, increase bolus dose to 15 mg/kg every 12 hours. Continue fomepizol until serum methanol, EG, DEG, or TEG are undetectable. The signs and symptoms of poisoning include anion gap metabolic acidosis, CNS depression, renal tubular injury, and possible late stage cranial nerve involvement. Respiratory symptoms, including pulmonary edema, may be delayed. Persons receiving significant exposure should be observed 24-48 hours for signs of respiratory distress. Folates may be administered to enhance the metabolism of formaldehyde. Acidosis must be treated by means of intravenous sodium bicarbonate. Maintain adequate ventilation and oxygenation of the patient. In severe poisoning, respiratory support with mechanical ventilation and positive end expiratory pressure may be required. Chemical eye burns may require extended irrigation. Obtain prompt consultation, preferably an ophthalmologist. If lavage is performed, suggest endotracheal and/or esophageal control. Danger from lung aspiration must be weighted against toxicity when considering emptying the stomach. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

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**SECTION 5. FIRE FIGHTING MEASURES**

**FIRE & EXPLOSION PREVENTIVE MEASURES**

NO open flames, NO sparks, & NO smoking.  
explosion-proof electrical equipment, lighting.

**EXTINGUISHING MEDIA**

Use dry powder, alcohol-resistant foam, water in large amounts, carbon dioxide.

**SPECIAL FIRE FIGHTING PROCEDURES**

Water spray may be ineffective on fire but can protect fire-fighters & cool closed containers. Use fog nozzles if water is used. Do not enter confined fire-space without full bunker gear. (Helmet with face shield, bunker coats, gloves & rubber boots). Use NIOSH approved positive-pressure self-contained breathing apparatus.

**UNUSUAL EXPLOSION AND FIRE PROCEDURES**

**HIGHLY FLAMMABLE!! VAPORS CAN CAUSE FLASH FIRE**  
Isolate from oxidizers, heat, sparks, electric equipment & open flame. Closed containers may explode if exposed to extreme heat. Applying to hot surfaces requires special precautions. Empty container very hazardous! Continue all label precautions! Burns with nonluminous blue flame.

**SECTION 6. ACCIDENTAL RELEASE MEASURES**

**SPILL AND LEAK RESPONSE AND ENVIRONMENTAL PRECAUTIONS:**

Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a spill, clear the affected area, protect people, and respond with trained personnel.

**PERSONAL PROTECTIVE EQUIPMENT**

The proper personal protective equipment for incidental releases (such as: 1 Liter of the product released in a well-ventilated area), use impermeable gloves (triple-gloves (rubber gloves and nitrile gloves, over latex gloves), goggles, face shield, and appropriate body protection. In the event of a large release, use impermeable gloves, specific for the material handled, chemically resistant suit and boots, and hard hat. Self-Contained Breathing Apparatus or respirator may be required where engineering controls are not adequate or conditions for potential exposure exist. When respirators are required, select NIOSH/MSHA approved based on actual or potential airborne concentrations in accordance with latest OSHA and/or ANSI recommendations.

**ENVIRONMENTAL PRECAUTIONS:**

Stop spill at source. Construct temporary dikes of dirt, sand, or any appropriate readily available material to prevent spreading of the material. Close or cap valves and/or block or plug hole in leaking container and transfer to another container. Keep from entering storm sewers and ditches which lead to waterways, and if necessary, call the local fire or police department for immediate emergency assistance.

**CONTAINMENT AND CLEAN-UP MEASURES:**

Absorb spilled liquid with polypads or other suitable absorbent materials. If necessary, neutralize using suitable buffering material, (acid with soda ash or base with phosphoric acid), and test area with litmus paper to confirm neutralization. Clean up with non-combustible absorbent (such as: sand, soil, and so on). Shovel up and place all spill residue in suitable containers. dispose of at an appropriate waste disposal facility according to current applicable laws and regulations and product characteristics at time of disposal (see Section 13 - Disposal Considerations).

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**SECTION 7. HANDLING AND STORAGE****HANDLING**

Isolate from oxidizers, heat, sparks, electric equipment & open flame.  
Use only with adequate ventilation. Avoid breathing of vapor or spray mist.  
Avoid contact with skin & eyes. Wear OSHA Standard goggles or face shield. Consult Safety Equipment Supplier. Wear goggles, face shield, gloves, apron & footwear impervious to material. Wash clothing before reuse.  
Avoid free fall of liquid. Ground containers when transferring. Do not flame cut, saw, drill, braze, or weld. Empty container very hazardous! Continue all label precautions!

**STORAGE**

Keep in fireproof surroundings. Keep separated from strong oxidants, food & feedstuffs.  
Keep cool. Do not store above 49 C/120 F.  
Keep container tightly closed & upright when not in use to prevent leakage.

**NONBULK: CONTAINERS:**

Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Material should be stored in secondary containers or in a diked area, as appropriate. Store containers away from incompatible chemicals (see Section 10, Stability and Reactivity). Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Empty containers should be handled with care. Never store food, feed, or drinking water in containers which held this product.

**BULK CONTAINERS:**

All tanks and pipelines which contain this material must be labeled. Perform routine maintenance on tanks or pipelines which contain this product. Report all leaks immediately to the proper personnel.

**TANK CAR SHIPMENTS:**

Tank cars carrying this product should be loaded and unloaded in strict accordance with tank-car manufacturer's recommendation and all established on-site safety procedures. Appropriate personal protective equipment must be used (see Section 8, Engineering Controls and Personal Protective Equipment.). All loading and unloading equipment must be inspected, prior to each use. Loading and unloading operations must be attended, at all times. Tank cars must be level, brakes must be set or wheels must be locked or blocked prior to loading or unloading. Tank car (for loading) or storage tanks (for unloading) must be verified to be correct for receiving this product and be properly prepared, prior to starting the transfer operations. Hoses must be verified to be in the correct positions, before starting transfer operations. A sample (if required) must be taken and verified (if required) prior to starting transfer operations. All lines must be blown-down and purged before disconnecting them from the tank car or vessel.

**PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:**

Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use this product in areas where adequate ventilation is provided. Collect all rinsates and dispose of according to applicable Federal, State, Provincial, or local procedures.

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**SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

MATERIAL	CAS#	EINECS#	TWA (OSHA)	TLV (ACGIH)
Methyl Salicylate	119-36-8	-	None Known	None Known
Methanol	67-56-1	200-659-6	200 ppm S	200 ppm S

MATERIAL	CAS#	EINECS#	CEILING	STEL(OSHA/ACGIH)	HAP
Methanol	67-56-1	200-659-6	None Known	250 ppm	Yes

Each component showing `Yes' under "HAP" is an EPA Hazardous Air Pollutant.

**RESPIRATORY EXPOSURE CONTROLS**

Seek professional advice prior to respirator selection and use. Maintain airborne contaminant concentrations below exposure limits given above. If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134, European Standard EN 149, or applicable State regulations. If adequate ventilation is not available or there is potential for airborne exposure above the exposure limits, a respirator may be worn up to the respirator exposure limitations, check with respirator equipment manufacturer's recommendations/limitations. For a higher level of protection, use positive pressure supplied air respiration protection or Self-Contained Breathing Apparatus or if oxygen levels are below 19.5% or are unknown.

**EMERGENCY OR PLANNED ENTRY INTO UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS**

Positive pressure, full-face piece Self-Contained Breathing Apparatus; or positive pressure, full-face piece Self-Contained Breathing Apparatus with an auxilliary positive pressure Self-Contained Breathing Apparatus.

**VENTILATION**

LOCAL EXHAUST: Necessary                      MECHANICAL (GENERAL): Necessary  
 SPECIAL: None                                      OTHER: None  
 Please refer to ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

**EYE PROTECTION:**

Splash goggles or safety glasses. Face-shields are recommended when the operation can generate splashes, sprays or mists.

**HAND PROTECTION:**

Wear appropriate impervious gloves for routine industrial use. Use impervious gloves for spill response, as stated in Section 6 of this SDS (Accidental Release Measures).  
 NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

**BODY PROTECTION:**

Use body protection appropriate for task. Cover-all, rubber aprons, or chemical protective clothing made from impervious materials are generally acceptable, depending on the task.

**WORK & HYGIENIC PRACTICES:**

Provide readily accessible eye wash stations & safety showers. Wash at end of each shift & before eating, smoking or using the toilet. Remove clothing that becomes contaminated. Destroy contaminated leather articles. Launder or discard contaminated clothing.

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**SECTION 9. PHYSICAL & CHEMICAL PROPERTIES**

APPEARANCE:	Liquid, Water-White
ODOR:	Oil of Wintergreen
ODOR THRESHOLD:	Not Available
pH (Neutrality):	Not Applicable
MELTING POINT/FREEZING POINT:	Not Available
BOILING RANGE (IBP,50%,Dry Point):	> 64 C / > 147 F
FLASH POINT (TEST METHOD):	11 C / 52 F (TCC)
EVAPORATION RATE (n-BUTYL ACETATE=1):	Not Applicable
FLAMMABILITY CLASSIFICATION:	Class I B
LOWER FLAMMABLE LIMIT IN AIR (% by vol):	7.3
UPPER FLAMMABLE LIMIT IN AIR (% by vol):	Not Available
VAPOR PRESSURE (mm of Hg)@20 C	97.0
VAPOR DENSITY (air=1):	1.1
GRAVITY @ 68/68F / 20/20C:	
SPECIFIC GRAVITY (Water=1):	0.986
POUNDS/GALLON:	8.213
WATER SOLUBILITY:	Appreciable
PARTITION COEFFICIENT (n-Octane/Water):	Not Available
AUTO IGNITION TEMPERATURE:	463C / 867F
DECOMPOSITION TEMPERATURE:	Not Available
VOCs (>0.044 Lbs/Sq In) :	40.2 Vol% / 396.0 g/L / 3.2 Lbs/Gal
TOTAL VOC'S (TVOC)*:	50.0 Vol% / 396.0 g/L / 3.2 Lbs/Gal
NONEXEMPT VOC'S (CVOC)*:	50.0 Vol% / 396.0 g/L / 3.2 Lbs/Gal
HAZARDOUS AIR POLLUTANTS (HAPS):	50.0 Wt% / 396.0 g/L / 3.2 Lbs/Gal
NONEXEMPT VOC PARTIAL PRESSURE (mm of Hg @ 20 C)	97.0

\* Using CARB (California Air Resources Board Rules).

**SECTION 10. STABILITY & REACTIVITY**

**STABILITY**

Stable under normal conditions.

**CONDITIONS TO AVOID**

Isolate from oxidizers, heat, sparks, electric equipment & open flame.

**MATERIALS TO AVOID**

Reacts violently with strong oxidants, causing fire & explosion hazard.

**HAZARDOUS DECOMPOSITION PRODUCTS**

Carbon Monoxide, Carbon Dioxide from burning.

**HAZARDOUS POLYMERIZATION**

Will not occur.

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**SECTION 11. TOXICOLOGICAL INFORMATION**

**ACUTE HAZARDS**

**EYE & SKIN CONTACT:**

Primary irritation to skin, defatting, dermatitis.  
 Primary irritation to eyes, redness, tearing, blurred vision.  
 Liquid can cause eye irritation. Wash thoroughly after handling.

**INHALATION:**

Anesthetic. Irritates respiratory tract. Acute overexposure can cause serious nervous system depression. Vapor harmful. Breathing vapor can cause irritation. Acute overexposure can cause harm to kidneys, blood, nerves, liver, lungs. Repeated exposure over TLV can cause blindness.

**SWALLOWING:**

Can be fatal or cause blindness if swallowed. Cannot be made non-poisonous. **POISON !** Can cause irreversible nervous system damage & death. Harmful or fatal if swallowed. Swallowing can cause abdominal irritation, nausea, vomiting & diarrhea.

**SUBCHRONIC HAZARDS/CONDITIONS AGGRAVATED**

**CONDITIONS AGGRAVATED**

Chronic overexposure can cause harm to kidneys, blood, nerves, liver, lungs. Persons with severe skin, liver or kidney problems should avoid use.

**CHRONIC HAZARDS**

**CANCER, REPRODUCTIVE & OTHER CHRONIC HAZARDS:**

This product has no carcinogens listed by IARC, NTP, NIOSH, OSHA or ACGIH, as of this date, greater or equal to 0.1%. Absorption thru skin may be harmful. Studies with laboratory animals indicate this product can cause damage to fetus. Depending on degree of exposure, periodic medical examination is indicated.

**IRRITANCY OF PRODUCT:** This product is irritating to contaminated tissue.

**SENSITIZATION TO THE PRODUCT:** No component of this product is known to be a sensitizer.

**MUTAGENICITY:** This product is not reported to produce mutagenic effects in humans.

**EMBRYOTOXICITY:** This product is not reported to produce embryotoxic effects in humans.

**TERATOGENICITY:** This product is not reported to produce teratogenic effects in humans.

**REPRODUCTIVE TOXICITY:** This product is not reported to cause reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (such as: within the eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

**MAMMALIAN TOXICITY INFORMATION**

MATERIAL	CAS#	EINECS#	LOWEST KNOWN LETHAL DOSE DATA
Methanol	67-56-1	-	LOWEST KNOWN LD50 (ORAL) 1000.0 mg/kg(Man)
Methanol	67-56-1	-	LOWEST KNOWN LD50 (SKIN) 20000.0 mg/kg (Rabbits)

COMPANY IDENTITY: Astro Chemicals, Inc.  
PRODUCT IDENTITY: ODORIZER FLUID 00-920933-001

SDS DATE: 06/21/2013  
ORIGINAL: 06/21/2013

**SECTION 12. ECOLOGICAL INFORMATION**

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

**EFFECT OF MATERIAL ON PLANTS AND ANIMALS:**

This product may be harmful or fatal to plant and animal life if released into the environment. Refer to Section 11 (Toxicological Information) for further data on the effects of this product's components on test animals.

**EFFECT OF MATERIAL ON AQUATIC LIFE:**

The most sensitive known aquatic group to any component of this product is: Goldfish 250 ppm or mg/L (24 hour exposure).  
Keep out of sewers and natural water supplies.

**MOBILITY IN SOIL**

Mobility of this material has not been determined.

**DEGRADABILITY**

This product is completely biodegradable.

**ACCUMULATION**

Bioaccumulation of this product has not been determined.

**SECTION 13. DISPOSAL CONSIDERATIONS**

Processing, use or contamination may change the waste disposal requirements. Do not dispose of on land, in surface waters, or in storm drains. Waste should be recycled or disposed of in accordance with regulations. Large amounts should be collected for reuse or consigned to licensed hazardous waste haulers for disposal.

**ALL DISPOSAL MUST BE IN ACCORDANCE WITH ALL FEDERAL, STATE, PROVINCIAL, AND LOCAL REGULATIONS. IF IN DOUBT, CONTACT PROPER AGENCIES. EPA CHARACTERISTIC: D001**

**SECTION 14. TRANSPORT INFORMATION**

IF > 10000 LB / 4545 KG OF THIS PRODUCT IS IN 1 CONTAINER, IT EXCEEDS THE RQ OF METHANOL. "RQ" MUST BE PUT BEFORE THE DOT SHIPPING NAME.

DOT/TDG SHIP NAME: UN1993, Flammable Liquids, n.o.s.  
(Contains: Methyl Salicylate, Methanol), 3, PG-II  
(FOR AIR/SHIP BULK SHIPMENTS, ADD `MARINE POLLUTANT' TO SHIPPING NAME.)  
DRUM LABEL: (FLAMMABLE LIQUID), (MARINE POLLUTANT)  
IATA / ICAO: UN1992, Flammable Liquids, Toxic, n.o.s.  
(Contains: Methyl Salicylate, Methanol), 3, (6.1), PG-II  
IMO / IMDG: UN1992, Flammable Liquids, Toxic, n.o.s.  
(Contains: Methyl Salicylate, Methanol), 3, (6.1), PG-II  
EMERGENCY RESPONSE GUIDEBOOK NUMBER: 131

**SECTION 15. REGULATORY INFORMATION**

**EPA REGULATION:**

SARA SECTION 311/312 HAZARDS: Acute Health, Fire

All components of this product are on the TSCA list.

**SARA Title III Section 313 Supplier Notification**

This product contains the indicated <\*> toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning & Community Right-To-Know Act of 1986 & of 40 CFR 372. This information must be included in all MSDSs that are copied and distributed for this material.



COMPANY IDENTITY: Astro Chemicals, Inc.  
PRODUCT IDENTITY: ODORIZER FLUID 00-920933-001

SDS DATE: 06/21/2013  
ORIGINAL: 06/21/2013

**SECTION 15. REGULATORY INFORMATION (CONTINUED)**

SARA TITLE III INGREDIENTS	CAS#	EINECS#	WT%	(REG.SECTION)	RQ(LBS)
*Methanol	67-56-1	200-659-6	45-55	(311,312,313,RCRA)	5000

Any release equal to or exceeding the RQ must be reported to the National Response Center (800-424-8802) and appropriate state and local regulatory agencies as described in 40 CFR 302.6 and 40 CFR 355.40 respectively. Failure to report may result in substantial civil and criminal penalties. State & local regulations may be more restrictive than federal regulations.

**STATE REGULATIONS:**

CALIFORNIA SAFE DRINKING WATER & TOXIC ENFORCEMENT ACT (PROPOSITION 65):  
This product contains the following chemical known to the State of California to cause reproductive toxicity: Methanol

**INTERNATIONAL REGULATIONS**

The components of this product are listed on the chemical inventories of the following countries:  
Australia (AICS), Canada (DSL or NDSL), China (IECSC), Europe (EINECS, ELINCS)G  
Japan (METI/CSCL, MHLW/ISHL), South Korea (KECI), New Zealand (NZIoC),  
Philippines (PICCS), Switzerland (SWISS), Taiwan (NECSI), USA (TSCA).

**CANADA: WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)**

B2: Flammable Liquid.  
D2B: Irritating to skin / eyes.

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations (CPR) and the SDS contains all the information required by the CPR.

**SECTION 16. OTHER INFORMATION**

**HAZARD RATINGS:**

HEALTH (NFPA): 1, HEALTH (HMIS): 3, FLAMMABILITY: 3, PHYSICAL HAZARD: 0  
(Personal Protection Rating to be supplied by user based on use conditions.)  
This information is intended solely for the use of individuals trained in the NFPA & HMIS hazard rating systems.

**EMPLOYEE TRAINING**

See Section 2 for Risk & Safety Statements. Employees should be made aware of all hazards of this material (as stated in this SDS) before handling it.

**NOTICE**

The supplier disclaims all expressed or implied warranties of merchantability or fitness for a specific use, with respect to the product or the information provided herein, except for conformation to contracted specifications. All information appearing herein is based upon data obtained from manufacturers and/or recognized technical sources. While the information is believed to be accurate, we make no representations as to its accuracy or sufficiency. Conditions of use are beyond our control, and therefore users are responsible for verifying the data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their handling, and disposal of the product. Users also assume all risks in regards to the publication or use of, or reliance upon information contained herein. This information relates only to the product designated herein, and does not relate to its use in combination with any other material or process.

Unless updated, the Safety Data Sheet is valid until 06/21/2016.

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06-237619-001 Rev. AC ©2021 Carrier

**06-237619-002**  
**August 2022**

# **Errata Addendum for Natura™ Inert Gas System**

Design, Installation, Operation, and  
Maintenance Manual with FM Approvals  
and UL Listing, Rev AC



**EXPORT INFORMATION (USA):**

Jurisdiction: EAR

US ECCN: EAR99

This document contains technical  
data subject to the EAR.



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This addenda provides corrections for the Kidde Fire Systems Natura™ Inert Gas System Design, Installation, Operation, and Maintenance Manual with FM Approvals and UL Listing, Rev AC, P/N: 06-237619-001, herein referred to as the "DIOM". This addendum supercedes the sections mentioned in the DIOM, but does not impact the rest of the DIOM.

This addendum applies only to the manual listed in Table 1. For other system details, see that manual.

Table 1. Kidde Fire Systems Manual Listing

Manual Title	Part Number	Rev
Kidde Fire Systems Natura™ Inert Gas System Design, Installation, Operation, and Maintenance Manual with FM Approval*	06-237619-001	AC

---

## 1 INTRODUCTION CHAPTER

### Section 1-3.1 Personal Safety

Updated 3rd paragraph to read as follows:

For systems with an MDC less than or equal to 43%, personnel must evacuate within 5 minutes. For systems with an MDC greater than 43%, but below 52%, personnel must evacuate within 3 minutes.

## 2 COMPONENT DESCRIPTION CHAPTER

### Section 2-5.1 Back-Plate Manifold

Adding:

Solenoid Specifications:

- Operating Voltage: 24 VDC 10W
- Current Draw: 0.42 Amps

Updated Note to read:

**Note:** The solenoid on the back-plate manifold leading to the hazard being protected by the discharge must be continuously powered during the system discharge.  
The solenoid includes a manual override. To operate, pull the pin, depress the button, and turn clockwise to lock the solenoid open.

### Section 2-5.1.2 Pressure Regulator

Updated 1st paragraph to read:

The pressure regulator (P/N 01-6017-0000) reduces the incoming pressure down to the 8 bar needed to operate the selector valves. This pressure comes from the agent manifold as described previously. The regulator is included with the back-plate manifold, but may be ordered separately if needed.

## 3 SYSTEM DESIGN CHAPTER

### Section 3-3 Extinguishing Values

Revised Warning text to read:

**LOAEL (Lowest Observed Adverse Effect Level) is the lowest concentration at which an adverse toxicological or physiological effect has been observed in humans. For Natura IGS agents this value is 52%, corresponding to a residual Oxygen concentration of 10% (sea level equivalent). The human exposure limit is 3 minutes for inert gas systems designed to concentrations between 43% and 52%.**



**NOAEL (No Observed Adverse Effect Level) is the highest concentration at which no adverse toxicological or physiological effect has been observed in humans. For Natura IGS agents this value is 43%, corresponding to a residual Oxygen concentration of 12% (sea level equivalent). The human exposure limit is 5 minutes for Inert gas systems designed to concentrations below 43%.**

### Section 3-17.1 Nozzle Coverage

Revised 1st sentence to read:

At the minimum height of 1 foot the maximum area coverage of the installed nozzle is 1250 sq ft (116 sq m).

**Section 4-4.2 Selector Valve Systems**

Updated Table 4-3 to:

Table 4-3. Selector Valve System Cylinder Bank Arrangement Components

<b>Item</b>	<b>Description</b>
1	Selector Valve Actuator
2	Connection for 1/4" Hi-flex hose
3	Actuator Vent Outlet
4	Selector Valve
5	Discharge Manifold
6	Back-plate Manifold
7	Pressure Regulator set to 120 PSI

**Section 4-4.3 Systems Using Discharge Delays**

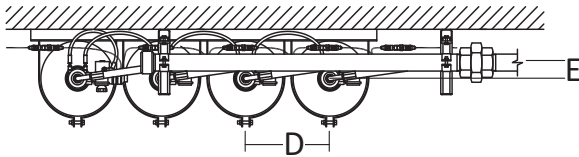
Updated Table 4-4 to:

Table 4-4. Discharge Delay System Components

<b>Number</b>	<b>Description</b>	<b>Part Number</b>
1	108 cu. in. Nitrogen Pilot Cylinder	06-129773-001
2	Electric Control Head Kit with Control Head Monitor (CHM not pictured)	85-890181-000
3	30" Actuation Hose	WK-264986-000
4	Nitrogen Discharge Delay Kit	34 sec.: 38-401140-030 61 sec.: 38-401140-060
5	Lever Operated Control Head	WK-870652-000
6	NPS to BSP Adapters: <ul style="list-style-type: none"> <li>• 3/4" Male x 1/4" NPT Female Bushing Adapter</li> <li>• 1/4" BSPP Male x NPT Male Straight Adapter</li> </ul>	Included in Nitrogen Discharge Delay Kit
7	Back-Plate Manifold Hose	Included in Nitrogen Discharge Delay Kit
8	Pressure Regulator	01-6017-0000
9	BSP to Quick Connect Adapters: <ul style="list-style-type: none"> <li>• Steel Bonded Washer</li> <li>• 1/4" BSPP Female x NPT Male Straight Adapter</li> <li>• 1/4" NPT Female 90° Elbow Connector</li> <li>• 1/4" NPT Male x 6mm Tube OD Adapter</li> </ul>	Included in Nitrogen Discharge Delay Kit
10	Pilot Line Actuation Hose	38-401110-X00 or 38-401130-X00
11	1st Cylinder with Secondary Gauge	Varies

## Section 4-5.2.1 Clamp Racking Layouts

Updated Figure 4-5 and Table 4-7 to:



### Note:

- Manifolds can be offset Front or rear of container centre
- Manifolds can be offset to the right (as illustrated) or to the left of the containers.

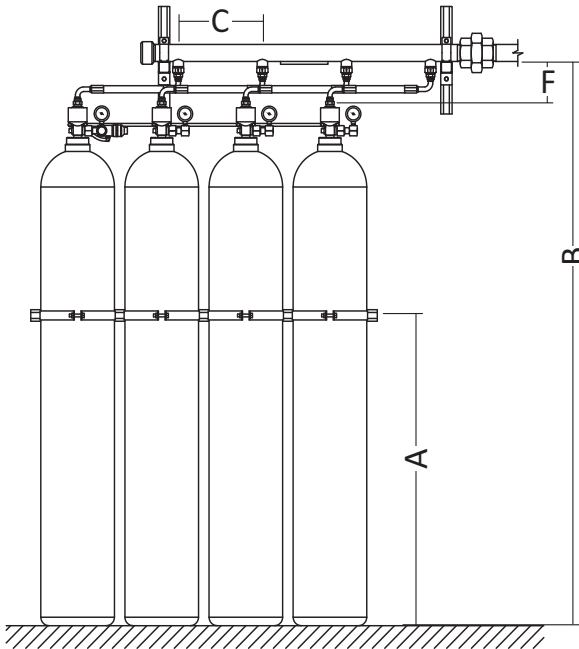


Figure 4-5. Racking System with Clamps

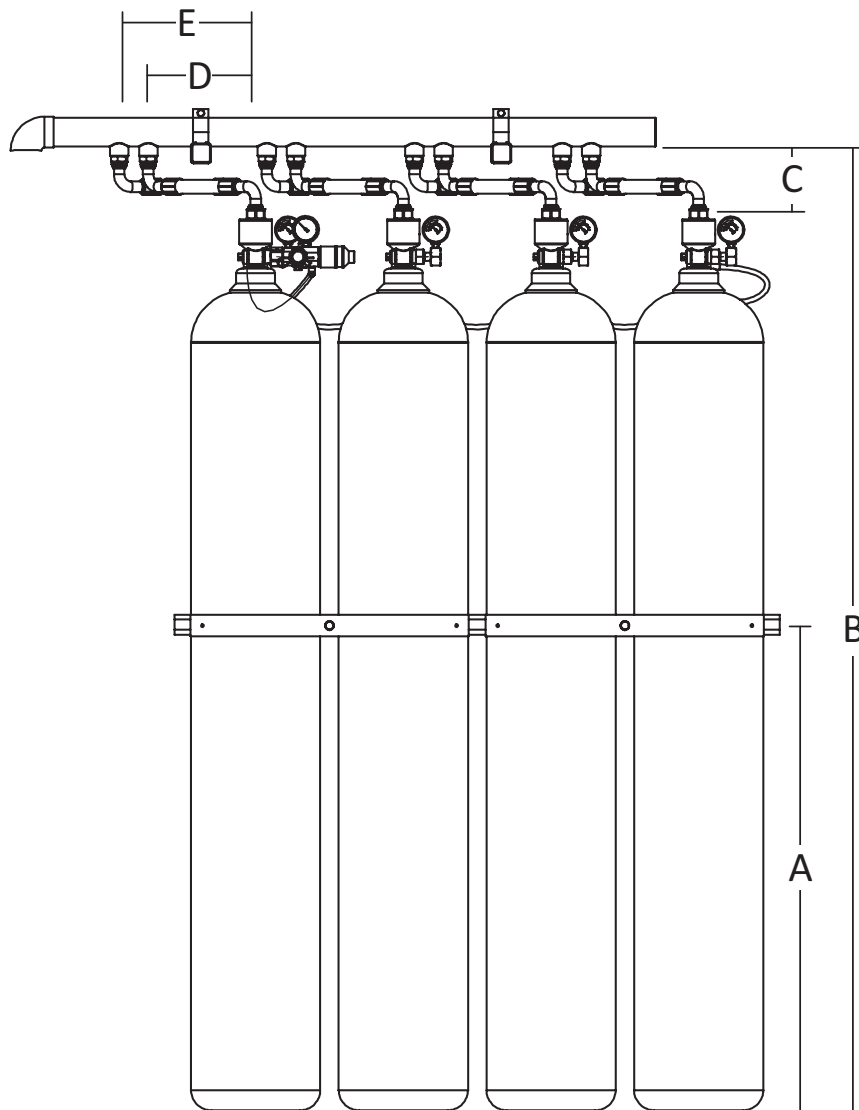
Table 4-7. Dimensions for Racking Systems with Clamps

Container Size	Dimension											
	Floor to Clamping Bar A		Floor to Bottom of Manifold* B		Center Container to Manifold Check Valve C		Container Centers (Side to Side) D		Centre of Container to Manifold Centre Offset (Minimum) E		Top of Valve Outlet to Bottom of Manifold F	
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
80 L	43.3	1100	79.5	2020	14.4	365	12.0	305	3.1	80	5.5	140
140 L	43.3	1100	78.9	2005	17.9	455	15.6	395	3.1	80	5.5	140

\* The height is an estimated guide. For actual height, reference off the actual cylinders being installed.

## Section 4-5.2.2 2 Row Wooden Racking Layouts

Updated Figure 4-6 and Table 4-8 to:



**Note:**

Manifolds can be offset to the left (as illustrated) or to the right of the containers.

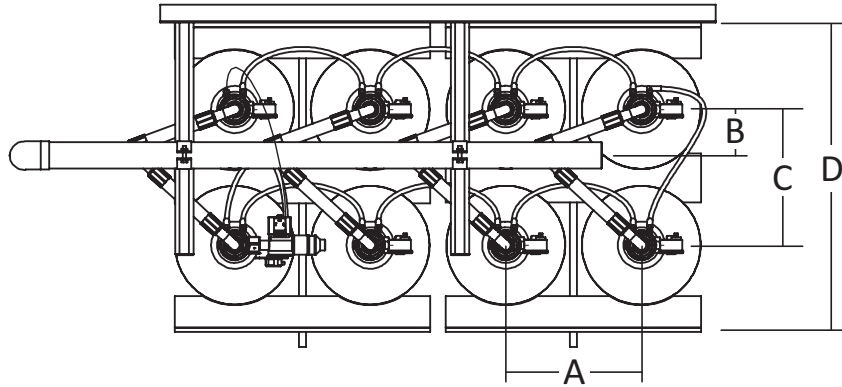
Figure 4-6. 2 Row Wooden Racking System with Wooden Bracketing, Side View

Table 4-8. Side View Dimensions for 2 Row Racking Systems with Wooden Bracketing

Container Size	Dimension									
	Floor to Clamping Bar A		Floor to Bottom of Manifold* B		Top of Valve Outlet to Bottom of Manifold C		Center Front Container to Manifold Check Valve D		Center Rear Container to Manifold Check Valve E	
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
80 L	43.3	1100	79.5	2020	5.5	140	12.0	305	14.4	365
140 L	43.3	1100	78.9	2005	5.5	140	15.6	395	17.9	455

\* The height is an estimated guide. For actual height, reference off the actual cylinders being installed.

Added Figure 4-7 and Table 4-9.



**Note:**  
Manifolds can be offset to the left (as illustrated) or to the right of the containers.

Figure 4-7. 2 Row Wooden Racking System with Wooden Bracketing, Top View

Table 4-9. Top View Dimensions for 2 Row Racking Systems with Wooden Bracketing

Container Size	Dimension							
	Container Centers (Side to Side) A		Centre of Rear Containers to Manifold Centre Offset B		Container Centers (Front to Back) C		Front of Bracket to back of Rear Bracket** D	
	inch	mm	inch	mm	inch	mm	inch	mm
80 L	12.0	305	6.1	155	12.2	310	25.0	634
140 L	15.6	395	7.9	200	15.8	400	32.7	830

\*\* The Front to back bracket dimension is an approximate as there may be fluctuations based on tightening of the bracket.

## Section 4-5.2.4 2 Manifold Installation

Updated Figure 4-9 to mention brace is supplied by the installer.

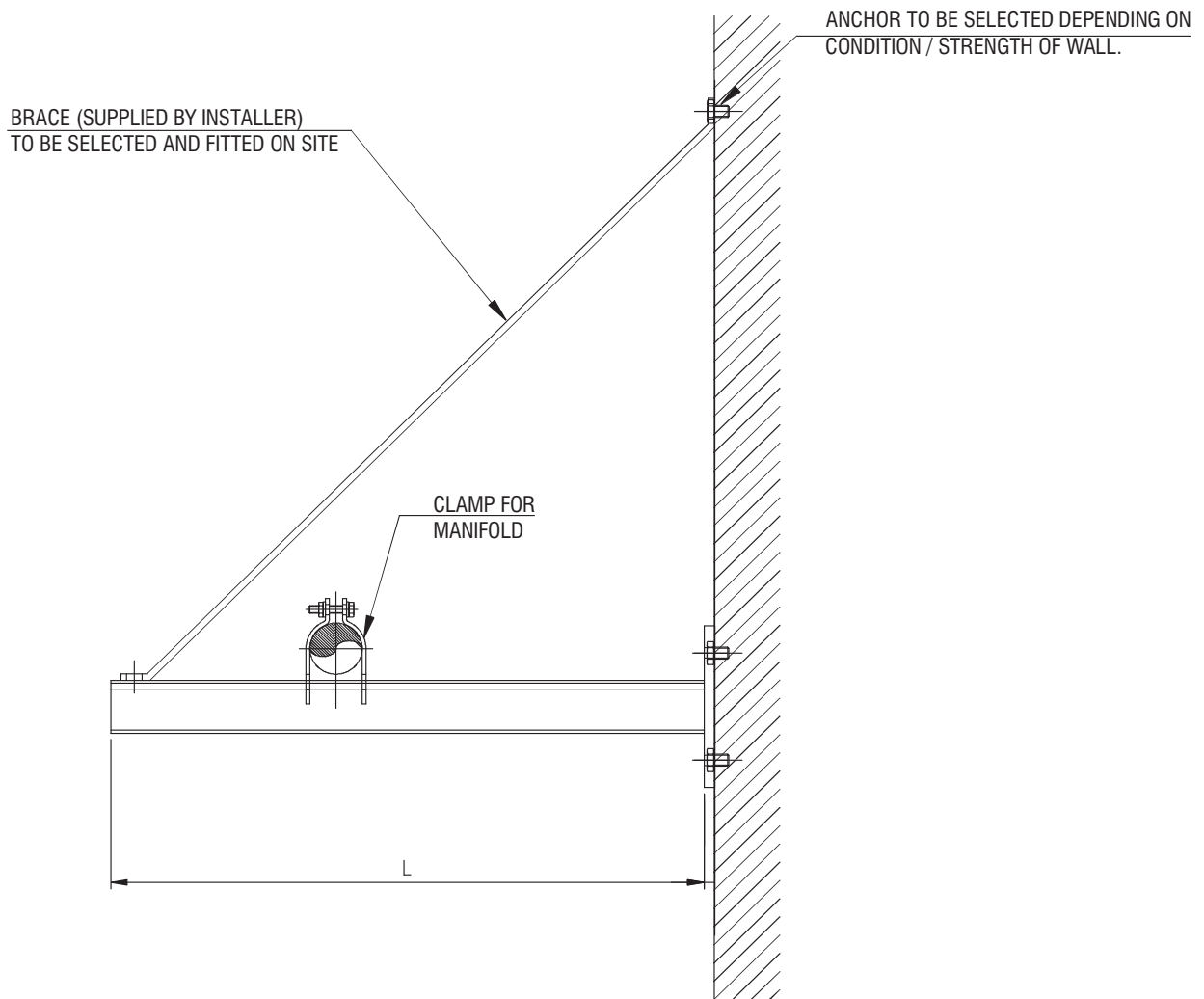


Figure 4-9. Manifold Installation

Updated Table 4-10 to include Imperial weights:

Table 4-10. Manifold Installation Details

Type No.	L		Weight		Used For		Max. Load	
	in.	mm	lbs	kgs	80 L	140 L	lbs	kgs
01-8160-0200	7.9	200	~ 2.2	~ 1.0 kg	1 - Row	N/A	1190.5	540
01-8160-0250	9.8	250	~ 3.3	~ 1.5 kg	N/A	1 - Row	952.4	432
01-8160-0520	20.5	520	~ 4.4	~ 2.0 kg	2 - Rows	N/A	463.0	210
01-8160-0600	23.6	600	~ 5.5	~ 2.5 kg	N/A	2 - Rows	396.8	*180
01-8160-0830	32.7	830	~ 6.6	~ 3.0 kg	3 - Rows	N/A	286.6	*130

\*Brace required for installation.

---

## Section 4-6.5 Securing Multi-Row Cylinders

Added Note after step 9:

**Note:** \*Kidde Fire Systems does not recommend setting up the 140L cylinders in a 3 row configuration due to restrictions on access to the back row.

## Section 4-8.3 Fittings

Rewrote section, correcting allowed Class of malleable or ductile iron fittings. New text is as follows:

Fittings shall conform to the requirements of NFPA 2001, 2022 Edition, Sections 5.2.2. Class 150 and cast iron fittings must not be used. Class 300 malleable or ductile iron fittings in sizes 3-inch and smaller, or 1000 lb ductile iron or forged steel fittings in sizes greater than 3-inch are to be used. Class 400 or higher flanged joints are acceptable for use in all sizes. Alternately, forged steel fittings can be used.

**Note:** Systems installed in Europe should not use malleable fittings unless approved by the local AHJ.

Pipe size reductions shall be through concentric reducers. Where pipe size reductions occur at flow splits, reducers shall be downstream of the tee.

Fittings of any type shall be a minimum of 10 nominal pipe diameters of length upstream of the entrance to the tee.

Fittings shall be used with a working pressure of not less than 70 bar i.e. EN 10241 (Seamless with test pressure of 150 bar) or BS 3799 (3000 lb) forged steel.



**The calculation software has only been verified for use with the piping, inside pipe diameter and fittings specified in this manual. When unspecified piping and fittings are used for unbalanced systems, there is a risk that the system will not supply the required quantity of agent.**

## Section 4-8.5.2 NPT/BSPT – Threading

Corrected reference to ASME Specification. Text now reads:

Threads on all pipe and fittings must be tapered threads conforming to ASME Specification B.1.20.1 or ISO 7-1.

## Section 4-13.1 Supervisory Gauge Assembly Wiring

Corrected section title, section text, and figures to read as follows:

Connect the pressure gauge on the release unit/secondary cylinder gauge assembly using the quick connect cables as indicated on the electrical schematic diagram and terminate in the allocated terminals in the control panel/junction box.

The secondary cylinder gauge assembly should be connected in a single loop configuration (between cylinders) using the quick connect cable joiners provided.

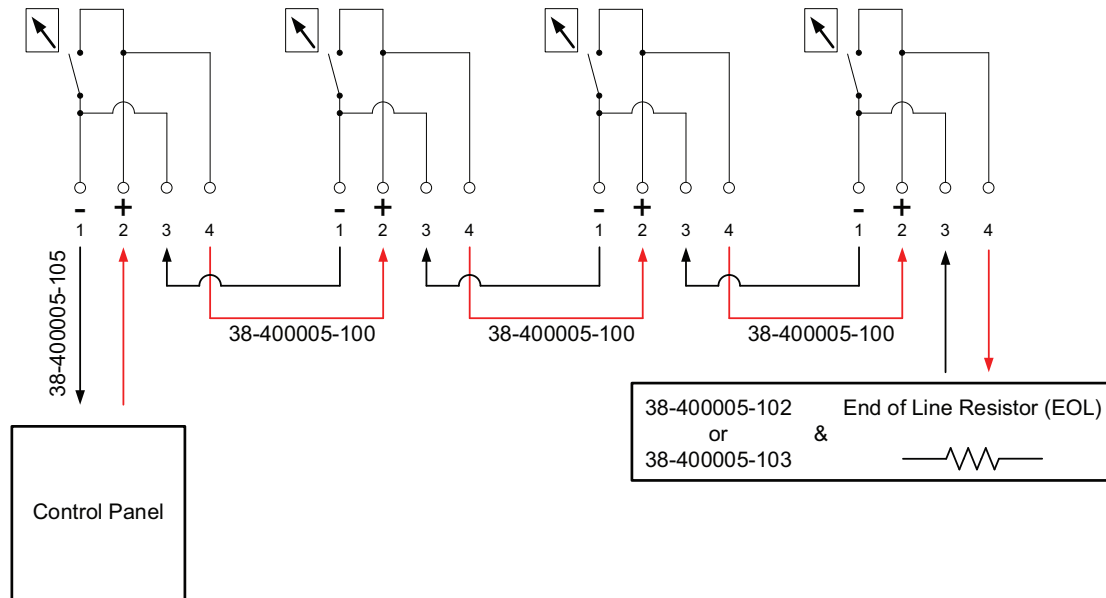


Figure 4-31. Quick Connect Wiring Example

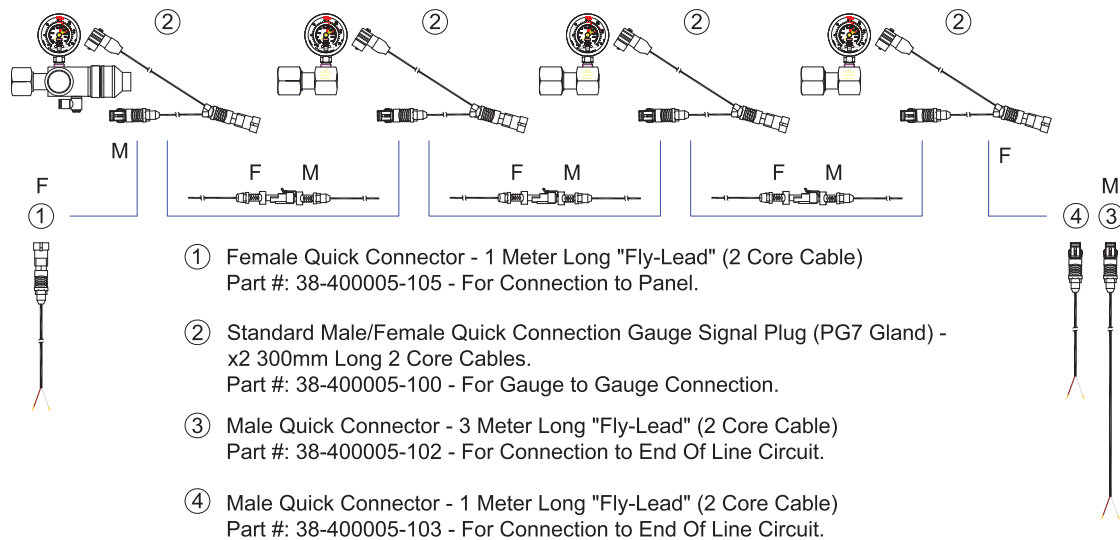


Figure 4-32. Quick Connect Cabling Example

## Section 4-13.2 Solenoid Valve, Release And Selection

Added the following note at the start of the section:

**Note:** Release unit solenoids must be continuously powered during system discharge.

## Section 4-17.4.1 Connecting Discharge Delay to the Pressure Regulator and Cylinder Valve

Changed references for copper washer to rubber bonded steel washer.

---

## **5 OPERATION CHAPTER**

No changes made.

## **6 MAINTENANCE CHAPTER**

### **Section 6-8.2 Conduct System Pressure Test**

Added this new section as part of the 2 year inspection procedure. Text is as follows:

Per NFPA 2001, Latest Edition, the piping system must be pressure tested in a closed circuit using Nitrogen or other dry gas. Ensure all sections of pipe are tested, including those separated by Selector valves. Ensure all Check, Lockout, and Selector valves are tested in all applicable states.

**Note:** A calibrated gauge must be used when monitoring the pressure during the test.

To perform a pressure test of the piping system, follow these steps:

1. Disconnect all actuation lines, release units, and, if applicable, control heads.
2. Disconnect the discharge hose from each agent cylinders. Immediately install the anti-recoil cap on the valve's discharge outlet..
3. Ensure all nozzles are removed with plugs in their place and there are no other openings in the system piping.
4. Pressurize the pipe system to at least 40 psi using Nitrogen or other dry gas, ensuring all section see this pressure. Pressure should be applied to one end of the agent manifold through to the pipe network. This ensures each check valve is also covered by the test. Remove the source of pressure, ensuring the system remains closed and that the pressure inside can be monitored.
5. Monitor the pressure for 10 minutes, ensuring the pressure does not drop below 80 percent of the test pressure (32 psi if using 40 psi as the test pressure).
6. If the pressure loss is greater than 20 percent of the test pressure, locate the leak and replace any necessary components.
7. Return the system to full service, ensuring all nozzles are replaced in the correct location, and all cylinders are properly connected to the system piping. Re-connect the actuation lines, release units, and, if applicable, control head(s).

## **7 POST-DISCHARGE MAINTENANCE CHAPTER**

No changes made.

## **8 PARTS LIST CHAPTER**

Removed references to BSP style nozzles.

---

**A REFILL INFORMATION APPENDIX**

**Section A-4.2 Natura IGS Cylinder Valve, P/N 38-400000-001**

Changed Warning text to read as follows:



**Valves must be replaced after 10 actuation.**

**Section A-5.1.1 Cylinder/Valve Replacement**

Changed 1st Warning text to read as follows:



**Valves must be replaced after 10 actuation.**

**Section A-5.3 Filling Cylinder and Valve Assemblies**

Add the following Caution statement to the end of the section:



**If the valve leaks during the refill process, replace the valve.**

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06-237619-003

March 2023

**TPED Approved Cylinder  
Addendum  
for  
Kidde Fire Systems  
Natura™ Inert Gas System  
Design, Installation, Operation, and  
Maintenance Manual with FM  
Approvals and UL Listing, Rev AC**



**EXPORT INFORMATION (USA):**

Jurisdiction: EAR

US ECCN: EAR99

This document contains technical  
data subject to the EAR.



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## 1 GENERAL

the Kidde Fire Systems Natura™ Inert Gas System (Natura IGS system) TPED Approved 80 liter cylinders are available in regions requiring this approval.

Natura IGS cylinders can be filled with the following Inert gas clean agents (herein referred to as "agent"):

- IG-100: Fixed fire extinguishing systems that use the pure inert gas Nitrogen
- IG-541: Fixed fire extinguishing systems that use inert, gaseous mixture of 52% Nitrogen, 40% Argon, and 8% Carbon Dioxide
- Argonite (IG-55): Fixed fire extinguishing systems that use inert, gaseous mixture of 50% Nitrogen and 50% Argon
- IG-01: Fixed fire extinguishing systems that use the pure inert gas Argon

These TPED approved cylinders are available only for the Kidde Fire Systems Natura™ Inert Gas System. This addendum applies to the manuals listed in Table 1. For other system details, see the associated manuals listed in Table 1.

Table 1. Kidde Fire Systems Manual Listing

Manual Title	Part Number	Rev
Kidde Fire Systems Natura™ Inert Gas System Design, Installation, Operation, and Maintenance Manual with FM Approval and UL Listing	06-237619-001	AC

---

## 2 COMPONENT DESCRIPTION

### 2.1 TPED Approved Natura IGS System Agent Containers

The agents are stored in high pressure containers having a filling pressure of 200 Bar (2900 PSI) or 300 Bar (4351 PSI). The 80 Liter containers can be installed in single and double, and triple row configurations.

Because the agents are stored as a non-liquefied gas, dip tubes are not used, allowing the containers to be installed either vertically or horizontally, as required. All rack configurations are for vertical mounting only.

**Note:** Containers in a system must all be of the same size, pressure, and agent. The Cylinder Assemblies, Release Units, Hoses, and other Natura IGS components connected to the manifold or valves must remain protected from exposure to moisture at all times.

The container valve assembly is equipped with a pressure gauge with a supervisory pressure switch connection for monitoring container pressure and a safety burst disc in compliance with DOT, UN, or TPED requirements.

Each container valve assembly is fitted with an anti-recoil cap to prevent uncontrolled discharge, in addition a safety transport cap, shroud or guard is provided to protect the container valve during transportation or container handling.

Each container, manufactured in accordance with TPED, and/or UN (DOT Recognized), ISO 9809-2, is fitted with a pressure operated high pressure container valve.

Standard containers are available in volumes of 80 liters filled with agent at pressures of 200 bar or 300 bar at a filling temperature of 15°C.

The containers are provided with the body painted red and green shoulder, with agency markings where applicable.

**Note:** All containers are fitted with a valve protection device in accordance with the United Nations ADR.



**The safety cap must be installed on the discharge outlet whenever a container/valve assembly is not connected to the system piping. Failure to install the safety cap could result in violent movement of the container in the event of inadvertent actuation. Failure to follow these instructions could cause death, personal injury and/or property damage.**

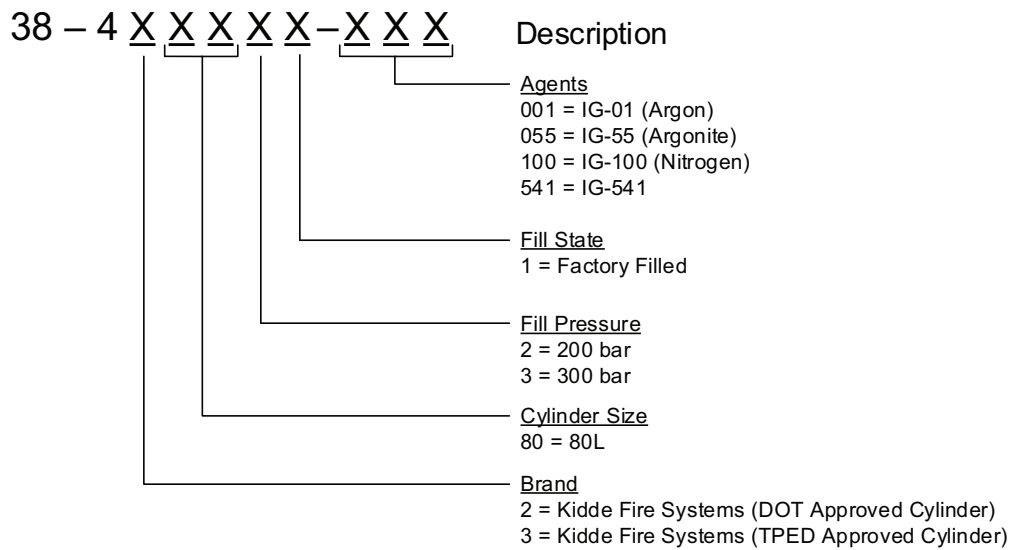


Figure 1. IGS System Agent and Cylinder Part Number Breakdown

Figure 2 represents a typical container assemblies. See Table 2 for container dimensions.

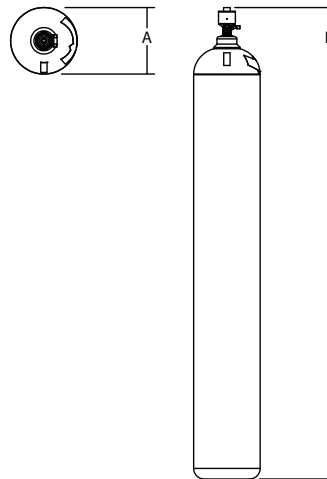


Figure 2. Typical Container Assembly

Table 2. Dimensions. Container and Valve Assemblies

Part Number	Capacity	Approximate Empty Weight		Approximate Height (B)		Approximate Diameter (A)		Volume	
		kg	lb	mm	in	mm	in	m <sup>3</sup>	in <sup>3</sup>
38-4380X1-XXX	80 L	103.0	227.1	1880	74.0	267	10.51	0.08	4882

**Note:** Agent choice does not impact container dimensions, only filled weights. For weights, see Table 3.

Table 3. Filled Container Weights

Part Number	Capacity	Pressure	IG-100		IG-541		Argonite (IG-55)		IG-01	
			kg	lb	kg	lb	kg	lb	kg	lb
38-438021-XXX	80 L	200 bar	120.8	266.4	126.6	279.1	125.8	277.4	131.5	289.9
38-438023-XXX	80 L	300 bar	127.6	281.4	136.1	300.0	135.1	297.9	143.8	317.0

---

The Natura IGS system equipment listed herein is designed for an operating temperature range of -20° to 50°C (-4° to 122°F). For UL Listed Natura IGS systems, the operating temperature range is -20° to 54°C (-4° to 130°F) unless superseded by local/national standards.

Agent information can be found in the manuals listed in Table 1. The Natura IGS system flow calculation program is designed for a 20°C (68°F) container operating/storage temperature.

## 2.2 Spare Parts for Containers

The following spare parts are available for the container:

Table 1-1. Natura IGS System Container Spare Parts

Part Number	Description
38-400011-001	Anti-recoil Cap, with Actuation Test Pin
15-0181-9000	Anti-recoil Cap Spare O-Ring
15-9604-0011	Transport Cap for 80L containers

## 3 DESIGN CONSIDERATION

All design considerations for the new TPED approved cylinders are the same as the other cylinders listed in manuals found in Table 1.

## 4 INSTALL

All installation details for the new TPED approved cylinders are the same as the other cylinders listed in manuals found in Table 1.

## 5 OPERATION

All operational details for the new TPED approved cylinders are the same as the other cylinders listed in manuals found in Table 1.

## 6 MAINTENANCE

All standard maintenance for the new TPED approved cylinders are the same as the other cylinders outlined in the manual listed in Table 1.

## 7 POST DISCHARGE MAINTENANCE

All standard post discharge maintenance for the new TPED approved cylinders are the same as the other cylinders outlined in the manual listed in Table 1.

---

**8****PARTS LIST**

Table 1-2. Kidde Fire Systems, Factory Filled Cylinders (TPED Approved)

Description	Part Number
Kidde Fire Systems Branded Cylinders with IG01	
Kidde Fire Systems Branded 80L Cylinder filled with IG01 to 200 bar (TPED Approved)	38-438021-001
Kidde Fire Systems Branded 80L Cylinder filled with IG01 to 300 bar (TPED Approved)	38-438031-001
Kidde Fire Systems Branded Cylinders with IG100	
Kidde Fire Systems Branded 80L Cylinder filled with IG100 to 200 bar (TPED Approved)	38-438021-100
Kidde Fire Systems Branded 80L Cylinder filled with IG100 to 300 bar (TPED Approved)	38-438031-100
Kidde Fire Systems Branded Cylinders with IG055	
Kidde Fire Systems Branded 80L Cylinder filled with IG055 to 200 bar (TPED Approved)	38-438021-055
Kidde Fire Systems Branded 80L Cylinder filled with IG055 to 300 bar (TPED Approved)	38-438031-055
Kidde Fire Systems Branded Cylinders with IG055	
Kidde Fire Systems Branded 80L Cylinder filled with IG541 to 200 bar (TPED Approved)	38-438021-541
Kidde Fire Systems Branded 80L Cylinder filled with IG541 to 300 bar (TPED Approved)	38-438031-541

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**06-237873-001**  
**January 2023**

**2-Way NPT and Grooved  
Selector and Lockout Valve  
Addendum  
for  
Kidde Fire Systems  
Clean Agent Systems**



**EXPORT INFORMATION (USA):**

Jurisdiction: EAR

US ECCN: EAR99

This document contains technical  
data subject to the EAR.



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# 1 GENERAL

Kidde Fire Systems 2-Way NPT and Grooved selector valves are used to distribute agent where multiple spaces are protected from a common bank of cylinders.

Kidde Fire Systems NPT and Grooved lockout valves can be locked in the close position to prevent agent from being discharged into a protected area for the safety of personnel.

These selector and lockout valves are available to multiple Kidde Fire Systems Clean Agent Fire Suppression Systems. This addendum applies to the following industrial, land-based Kidde Fire Systems fire suppression systems:

- Kidde Fire Systems Natura™ Inert Gas System
- Kidde Fire Systems ECS-500™ psi Fire Suppression System with 3M™ Novec™ 1230 Fire Protection Fluid
- Kidde Fire Systems ADS™ Fire Suppression System with 3M Novec 1230 Fire Protection Fluid
- Kidde Fire Systems ECS™ Fire Suppression System with 3M Novec 1230 Fire Protection Fluid
- Kidde Fire Systems ADS Fire Suppression System with HFC-227ea Agent (a discontinued brand)
- Kidde Fire Systems ECS Fire Suppression System with HFC-227ea Agent (a discontinued brand)

This addendum applies to the manuals listed in Table 1. For other system details, see the associated manuals listed in Table 1.

Table 1. Kidde Fire Systems Manual Listing

Manual Title	Part Number	Rev
Kidde Fire Systems Natura™ Inert Gas System Design, Installation, Operation, and Maintenance Manual with FM Approval	06-237619-001	AC
Kidde Fire Systems ECS-500™ psi Fire Suppression System with 3M™ Novec™ 1230 Fire Protection Fluid Design, Installation, Operation, and Maintenance Manual	06-237585-001	AB
Kidde Fire Systems ADS™ Fire Suppression System with 3M™ Novec™ 1230 Fire Protection Fluid Design, Installation, Operation and Maintenance Manual	06-237256-001	AB
Kidde Fire Systems ECS™ Fire Suppression System with 3M™ Novec™ 1230 Fire Protection Fluid Design, Installation, Operation, and Maintenance Manual	06-236553-001	BA
Kidde Fire Systems ADS™ Fire Suppression System with HFC-227ea Agent Design, Installation, Operation, and Maintenance Manual	06-236068-001	BA
Kidde Fire Systems ECS™ Fire Suppression System with HFC-227ea Agent Design, Installation, Operation, and Maintenance Manual	06-236115-001	BA

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## 2 COMPONENT DESCRIPTION

### 2.1 2-Way NPT and Grooved Selector Valves

**P/N: See Table 2**

Selector valves are used to distribute agent where multiple hazards are protected from the same or multiple banks of cylinders. These selector valves are 2-way ball valves with full bore, available in sizes to match 1, 1 1/2, 2, 3, and 4 inch pipes.

The valves operate pneumatically, using pressure from either a Nitrogen pilot cylinder or, in the case of inert systems, from the agent manifold. The pressure passes through a pressure regulator, then through the associated solenoid which is opened via the control panel, allowing the pressure to flow to the required selector valve.

For selector valves with NEMA 4 rated solenoids, Kidde Fire Systems offers back-plate manifolds which includes the various number of solenoids to ease installation. For more information, see Section 2.1.1, Back Plate Manifold with Solenoids for Selector Valves.

Selector valves with NEMA 7 rated solenoids cannot use the back-plate manifolds as, the solenoids are mounted directly on the selector valve.

Selector valve sizes 1, 1 1/2, and 2 in. have NPT threaded inlet and outlet ports for connection to the distribution piping. Selector valve sizes 3 and 4 in. use grooved fitting to connect to the system piping. When installing, choose the correct mating fittings to match with the groove fitting of the selector valves.

Table 2. Selector Valve Part Numbers

Part Number	Description
<b>NEMA 4 Rated Selector Valves</b>	
85-100025-100	1 in. Selector valve, NPT, 8-10 bar Actuator, NEMA 4 Rated Solenoid
85-150025-150	1 1/2 in. Selector valve, NPT, 8-10 bar Actuator, NEMA 4 Rated Solenoid
85-200025-200	2 in. Selector valve, NPT, 8-10 bar Actuator, NEMA 4 Rated Solenoid
85-300025-300	3 in. Selector valve, Grooved, 8-10 bar Actuator, NEMA 4 Rated Solenoid
85-400025-400	4 in. Selector valve, Grooved, 8-10 bar Actuator, NEMA 4 Rated Solenoid
<b>NEMA 7 Rated Selector Valves</b>	
85-100724-100	1 in. Selector valve, NPT, 8-10 bar Actuator, NEMA 7 Rated Solenoid
85-150724-150	1 1/2 in. Selector valve, NPT, 8-10 bar Actuator, NEMA 7 Rated Solenoid
85-200724-200	2 in. Selector valve, NPT, 8-10 bar Actuator, NEMA 7 Rated Solenoid
85-300724-300	3 in. Selector valve, Grooved, 8-10 bar Actuator, NEMA 7 Rated Solenoid
85-400724-400	4 in. Selector valve, Grooved, 8-10 bar Actuator, NEMA 7 Rated Solenoid

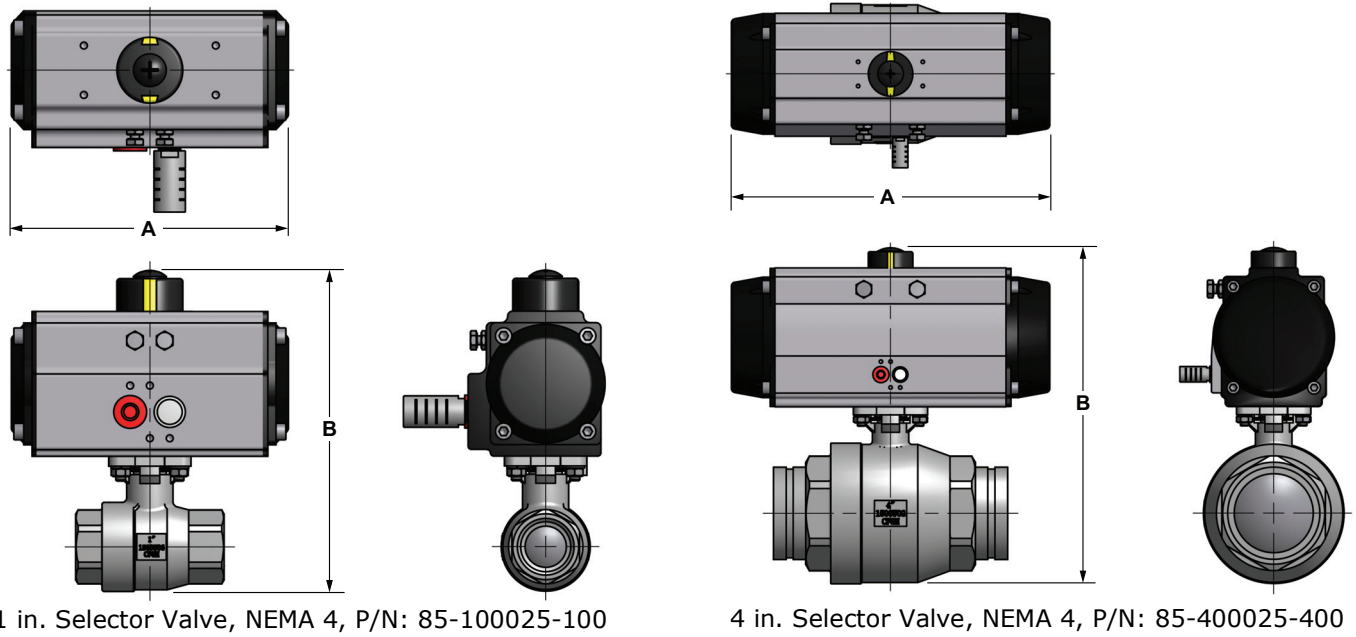
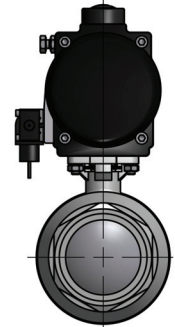
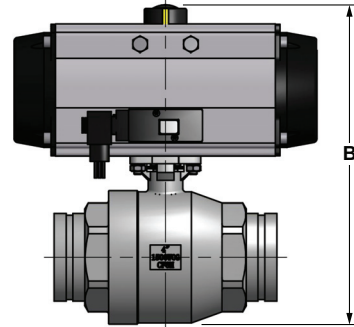
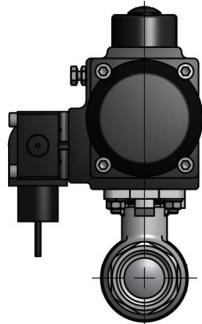
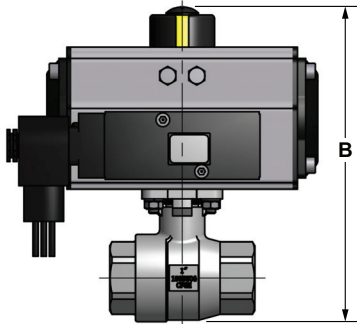
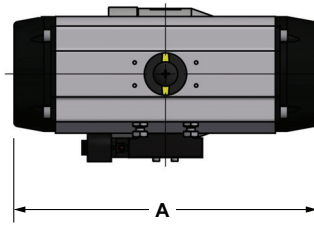
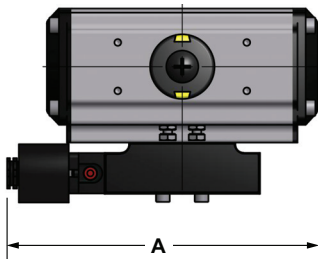


Figure 1. 1 and 4 inch Selector Valve, NEMA 4

Table 3. NEMA 4 Selector Valve Specifications

Part Number	Size	Thread Type	Dimensions				Pressure Rating
			A		B		
			inches	mm	inches	mm	
85-100025-100	1 in.	NPT	6 5/8	168	6 11/16	195	1015 PSI (70 Bar)
85-150025-150	1.5 in.	NPT	10 1/3	263	9 15/16	252	1015 PSI (70 Bar)
85-200025-200	2 in.	NPT	10 9/16	268	11 1/4	286	1015 PSI (70 Bar)
85-300025-300	3 in.	Grooved	11 7/8	301	14 1/4	362	1015 PSI (70 Bar)
85-400025-400	4 in.	Grooved	15 1/2	394	16 3/8	416	1015 PSI (70 Bar)



1 in. Selector Valve, NEMA 7, P/N: 85-100724-100

4 in. Selector Valve, NEMA 7, P/N: 85-400724-400

Figure 2. 1 and 4 inch Selector Valve, NEMA 7

Table 4. NEMA 7 Selector Valve Specifications

Part Number	Size	Lead Length	Thread Type	Dimensions				Pressure Rating
				A		B		
				inches	mm	inches	mm	
85-100724-100	1 in.	70" (1778 mm)	NPT	7 9/16	193	6 11/16	195	1015 PSI (70 Bar)
85-150724-150	1.5 in.	70" (1778 mm)	NPT	10 1/3	263	9 15/16	252	1015 PSI (70 Bar)
85-200724-200	2 in.	70" (1778 mm)	NPT	10 9/16	268	11 1/4	286	1015 PSI (70 Bar)
85-300724-300	3 in.	70" (1778 mm)	Grooved	11 7/8	301	14 3/16	360	1015 PSI (70 Bar)
85-400724-400	4 in.	70" (1778 mm)	Grooved	15 1/2	394	16 3/8	416	1015 PSI (70 Bar)

## 2.1.1 Back Plate Manifold with Solenoids for Selector Valves

### P/N: 01-3508-000X

**Note:** Use only with NEMA 4 rated solenoids. Not to be used with selector valves P/N: 85-100724-100, 85-150724-150, 85-200724-200, 85-300724-300 or 85-400724-400.

To simplify the selector valve installation, KFS offers a back-plate manifold with the pressure regulator, piping, and the required number of solenoids to provide pressure to the appropriate selector valve. This back-plate manifold includes one hose (P/N 01-3273-1200) to connect the pressure regulator on the back-plate to a Nitrogen pilot cylinder or agent manifold. Use one 108 cu. in. Nitrogen pilot cylinder per back-plate manifold to provide pressure to open the selector valves.

Solenoid Specifications:

- Operating Voltage: 24 VDC 10W
- Current Draw: 0.42 Amps

**Note:** The solenoid on the back-plate manifold leading to the hazard being protected by the discharge must be continuously powered during the system discharge. The solenoid includes a manual override. To operate, pull the pin, depress the button, and turn clockwise to lock the solenoid open.

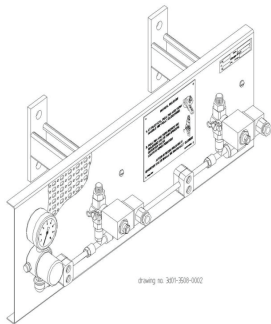


Figure 3. Back-Plate Manifold Arrangement

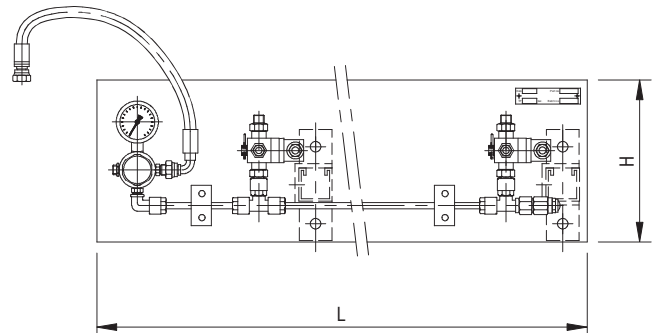


Figure 4. Back-Plate Manifold Dimensions

Table 5. Back-Plate Manifold Dimensions

Part Number	Number of Selector Valve Connections	Dimensions				Weight	
		L		H			
		inches	mm	inches	mm	lbs	kg
01-3508-0002	2	23.8	605	7.9	200	~8.8	~4
01-3508-0003	3	35.8	910	7.9	200	~11.0	~5
01-3508-0004	4	47.8	1215	7.9	200	~17.6	~8
01-3508-0005	5	59.8	1520	7.9	200	~22.0	~10

Table 6. Back-Plate Manifold Part Numbers

Part Number	Description
01-3508-0002	Back-Plate Manifold with Solenoids - 2 Area, Selector Valve Control, 8 bar
01-3508-0003	Back-Plate Manifold with Solenoids - 3 Area, Selector Valve Control, 8 bar
01-3508-0004	Back-Plate Manifold with Solenoids - 4 Area, Selector Valve Control, 8 bar
01-3508-0005	Back-Plate Manifold with Solenoids - 5 Area, Selector Valve Control, 8 bar

**Note:** For systems with more than 5 areas protected, use multiple back-plate manifolds.

## 2.1.2 Back-Plate Manifold Hose

**P/N: 01-3273-1200**

Use the hose to connect the NEMA 4 solenoid to the selector valves or to connect the Nitrogen pilot cylinder to the pressure regulator on the back-plate manifold. When connecting a back-plate manifold hose to the Nitrogen pilot cylinder, use adapter P/N: 85-025125-000.

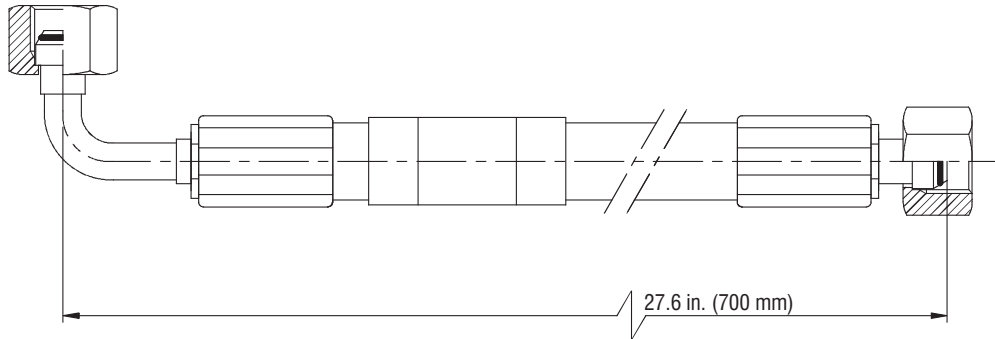


Figure 5. Back-Plate Manifold Hose

Table 7. Back-Plate Manifold Hose Part Numbers

Part Number	Description
01-3273-1200	Back-Plate Manifold Hose

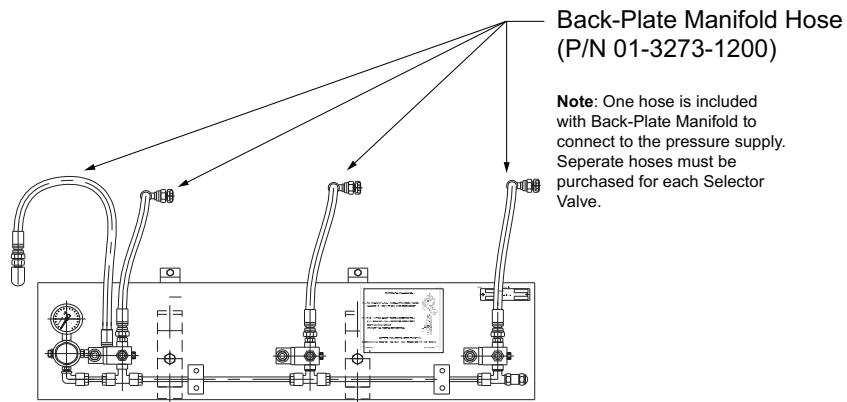


Figure 6. Back-Plate Manifold Hose Installed on Back-Plate Manifold

### 2.1.3 1/8 in. NPT Male to 1/4 in. Male BSPP Adapter

**P/N: 85-025125-000**

Use the adapter when connecting the Nitrogen pilot cylinder to the back-plate manifold hose.

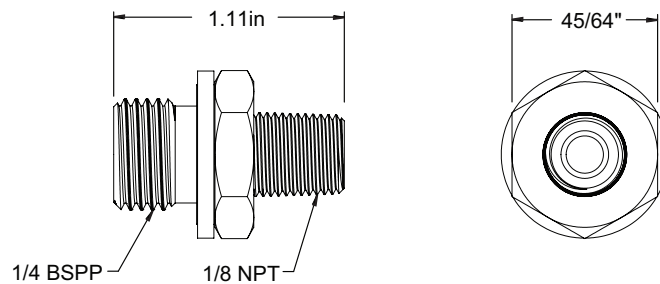


Figure 7. Back-Plate Manifold Hose

Table 8. Back-Plate Manifold Hose Part Numbers

Part Number	Description
85-025125-000	1/8 in. NPT Male to 1/4 in. Male BSPP Adapter

### 2.1.4 Pressure Regulator and Bracket Kit

**P/N: 01-6017-0000**

The pressure regulator reduces the incoming pressure from a Nitrogen pilot cylinder down to the 8 bar needed to operate the selector valves. The regulator is included with the back-plate manifold, but may be ordered separately for selector valves with NEMA 7 rated solenoids.

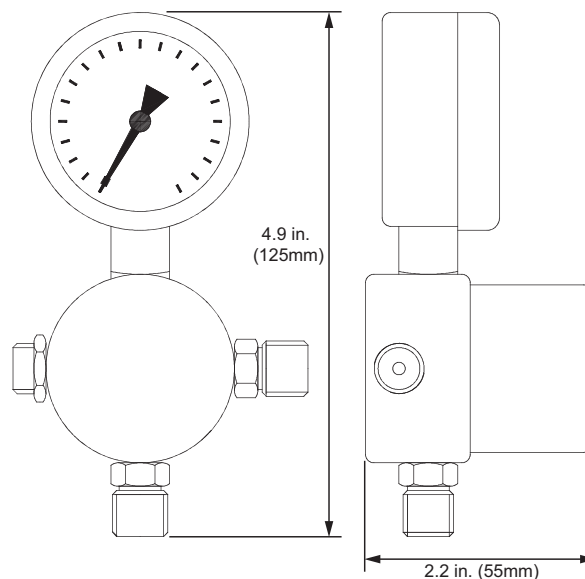


Figure 8. Pressure Regulator and Bracket

Table 9. Pressure Regulator Part Numbers

Part Number	Description
01-6017-0000	Pressure Regulator

## 2.1.5 Spare NEMA 7 Actuation Assembly

**P/N: 85-063724-XX0**

If necessary, the NEMA 7 solenoid and actuation assembly on the selector valves can be replaced.

Solenoid Specifications:

- Operating Voltage: 24 VDC 10W
- Current Draw: 0.187 Amps

Figure 9. NEMA 7 Actuation Assembly

Table 10. NEMA 7 Actuation Assembly Part Numbers

Part Number	For Valve Size	Operating Voltage	Current Draw	Rating
85-063724-100	1 in.	24 VDC 10W	.187 Amps	NEMA 7
85-092724-150	1 1/2 in.	24 VDC 10W	.187 Amps	NEMA 7
85-105724-200	2 in.	24 VDC 10W	.187 Amps	NEMA 7
85-125724-300	3 in.	24 VDC 10W	.187 Amps	NEMA 7
85-140724-400	4 in.	24 VDC 10W	.187 Amps	NEMA 7

**Note:** The solenoid includes a manual override. To operate, depress the button, and turn clockwise to lock the solenoid open.

## 2.1.6 Flexible Actuation Hoses

**P/N: WK-264986-000 and WK-264987-000**

The flexible actuation hoses can be used to connect the pressure regulator to a NEMA 7 solenoid.

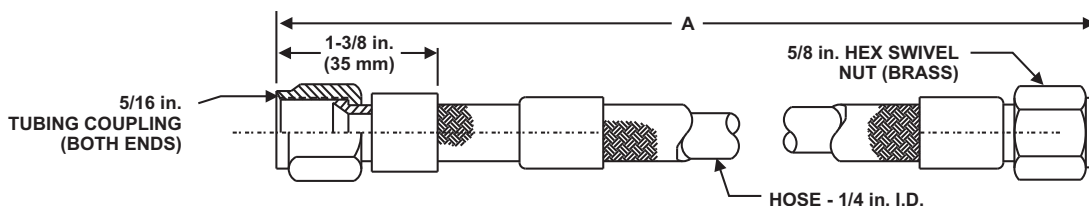


Figure 1-1. Flexible Actuation Hose

Table 1-1. Dimensions, Flexible Actuation Hose

Part Number	Dimension A	
WK-264986-000	30 in.	762 mm
WK-264987-000	22 in.	559 mm

## 2.1.7 NEMA 7 Solenoid Adapter Kit

**P/N: 85-118990-001**

**Note:** Use only with NEMA 7 rated solenoids.

This kit includes an adapter and washer to connect the solenoid on a NEMA 7 rated selector valve to the pressure regulator using a flexible hose. The kit includes an adapter and washer.

## 2.1.8 108 cu. in. Nitrogen Pilot Cylinders

**P/N: 85-877940-001 and 85-877940-002**

Use the 108 cu. in. Nitrogen pilot cylinder to provide operating pressure for the selector valves. When activated by a control head, gas pressure is routed from the Nitrogen pilot cylinder to the pressure regulator connected to the selector valve solenoids via piping or a manifold. The control panel singles which solenoid to open, directing the Nitrogen pressure to and opening the corresponding selector valve. Use one 108 cu. in. Nitrogen pilot cylinder per back-plate manifold to provide pressure to open the selector valves. For information on standard or ATEX approved supervisory pressure switch, see Section 2.1.10.

**Pressurized (charged) cylinders are extremely hazardous and, if not handled properly, are capable of violent discharge. This could result in death, personal injury or property damage. Always handle charged cylinders according to the instructions in this manual and applicable federal codes.**



**108 cu. in. Nitrogen pilot cylinders are factory-equipped with a safety cap threaded securely over the control head connection port and a plastic cap for the outlet port. These devices are safety feature and provides protection during shipping and handling. The safety cap must be installed at all times, except when the cylinder is connected into the system piping or is being filled. Do not move or handle a cylinder unless the safety cap is installed. Ensure that the safety cap is retained in a safe place close to the installed cylinder.**

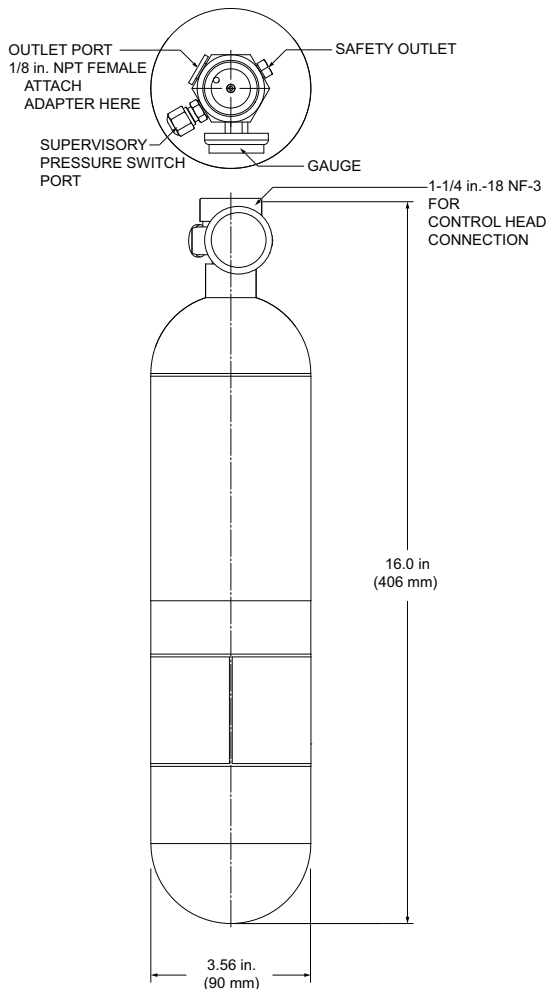


Table 2. Nitrogen Actuator, Mounting Bracket and Adapter Specifications

Description	Standard	Metric
Cylinder Capacity	108 cu. in.	1770 cm <sup>3</sup>
Safety Outlet Burst Range	2650 psig to 3000 psig @ 70°F	183 bar to 207 bar @ 21°C
Cylinder Contents	Nitrogen BB-n-411b, Grade A, Type 1 1800 psig @ 70°F	Nitrogen BB-n-411b, Grade A, Type 1 124 bar @ 21°C

Table 3. 108 cu. in. Nitrogen Pilot Cylinder Kit Order Information

Description	Part Number
Factory Filled 108 cu. in. Nitrogen Pilot Cylinder	85-877940-001
Empty 108 cu. in. Nitrogen Pilot Cylinder	85-877940-002

Figure 2. 108 cu. in. Nitrogen Pilot Cylinder

## 2.1.9 Mounting Bracket for 108 cu. in. Nitrogen Pilot Cylinder

### P/N WK-877845-000

P/N WK-877845-000 is a steel mounting bracket used to secure the 108 cu. in. Nitrogen pilot cylinder (see Figure 3). The bracket includes the clamp to secure the cylinder.

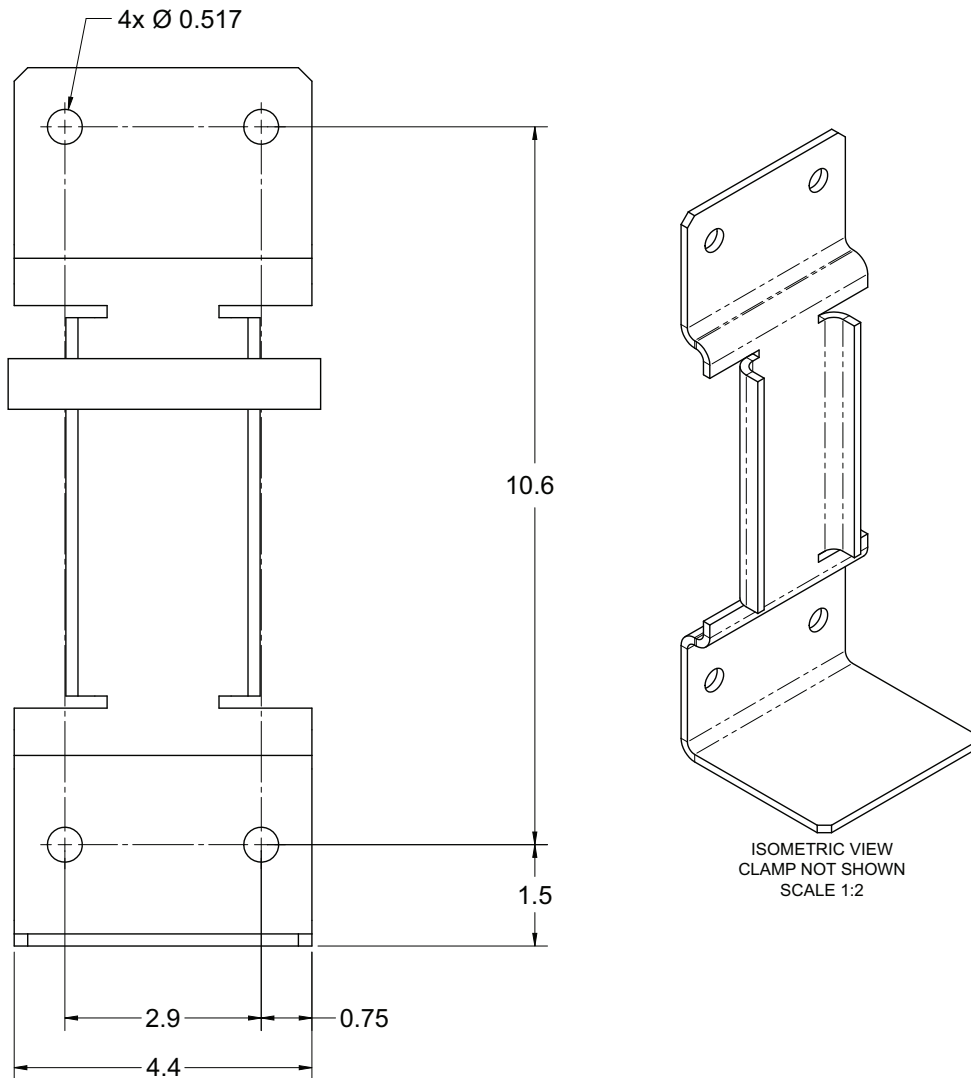


Figure 3. Mounting Bracket for 108 cu. in. Nitrogen Pilot Cylinder

## 2.1.10 Nitrogen Pilot Cylinder Supervisory Pressure Switch

### P/N 85-111540-001 and 85-111540-100

**Note:** See Table 4 for approvals.

The Nitrogen pilot cylinder supervisory pressure switch is intended to detect a drop in pressure in the Kidde Fire Systems Nitrogen pilot cylinders (see Figure 2-49).

**Note:** The Nitrogen pilot cylinder supervisory pressure switch differentiator is a blue colored band on both the box and switch (see Table 5).

The Nitrogen pilot cylinder supervisory pressure switch can be wired for either normally-open (N.O.) or normally-closed (N.C.) operation, depending on installation requirements and those of the Authority Having Jurisdiction (AHJ). When wired for N.O. under pressure, if the pressure inside the cylinder drops below 1625 psig (112.0 bar gauge), the switch contacts will transfer and, if wired correctly, invoke a "supervisory" signal at the control panel.

**Note:** When the Nitrogen pilot cylinder supervisory pressure switch (P/N 85-111540-001 or P/N 85-111540-100) is connected to a supervised control panel circuit, and the switch is wired N.C. under pressure, it is not possible to distinguish between a wiring fault and a loss of cylinder pressure. This configuration should only be used if accepted by the AHJ.

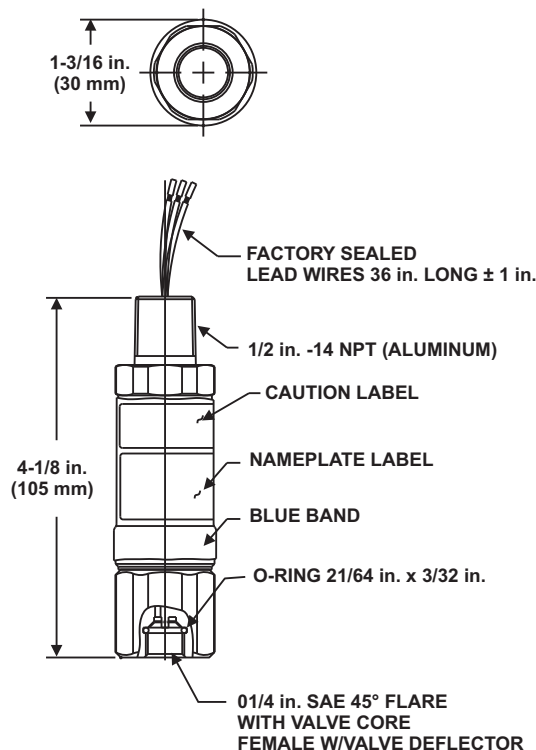


Figure 4. Supervisory Pressure Switch, Female Fitting, (P/N 85-111540-001 shown)

Table 4. Approvals

Part Number	Approvals
85-111540-001	UL, FM
85-111540-100	UL, FM, ATEX





**Note:** Nitrogen pilot cylinder valves manufactures prior to November 2020 do not include the necessary port for this driver supervisory pressure switch.

### 2.1.10.1 Supervisory Pressure Switch Differentiation

Kidde Fire Systems offers supervisory pressure switches for multiple products and product lines. When ordering and installing supervisory pressure switches, please select the appropriate switch. The switches have a colored band to help differentiate them.

**Note:** Due to the various differences in screen displays and printers, the colors displayed here may not perfectly match the colors on the actual products.

Table 5. Supervisory Pressure Switch Specifications

Switch	Part Numbers	Band Color	Pressure Trip Setting	Compatible with
	85-111540-001 85-111540-100 (ATEX)	Blue	1540 psig (106.2 bar)	Nitrogen Pilot Cylinders ADS™ Systems Nitrogen Drivers Nitrogen Siren Drivers
	06-118262-001 06-118537-001 (ATEX)	Silver	305 psig (21.0 bar)	ECS™ 360 psi Agent Cylinders
	45-118500-001 45-500537-001 (ATEX)	Orange	435 psig (30.0 bar)	ECS-500™ psi Agent Cylinders
	81-111350-001 81-111350-100 (ATEX)	Red	1350 psig (93.1 bar)	Carbon Dioxide Pilot Cylinders and Siren Drivers (High and Low Pressure systems)

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## 2.2 Lockout Valves

### P/N: See Table 6

A lockout valve is a manually operated valve installed between the agent manifold and the discharge pipe to the protected area. Lockout valves are normally open, but can be locked in the closed position when maintenance is under way. This prevents agent from discharging into the protected area for the safety of the maintenance personnel. The lockout valve shall be installed at the end of the agent manifold or, if a common manifold protects multiple hazards, downstream of each selector valve.

Lockout valve assemblies include a high visibility indicator and weatherproof limit switch. The limit switch shall initiate a "Trouble" signal at the control panel when the valve is in the closed position. All valves have a maximum pressure rating of 70 bar (1015 PSI). When using lockout valves, also install a pressure relief valve wherever pressure could be trapped in closed sections of pipe.

The lockout valves are available in sizes 1, 1 1/2, 2, 3, and 4 inches. Lockout valve sizes 1, 1 1/2, and 2 in. have NPT threaded inlet and outlet ports for connection to the distribution piping. Lockout valve sizes 3 and 4 in. use grooved fitting to connect to the system piping. When installing, choose the correct mating fittings to match with the groove fitting of the lockout valves.

Table 6. Selector Valve Part Numbers

Part Number	Description
<b>NEMA 4 Rated Lockout Valves</b>	
85-100210-101	1 in. Lockout Valve, NPT, NEMA 4 Rated Switch
85-150210-151	1 1/2 in. Lockout Valve, NPT, NEMA 4 Rated Switch
85-200210-201	2 in. Lockout Valve, NPT, NEMA 4 Rated Switch
85-300210-301	3 in. Lockout Valve, Grooved, NEMA 4 Rated Switch
85-400210-401	4 in. Lockout Valve, Grooved, NEMA 4 Rated Switch
<b>NEMA 7 Rated Lockout Valves</b>	
85-100120-101	1 in. Lockout Valve, NPT, NEMA 7 Rated Switch
85-150120-151	1 1/2 in. Lockout Valve, NPT, NEMA 7 Rated Switch
85-200120-201	2 in. Lockout Valve, NPT, NEMA 7 Rated Switch
85-300120-301	3 in. Lockout Valve, Grooved, NEMA 7 Rated Switch
85-400120-401	4 in. Lockout Valve, Grooved, NEMA 7 Rated Switch

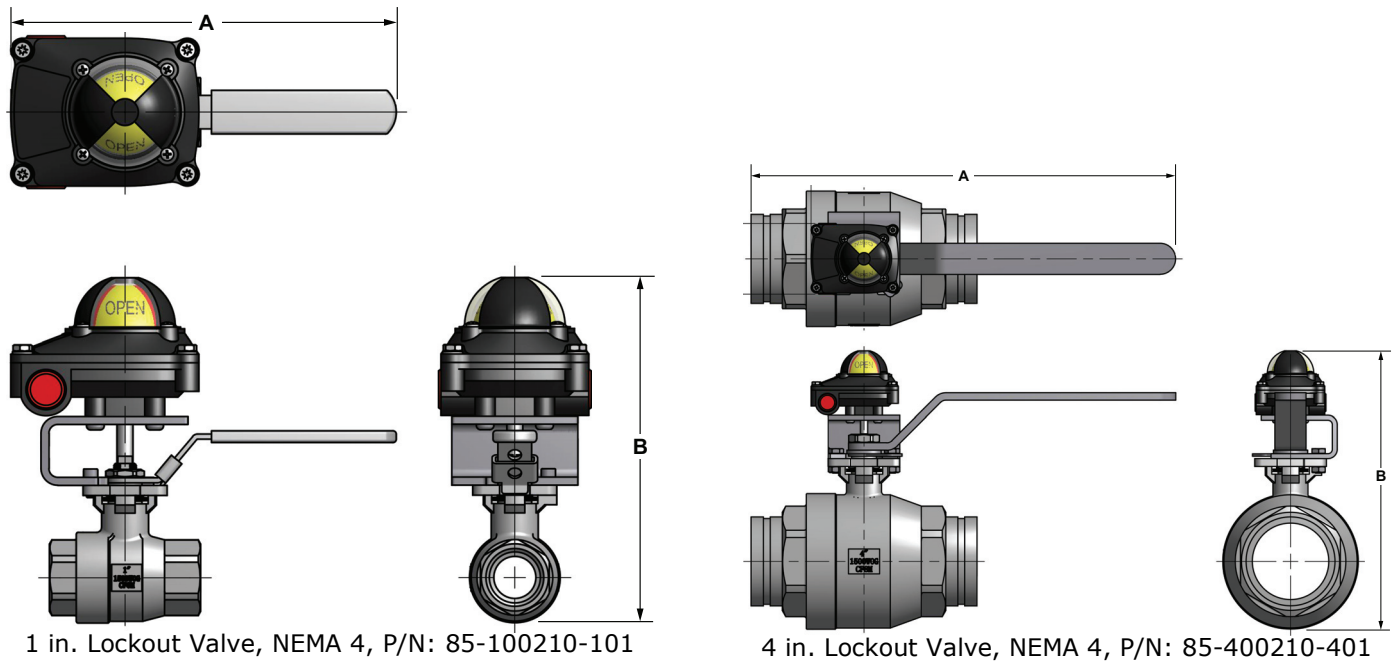


Figure 5. 1 and 4 inch Lockout Valve, NEMA 4

Table 7. NEMA 4 Lockout Valve Specifications

Part Number	Size	Thread Type	Dimensions				Pressure Rating
			A		B		
			inches	mm	inches	mm	
85-100210-101	1 in.	NPT	9	230	7 7/8	200	1015 PSI (70 Bar)
85-150210-151	1.5 in.	NPT	10	255	8 15/16	227	1015 PSI (70 Bar)
85-200210-201	2 in.	NPT	10	255	9 5/8	244	1015 PSI (70 Bar)
85-300210-301	3 in.	Grooved	17	430	12 3/8	314	1015 PSI (70 Bar)
85-400210-401	4 in.	Grooved	21 1/2	545	13 13/16	351	1015 PSI (70 Bar)

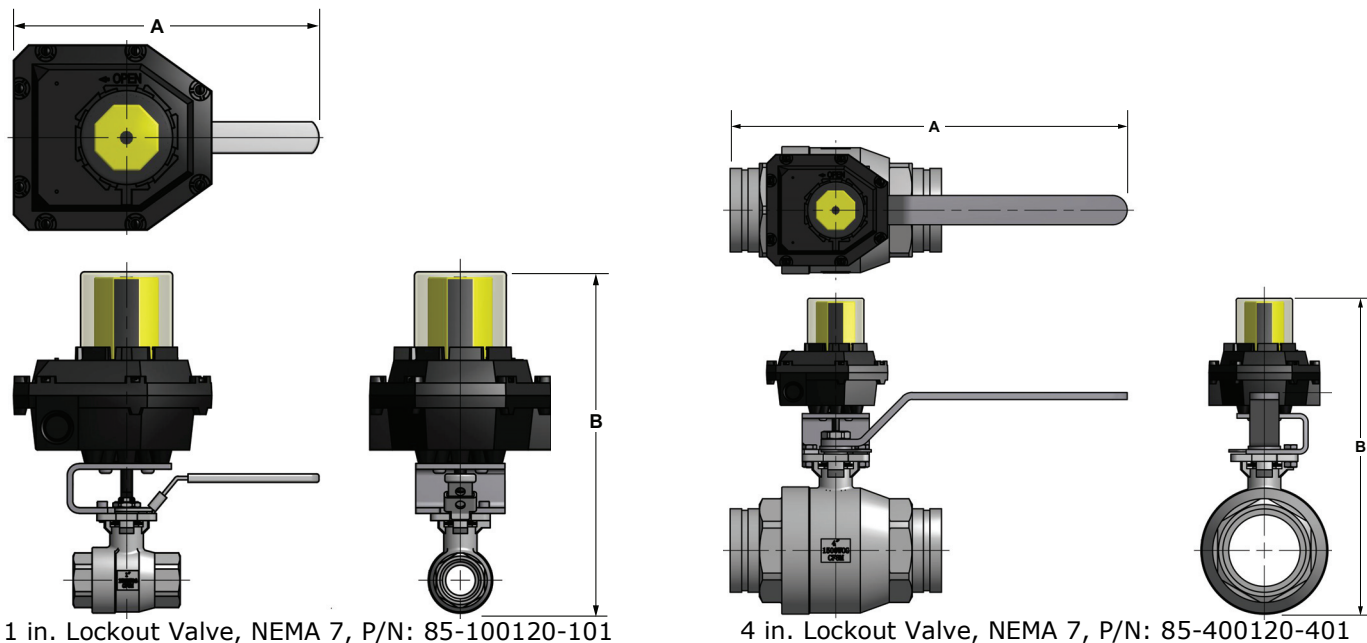


Figure 6. 1 and 4 inch Lockout Valve, NEMA 7

Table 8. NEMA 7 Lockout Valve Specifications

Part Number	Size	Thread Type	Dimensions				Pressure Rating
			A		B		
			inches	mm	inches	mm	
85-100120-101	1 in.	NPT	10 1/3	256.5	11 1/16	280.7	1015 PSI (70 Bar)
85-150120-151	1.5 in.	NPT	11	282	12 1/8	308.2	1015 PSI (70 Bar)
85-200120-201	2 in.	NPT	11	282	12 13/16	325.2	1015 PSI (70 Bar)
85-300120-301	3 in.	Grooved	17	430	15 9/16	395.2	1015 PSI (70 Bar)
85-400120-401	4 in.	Grooved	21 1/2	545	17	432.2	1015 PSI (70 Bar)

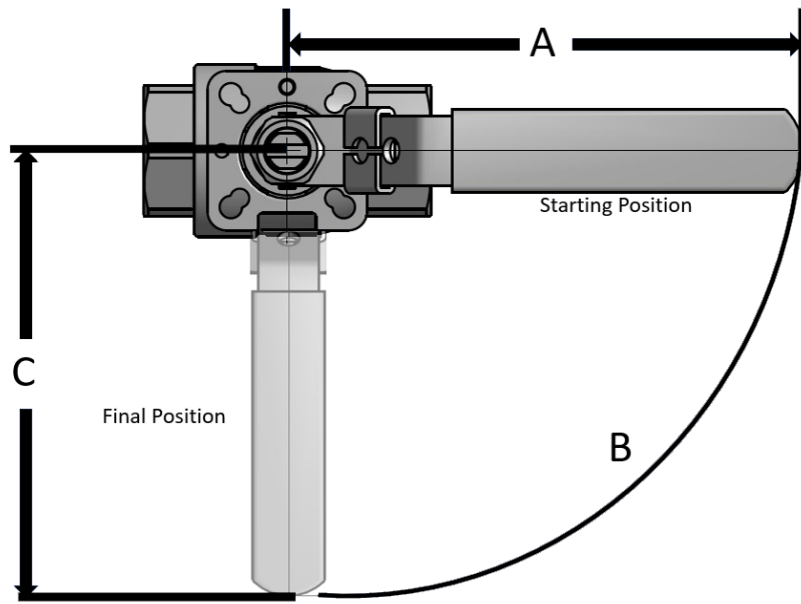


Figure 7. Lockout Valve Clearance Requirements

Table 9. NEMA 4 Lockout Valve Clearance Requirements

Part Number	Size	Dimensions					
		A		B		C	
		mm	inches	mm	inches	mm	inches
85-100210-101	1 in.	161.5	6 11/32	253.5	10	161.5	6 11/32
85-150210-151	1.5 in.	187	6 3/8	293.75	11 9/16	187	6 3/8
85-200210-201	2 in.	187	6 3/8	293.75	11 9/16	187	6 3/8
85-300210-301	3 in.	310	12 7/32	487	19 3/16	310	12 7/32
85-400210-401	4 in.	400	15 3/4	628.5	24 3/4	400	15 3/4

Table 10. NEMA 7 Lockout Valve Clearance Requirements

Part Number	Size	Dimensions					
		A		B		C	
		mm	inches	mm	inches	mm	inches
85-100120-101	1 in.	161.5	6 11/32	253.5	10	161.5	6 11/32
85-150120-151	1.5 in.	187	6 3/8	293.75	11 9/16	187	6 3/8
85-200120-201	2 in.	187	6 3/8	293.75	11 9/16	187	6 3/8
85-300120-301	3 in.	310	12 7/32	487	19 3/16	310	12 7/32
85-400120-401	4 in.	400	15 3/4	628.5	24 3/4	400	15 3/4

### 3 DESIGN CONSIDERATION

#### 3.1 Selector Valves

Standard EN12094-5 requires that selector valves be opened within a maximum time span of 3 seconds. Use the following rules for designing all selector valve systems:

- 3-Way and 2-Way selector valves must not be mixed in a system. A system may use only 2-way or 3-way selector valves, not both.
- Always confirm the duration for which the solenoid valve will be kept energized by the control panel. The solenoid must be energized for the full discharge time.

#### 3.2 Back-Plate Manifold with NEMA 4 Rated Solenoids

**Note:** Use only with NEMA 4 rated solenoids. Not to be used with selector valves P/N: 85-100724-025, 85-150724-040, 85-200724-050, 85-300724-080 or 85-400724-100.

The NEMA 4 rated solenoid valves with manual override used for controlling the opening of the selector valves are supplied as part of a back-plate manifold. This back-plate manifold holds the required numbers of solenoid valves. The back-plate manifold receives pressure from a Nitrogen pilot cylinder in the case of clean agent systems or from the manifold for inert gas systems. A pressure regulator reduces the supplied pressure to approx. 8 bar. Use one 108 cu. in. cylinders per back-plate manifold to provide pressure to open the selector valves.

**Note:** The solenoid on the back-plate manifold leading to the hazard being protected by the discharge must be continuously powered during the system discharge.

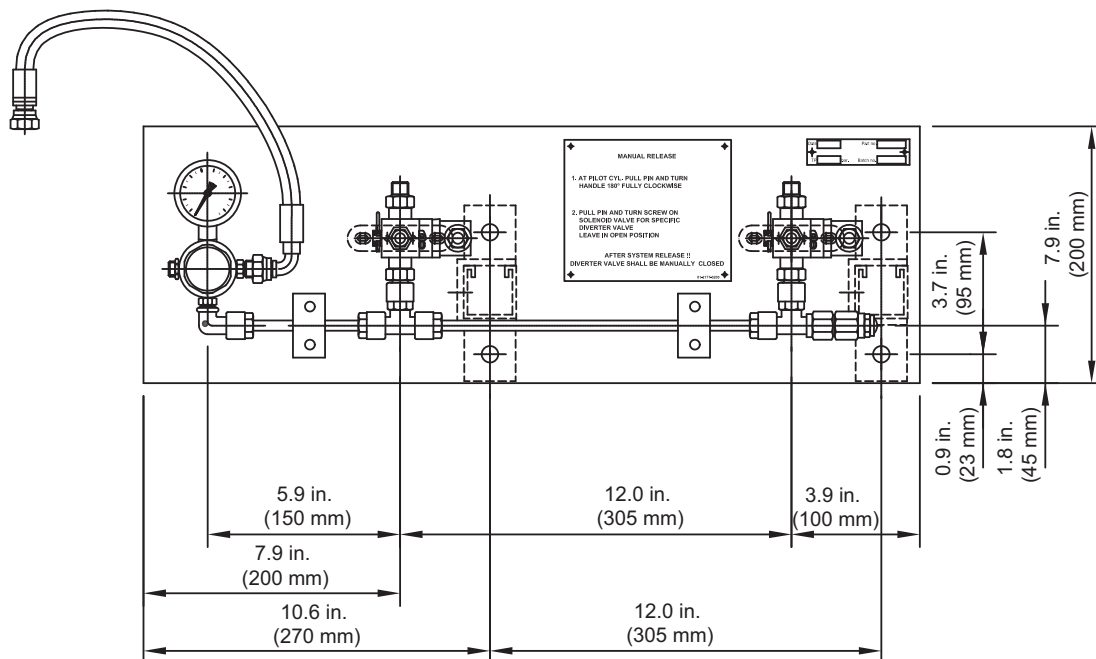


Figure 8. Back-Plate Manifold Dimensions (2 Area Manifold shown)

**Note:** For larger Back-Plate Manifolds, the distance between each solenoid is still 12.0 in. (305 mm).

#### 3.3 Lockout Valve Clearance

Ensure that ample space is given to the arm of the lockout valve. There must be space to position the lever in both the open and closed positions. For dimension, see Table 9 and Table 10.

---

## 4 INSTALL

### 4.1 2- Way Selector Valves

**Note:** Valves can be installed horizontally or vertically.

Kidde Fire Systems recommends installing union fittings before and after the valves to facilitate future service work.

#### 4.1.1 1-inch, 1 1/2-inch, and 2-inch Selector Valves

Install the 1, 1 1/2, and 2 in. selector valves by following the steps listed below:

1. Inspect the valves to verify the threads are not damaged.
2. Inspect the visible surface of the ball valves to ensure no debris is present.
3. Apply Teflon™ tape or pipe sealant to the piping male threads.



**Do not drip sealant into the internal part of the valve.**

4. Ensure the piping is properly supported with pipe hangers prior to installing the valves.
5. Install the valve.
6. Once the installation is finished, perform the necessary system pressure test ensuring the valve is tested in all states.

#### 4.1.2 3 and 4 inch Selector Valves

Install the 3 and 4 in. Selector valves by following the steps listed below:

1. Inspect the gaskets and valve assemblies for damage.
2. Inspect the visible surface of the ball valves to ensure no debris is present.
3. Add grooves to the corresponding section of pipe that connects to the selector valve.
4. Ensure the piping is properly supported with pipe hangers prior to installing the valves.
5. Connect the pipe to the selector valve using the appropriate Victolic coupling.
6. Tighten the nuts on the clamp until secure.
7. Once the installation is finished, perform the necessary system pressure test ensuring the valve is tested in all states.

### 4.2 Selector Valves with NEMA 7 Rated Solenoids

Selector Valves with NEMA 7 rated solenoids cannot be used with the Back-Plate manifold.



**For US and Canada explosion proof installations, seal all conduits within 18 inches from the end of the component.**

### 4.3 Installing the Nitrogen Pilot Cylinder with Supervisory Pressure Switch

**Note:** Supervision of electric control heads is a requirement of NFPA 2001



**The placement supervision signal is not a substitute for ensuring the proper interlock of the actuator plunger to the pilot check assembly. Make sure the control head is properly seated.**

Follow these steps to install a Nitrogen pilot cylinder:

1. Install mounting bracket clamps and hardware as instructed in the corresponding manual.
2. Install the Nitrogen pilot cylinder in the mounting bracket, ensuring the gauge is forward facing.

**Note:** If the discharge port is too close to a wall or obstruction, install the Nitrogen pilot cylinder bracket using a spacer such as a Unistrut channel setup as shown in Figure 9. One section of Unistrut may not create enough space. Ensure the spacer is structurally sound and can support the weight of the components.

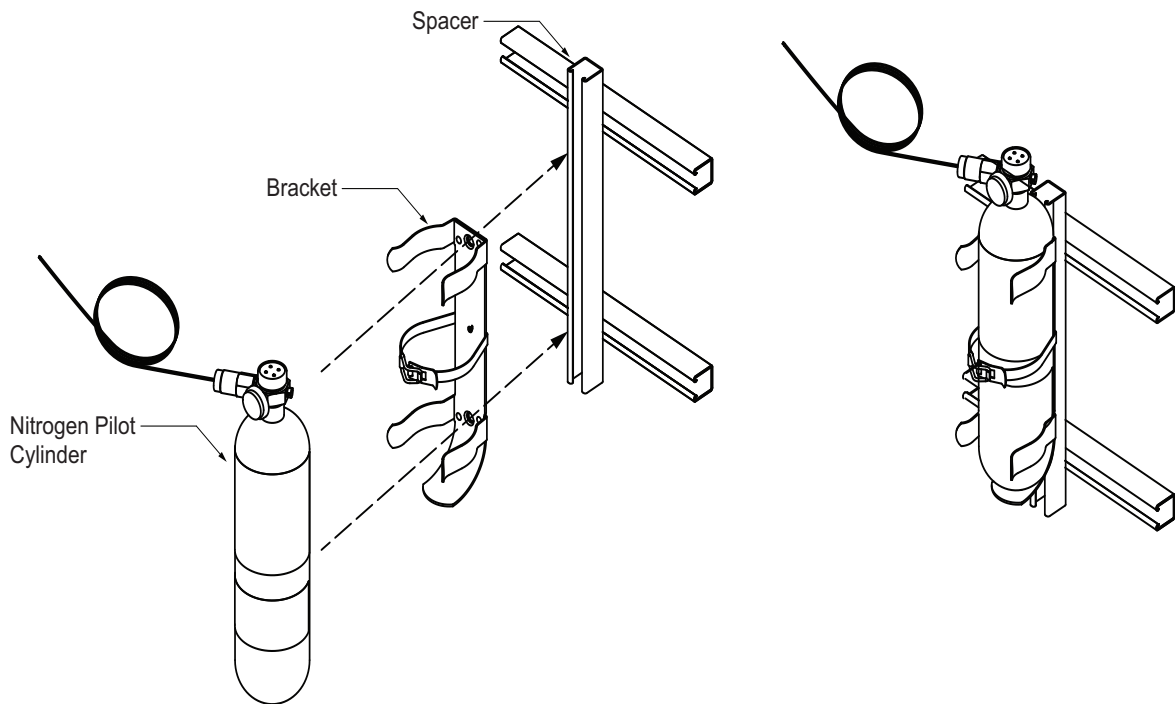


Figure 9. Nitrogen Pilot Cylinder with Bracket and Spacer

3. Install the CHM over the cylinder valve actuation port as shown in Figure 10 and Figure 11.

**Important: Make sure the safety burst disc outlet port lines up and sits in the slot on the underside of the CHM (see Figure 11). The body of the CHM should be opposite the supervisory pressure switch.**

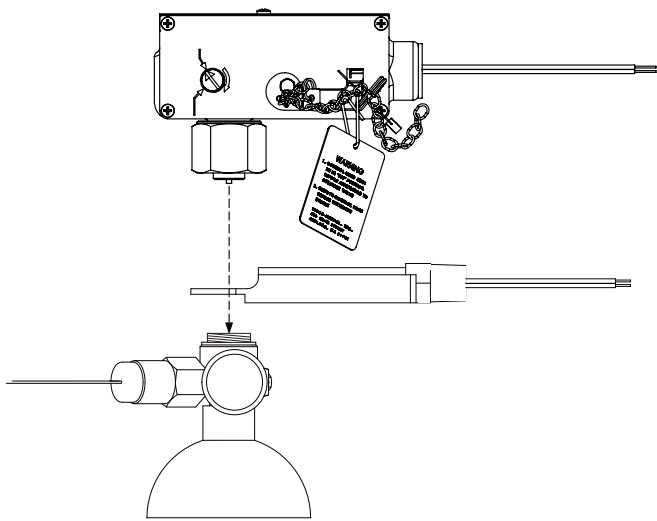


Figure 10. Installation Side View

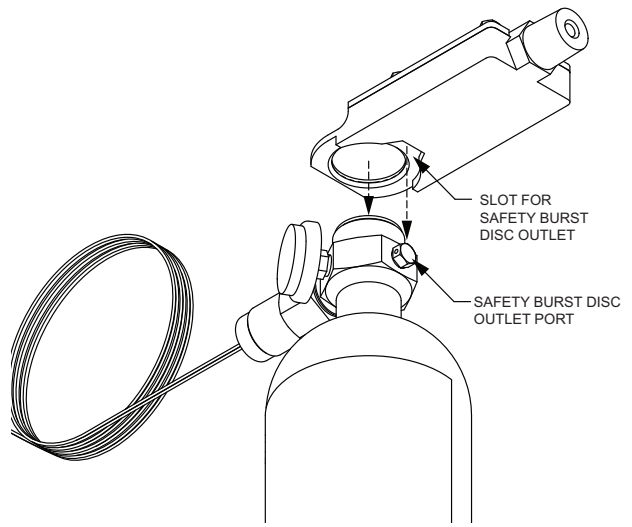


Figure 11. Installation Isometric View

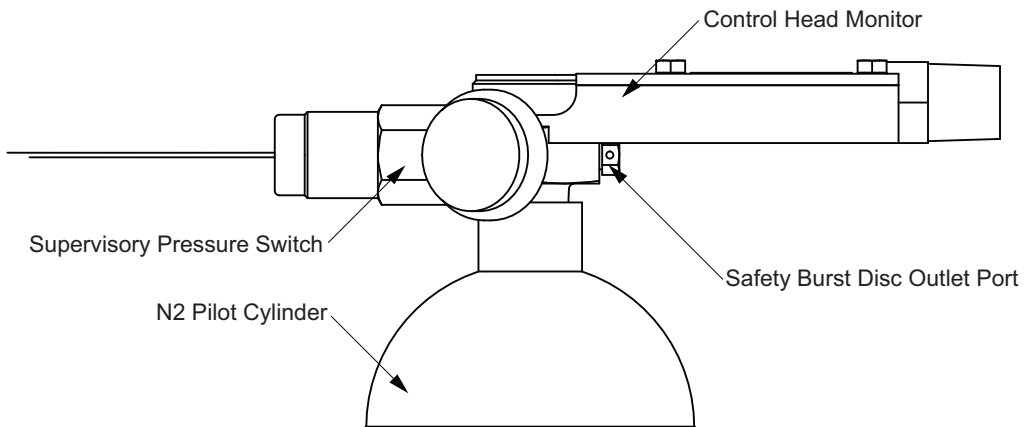


Figure 12. Control Head Monitor and Pilot Cylinder, Side View

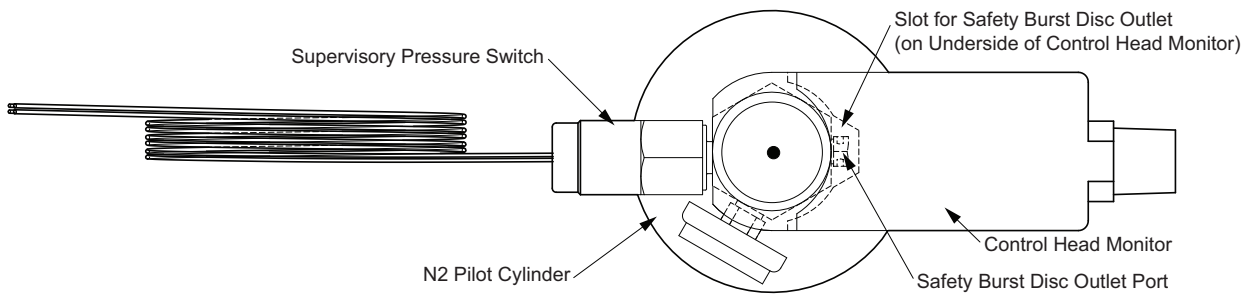


Figure 13. Control Head Monitor and Pilot Cylinder, Top View, no Control Head Shown



Ensure the control head is in the SET position (that is, the actuating pin is in the fully retracted and the arrow on the front is pointing to the SET position) before attaching the control head to the cylinder valve. Also, ensure the safety pin is installed and secured with a listed tamper seal. If the control head is not in the SET position, the cylinder will discharge.

4. Attach the control head to the Nitrogen pilot cylinder valve body by hand threading the swivel nut onto the mating threads of the valve. Hand thread the swivel until it stops.

**Note:** The lever on the control head used for manual operation must be positioned so it is readily accessible.

5. Using the two available flats of the valve body, hold the valve body while using a wrench on the flats of the swivel nut to secure the control head. Tighten the control head swivel nut until the nut is tight and the control head body does not swivel further. Tighten the swivel nut to 55-60 ft-lbs of torque.



The placement supervision signal is not a substitute for ensuring the proper interlock of the actuator plunger to the pilot check assembly. Make sure the control head is properly seated.

**Note:** The CHM body should not be held down tight by the swivel nut of the control head. Some play or movement of the CHM body is acceptable, and the CHM should not touch the supervisory pressure switch or the gauge.

6. Attach outlet adapter, connect the Nitrogen pilot lines, wire all components, and perform necessary testing as instructed in the corresponding manual.

#### 4.3.1 Wiring the Control Head Monitor

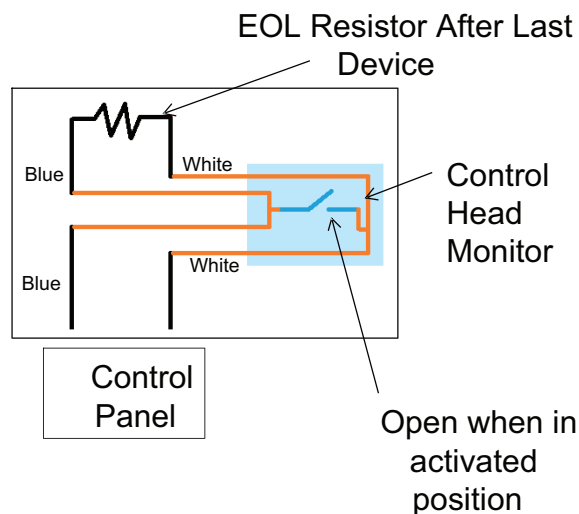


Figure 14. Control Head Monitor Wiring

Use the wiring diagram found in Figure 14 when wiring the CHM.



For US and Canada explosion proof installations, seal all conduits within 18 inches from the end of the component.

## 4.4 Connecting Nitrogen Pilot Cylinder to Pressure Regulator

The pressure from a 108 cu. in. Nitrogen pilot cylinder must be reduced before being used to operate a selector valve. The pressure regulator is included with the back-plate manifold. For NEMA 7 solenoids, the pressure regulator must be purchased separately.

**Note:** Use the 108 cu. in. Nitrogen pilot cylinder to provide pressure to open the selector valves. Use one 108 cu. in. pilot cylinder per back-plate manifold.

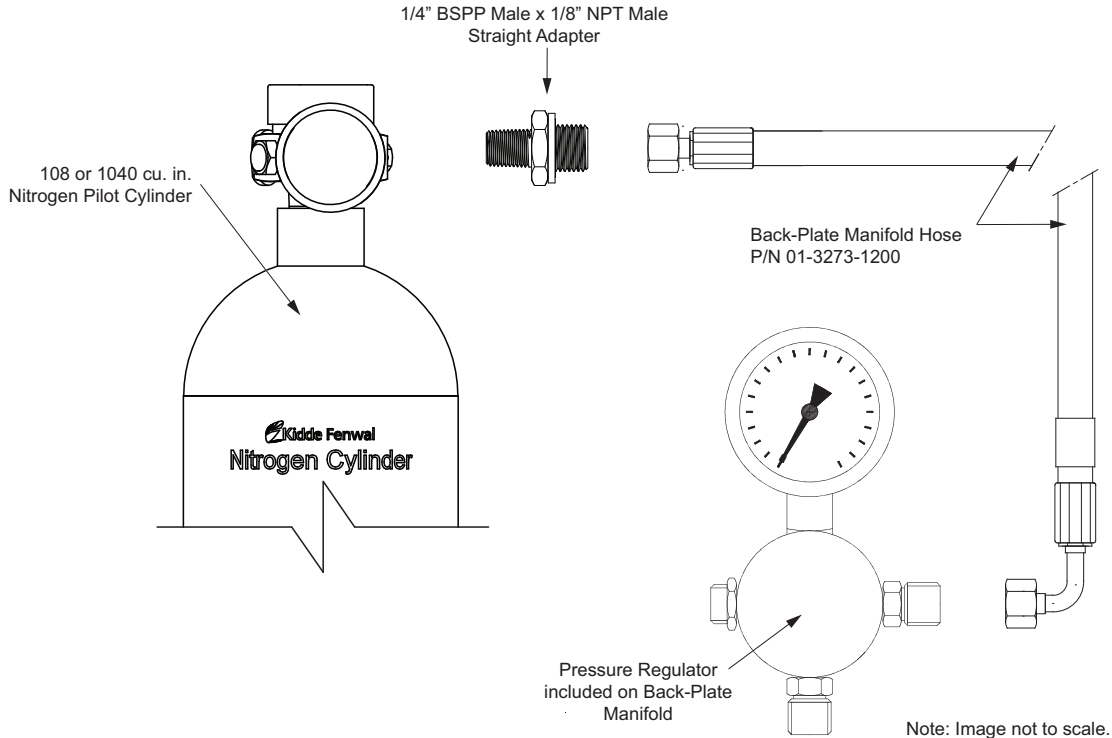


Figure 15. Connecting Nitrogen Pilot to Pressure Regulator

1. Secure the Pilot Cylinder per the installation instructions outlined in this addendum, in the corresponding manual listed in Table 1, and in the addendum 06-237750-001.
2. Apply a stripe of an anaerobic liquid pipe sealant around the male threads leaving the first two threads uncovered. If no liquid sealant is available, wrap Teflon tape (or equivalent) 2-1/2 turns in a clockwise direction, viewed from the pipe end, leaving the first two threads uncovered (only use tape suitable for gas applications).
3. Thread the 1/8 in. NPT end of the BSPP to NPT adapter into the Nitrogen Pilot cylinder. Wrench tight.
4. Connect the Back-Plate Manifold hose to the BSPP end of the adapter.
5. Install all necessary control heads and control head monitors to the pilot cylinder as outlined in this addendum, in the corresponding manual listed in Table 1, and in the addendum 06-237750-001.

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## 4.5 Connecting Pressure Regulator to NEMA 7 Selector Valve

Follow these steps to connect the pressure regulator to the NEMA 7 selector valve:

1. Place the rubber bonded steel washer onto the outlet of the pressure regulator.

**Note:** The rubber bonded steel washer may only be installed once. It cannot be reused after it has been removed. If the bonded steel washer is ever removed, it must be replaced with a new washer.

This does not mean the washer must be replaced after a discharge, only that the washer must not be re-installed if the adapter or washer is removed after installation.

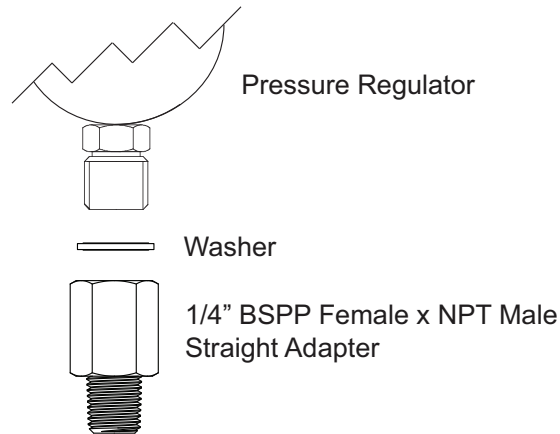


Figure 16: Pressure Regulator Outlet Washer and Adapter

2. Screw the 1/4" BSPP female end of the 1/4" BSPP female x NPT male straight adapter onto the outlet of the pressure regulator with a minimum torque of 25 ft-lbs.
3. Use either WK-264986-000 or WK-264987-000 to connect the adapter to the NEMA 7 solenoid.

## 4.6 Lockout Valves

**Note:** Lockout valves are required when the agent concentration is at or above the LOAEL.

The lockout valve with limit switch must be installed in the discharge pipe network, downstream of all cylinders, check valves, and selector valves. All valves must be easily accessible. Lockout valves can be installed in either the vertical or horizontal position using good pipe fitting practices.

Inspect the valve to ensure no dirt or debris is inside the valve, ensuring to check the valve in the open and closed position. Place two to three wraps of Teflon tape on male threads of pipe. A union is recommended before and after the valve to facilitate future service work. The valve should be locked in the "open" position using a padlock. All valves must be electrically supervised.

Figure 17 shows the lockout valve wiring diagram when the ball valve is in the fully open position.

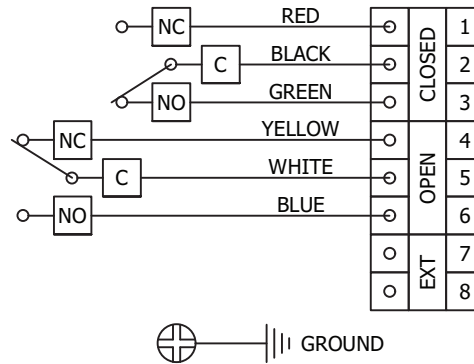


Figure 17. NEMA 4 Wiring Diagram for Lockout Valve when Ball Valve is in Fully Open Position

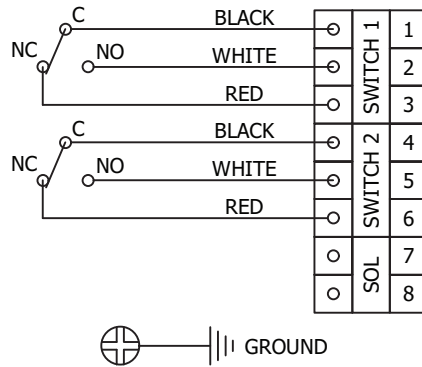


Figure 18. NEMA 7 Wiring Diagram for Lockout Valve when Ball Valve is in Fully Open Position

## 4.7 System Pressure Test

Per NFPA 2001, 2022 Edition, the piping system must be pressure tested in a closed circuit using nitrogen or other dry gas. Ensure all sections of pipe are tested, including those separated by Selector or Directional valves. Ensure all Selector or Directional valves are tested in all applicable states. For more details on the system pressure test, consult the corresponding manual listed in Table 1.

**Note:** A calibrated gauge must be used when monitoring the pressure during the test.

---

## 5 OPERATION

### 5.1 Local Manual Operation of 2-Way Selector Valves with NEMA 4 Solenoids

Manual control of selector valves is not part of normal system actuation and should only be used in an emergency. Ensure the hazard area is evacuated and emergency services are being called:

1. Proceed to appropriate back-plate manifold for the selector valve corresponding to the hazard.
2. Pull the safety pin out from the override button on the solenoid.
3. Push the button down and turn it 90° clockwise to lock the solenoid in the open state.
4. If necessary, use the manual leveler operated control head on the Nitrogen pilot cylinder to discharge the pilot cylinder, providing pressure to operate the selector valve.
5. Proceed to appropriate primary cylinder release unit or control head for the hazard.
6. Remove the safety pull pin from the cylinder release unit or control head. This will also break the tamper seal.
7. Operate the manual release knob or lever in the direction indicated on the unit.

**Note:** Allow no one to enter the hazard area. Call the fire department immediately.

### 5.2 Local Manual Operation of 2-Way Selector Valves with NEMA 7 Solenoids

Manual control of selector valves is not part of normal system actuation and should only be used in an emergency. Ensure the hazard area is evacuated and emergency services are being called:

1. Proceed to appropriate selector valve for the hazard.
2. Push the manual override button down and turn it 90° clockwise to lock the solenoid in the open state.
3. If necessary, use the manual leveler operated control head on the Nitrogen pilot cylinder to discharge the pilot cylinder, providing pressure to operate the selector valve.
4. Proceed to appropriate primary cylinder release unit or control head for the hazard.
5. Remove the safety pull pin from the cylinder release unit or control head. This will also break the tamper seal.
6. Operate the manual release knob or lever in the direction indicated on the unit.

**Note:** Allow no one to enter the hazard area. Call the fire department immediately.

---

## 5.3 Lockout Valves

If applicable, it is recommended to lock-out the clean agent system when performing maintenance on the system or there is need to perform work that could cause false alarms and a discharge. Use the following steps to lockout the system:

1. Unlock the valve and place it in the Closed position.
2. Lock the valve. Locations for the lock are shown in Figure 19.

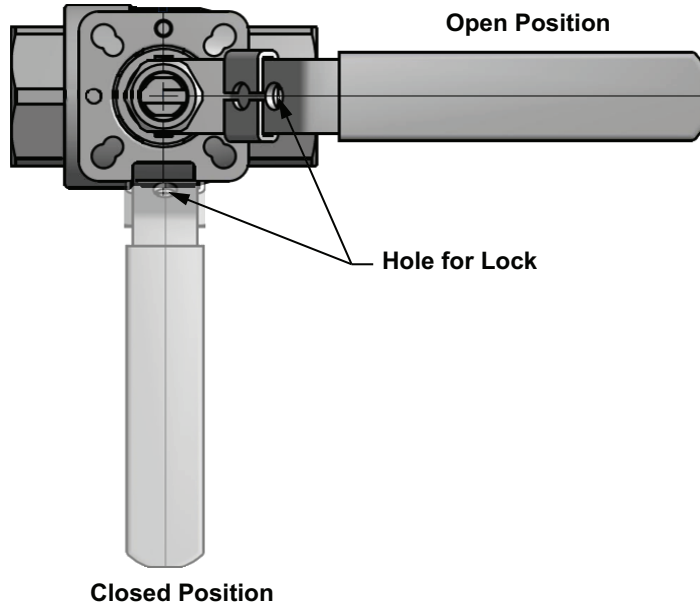


Figure 19. Lock Locations (Limit Switch not shown)

3. Verify that a Trouble indicator appears on the control unit.
4. When maintenance or test is complete, unlock the valve and place it in the Open position.
5. Lock the valve.
6. Verify the Trouble indicator is clear on the control unit.

---

## 6 MAINTENANCE

All standard maintenance must be performed as outlined in the manual listed in Table 1. In addition, maintenance on the selector and lockout valves must be performed as part of the standard semi-annual and 2 year maintenance procedures.

### 6.1 Semi-Annual Inspection

#### 6.1.1 Actuator Test on 2-Way Selector Valve

1. Operate the valve using pilot Nitrogen pressure.
2. Replace/Refill the Nitrogen pilot cylinder.

Should for any reason the unit fail to operate as intended or should there be any doubt about the opening/closing of the valve, contact Kidde Fire Systems.

Never attempt to modify the actuator assembly (i.e. never open the actuator).

**Note:** In addition to the actuator test, a pressure test of the system should be conducted every two years. This test should include check all lockout and selector valves in all applicable states.

#### 6.1.2 System Lockout Valve (if Fitted)

The ball valve should be manually operated and the operation of the micro-switch (if fitted) observed.

1. Signal to be initiated on control panel.
2. Replace the micro-switch if found to be defective.

### 6.2 Inspection Procedures - 2 Years

Once every two years, perform a system pressure test on the piping to ensure that no new leak paths have developed. Ensure all sections of pipe are tested, including those separated by Selector or Directional valves. Ensure all Selector or Directional valves are tested in all applicable states.

### 6.3 Service: Replacing NEMA 7 Actuation Assembly

If the solenoid or actuation assembly becomes damaged on a NEMA 7 selector valve, it can be replaced with a new actuation assembly. Follow the steps below when replacing the actuation assembly.

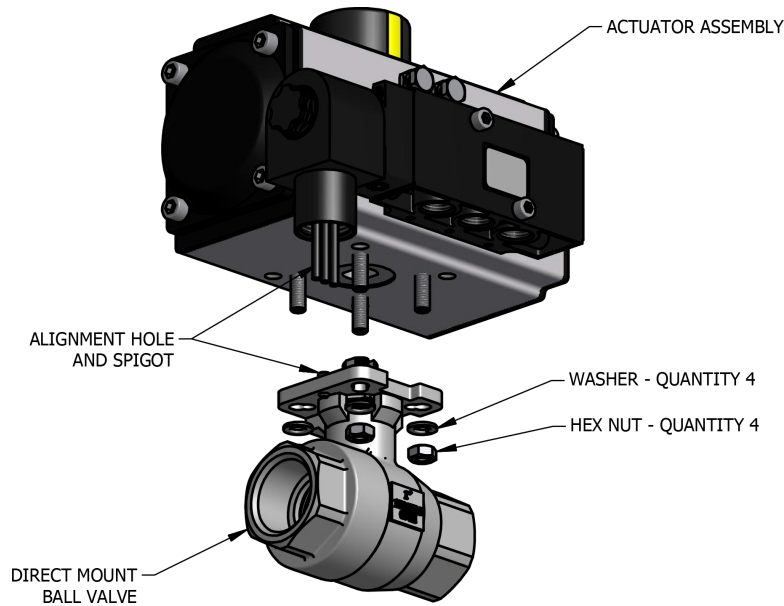


Figure 20. NEMA 7 Actuator Assembly Installation

1. Remove the pressure and electrical connections to the actuation assembly.
2. Remove the 4 hex nuts and washers holding the actuator assembly to the valve.
3. Remove the old actuator assembly.
4. Install the new actuator assembly, making sure the spigot fits in the alignment hole. This prevents installing the actuation assembly in an incorrect orientation.
5. Place the washer on the mounting post, then screw on the nut to the torque specified in Table 11. Repeat for the other 3 washers and nuts.

Table 11. NEMA 7 Actuation Assembly Hex Bolt Torque Specification

Part Number	Hex Bolt Torque Specification
85-100724-100	70 in-lbs
85-150724-150	170 in-lbs
85-200724-200	170 in-lbs
85-300724-300	340 in-lbs
85-400724-400	340 in-lbs

6. Reconnect the pressure and electrical connections on the replacement actuator assembly.

## 7 POST DISCHARGE MAINTENANCE

All standard post discharge maintenance must be performed as outlined in the manual listed in Table 1. Additionally, all solenoids must be returned to their normal operating state.

### 7.1 Resetting Selector Valves after Operation

**Note:** Manual control of selector valves is not part of normal system actuation and should only be used in an emergency. After such an emergency, the selector valves and associated solenoid must be returned to the normal active state.

For NEMA 4 solenoids, turn the manual override 90° counter-clockwise, then re-insert the safety pin.

For NEMA 7 solenoids, turn the button 90° clockwise, and let the button pop out.

## 8 PARTS LIST

Table 12. Selector Valve, Lockout Valve, and Associated Equipment Parts List

Description	Part Number
<b>2-Way Selector Valves, NEMA 4 Rated</b>	
1" Selector valve, NPT, 8-10 bar Actuator, NEMA 4 Rated Solenoid	85-100025-100
1 1/2" Selector valve, NPT, 8-10 bar Actuator, NEMA 4 Rated Solenoid	85-150025-150
2" Selector valve, NPT, 8-10 bar Actuator, NEMA 4 Rated Solenoid	85-200025-200
3" Selector valve, Grooved, 8-10 bar Actuator, NEMA 4 Rated Solenoid	85-300025-300
4" Selector valve, Grooved, 8-10 bar Actuator, NEMA 4 Rated Solenoid	85-400025-400
<b>2-Way Selector Valves, NEMA 7 Rated</b>	
1" Selector valve, NPT, 8-10 bar Actuator, NEMA 7 Rated Solenoid	85-100724-100
1 1/2" Selector valve, NPT, 8-10 bar Actuator, NEMA 7 Rated Solenoid	85-150724-150
2" Selector valve, NPT, 8-10 bar Actuator, NEMA 7 Rated Solenoid	85-200724-200
3" Selector valve, Grooved, 8-10 bar Actuator, NEMA 7 Rated Solenoid	85-300724-300
4" Selector valve, Grooved, 8-10 bar Actuator, NEMA 7 Rated Solenoid	85-400724-400
<b>2-Way Directional Valve Assemblies Accessories</b>	
Back-Plate Manifold with Solenoids - 2 Area, Selector Valve Control, 8 bar	01-3508-0002
Back-Plate Manifold with Solenoids - 3 Area, Selector Valve Control, 8 bar	01-3508-0003
Back-Plate Manifold with Solenoids - 4 Area, Selector Valve Control, 8 bar	01-3508-0004
Back-Plate Manifold with Solenoids - 5 Area, Selector Valve Control, 8 bar	01-3508-0005
Back-Plate Manifold Hose	01-3273-1200
1/8 in. NPT Male to 1/4 in. Male BSPP Adapter	85-025125-000
Pressure Regulator - 300 bar to 8 bar	01-6017-0000
1 in. NEMA 7 Actuation Assembly	85-063724-100
1 1/2 in. NEMA 7 Actuation Assembly	85-092724-150
2 in. NEMA 7 Actuation Assembly	85-105724-200
3 in. NEMA 7 Actuation Assembly	85-125724-300
4 in. NEMA 7 Actuation Assembly	85-140724-400
Actuation Hose, 30 in 350 lb to 900 lb (159 kg to 408 kg) Cylinders	WK-264986-000
Actuation Hose, 36 in 1100 lb (499 kg) Cylinders	85-264988-036

Table 12. Selector Valve, Lockout Valve, and Associated Equipment Parts List (Continued)

Description	Part Number
<b>Nitrogen Pilot Cylinders and Mounting Equipment</b>	
Factory Filled 108 cu. in. Nitrogen Pilot Cylinder	85-877940-001
Empty 108 cu. in. Nitrogen Pilot Cylinder	85-877940-002
1040 cu. in. Nitrogen Cylinder (Pilot, Siren Driver) Kit, Includes: <ul style="list-style-type: none"> <li>• Supervisory Pressure Switch for Nitrogen Pilot and Siren Driver Cylinders, P/N 85-111540-001</li> <li>• 1040 cu. in. Nitrogen Cylinder (Pilot, Siren Driver), P/N: 85-101040-001</li> </ul>	85-101040-101
Supervisory Pressure Switch for Nitrogen Pilot Cylinders	85-111540-001
ATEX Supervisory Pressure Switch for Nitrogen Pilot Cylinders	85-111540-100
Mounting Bracket, 108 cu. in. Nitrogen Pilot Cylinder	WK-877845-000
<b>NEMA 4 Rated Lockout Valves</b>	
1" Lockout Valve, NPT, NEMA 4 Rated Switch	85-100210-101
1 1/2" Lockout Valve, NPT, NEMA 4 Rated Switch	85-150210-151
2" Lockout Valve, NPT, NEMA 4 Rated Switch	85-200210-201
3" Lockout Valve, Grooved, NEMA 4 Rated Switch	85-300210-301
4" Lockout Valve, Grooved, NEMA 4 Rated Switch	85-400210-401
<b>NEMA 7 Rated Lockout Valves</b>	
1" Lockout Valve, NPT, NEMA 7 Rated Switch	85-100120-101
1 1/2" Lockout Valve, NPT, NEMA 7 Rated Switch	85-150120-151
2" Lockout Valve, NPT, NEMA 7 Rated Switch	85-200120-201
3" Lockout Valve, Grooved, NEMA 7 Rated Switch	85-300120-301
4" Lockout Valve, Grooved, NEMA 7 Rated Switch	85-400120-401



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