Kidde Fire Systems

P/N 06-237619-001
April 2020, Rev. AA

Inert Gas Engineered Fire Suppression System

Design, Installation, Operation, and Maintenance Manual with FM Approval

EXPORT INFORMATION (USA)
Jurisdiction: EAR
US ECCN: EAR99
This document contains technical data subject to the EAR

FOREWORD

This manual is written for those who design, install, operate, or maintain the Kidde Fire Systems Inert Gas Engineered Fire Suppression System (Kidde® IGS) using IG-55 or IG-100 (herein refer to collectively as the "Agent") manufactured after June 2018. For Kidde® Argonite® Engineered Fire Systems manufactured prior to July 2018, see DIOM P/N: 06-236432-001. For Kidde Nitrogen Engineered Fire Systems manufactured prior to July 2018, 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.

Kidde IGS 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 2015 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: http://www.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): www.nfpa.org
- Fire Industry Association (UK): www.fia.uk.com

The design concentration for Class A and C fires applies to systems designed to meet and comply with FM5600, and NFPA 2001, Edition 2015 requirements. As such, our customers are reminded and advised:

- In accordance with 4.3.1.2 and 4.3.1.3 of NFPA 2001, Edition 2015, 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 4.3.5.6 in NFPA 2001, Edition 2015 with regard to discharge delays.
- The designer should also review A.5.4.2.4 in NFPA 2001, Edition 2015 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.5.6 in NFPA 2001, Edition 2015 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 5.4.2.5 in NFPA 2001, Edition 2015. 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.

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

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www.kiddefiresystems.com
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SAFETY DATA SHEETS

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

SAFETY SUMMARY

Kidde IGS 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 Kidde IGS equipment and follow the instructions used in this manual and in the Safety Bulletin and cylinder nameplate.

Kidde 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

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

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

SAFE CYLINDER HANDLING PROCEDURES

WARNING

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. Never dispose of liquefied agent in an indoor work or storage area.

WARNING

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 Kidde IGS 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.

WARNING

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 PI 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.

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 slave 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.

WARNING **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.

WARNING **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, slave 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.

WARNING **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 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.

WARNING **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 Inert Gas Engineered Fire Suppression System (Kidde® IGS) using IG-100 or IG-55 (herein refer to collectively as the "Agent") are designed to suppress fires in specific hazards or equipment located where an electrically non-conductive Agent is required and where an electrically non-conductive Agent with little to no clean up is required. These Agents are approved by the EPA, NFPA, and ISO for use in fire suppression systems. Use Kidde IGS 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 of zero days
- Colorless, with low odor and no particulate or residue allowing for minimal business disruption after a discharge
- Electrically non-conductive

For specific design concentrations see Section 3-3.

1-1.1 Use

Kidde IGS is used to extinguish fires in almost all flammable substances with only a few exceptions. The Kidde IGS 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 density of the Kidde IGS gases are similar to that of atmospheric air, therefore longer hold times are expected as opposed to other heavier clean agents. The gases used in the Kidde IGS are non-conductive and therefore suitable for the extinguishment of fires involving electrical and electronic equipment.

The normal design concentrations used in Kidde IGS will result in an oxygen concentration above 10% and thus are acceptable for protecting normally occupied enclosures.

Kidde IGS is also useful for extinguishing fires involving:

- Flammable and combustible liquids
- Sub floors 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

Kidde IGS 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 extinguishant
- 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

Description	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
Electrical fire	Class C	not classified (formerly Class E)	Class E
Cooking oils and fats	Class K	Class F	Class F

LOAEL (Lowest Observed Adverse Effect Level) is the lowest concentration at which an adverse toxicological or physiological effect has been observed in humans. For Kidde 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, the health concern in this instance being the lowered 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 Kidde 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%.

1-1.4 Agent Cylinder Quantity

There are no limits to the number of agent cylinders that can be used in a Kidde IGS system. However, the size of the system is limited by the space available for storage of the Agent cylinders. Large systems may require more space in comparison to other solutions. 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.

1-2 FIRE EXTINGUISHMENT METHODS

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

- Total Flooding: Release of Agent into an enclosure (Total Flooding) means that the minimum design concentration is created within the entire room volume.
- Dedicated protection: Release of Kidde IGS systems may be executed inside protected unit(s) (machine/equipment) for example, EDP equipment or electrical cabinets, if it is deemed to be more appropriate 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 cabinets etc.
- Selector valve system – Central bank system: If more than one room in a building 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 together with any adjoining rooms 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 Kidde IGS 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 untenable for human occupancy until the enclosure is properly vented. Kidde IGS systems are designed to provide a Residual Oxygen Level (ROL) between 10-14% after a discharge.

Following a discharge the residual oxygen concentration will not support combustion of most fires, but it will allow occupants to breathe normally. Evacuation of the protected room can be performed in a calm and orderly manner. Occupants should never be encouraged to intentionally remain in the area during a discharge, even in the event of accidental or test discharge. The release of the Agent may create considerable turbulence in the enclosure, causing dust etc. to be mixed in the atmosphere which could cause breathing problems.

1-3.1 Personal Safety

Suitable safeguards shall always be provided to ensure prompt evacuation of and prevent entry into a hazardous atmosphere and to provide means for prompt rescue of any trapped personnel. 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, Kidde IGS systems may be designed for a Residual Oxygen Level (ROL) as low as of 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:

- Pneumatic Discharge Delay
- Pneumatic 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.

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

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

1-3.2 Agent Safety Concentrations

Kidde 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 Kidde 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 Kidde IGS agents are as follows:

- Unnecessary exposure to Kidde 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 2015 Edition, table 5.5.3.3 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, 2015 Edition.
- Unprotected personnel shall not enter the area during or after Agent discharge.

The following additional provisions shall apply:

- Kidde IGS 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.
- Kidde IGS 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.
- Kidde IGS 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
- Kidde IGS 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.
  - Pneumatic siren
  - Pneumatic Time Delay
  - Lockout Valve
  - Caution Signs

Note: The term "…sea level equivalent of oxygen…," used above, deserves some clarification. The allowed exposure limit to air diluted with Kidde 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 Kidde IGS Agent

Agent Conc. vol %	% O_2 at Sea Level	P_{O2}, psi	Allowed Occupancy	Egress Time Limit
C < 43	**%O_2** > 12	**P_{O2}** > 1.78	Normally occupied	5 min
43 < C < 52	12 > **%O_2** > 10	1.78 > **P_{O2}** > 1.47	Normally occupied	3 min
52 < C < 62	10 > **%O_2** > 8	1.47 > **P_{O2}** > 1.18	Not normally occupied	30 s
C > 62	**%O_2** < 8	**P_{O2}** < 1.18	Unoccupied areas only	n/a

1-3.2.1 Oxygen Concentration Above or Below Sea Level

At altitudes different than sea level, atmospheric pressure can be calculated using the following equation:

$$P(h) = 14.7 (1 - 6.88x10\text{-}6\ h)5.25588$$

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

$$PO2 = 0.21\ P(h)$$

where

h = Altitude above sea level, ft

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

PO2 = Partial pressure of oxygen, psi

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

$$PO2,POST\text{-}DISCHARGE = 0.21(1\text{-}C/100)\ PO2$$

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

Kidde IGS 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 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.

Kidde Systems are designed for the following classes of fire:

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

For hazards beyond the scope described in this manual, the designer must consult with Kidde on the suitability of the Agent for the protection, necessary design concentration, and personnel exposure effects from that 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 Kidde IGS may involve several elements as described in the following sections.

1-4.1 Central Cylinder Bank

When multiple cylinders are required, Kidde IGS cylinders can be setup 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 connection on the manifold is to a manifold check valve which allows for removal of single cylinders for maintenance as required, leaving 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. However, each group would have to be accounted for in the flow calculation software and require 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.

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

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

Kidde IGS offers 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 wiring to the pressure gauge/switch on each cylinder
- Remote monitoring which is performed 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.

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, 2015 Edition requirements for placement supervision.

1-5 EXTINGUISHING AGENT

Kidde IGS is approved for use with the following Agents:

- IG-100: Fixed fire extinguishing systems that use the pure inert gas Nitrogen
- IG-55: Fixed fire extinguishing systems that use inert, gaseous mixture of 50% Nitrogen and 50% Argon

The gases used in Kidde IGS occur naturally within the earth's atmosphere. Nitrogen constitutes approximately 78% and Argon approximately 0.9% of the atmosphere. As a result, the global warming effect of the Kidde 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.

1-5.1 Design Concentration Safety Factor

The design concentration in most countries is accepted as the percentage of mixture of air and extinguishing agent which is required to extinguish a fire in a cup-burner holding the flammable liquid involved. The basic extinguishing concentration has in general been agreed to be that which can extinguish an n-Heptane cup-burner fire.

Currently all international standards recommend that a safety factor of some kind is added to the extinguishing concentration for use as minimum design concentration:

ISO 14520/EN 15004-1; safety factor of 30% for Class "A" fires, 30% for Class "B" fires

NFPA 2001; safety factor of 20% for Class "A" fires, 30% for Class "B" fires, 35% for electrical Class C fires.

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)

Kidde IGS 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 measurements may include: Carbon Monoxide, Carbon Dioxide, Nitrogen Oxide, and Nitrogen Dioxide most < 20 ppm.

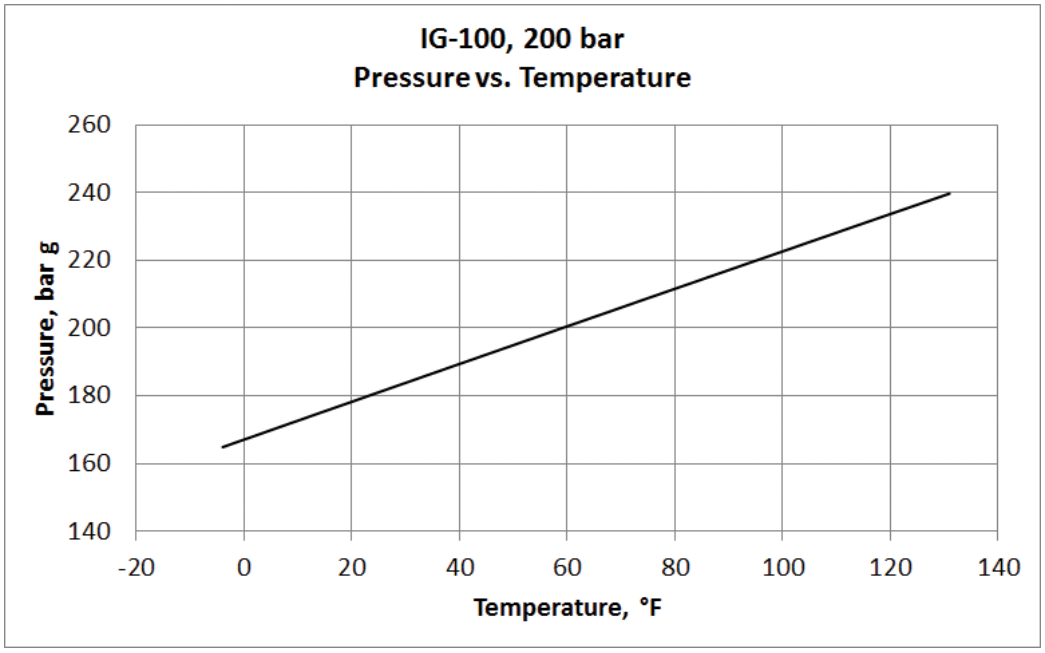


Figure 1-1. IG-100 Pressure/Temperature Curve Isometric Diagram for 200 bar, U.S. Customary Units

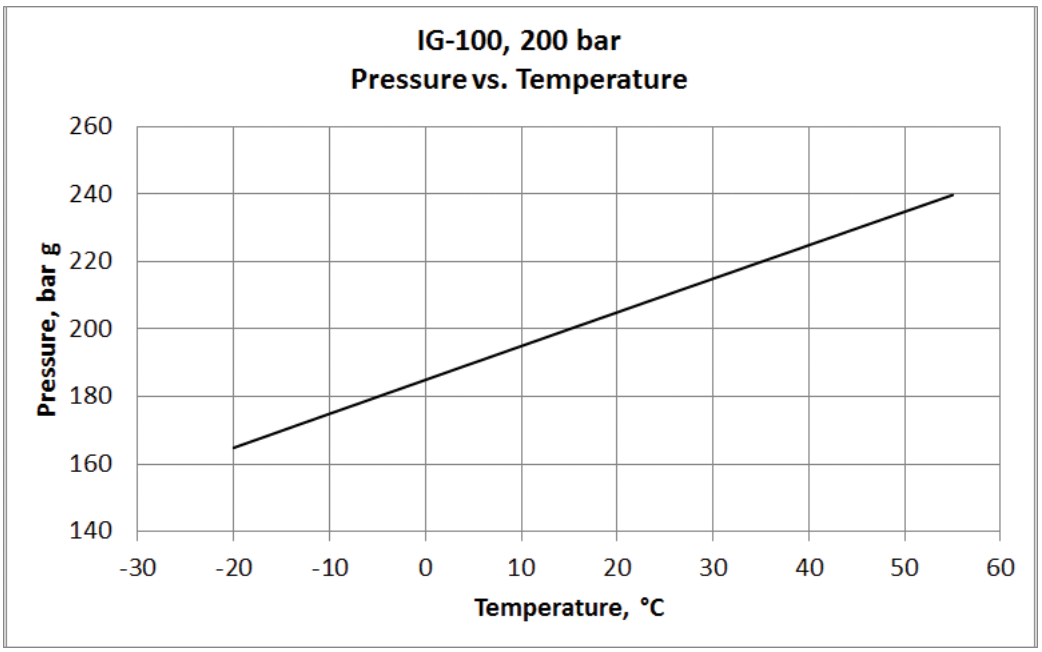


Figure 1-2. IG-100 Pressure/Temperature Curve Isometric Diagram for 200 bar, SI Units

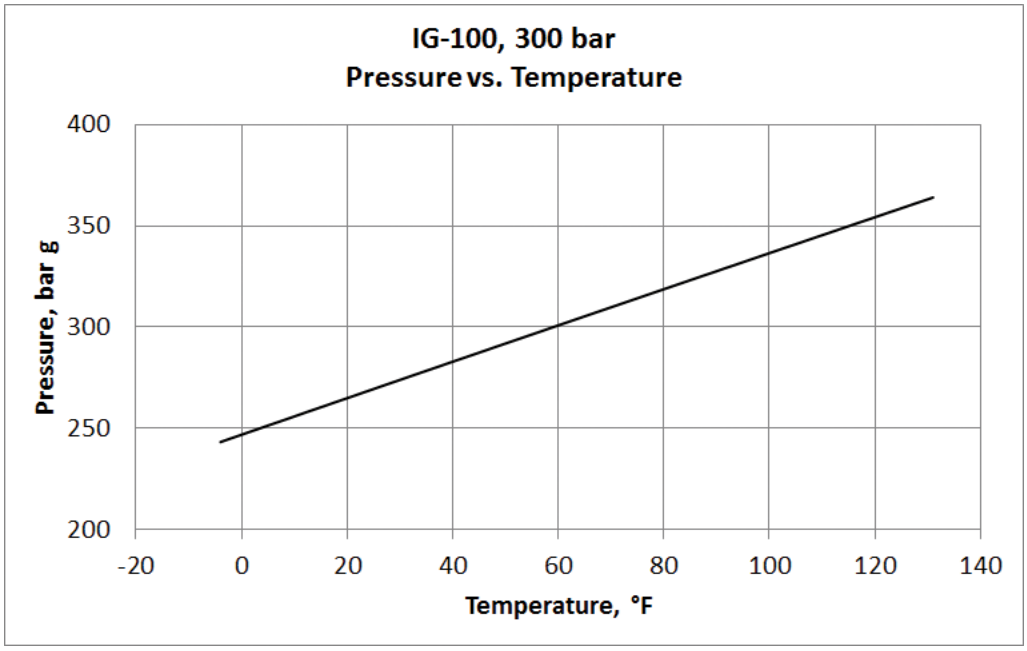


Figure 1-3. IG-100 Pressure/Temperature Curve Isometric Diagram for 300 bar, U.S. Customary Units

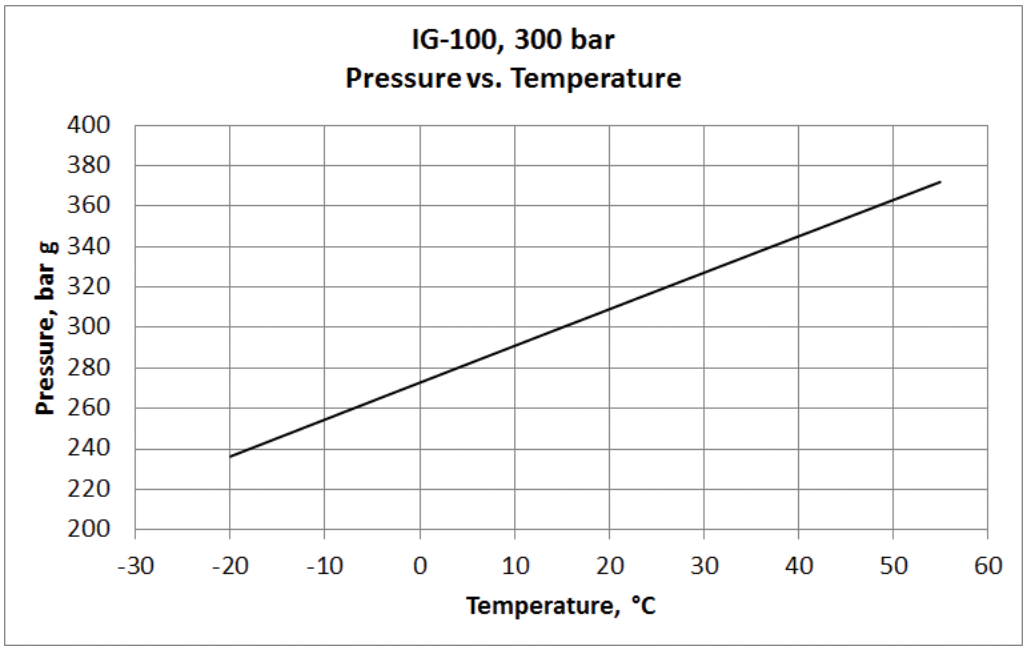


Figure 1-4. IG-100 Pressure/Temperature Curve Isometric Diagram for 300 bar, SI Units

1-5.3 IG-55 (Nitrogen and Argon)

Kidde IGS using IG-55 are fixed fire extinguishing systems that use an inert, gaseous mixture of 50% Nitrogen and 50% Argon known as Argonite®, 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%

1-5.3.1 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.

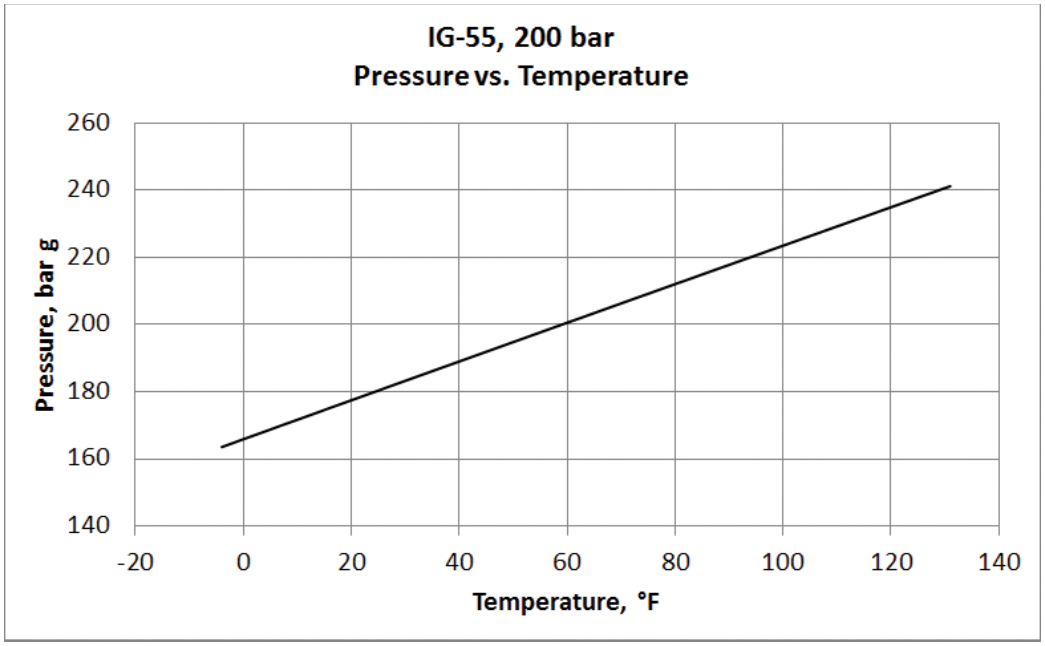


Figure 1-5. IG-55 Pressure/Temperature Curve Isometric Diagram for 200 bar, U.S. Customary Units

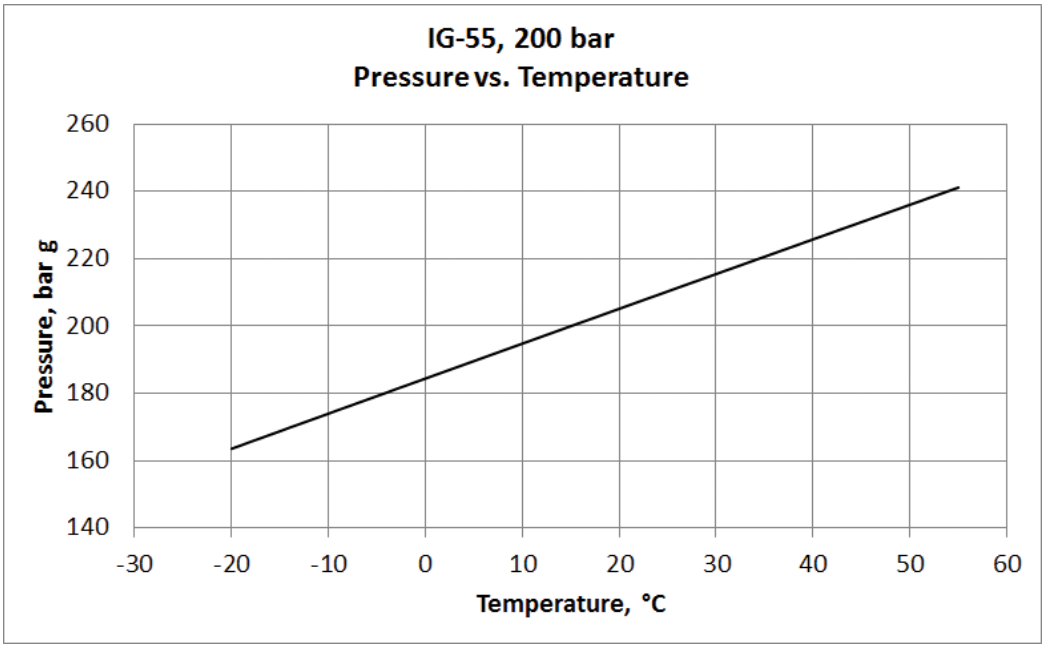


Figure 1-6. IG-55 Pressure/Temperature Curve Isometric Diagram for 200 bar, SI Units

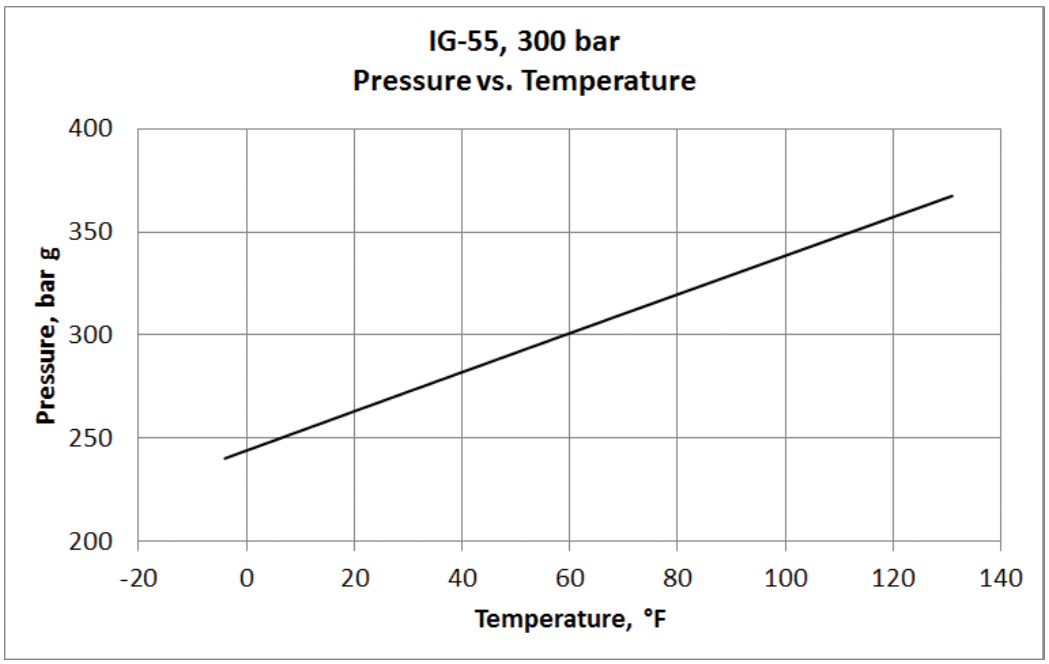


Figure 1-7. IG-55 Pressure/Temperature Curve Isometric Diagram for 300 bar, U.S. Customary Units

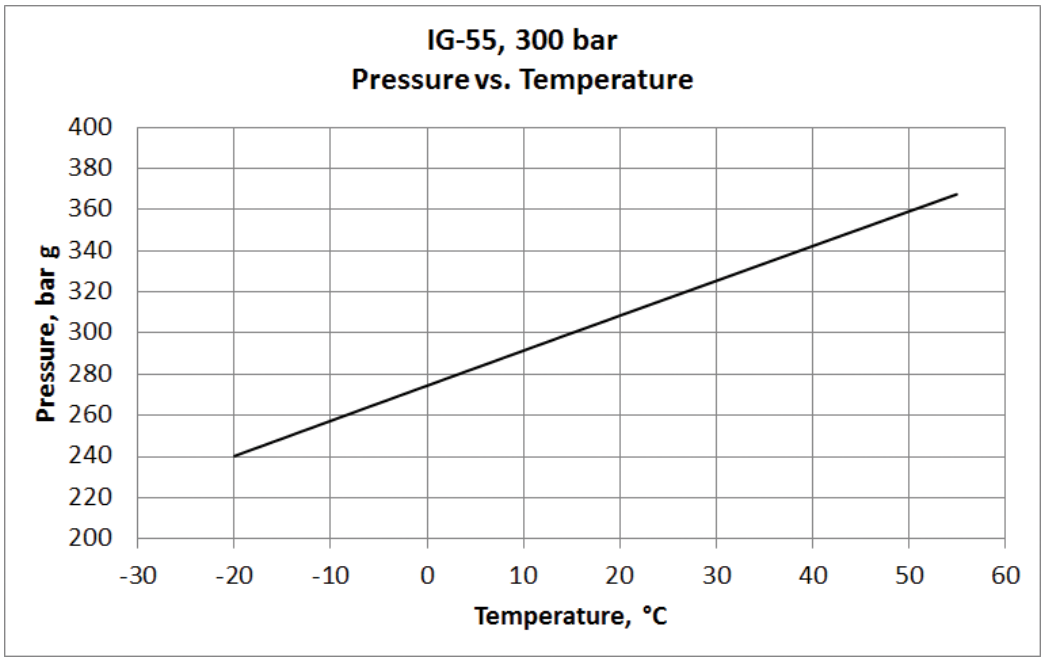


Figure 1-8. IG-55 Pressure/Temperature Curve Isometric Diagram for 300 bar, SI Units

1-5.4 Agent Pressure verse Temperature Formulas

See the individual Agent sections for the corresponding graphs.

Table 1-3. 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-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

1-5.5 Operating Temperature Range Limitations

The Kidde IGS has 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.

1-5.6 Agent Storage Container Temperature Range Limitations

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

1-5.6.1 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).

1-5.6.2 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 Flow Calculation Software User's Guide 06-237621-001). If the Agent cylinder storage temperature is outside of this range, an insufficient quantity of Agent may be discharged from one or more nozzles in an unbalanced system, resulting in one or more hazards receiving an insufficient concentration of Agent.

1-5.6.3 Storage

The seamless steel container is filled to 300 bar at 15°C (4351 psig at 59°F) or 200 bar at 15°C (2901 psig at 59°F) 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 Kidde IGS 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, 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.

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 by 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 to only be activated between 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 Kidde IGS shall be listed with the fire alarm and suppression control panel.

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 valve on the master cylinder.

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 master 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 shall be evaluated and if necessary the flow calculation repeated and orifices in nozzles 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 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

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 at risk the lives of occupants of the premises, the equipment being protected, and could cause potentially crippling financial losses.

The importance of maintenance cannot be emphasized enough.

Trained distributors and competent personnel shall regularly service a Kidde Inert Gas System.

The service engineer shall be proficient at installation and commissioning of Kidde Inert Gas systems as well as having detailed knowledge of the system’s components.

A minimum of two thorough inspection per year shall be undertaken for an installation. The inspection 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 Kidde Inert Gas 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, 2015 Edition.
- ISO 14520 part 1 / EN 15004 part 1 General requirement
- IG-55: ISO 14520 part 14 / EN 15004 part 9
- IG-100: ISO 14520 part 13 / EN 15004 part 8
- LPS 1230 - LPCB
- AS 4214 – Standard Australia

1-14 APPROVALS

The approval(s) required for installation of a Kidde 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 Kidde IGS systems for fixed fire protection systems. This system has been approved for use as a fixed (total flood) fire extinguishing system.

CHAPTER 2
COMPONENT DESCRIPTIONS

2-1 INTRODUCTION

This chapter provides a functional description of the modules and assemblies in Kidde Fire Systems Inert Gas Engineered Fire Suppression System (Kidde® IGS) using IG-100 or IG-55 (herein refer to collectively as the "Agent").

2-2 FUNCTIONAL DESCRIPTION

The Agent is held in the Agent 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 Kidde IGS System is composed of the following components and assemblies:

- Section 2-3, Kidde IGS 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.

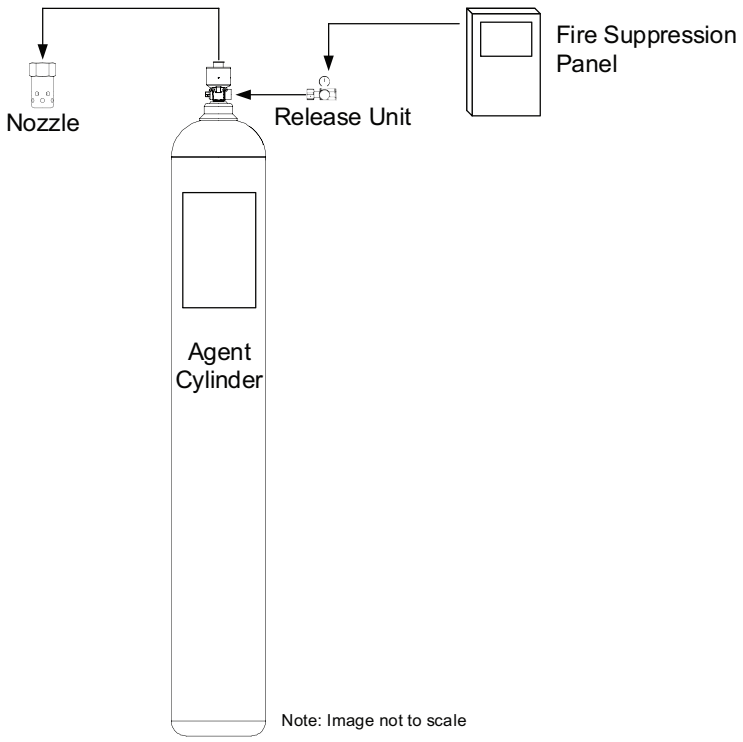


Figure 2-1. Typical Kidde Inert System

2-3 KIDDE IGS 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 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. The cylinder valve assembly is equipped with a pressure gauge with a supervisory pressure switch connection for monitoring cylinder pressure and a safety burst disc in compliance with DOT or TPED requirements.

Each cylinder 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 cylinder valve during transportation or cylinder handling.

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

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

Note: All cylinders are fitted with a valve protection device in accordance with the United Nations ADR.

WARNING

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.

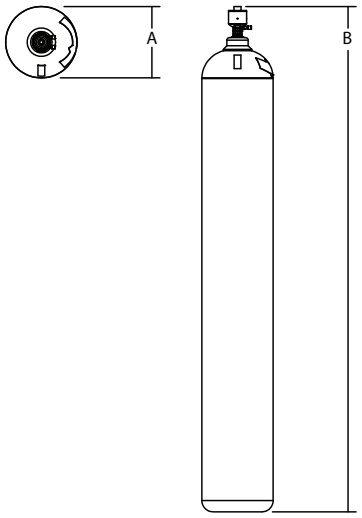


Figure 2-2. Typical Cylinder Assembly

Table 2-1. Dimensions. Cylinder and Valve Assemblies

Part Number	Capacity	Approximate Empty Weight		Height		Diameter		Volume	
				B		A			
		lb	kg	in	mm	in	mm	in^3	m^3
38-4X80X1-XXX	80 L	227.1	103.0	73.3	1862	10.5	267	4882	0.08
Note: Agent 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-55	
			lb	kg	lb	kg
38-4X8021-XXX	80 L	200 bar	266.4	120.8	277.4	125.8
38-4X8023-XXX	80 L	300 bar	281.4	127.6	297.9	135.1

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

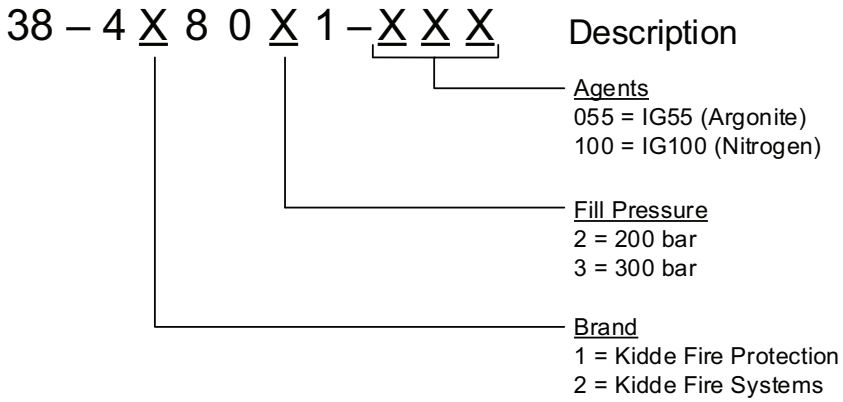


Figure 2-3. Kidde Inert Agent and Cylinder Part Number Breakdown

2-3.1.1 Spare Parts for Cylinders

The following spare parts are available for the cylinder:

Table 2-3. Kidde IGS Cylinder Spare Parts

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

2-3.2 Cylinder Valves

Kidde IGS 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 master cylinder in the bank will be fitted with an electrical/manual release unit.

A pressure gauge/switch included in the release unit or slave 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 valve arrangement.

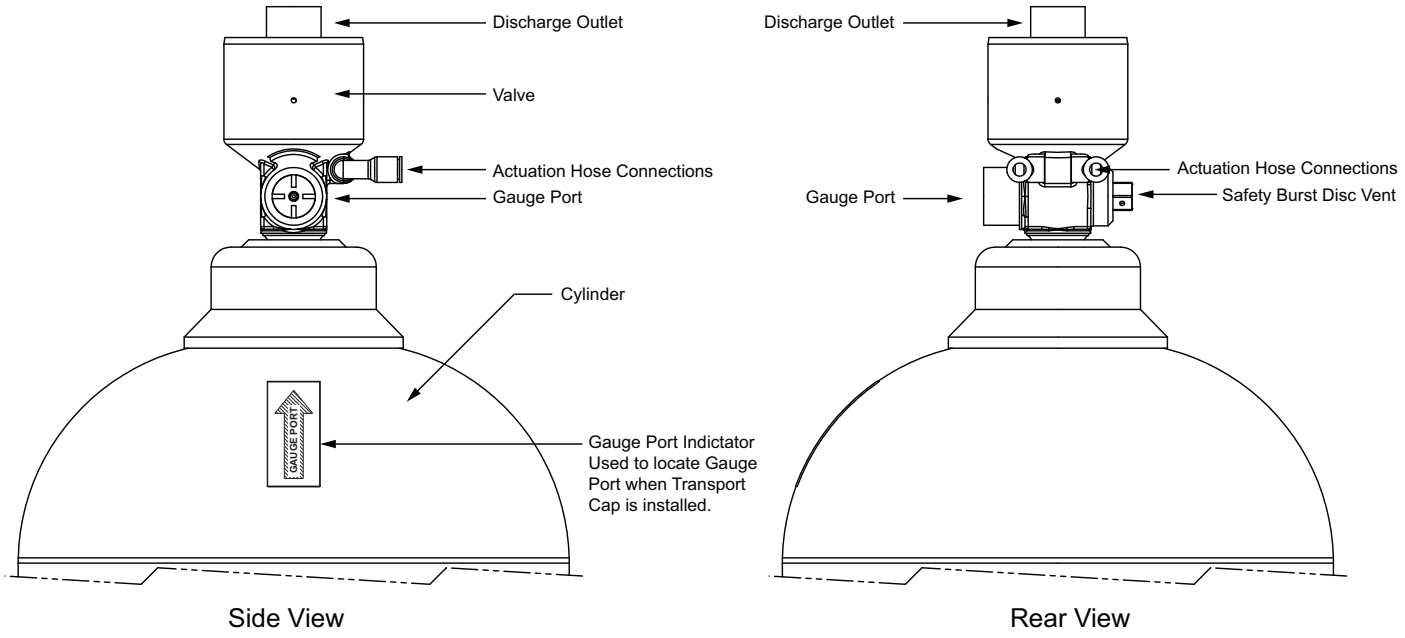


Figure 2-4. Valve General Arrangement, P/N 38-400000-001

WARNING **Valve replacement is not FM Approved.**

2-3.3 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 can be electric operated only or manual/electric. 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 that include manual operation have a tamper proof 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.

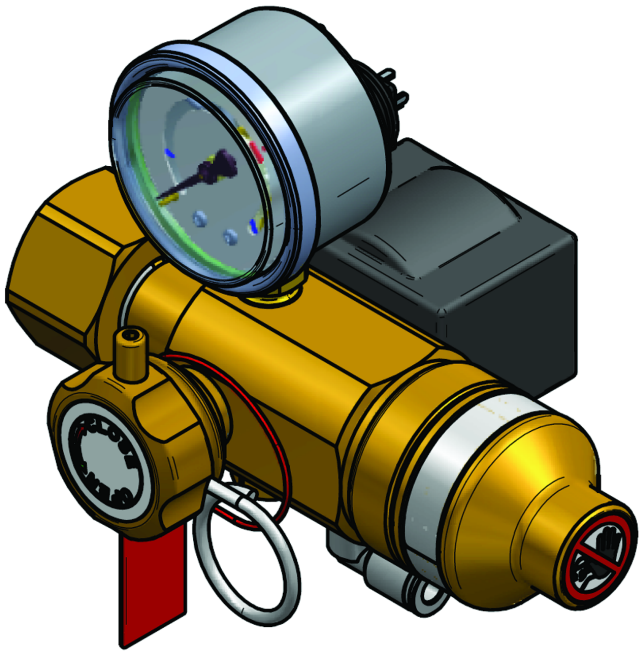


Figure 2-5. Release Unit

Part Number	Pressure Rating	Operation	Contact
38-400001-001	200 Bar	Manual/Electric	Normally Open
38-400001-003	300 Bar	Manual/Electric	Normally Open

2-3.4 Slave Cylinder Gauge Assemblies

Slave Cylinder Gauge Assemblies provide a pressure indicator for all slave cylinders in a system. The Slave 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.

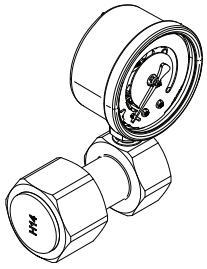


Figure 2-6. Slave Cylinder Gauge Assembly

Table 2-4. Kidde IGS Slave Cylinder Gauge Part Numbers

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

2-3.5 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 2-5). These hoses include Quick Connect fitting for ease of installation and maintenance. The grove on the festo connector 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.

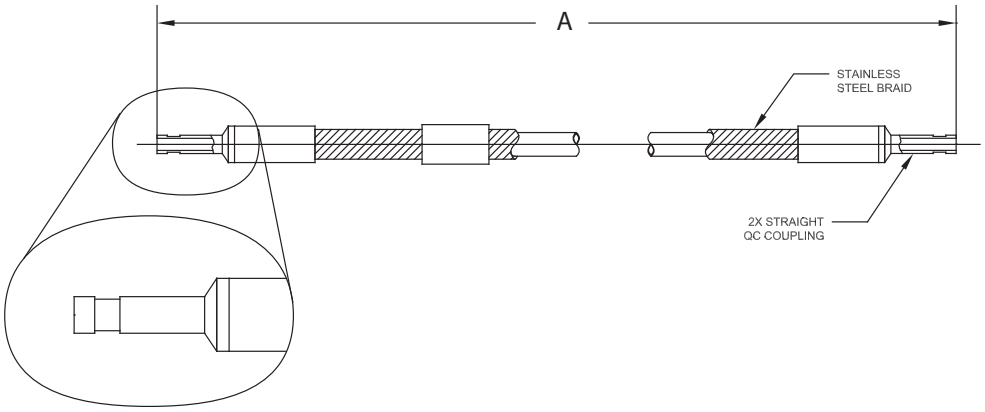


Figure 2-7. Flexible Actuation Hose with Straight to Straight Couplings

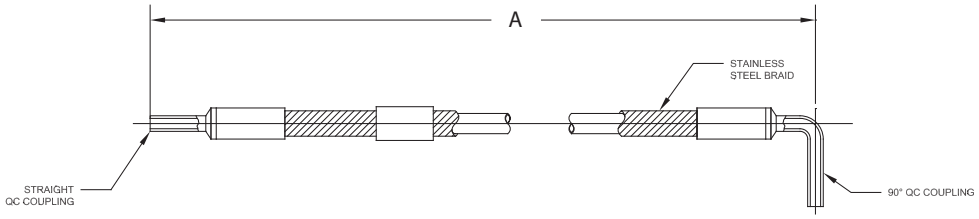


Figure 2-8. Flexible Actuation Hose with Straight to 90° Couplings

Table 2-5. Dimensions, Flexible Actuation Hose

Part Number	Connection Angle	Dimension A	Min. Bend Radius
38-401110-400	Straight to Straight	15.75”	3" (76 mm)
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)

When connecting multiple cylinders using the actuation hoses, use the following:

Table 2-6. Actuation Hose Usage

Connection Type	Actuation Hose Used
80 Liter Cylinders	
Release Unit to Cylinder Valve	38-401110-400 38-401110-500
Interconnecting Valves in the same row (inline valve to valve)	38-401110-500
Interconnecting Valves in different rows (inbetween cylinder rows)	38-401130-600

2-3.6 Pilot Line Bleed Valve

Install a Pilot Line Bleed Valve (P/N 38-400007-001) in the unused actuation hose connection in the last cylinder of a cylinder bank. The end-of-line leak/vent 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 bleed valve includes a Quick Connect fitting for ease of installation and maintenance. The grove on the festo connector provides additional grip surface when the connector is installed into the mated connection.

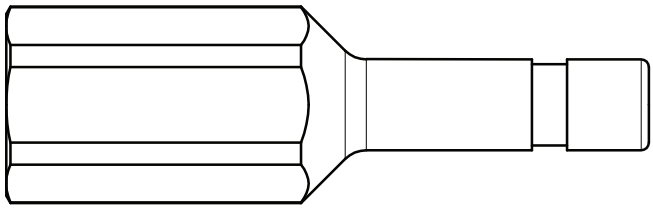


Figure 2-9. Pilot Line Bleed Valve

2-3.7 Quick Connect Cables

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

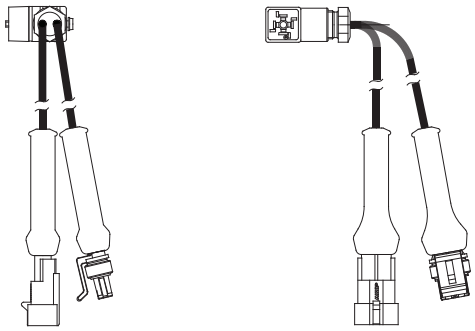
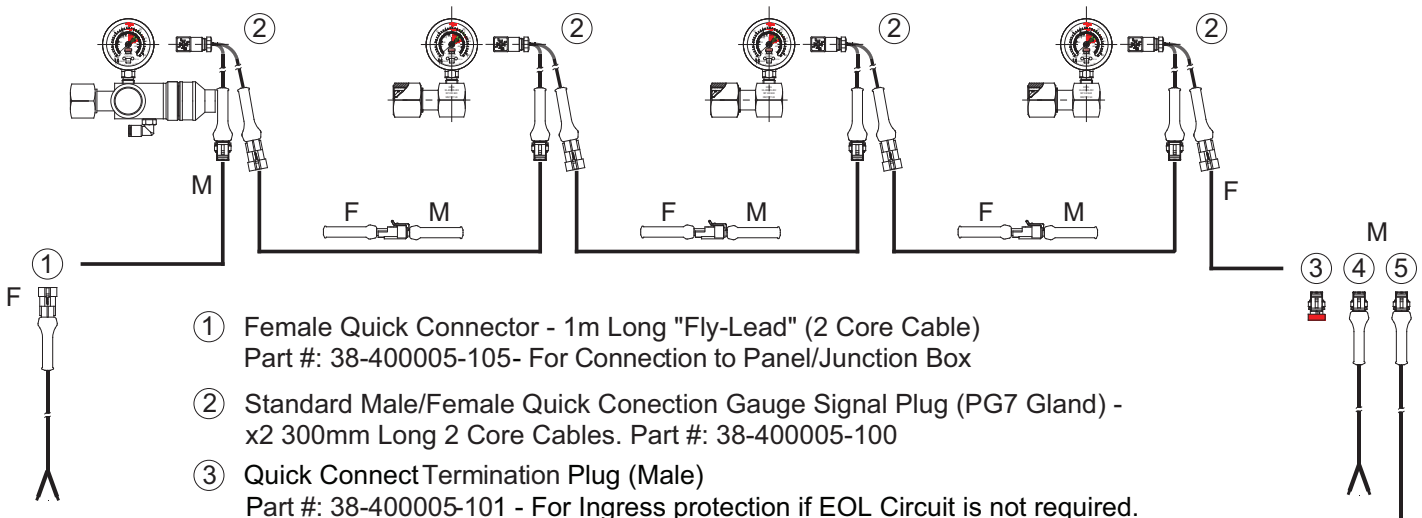


Figure 2-10. Quick Connect Cables

Table 2-7. Kidde IGS Quick Connect Cable Part Numbers

Part Number	Description
38-400005-100	L Plug x 2 Cable, Dual Core 0.013” x 11.8” (0.34mm x 300mm) x Quick Connects (Male & Female)
38-400005-101	Gauge Signal Line - Quick Connect Terminal Plug (MALE)
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 0.013” x 39.4” (0.34mm x 1000mm) Fly-Lead
38-400005-105	Quick Connect (Female) x Dual Core 0.013” x 39.4” (0.34mm x 1000mm) Fly-Lead



① Female Quick Connector - 1m Long "Fly-Lead" (2 Core Cable)
Part #: 38-400005-105- For Connection to Panel/Junction Box

② Standard Male/Female Quick Conection Gauge Signal Plug (PG7 Gland) - x2 300mm Long 2 Core Cables. Part #: 38-400005-100

③ Quick Connect Termination Plug (Male)
Part #: 38-400005-101 - For Ingress protection if EOL Circuit is not required.

④ Male Quick Connector - 3m Long "Fly-Lead" (2 Core Cable)
Part #: 38-400005-102 - Back to Junction Box for Class A wiring

⑤ Male Quick Connector - 1m Long "Fly-Lead" (2 Core Cable)
Part #: 38-400005-103 - Back to Junction Box for Class A wiring

Figure 2-11. 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. The hose is connected to the discharge outlet of the Agent cylinder valve and terminates at the system piping or discharge manifold (see Figure 2-12, and Table 2-8). Use the 16.1” (410 mm) hose with 80L cylinders. A straight to straight hose option is available when needed.

Note: An alternate to the straight to straight hose (38-400110-300), 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 end.

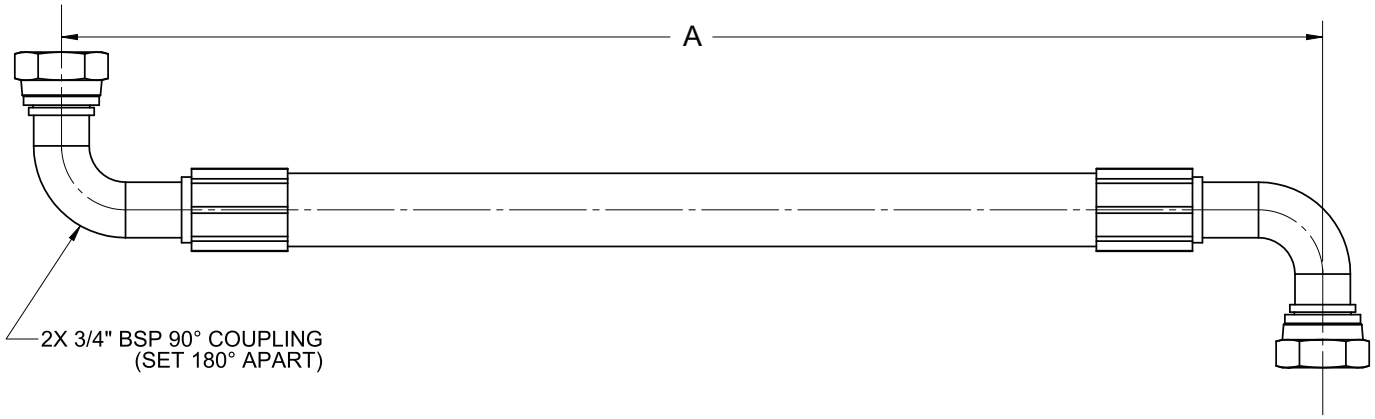


Figure 2-12. Discharge Hose with 90° to 90° Couplings

Table 2-8. 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)
38-400110-300	Straight to Straight	11.8” (300 mm)	9.6" (240mm)

2-4.2 Manifold Safety Device

The manifold safety device (P/N 38-400006-002) consists of 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 are available with NPT or BSP threading.

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 or to vent to the pipe network downstream of any selector valve.

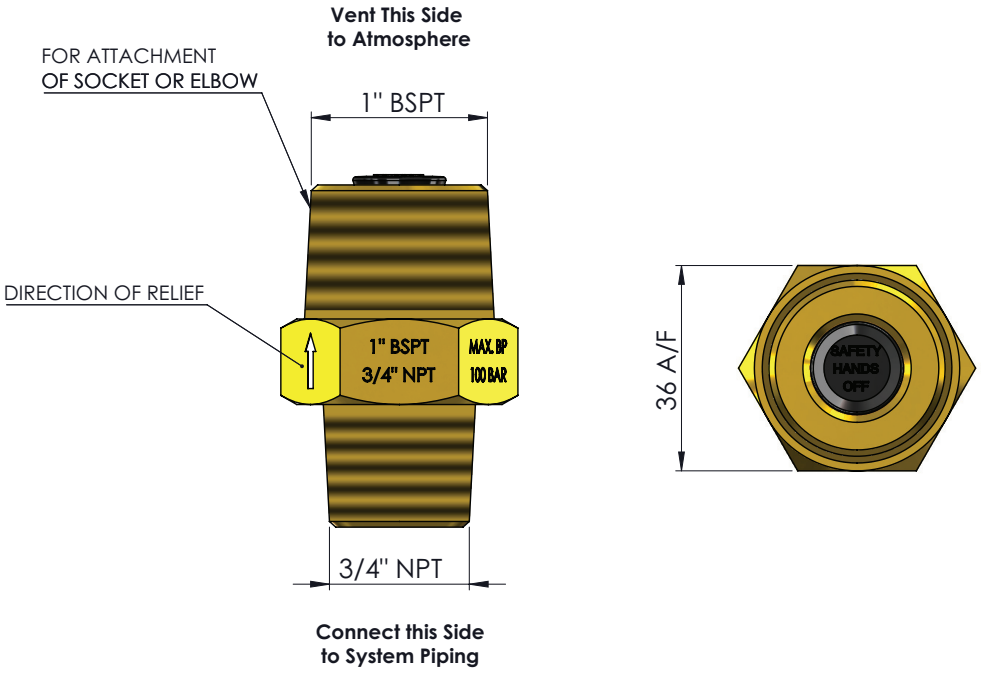


Figure 2-13. Manifold Safety Device

Table 2-9. Kidde IGS Discharge Accessories Part Numbers

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

2-4.3 Manifold Pressure Gauge

The manifold pressure gauge (P/N 01-7221-0300) is a gauge that is connected to the manifold to provide pressure indication.

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.

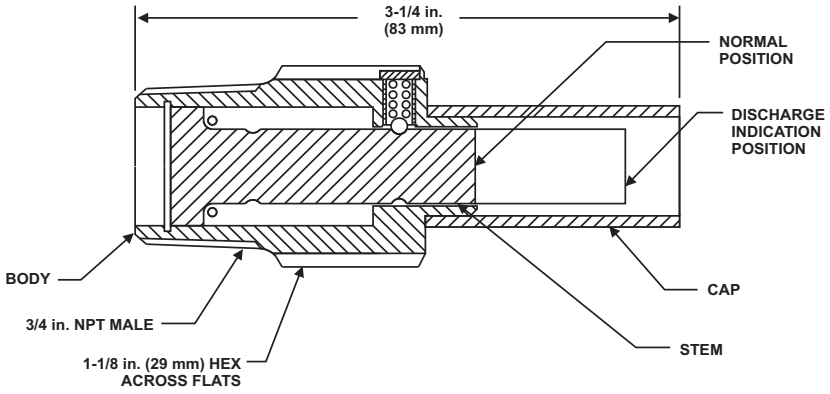


Figure 2-14. Discharge Indicator

2-4.5 3/4” Manifold Check Valves

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.

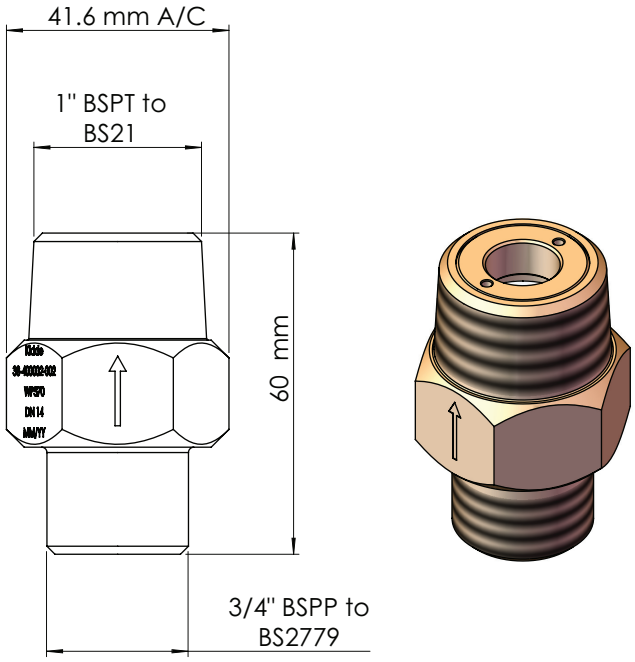


Figure 2-15. Manifold Check Valves

Table 2-10. Kidde IGS Manifold Check Valve

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

2-4.6 Pressure Operated Switches

Pressure operated switches (Figure 2-16 and Figure 2-17) are connected to the distribution piping and utilize 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. 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.

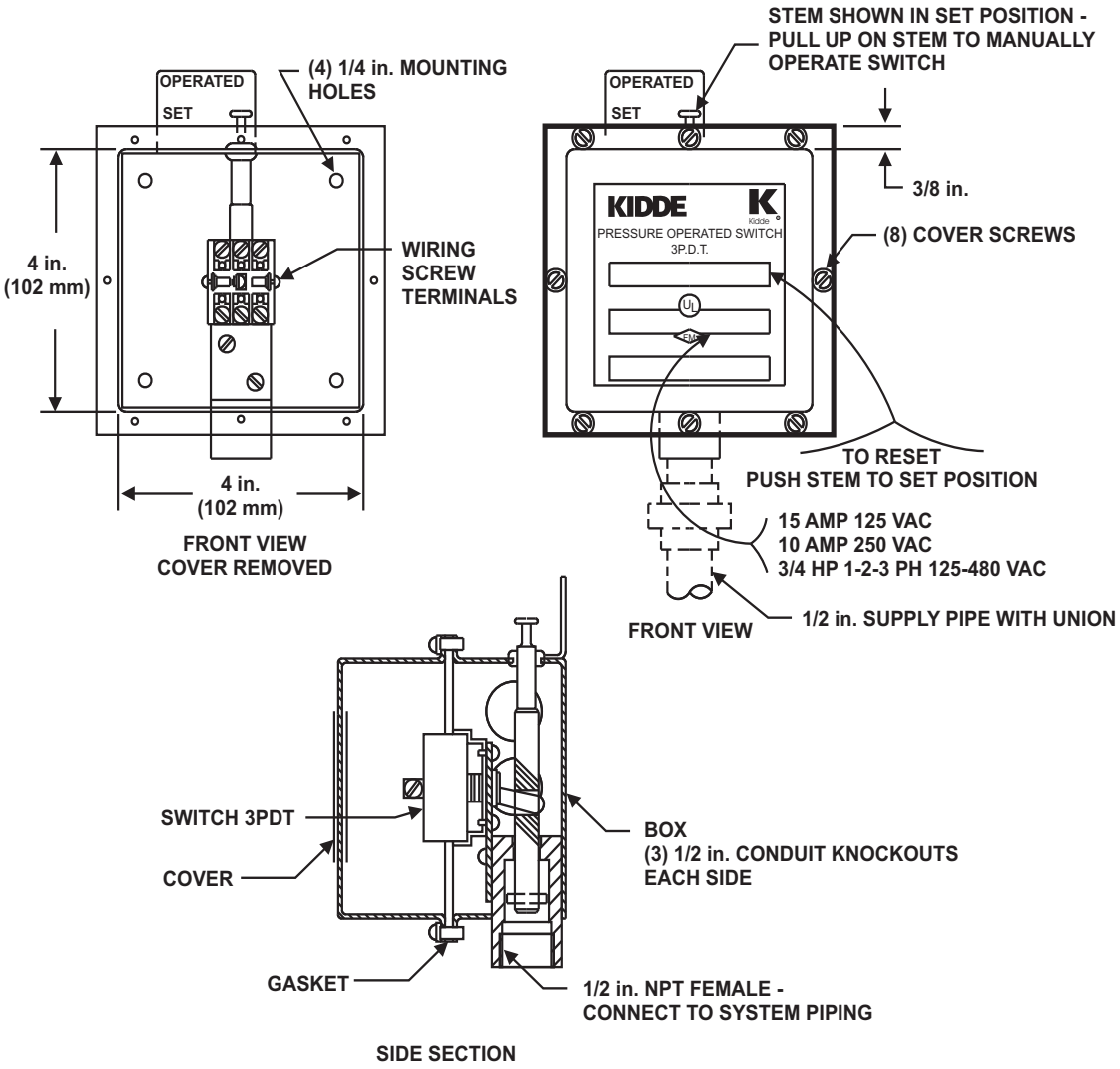


Figure 2-16. Pressure Operated Switch

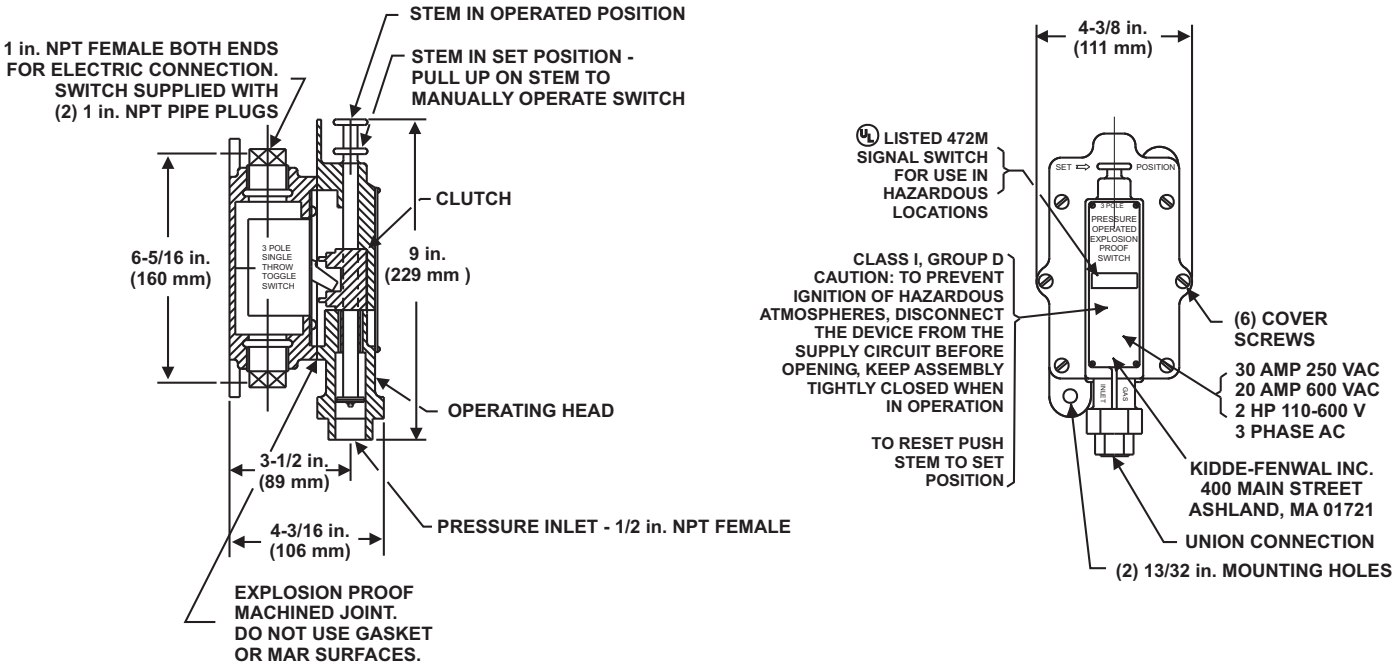


Figure 2-17. Pressure Operated Switch, Hazloc

2-4.7 Pressure Operated Trip

The pressure operated trip, Part No. 81-874290-000 (Figure 2-18), 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.

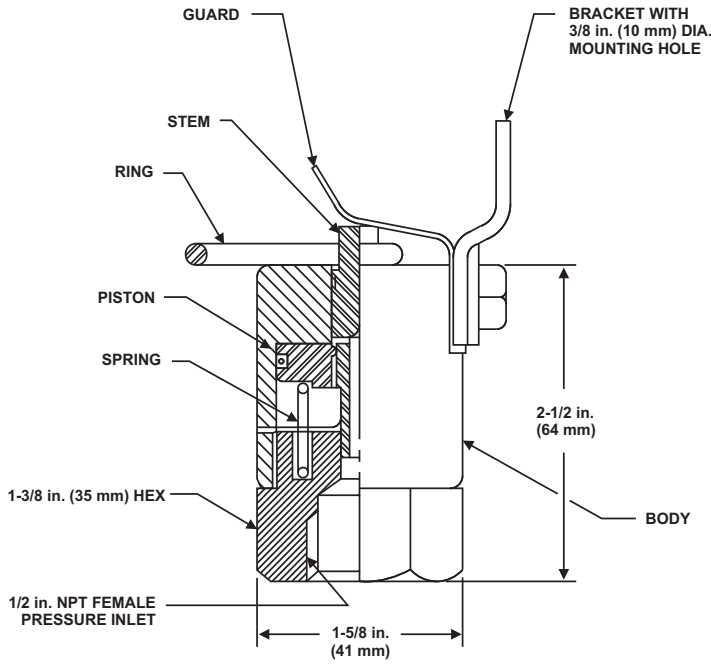


Figure 2-18. Pressure Operated Trip

2-4.8 Main to Reserve Transfer Switch

The main to reserve transfer switch, Part No. 84-802398-000 (Figure 2-19) is installed on systems having main and reserve cylinders. Placing the switch in either the "main" or "reserve" position provides uninterrupted fire protection capability during system maintenance or in the event of a system discharge.

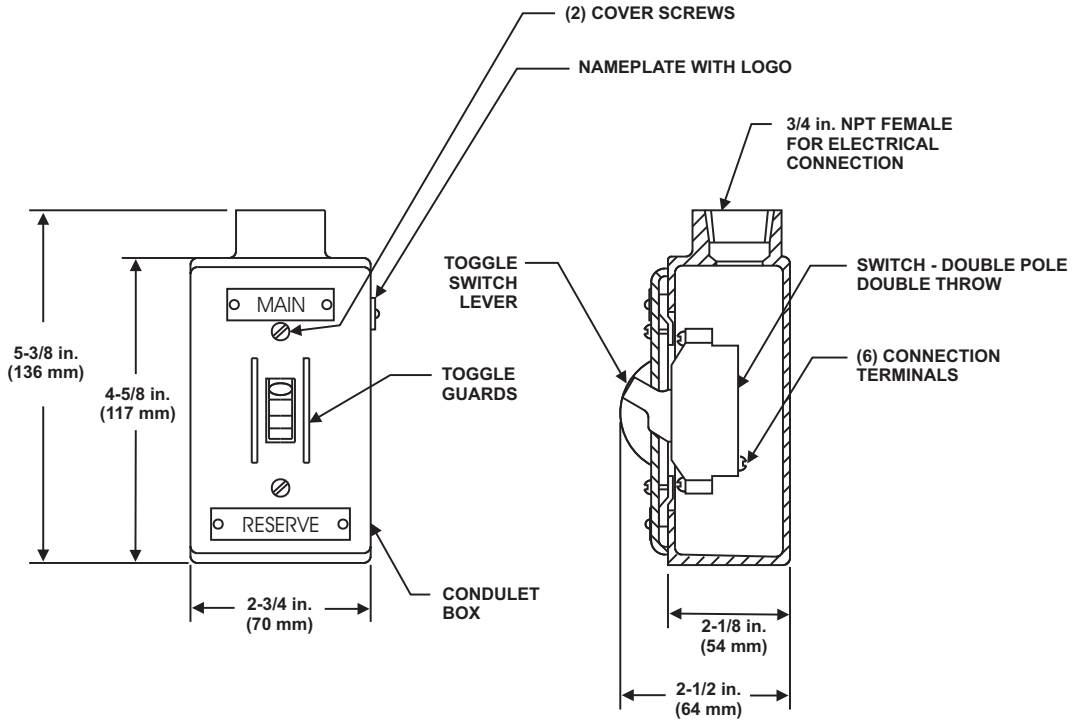


Figure 2-19. Main to Reserve Transfer Switch (84-802398-000)

2-4.9 Odorizer Assembly

The odorizer assembly, P/N 81-897600-000, 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.

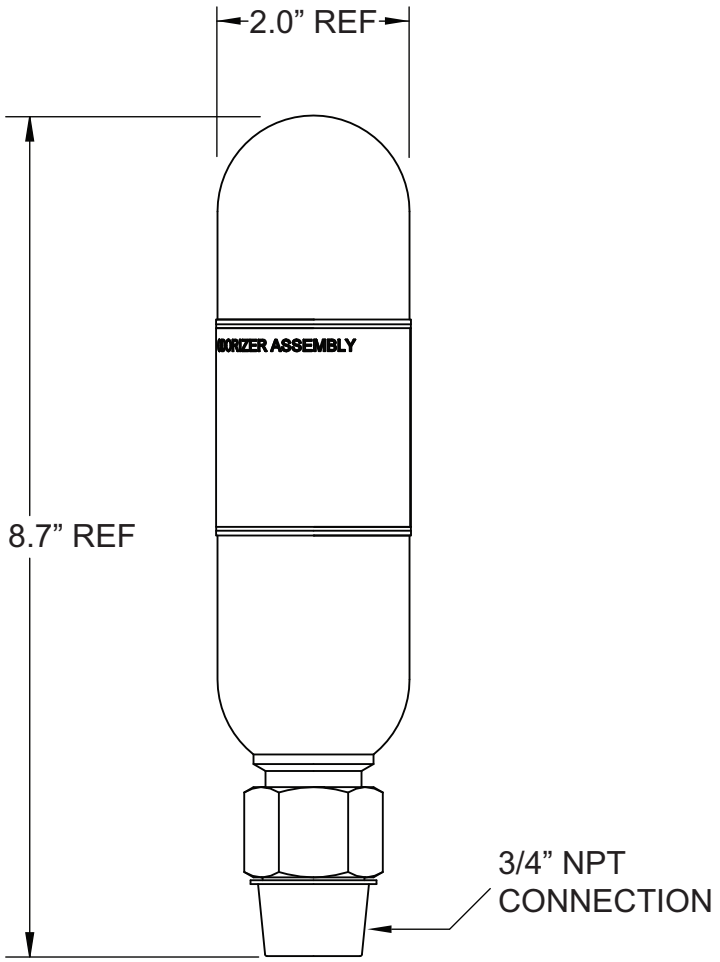


Figure 2-20. Odorizer Assembly

2-4.10 Main and Reserve Nameplates

The main and reserve nameplates, Part Nos. WK-310330-000 and WK-310340-000 respectively (Figure 2-21), are used to identify the primary and backup agent cylinders.

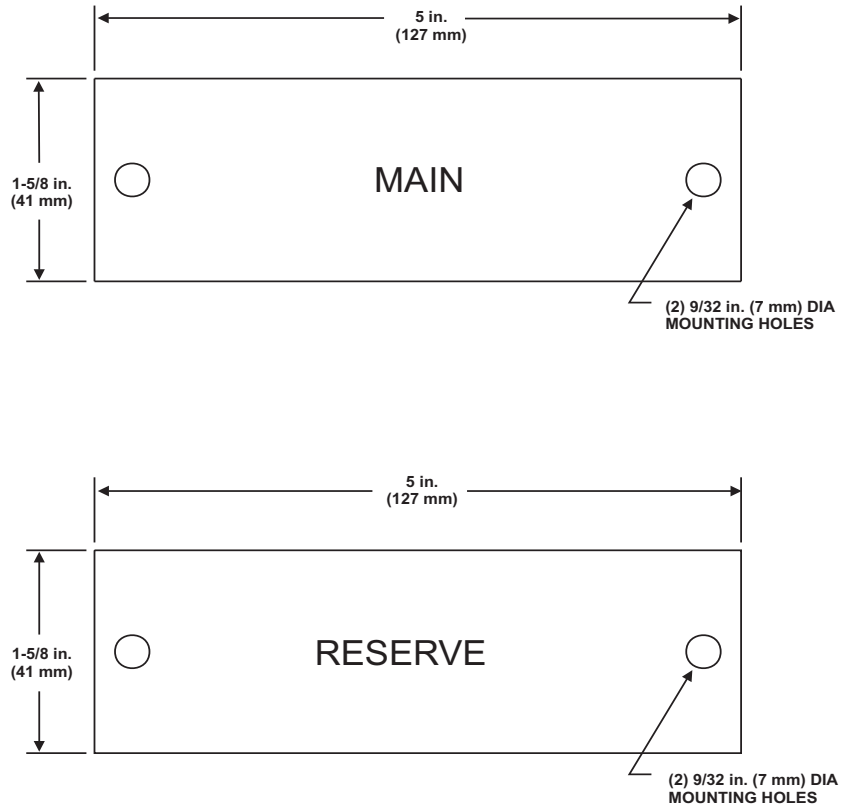


Figure 2-21. Main and Reserve Nameplates

2-4.11 Caution Signs

There are two warning signs available for use with Kidde IGS systems, a caution sign used for entrances to the protected area, and one for the exits from the protected area.

Table 2-11. Kidde IGS Discharge Accessories Part Numbers

Part Number	Description
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)
85-909300-001	Caution Label - Entrance
85-909300-002	Caution Label - Exit

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 Kidde IGS Systems 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 backplate manifold. This pressure passes through the associated solenoid on the backplate manifold which is opened via the control panel, allowing agent pressure to flow to the required selector valve.

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

Selector valves have threaded inlet and outlet ports for connection to the distribution piping for sizes 1”, 1 1/2”, and 2”. For 3” and 4” selector valves, use flanges to connect to the system piping. To enable connection of actuation hose to selector valve the following adapters are required; for DN 25mm to DN 50mm use part# 15-8662-0042 and for DN80mm to DN 100mm use part# 15-8662-0041.

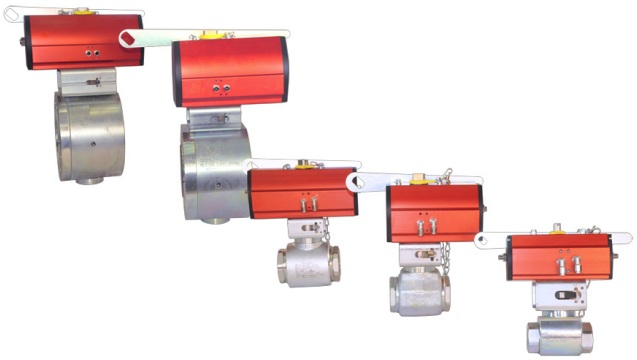


Figure 2-22. Selector Valves

Table 2-12. Kidde Fire Protection IGS 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

2-5.1 Back-Plate Manifold

Use the back-plate manifold in systems using selector valves to provide pressure to the needed selector valve. The back-plate manifold provides a pressure regulator valve so that manifold pressure can be used to operate selector valve. The backplate manifold includes solenoids to control which selector valve will receive pressure. The backplate manifold includes one Back-Plate Manifold Hose (P/N 01-3273-1200) used to connect the back-plate manifold to the agent manifold.

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.

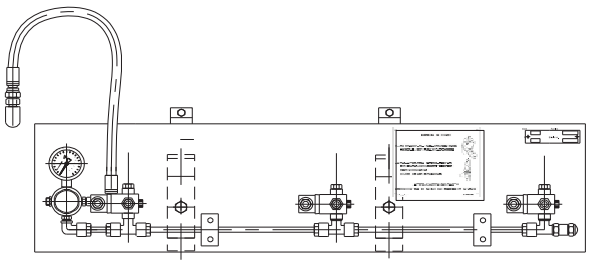


Figure 2-23. 3 Area Back-Plate Manifold

Table 2-13. Kidde Fire Protection IGS 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 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.

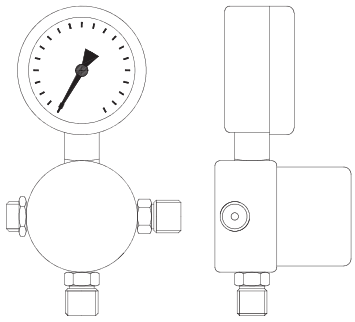


Figure 2-24. Pressure Regulator

Table 2-14. Kidde Fire Protection IGS Pressure Regulator Part Numbers

Part Number	Description
01-6017-0000	Pressure Regulator

2-5.1.2 Back-Plate Manifold Hose

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

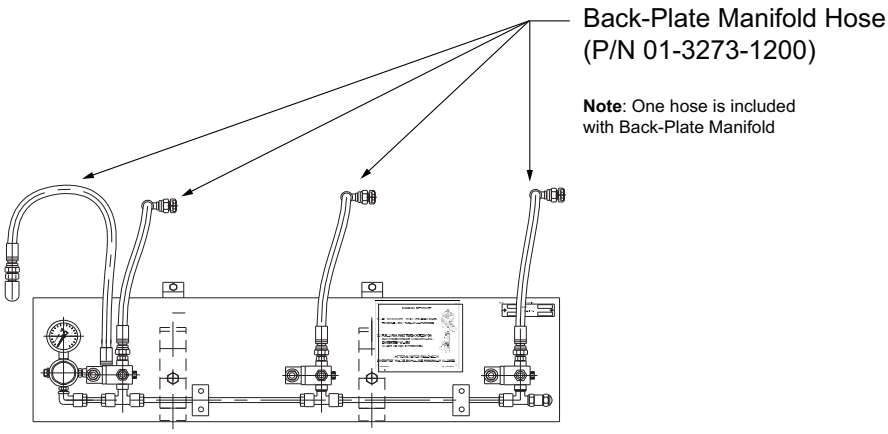


Figure 2-25. Back-Plate Manifold Hose

Table 2-15. Kidde Fire Protection IGS Back-Plate Manifold Hose Part Numbers

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

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.

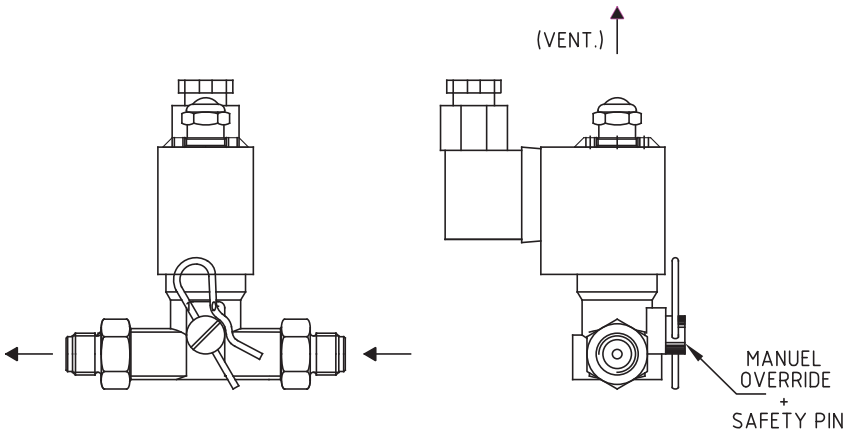


Figure 2-26. Back-Plate Manifold Spare Solenoid

Table 2-16. Kidde Fire Protection IGS Back-Plate Manifold Spare Solenoid Part Numbers

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

2-6 LOCKOUT VALVES

Note: Required in conjunction with use of time delay.

A lockout valve is a manually operated valve installed between the agent manifold and the discharge pipe to the protected area. The lockout valve can be locked in the closed position to prevent agent from discharging into the protected area. 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 2031 PSI (140 bar). When using lockout valves, a pressure relief valve should also be installed wherever pressure could be trapped in closed sections of pipe.

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

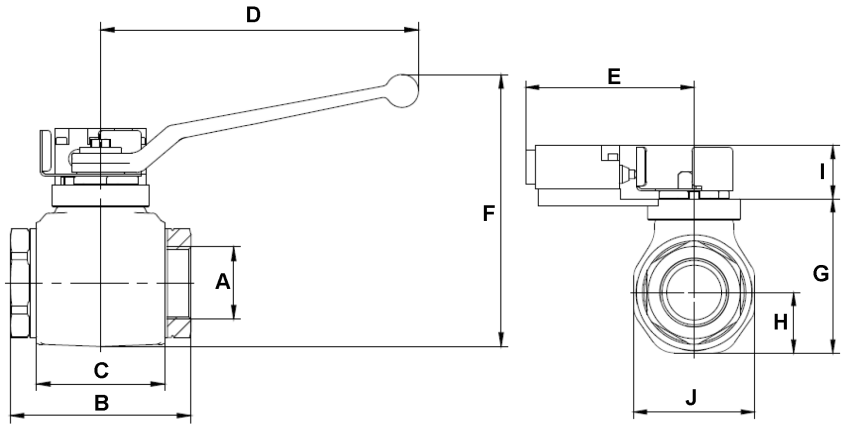


Figure 2-27. 1", and 2" Lockout Valves

Table 2-17. Lockout Valves Dimensions and Part Numbers for 1 1-2" 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 2-18. 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

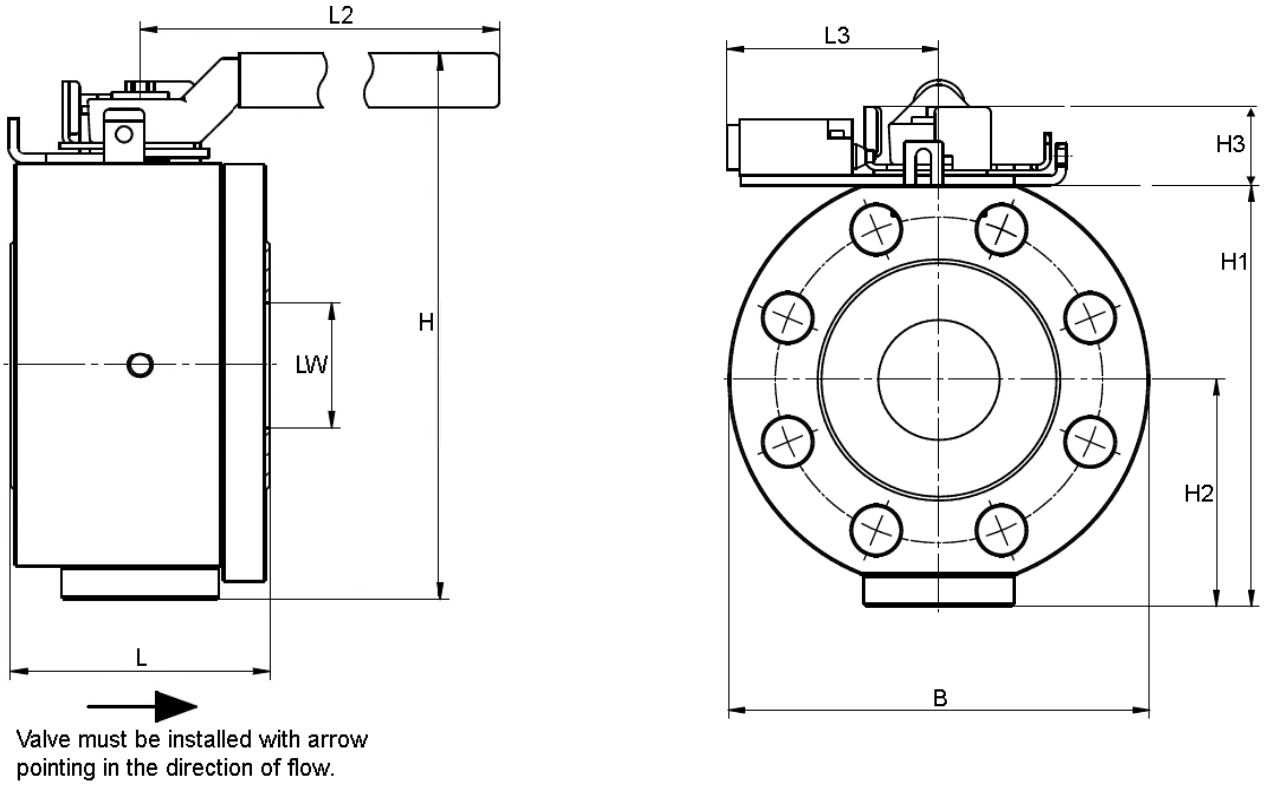


Figure 2-28. 3”, and 4” Lockout Valves

Table 2-19. 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 2-20. 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 2-21. Kidde IGS 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

WARNING **Only listed Kidde IGS nozzles are to be used on Kidde Inert Gas Systems. 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 8-10 and Table 8-12. For the full list of BSP nozzles with corresponding orifice areas, see Table 8-11 and Table 8-13.

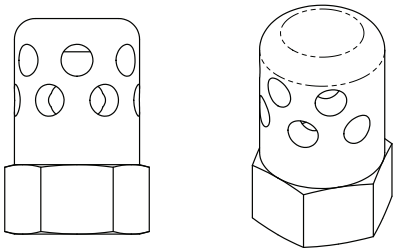


Figure 2-29. 180 Degree Nozzle

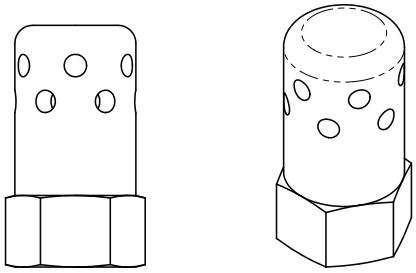


Figure 2-30. 360 Degree Nozzle

Table 2-22. Kidde IGS 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, reference section 1.5.1.4.3

WARNING

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 backplate 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 2-31 and Table 2-23 for more details.

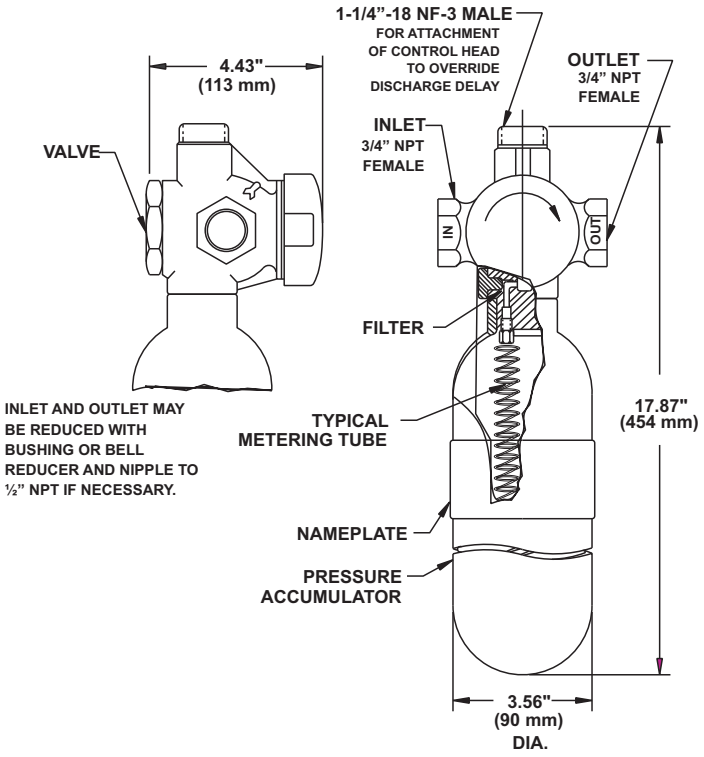


Figure 2-31. Discharge Delays (30/60 sec.)

Table 2-23. Discharge Delays

Part Number	Agent	Nominal Delay Time Approx.	Type of Metering Tube
38-401140-030	Nitrogen	34	Curled
38-401140-060	Nitrogen	61	Curled

2-8.2 Pressure Operated Siren

The pressure operated siren provide a mechanical means to generate an audible alarm. The flow of nitrogen (P/N 90-981574-001) 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.

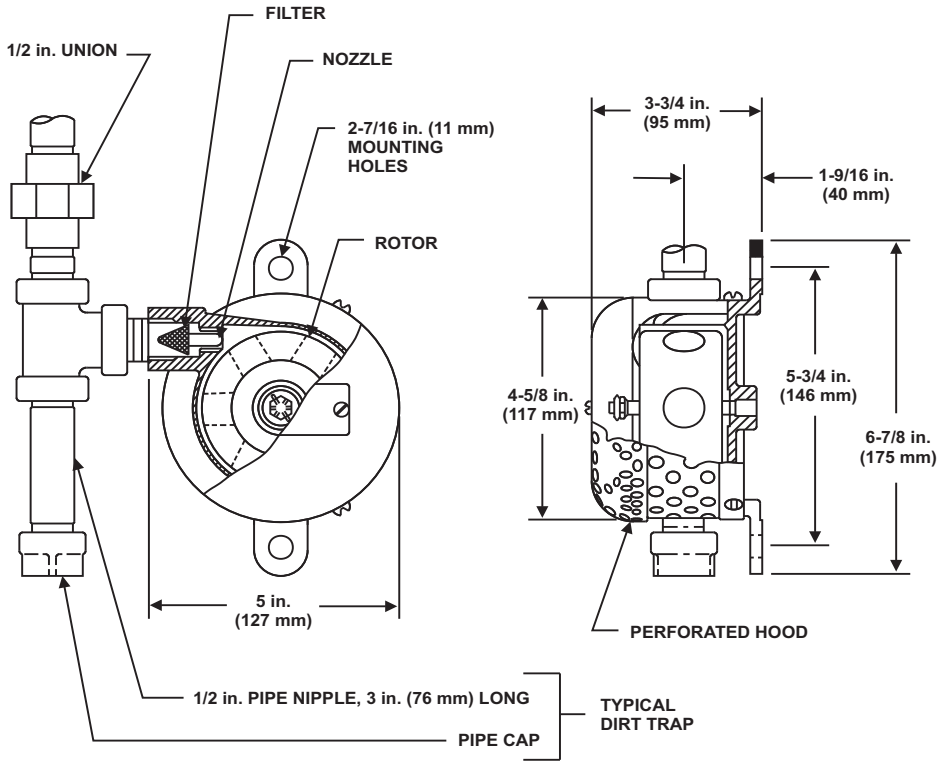


Figure 2-32. Pressure Operated Siren

Nitrogen Pilot Cylinder Part Number	Maximum Number of Sirens per Cylinder
06-129773-001	1
90-101040-200	4

2-8.3 Nitrogen Pilot Cylinders

Two different sized cylinder capacities are provided for use with Kidde 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 @ 70F 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 2-24. Kidde IGS Nitrogen Pilot Cylinder Part Numbers

Part Number	Description
06-129773-001	108 cu. in. (1.77 L) Nitrogen Pilot Cylinder with Supervisory Pressure Switch, Normally Open Under Pressure
90-101040-200	1040 cu. in. (17.0 L) Nitrogen Pilot Cylinder with pressure switch

2-8.3.1 108 cu. in. Nitrogen Pilot Cylinder

The 108 cu. in. N_2 pilot cylinder (P/N WK-877940-000) can be used to operate one N_2 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 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.

2-8.3.1.2 108 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.

2-8.3.1.3 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.

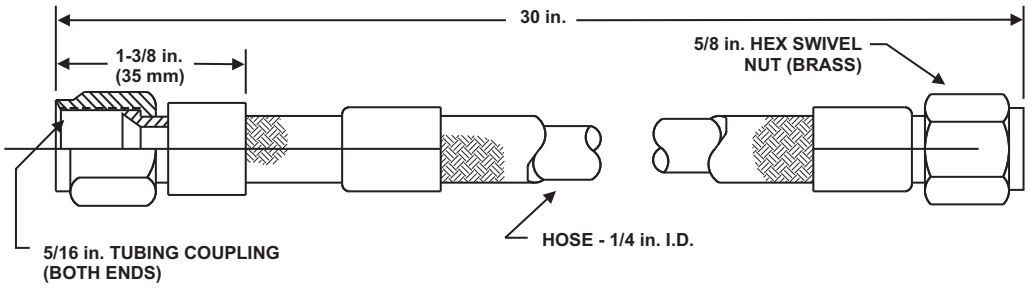


Figure 2-33. 1/4-inch Actuation Hose

2-8.3.2 1040 cu. in. Nitrogen Pilot Cylinder

The 1040 cu. in. N_2 pilot cylinder (P/N 90-101040-000) 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 N_2 discharge hose (P/N WK-251821-000) connects the discharge head to the corresponding siren line or dicharge 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 2-34).

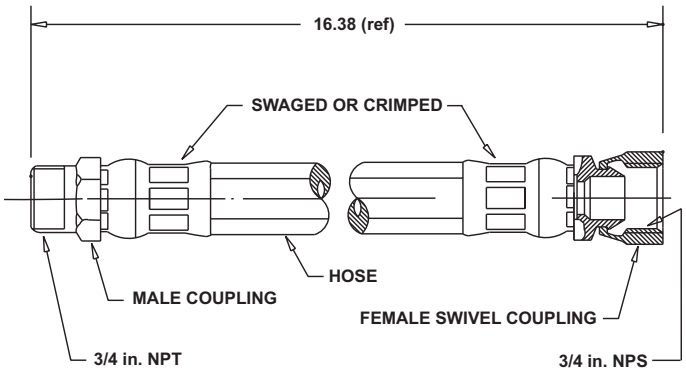


Figure 2-34. Discharge Hose, 3/4 in.

2-8.3.2.3 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.

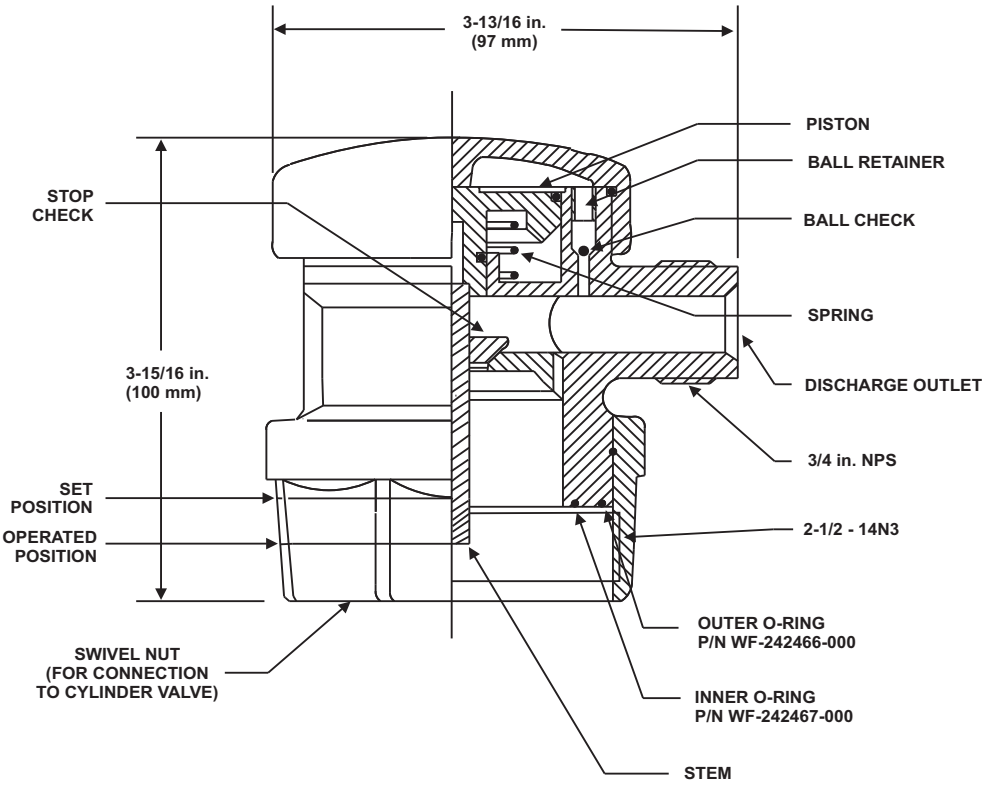


Figure 2-35. Discharge Head, Plain Nut

2-8.4 Electric Control Heads Kit, P/N 85-890181-000

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 2-36 and Table 2-25.

The Electric Control Head kit includes the following items:

Part Number	Description
85-890181-000	Kit, Includes: • Control Head Monitor, P/N 85-100000-100 • Electrical Control Head, 24 VDC, P/N WK-890181-000

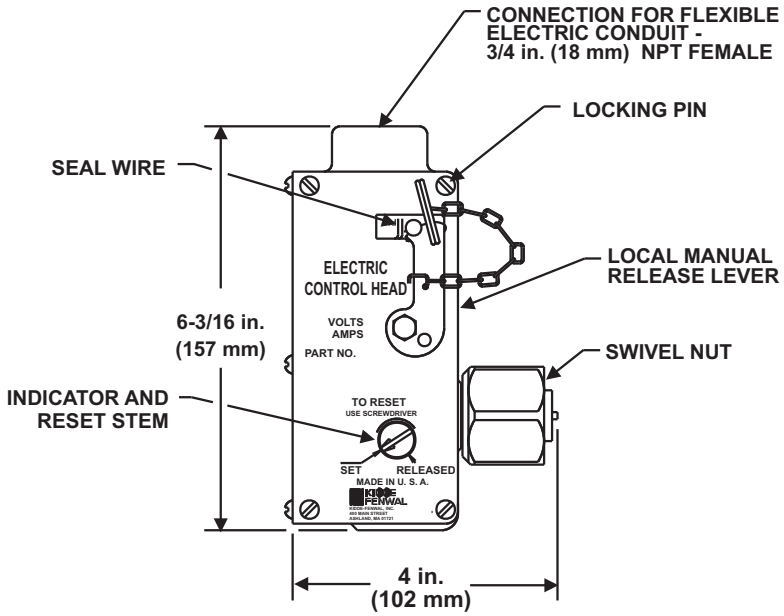


Figure 2-36. Electric Control Head

Table 2-25. Electric Control Head Specifications

Part Number	Nominal Voltage	Current
WK-890181-000	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 2-37).

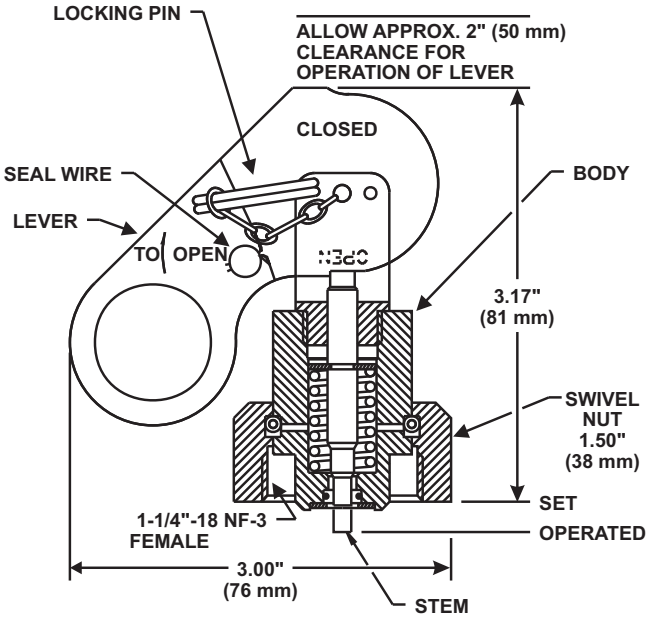


Figure 2-37. Lever Operated Control Head

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

The Lever/Pressure Operated Control head allows manual operation and pressure actuation (see Figure 2-38) 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.

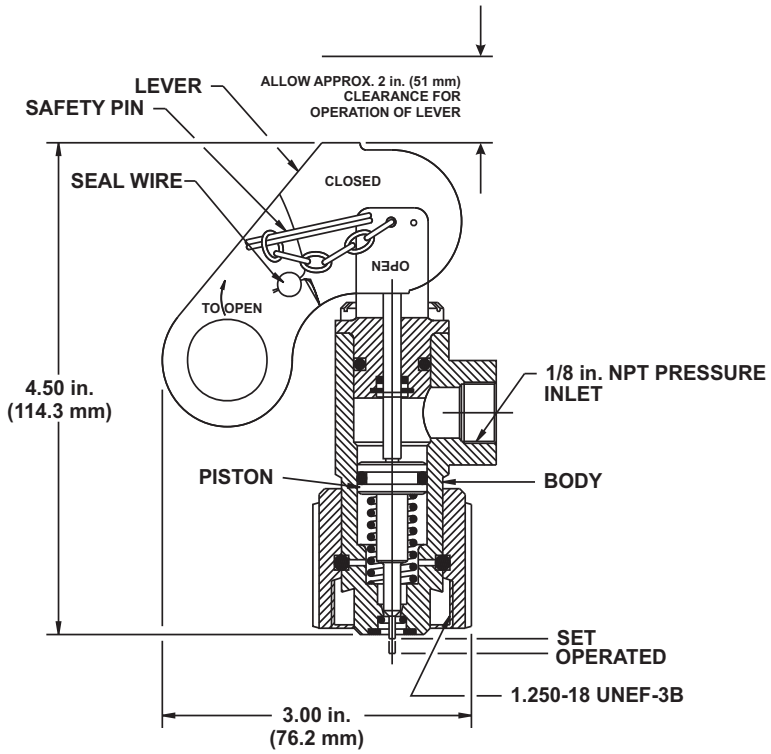


Figure 2-38. Lever/Pressure Operated Control Head

WARNING

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 85-100000-100

The Control Head Monitor with Hazloc assembly provides supervision for control head placement in normal and explosive environments in one easy to install component.

The following specifications apply to the Control Head Monitor:

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

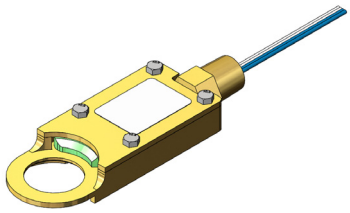


Figure 2-39. Control Head Monitor with Hazloc Assembly

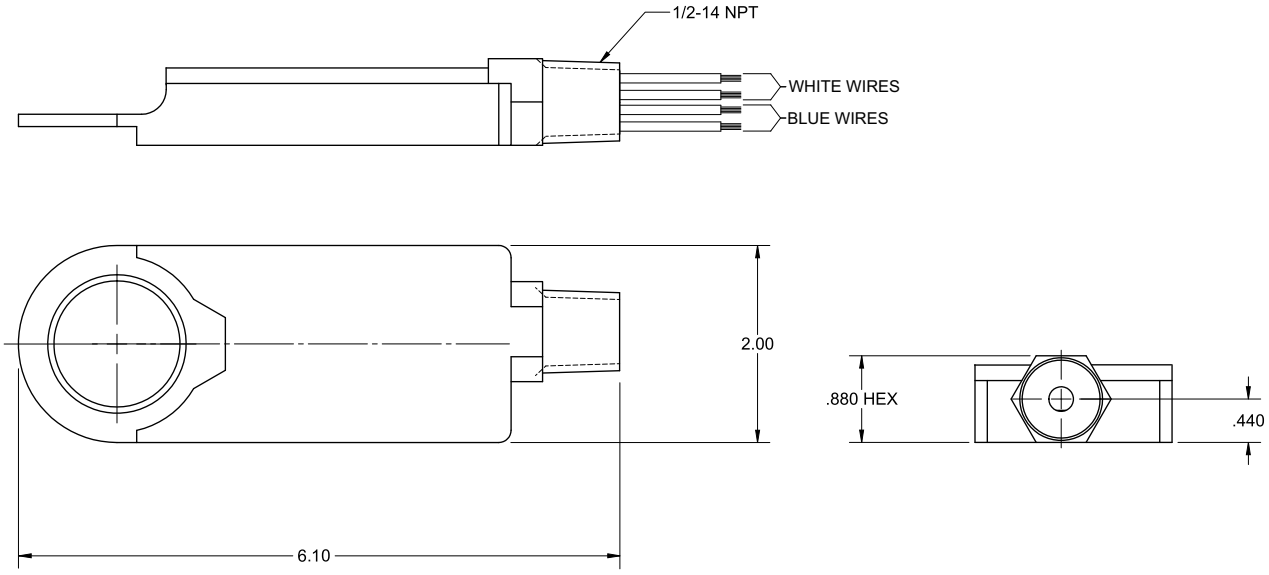


Figure 2-40. Control Head Monitor Dimensions

This component can be placed between the nitrogen pilot cylinder (P/N: 90-101040-000 or WK-877940-000) 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).

WARNING

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 cylinder/valve assemblies. The adapter is attached to the cylinder valve gauge port during cylinder charging.

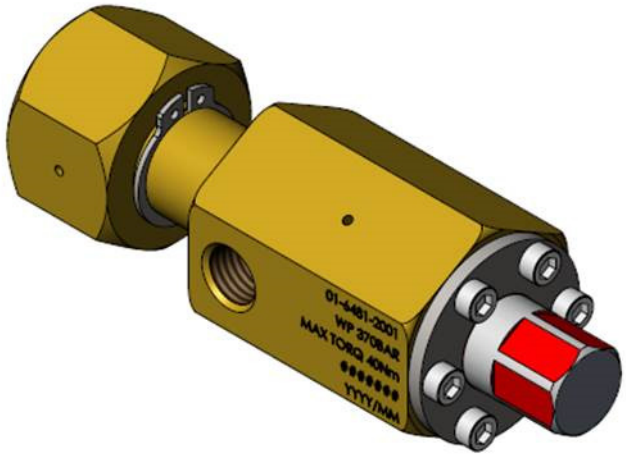


Figure 2-41. Charging Adapter

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

Table 2-26. Kidde IGS Fill Adapter Part Numbers

Part Number	Description
38-406000-001	European Filling Adapter Assembly
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 2-27. Kidde IGS Manifold Equipment Part Numbers

Part Number	Description
38-351000-004	80 Liter 2 Stub 1 Row 2" Manifold BSP, with 2 manifold check valves
38-351000-005	80 Liter 3 Stub 1 Row 2" Manifold BSP, with 3 manifold check valves
38-351000-006	80 Liter 4 Stub1 Row 2" Manifold BSP, with 4 manifold check valves
38-351000-007	80 Liter 5 Stub 1 Row 2" Manifold BSP, with 5 manifold check valves
38-351000-008	80 Liter 6 Stub 1 Row 2" Manifold BSP, with 6 manifold check valves
38-351000-009	80 Liter 4 Stub 2 Row 2" Manifold BSP, with 4 manifold check valves
38-351000-010	80 Liter 6 Stub 2 Row 2" Manifold BSP, with 6 manifold check valves
38-351000-011	80 Liter 8 Stub 2 Row 2" Manifold BSP, with 8 manifold check valves
38-400020-100	2" BSP Manifold Coupling
38-400020-101	2" BSP Manifold End Cap
38-400020-102	3/4" BSP Manifold End Cap For 14mm Check Valve

2-10.1 Manifold Bracket

Use to support the manifold.

Figure 2-42. Manifold Bracket

Table 2-28. Kidde IGS Manifold Bracket Part Numbers

Part Number	Description
01-8160-0200	Bracket for 80L Cylinder manifold 1 Row 200mm (inc 2" Clamp)
01-8160-0520	Bracket for 80L Cylinder Manifold 2 Rows 520 mm (inc 2" Clamp)
01-8160-0830	Bracket for 80L Cylinder Manifold 3 Rows 830 mm (inc 2" Clamp)

2-10.2 Manifold Clamp

Use to clamp the manifold to unistrut channels.

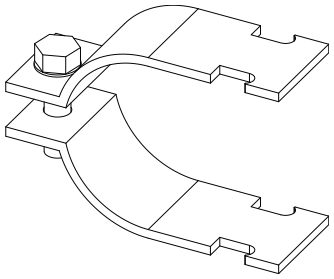


Figure 2-43. Manifold Clamp

Table 2-29. Kidde IGS Manifold Clamp Part Numbers

Part Number	Description
01-8143-0000	2" Pipe Clamp ø58.7 - ø63.5 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 Kidde IGS systems 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, Endcover
- Section 2-11.8, Distance Pipe

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.

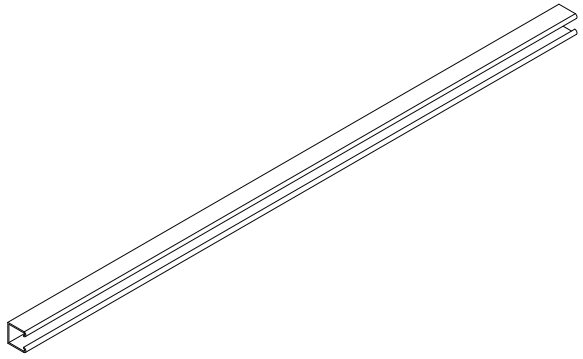


Figure 2-44. Unistrut

Table 2-30. Kidde IGS Unistrut Part Numbers

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

2-11.2 Front Clamping Bar

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

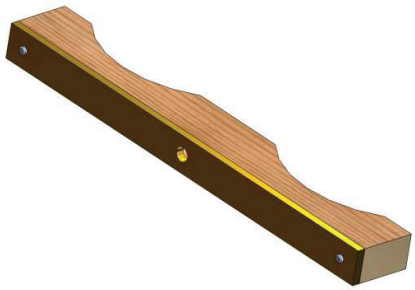


Figure 2-45. 2 Cylinder Front Clamping Bar

Table 2-31. Kidde IGS Front Clamping Bar Part Numbers

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

2-11.3 Rear Wooden Spacer

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

Figure 2-46. 2 Cylinder Rear Wooden Spacer

Table 2-32. Kidde IGS Rear Wooden Spacer Part Numbers

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

2-11.4 Center Wooden Spacer

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

Figure 2-47. 2x2 Cylinder Center Wooden Spacer

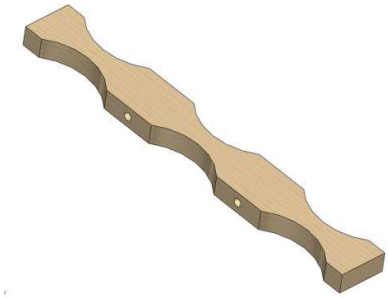


Figure 2-48. 2x3 Cylinder Center Wooden Spacer

Table 2-33. Kidde IGS Center Wooden Spacer Part Numbers

Part Number	Description
03-8164-0000	Wooden Spacer 2 x 2 for 80 L Cyl (Center)
03-8165-0000	Wooden Spacer 2 x 3 for 80 L Cyl (Center)

2-11.5 Single Cylinder Clamping Bracket

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

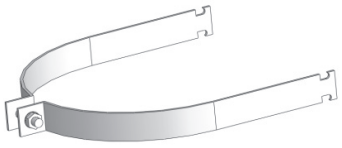


Figure 2-49. Single Cylinder Clamping Bracket

Table 2-34. Kidde IGS Single Cylinder Clamping Bracket Part Numbers

Part Number	Description
01-8131-0000	Single Clamp 80L Cyl 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.

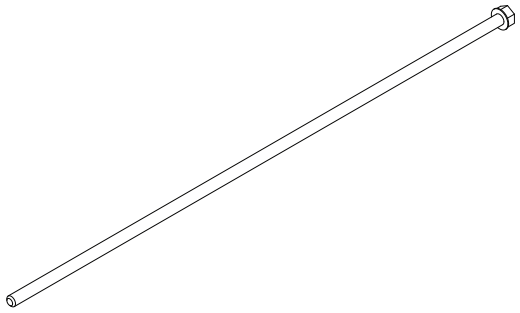


Figure 2-50. Clamping Bolt

Table 2-35. Kidde IGS Clamping Bolt Part Numbers

Part Number	Description
01-8337-0200	Clamping Bolt, 2 Row, 80L - 28.2” (715 mm Long)
01-8337-0300	Clamping Bolt, 3 Row, 80L - 40.6” (1030 mm) Long

2-11.7 Endcover

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

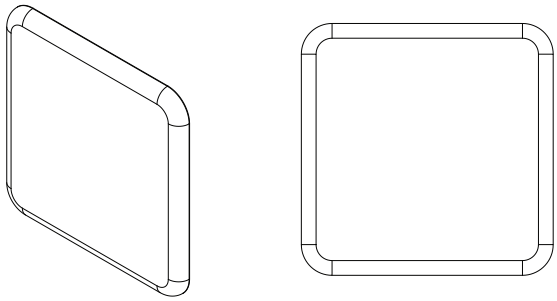


Figure 2-51. End Cover

Table 2-36. Kidde IGS End Cover Part Numbers

Part Number	Description
01-8131-0002	Endcover, White PVC

2-11.8 Distance Pipe

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

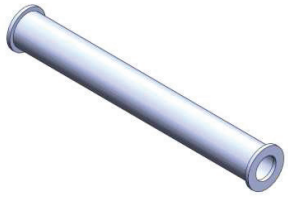


Figure 2-52. Distance Pipe

Table 2-37. Kidde IGS Distance Pipe Part Numbers

Part Number	Description
03-8331-0000	Distance Pipe 3/4" + Washers 80L

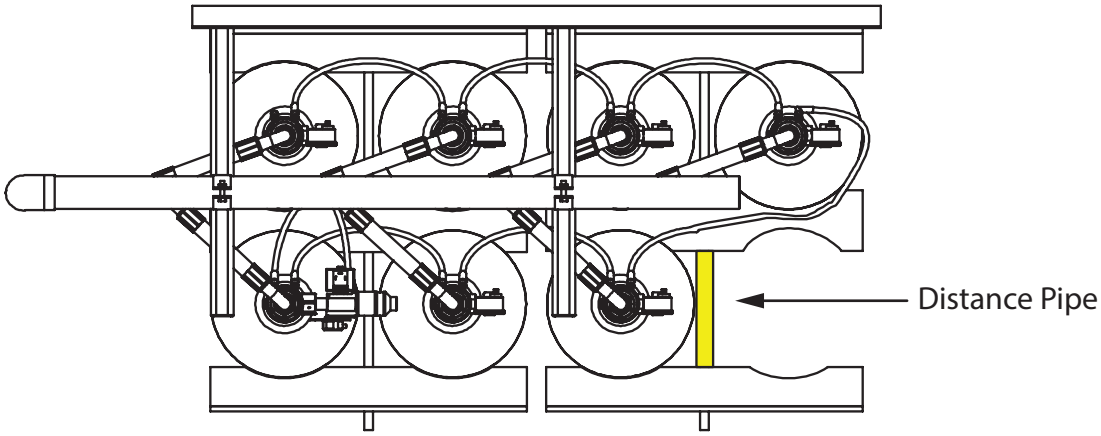


Figure 2-53. Installed Distance Pipe

CHAPTER 3
SYSTEM DESIGN

3-1 INTRODUCTION

The Kidde Fire Systems Inert Gas Engineered Fire Suppression System (Kidde® IGS) using IG-100 or IG-55 (herein refer to collectively as the "Agent") are Approved by Factory Mutual (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 by 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 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 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 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.

3-2 EVALUATION OF RISK/HAZARD

The design and installation of an Kidde IGS 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 Risk 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.

CAUTION

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.

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 considered including:

- Never install cylinders in an atmosphere containing ammonium 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 vents 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 3-11).
- 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 for IG-01 and IG-55

Fuel	IG-100	IG-55
	Minimum design % by volume	Minimum design % by volume
Class B (Heptane)	44.0	47.8
Class A	42.1	42.5
Class C	47.4	47.8

The extinguishing concentration required is independent of the temperature. However, the quantity (in kg/m^3) needed to reach the required concentration is dependent on the temperature. i.e. the quantity (kg/m^3) 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.

WARNING **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 based on a 20 percent safety factor 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-55 TOTAL FLOODING CONCENTRATION FACTOR TABLES

Table 3-2. IG-55 US Customary Units Total Flooding Quantity

Temperature t °F	Specific Vapor Volume S	IG-55 mass required per unit volume of protected space, *m/V* (lb/ft^3)							
		Design Concentration (volume %)							
	ft^3/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)·ln(100/(100-C)), agent mass, lb
FF = m/V=(1/s)·ln(100/(100-C)), mass flooding factor, lb/ft3
C = agent concentration, vol %
V = volume, ft3
*s = a + b*t, specific volume of agent, ft3/lb, where a and b are agent-specific constants*
IG-55: a = 9.8809 ft3/lb
IG-55: b = 0.0215 ft3/lb-°F
t = temperature, °F

Table 3-3. 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/m3)							
		Design Concentration (volume %)							
	m3/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)·ln(100/(100-C)), agent mass, kg
W = m/V=(1/s)·ln(100/(100-C)), mass flooding factor, kg/m3
C = agent concentration, vol %
V = volume, m^3
s = a + b*t, specific volume of agent, m^3/kg, where a and b are agent-specific constants
IG-55: a = 0.6598 kg/m^3
IG-55: b = 0.00242 kg/m^3-°C
t = temperature, °C

3-7 IG-100 TOTAL FLOODING CONCENTRATION FACTOR TABLES

Table 3-4. 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^3)							
		Design Concentration (volume %)							
	ft^3/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)·ln(100/(100-C)), agent mass, lb
FF = m/V=(1/s)·ln(100/(100-C)), mass flooding factor, lb/ft3
C = agent concentration, vol %
V = volume, ft3
*s = a + b*t, specific volume of agent, ft3/lb, where a and b are agent-specific constants*
IG-100: a = 11.976 ft3/lb
IG-100: b = 0.02606 ft3/lb-°F
t = temperature, °F

Table 3-5. 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)·ln(100/(100-C)), agent mass, kg
W = m/V=(1/s)·ln(100/(100-C)), mass flooding factor, kg/m3
C = agent concentration, vol %
V = volume, m^3
s = a + b*t, specific volume of agent, m^3/kg, where a and b are agent-specific constants
IG-100: a = 0.7997 kg/m^3
IG-100: b = 0.00293 kg/m^3-°C
t = temperature, °C

3-8 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, reigniting 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 3-8.8).

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

3-8.1 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 3-6. 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)**	
kV	**To the nearest unscreened 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′ (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		

3-8.2 Hold Time

Design concentration shall not only be achieved within the prescribed discharge time, but also that the extinguishing concentration shall be maintained for the specified period of time to allow effective emergency action by trained personnel. This is equally important in all classes of fires (A, B, & C) since a persistent ignition source (e.g. an arc, heat source, oxyacetylene torch, 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 authorities having jurisdiction or comply with ISO 14520/BS EN 15004 latest or NFPA 2001, 2015 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.

3-8.3 Temperature Considerations

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

3-8.4 Flow Calculation

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

3-8.4.1 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.
- Total quantity of Extinguishant allowed
- Cylinder size (80 liter)
- Number of cylinders.
- 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 building parts can withstand (normally 5 mbar maximum).

3-8.4.2 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. Standard nozzle size up to and including 1½" are stock items, see Section 8-9.

- 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 3-15.4.

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.

3-8.5 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.

3-8.6 Calculation of the Quantity of Extinguishant

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

3-8.7 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.)

3-8.8 Atmospheric Correction Factors

The ambient pressure is affected by changes in altitude, therefore the extinguishant quantity shall be multiplied, where applicable, by the correction factor (at the associated altitude) as listed in Table 3-7.

Table 3-7. 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

3-9 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 3-8. Kidde IGS IG-100

Cylinder Volume (liters)	Nominal Filling 200 bar	Nominal Filling 300 bar
80	39.33 lb 17.84 kg	54.3 lb 24.63 kg

Table 3-9. Kidde IGS IG-55

Cylinder Volume (liters)	Nominal Filling 200 bar	Nominal Filling 300 bar
80	50.33 lb 22.83 kg	70.79 lb 32.11 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.

3-10 CYLINDER BANK INSTALLATION

3-10.1 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, it is vital to check that the floor is capable of supporting the total load.

3-10.2 Typical Foot Print

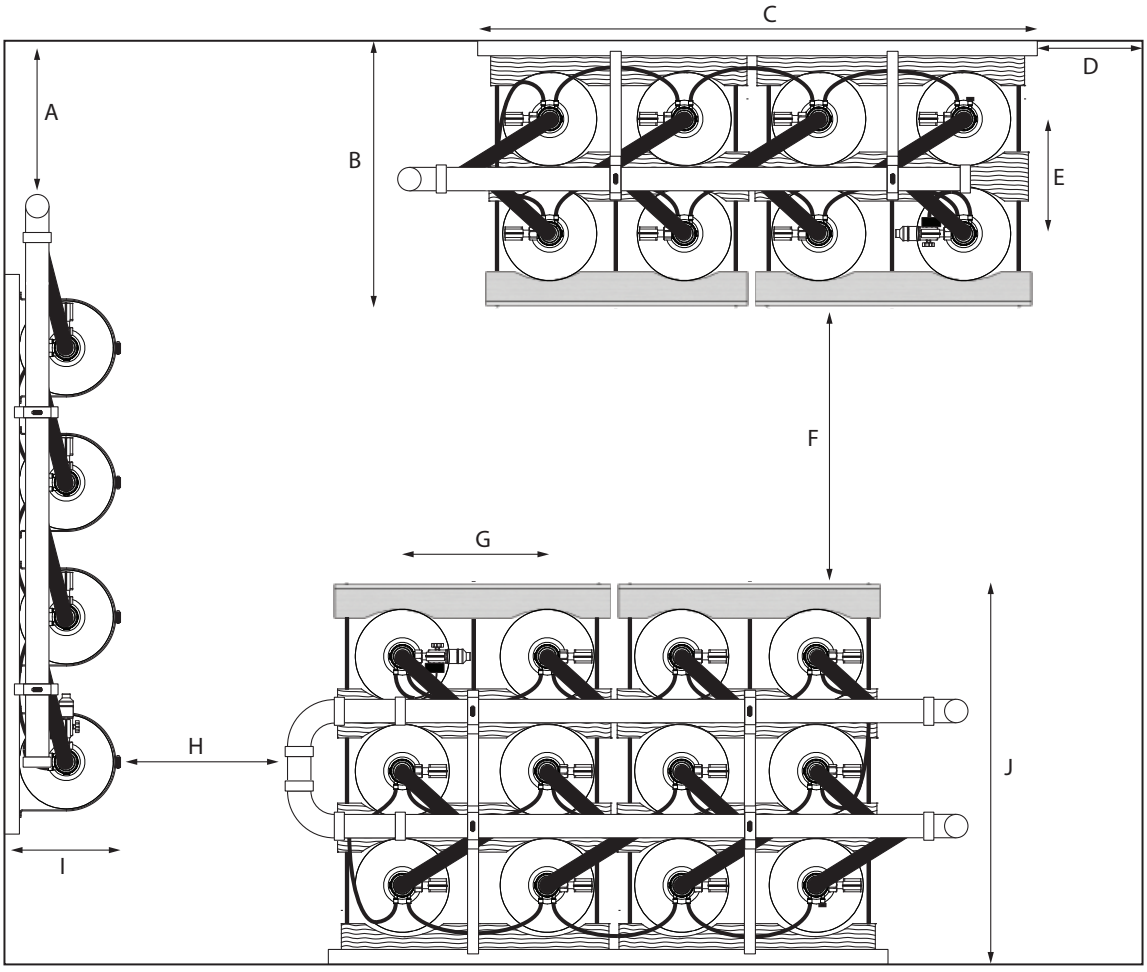


Figure 3-2. Typical Footprint of a Kidde IGS

Cylinder Size	Dimensions (inches)									
	A	B	C	D	E	F	G	H	I	J
80 L	MIN 9.5	29.1	([NO Cyl -1] x 12.0) + 11.8	MIN 9.8	12.2	MIN 31.5	12.0	MIN 31.5	13.4	41.3

3-11 TYPICAL FLOOR LOAD

Use these table to calculate the floor load of the cylinder bank.

Table 3-10. Approximate Weight per Foot of 80.0 Liter Cylinders

Number of Rows	IG-100		IG-55	
	Weight (lb)		Weight (lb)	
	200 bar	300 bar	200 bar	300 bar
Single row	244	257	254	272
Double row	487	515	508	545
Triple row	731	772	762	817

3-12 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.

3-13 AGENT CYLINDER RELEASE CONSTRAINTS

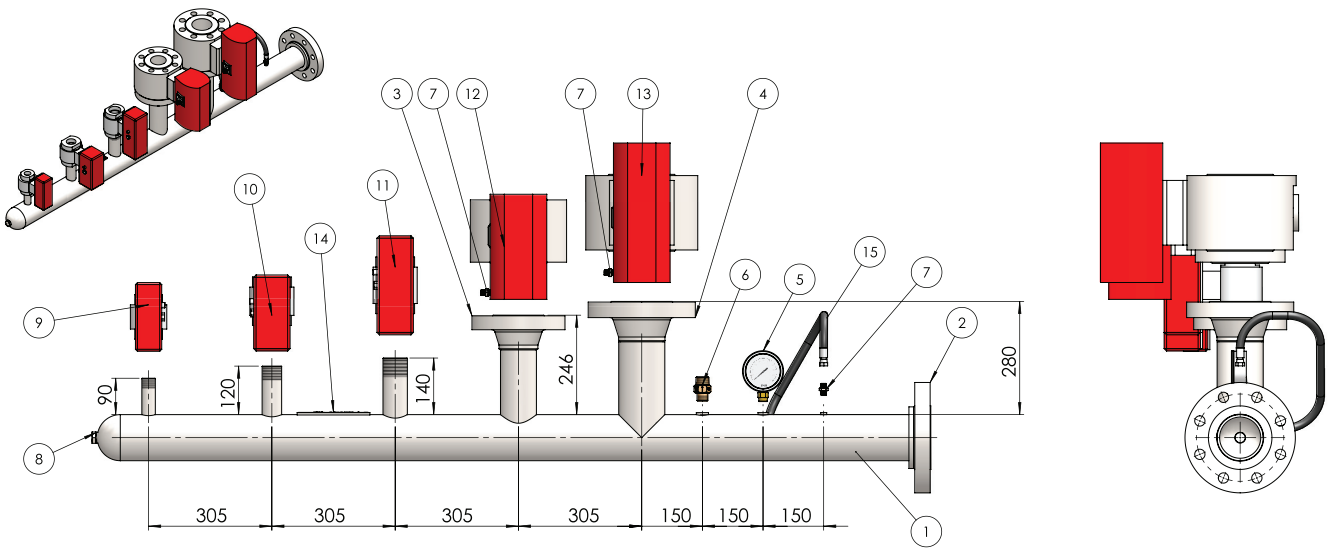
Each valve shall be actuated no more than 50 times. (The valve has been tested for 100 actuations at 300 bar at the BAM institute and 500 actuations (300 bar) at FM without comment.

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.

3-14 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.



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	-	M400 Divertor Valve Pipework	1
2	-	4" ANSI B16.5 Class 600 Slip-On Flange	1
3	-	DIN 2638 WELD FLANGE DN80 PN160	1
4	-	DIN 2638 WELD FLANGE DN100 PN160	1
5	01-7221-0300	GAUGE CONTACT 1/2" NPT 400BAR (46368884)	1
6	38-400002-002	MANIFOLD CHECK VALVE 3/4" BSP	1
7	15-8662-0041	NIPPLE MA/MA 1/4" BSP - 1/4" BSPT	3
8	15-9602-0001	3/4" NPT HEX PLUG 6000LB BS3799 316L ST.ST.	1
9	22-37140-025	DIVERTOR VALVE DN 25 (1" BSPP)	1
10	22-37140-040	DIVERTOR VALVE DN 40 (1.5" BSPP)	1
11	22-37140-050	DIVERTOR VALVE DN 50 (2" BSPP)	1
12	22-37140-080	DIVERTOR VALVE DN 80 (3" FLANGE)	1
13	22-37140-100	DIVERTOR VALVE DN 100 (4" FLANGE)	1
14	03-2112-0200	SIGN - MANIFOLD PRESSURE TEST	1
15	01-3273-1200	PILOT HOSE 1/4" x 700mm x 90	1

Figure 3-3. Typical Distribution Manifold Design

3-14.1 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.

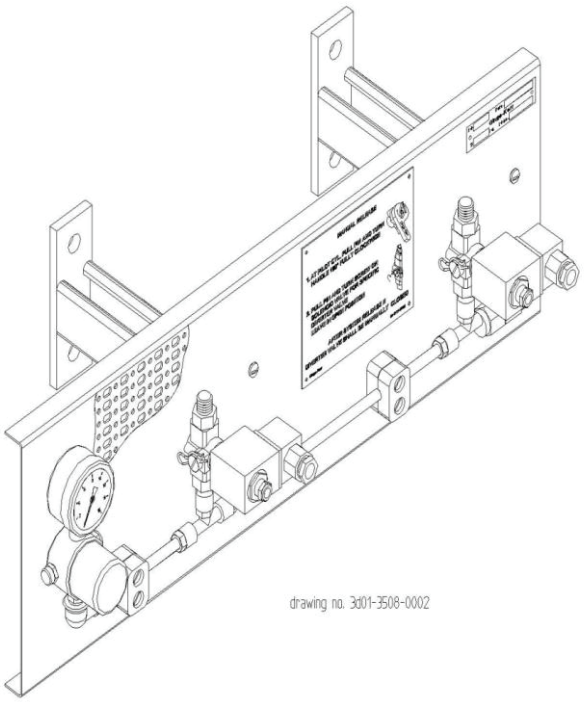


Figure 3-4. Back-Plate Manifold Arrangement

3-15 SELECTING NUMBER OF NOZZLES

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 ½”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.

A range of nozzles, ½” to 1 ½”, with orifices from 3mm to 26mm can be provided. Nozzles have a 180° or 360° discharge pattern. Nozzles can be installed pendant or upright.

3-15.1 Nozzle Coverage

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

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

3-15.2 Nozzle Selection and Placement

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

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

3-15.2.1 Nozzle Placement

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

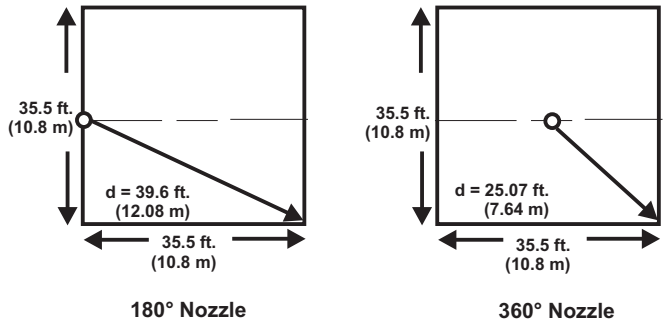


Figure 3-5. Nozzle Placement and Coverage

- **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.

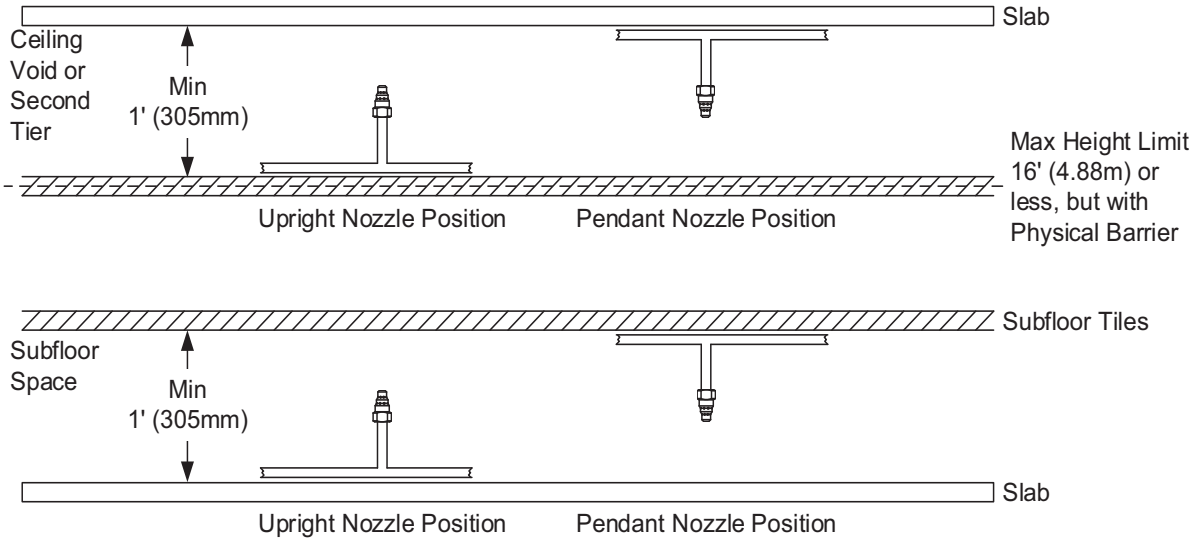


Figure 3-6. Nozzle Orientation

- **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 16.4 feet (5 m), but no greater than 32 ft (9.8 m).
- **Minimum Ceiling Height**-The minimum ceiling height is 1 ft or 12 in (0.3 m).
- **180° Nozzles**-180° nozzles must be located 6 +/- 2 inches (0.15 +/- 0.05 m) 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 nozzle pressure must be a minimum of 12.9 bar (188 psig) for the nozzle to effectively distribute the Agent and mix the Agent into the air of the enclosure being protected.
- **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.

3-15.3 Tee Split Limitations

The following table outlines the tee split limitations:

Table 3-11. 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

3-15.4 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 IGS Flow Calculation software for the final design.

Table 3-12. Pipe Size Estimating Table

Nominal PipeSize (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

3-15.5 Temperature Limitations

3-15.5.1 Operating/Storage Temperature Range

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

3-15.5.2 Storage Temperature

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

3-15.6 Cylinder Actuation Limitations

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

Table 3-13. Maximum Number of Cylinders that can Be Actuated per Actuation Device

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

3-15.7 Pressure Actuation Limitations

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

Table 3-14. Nitrogen Pilot Cylinder Actuation Cylinder, Driver and Ancillary Limits

Detail	108 cu. in.	1040 cu. in.
Pilot/Driver Cylinder Part Number	WK-877940-000	90-101040-000
Pilot Cylinder Capability	Yes	No
Siren Driver Capability	Yes	Yes
Number of 80L Agent Cylinders	44	N/A
Number of Siren Drivers	2	3
Length of Actuation Pipe to First Agent Cylinder	75	75
Length of Actuation Pipe to Siren Driver(s)	20	90
Siren Driver: Number of Sirens	1	4
Siren Driver: Length of Siren Piping	90	500
Time Delay in seconds	34/61	35/68

3-15.7.1 Pressure Trip Limitations

The maximum load to be attached to pressure trip (P/N 81-874290-000) is 100 lb (45.3 kg, based on a minimum pressure of 75 psig [5.17 bar gauge] at the pressure trip).

3-15.7.2 Pressure Operated Sirens

Pressure Operated Sirens (N_2 operated) are used to provide an audible alarm prior to the start of and during discharge. The siren must be located upstream of the 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_2 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 3-15 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 3-15. 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.

CHAPTER 4
INSTALLATION

4-1 GENERAL EQUIPMENT INSTALLATION

This section contains installation instructions for Kidde Fire Systems Inert Gas Engineered Fire Suppression System (Kidde® IGS) using IG-100 or IG-55 (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. Installation must conform to applicable engineering best practices.

CAUTION

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.

CAUTION

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

- Safety 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 Kidde IGS 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 slave 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 the detection and control systems (not supplied by Kidde Fire 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
- Slave cylinder pressure gauge with switch
- Discharge hoses
- Actuation hoses with quick-connect fittings
- Discharge nozzles

The solenoid actuator valve and the contact gauges for slave cylinders (on one loop) 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 slave cylinders are joined together using "quick connect" cable joints, the lead from the master 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 shut 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 the fire alarm & control panel, initiated by detectors installed in the protected area.
- 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 Master cylinder valve's release unit. For multiple area systems, open the appropriate 2-way solenoid valve on the backplate manifold manually before operating the release unit. For more information, see Chapter 5.

4-4.1 System Overview

The cylinders, stored in the 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 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 master 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 "master" cylinder will include a solenoid valve release unit. The pressure from the "master" cylinder is channeled to valves on the slave cylinders, releasing their content. During a discharge, the cylinders in the cylinder bank will be released almost simultaneously.

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

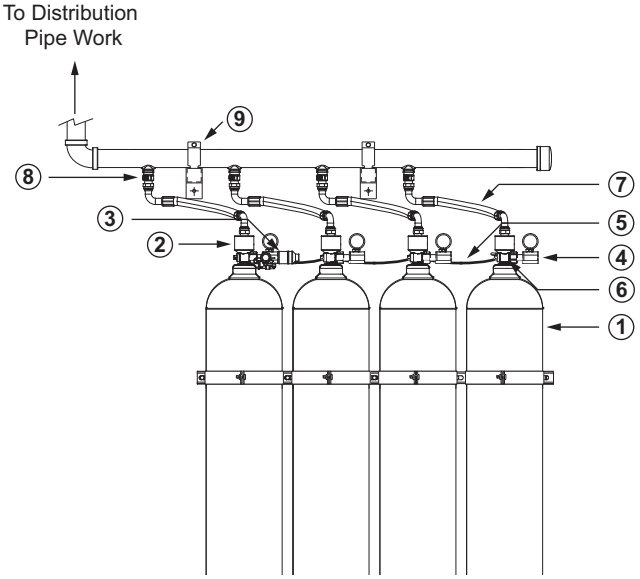


Figure 4-1. Single Area Cylinder Bank Arrangement

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	Slave 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-X10
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. Only one hazard can be protected at a time. Therefore, it is recommended that a reserve bank of cylinders is maintained such 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 "master" cylinder in the bank. By only energizing certain "master" 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 propellant pressure from the discharge manifold. The propellant 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 master cylinders in the bank and the associated low-pressure solenoid valve on the backplate 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.

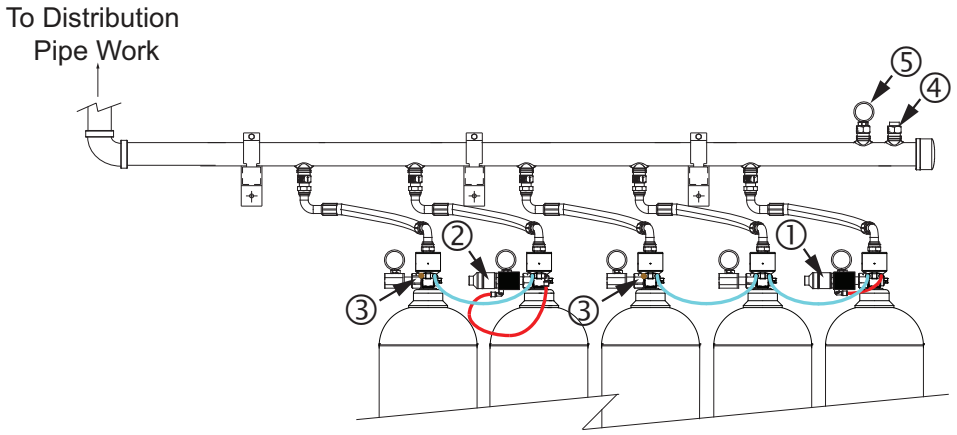


Figure 4-2. Typical Pilot Line on Selector Valve System (Rear View)

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 backplate manifold. Not all release units are shown in the image.

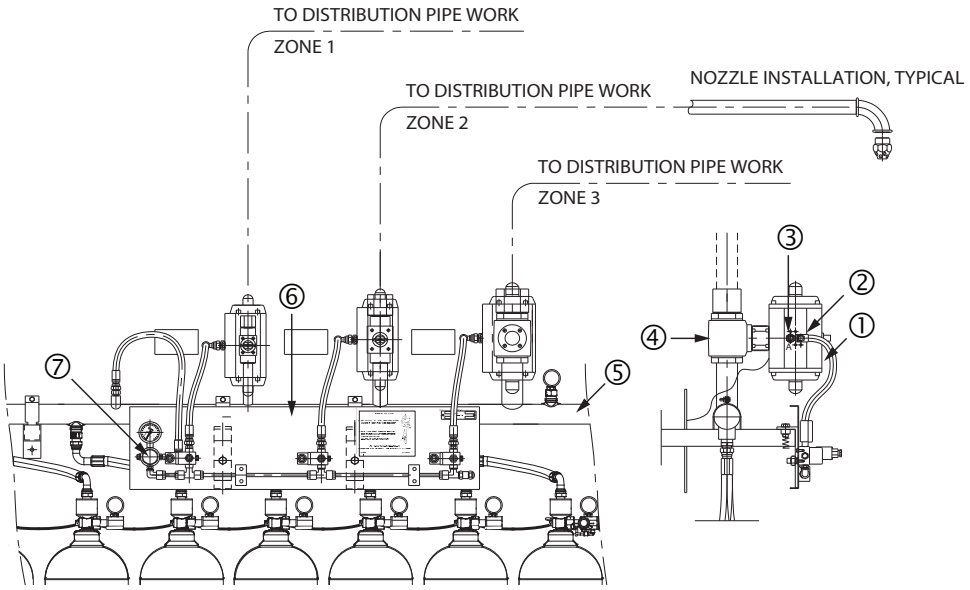


Figure 4-3. Typical Detailed Cylinder Bank Selector Valve System

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.

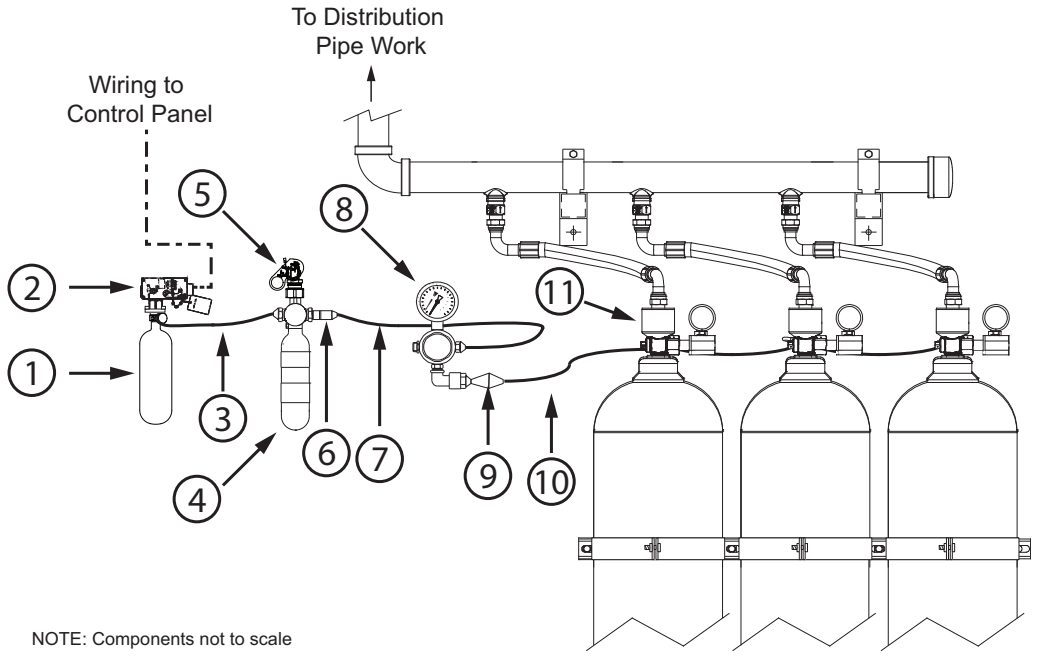


Figure 4-4. System with Discharge Delay

Table 4-4. Discharge Delay System Components

Number	Description	Part Number
1	104 cu. in. Nitrogen Pilot Cylinder	06-129773-001
2	Electric Control Head Kit with Control Head Monitor	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 Festo Adapter	Included in Nitrogen Discharge Delay Kit
10	Pilot Line Actuation Hose	38-401110-X00 or 38-401130-X00
11	1st Cylinder with Slave 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 fixing 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

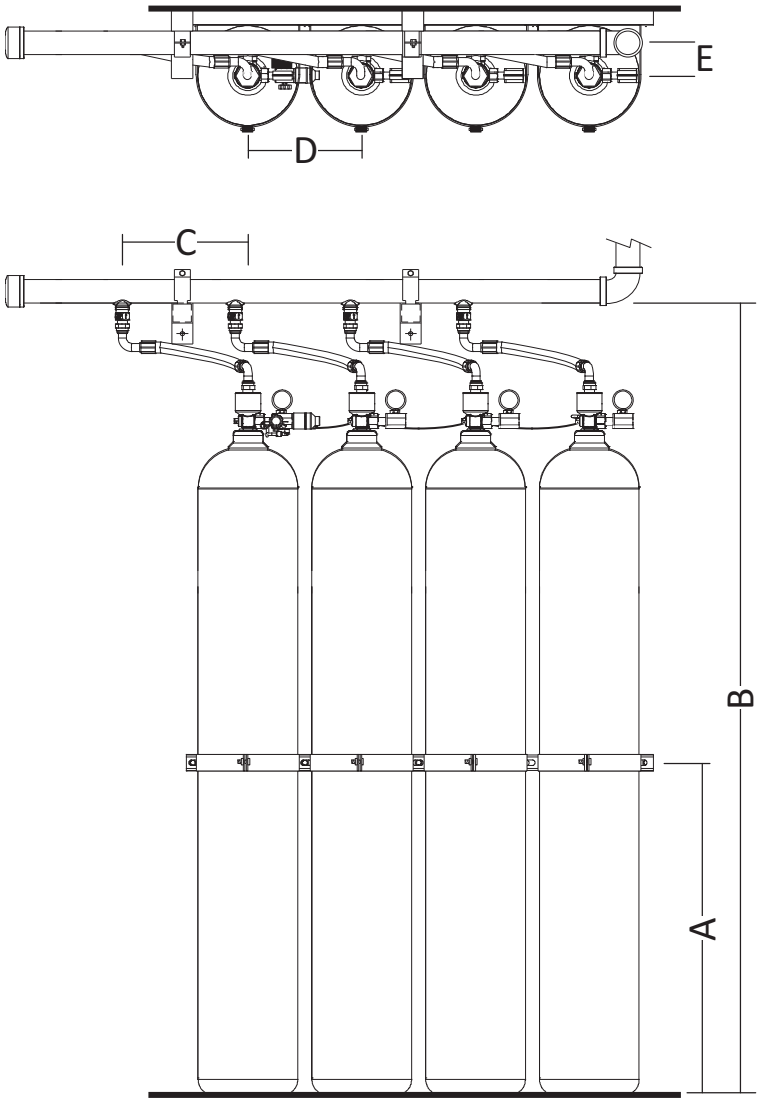
Number of Rows	IG-100		IG-55	
	Weight (lb)		Weight (lb)	
	200 bar	300 bar	200 bar	300 bar
Single row	244	257	254	272
Double row	487	515	508	545
Triple row	731	772	762	817

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

4-5.2 Racking Install Diagrams

Use the following diagrams when planning out the install.

4-5.2.1 Clamp Racking Layouts



Note:

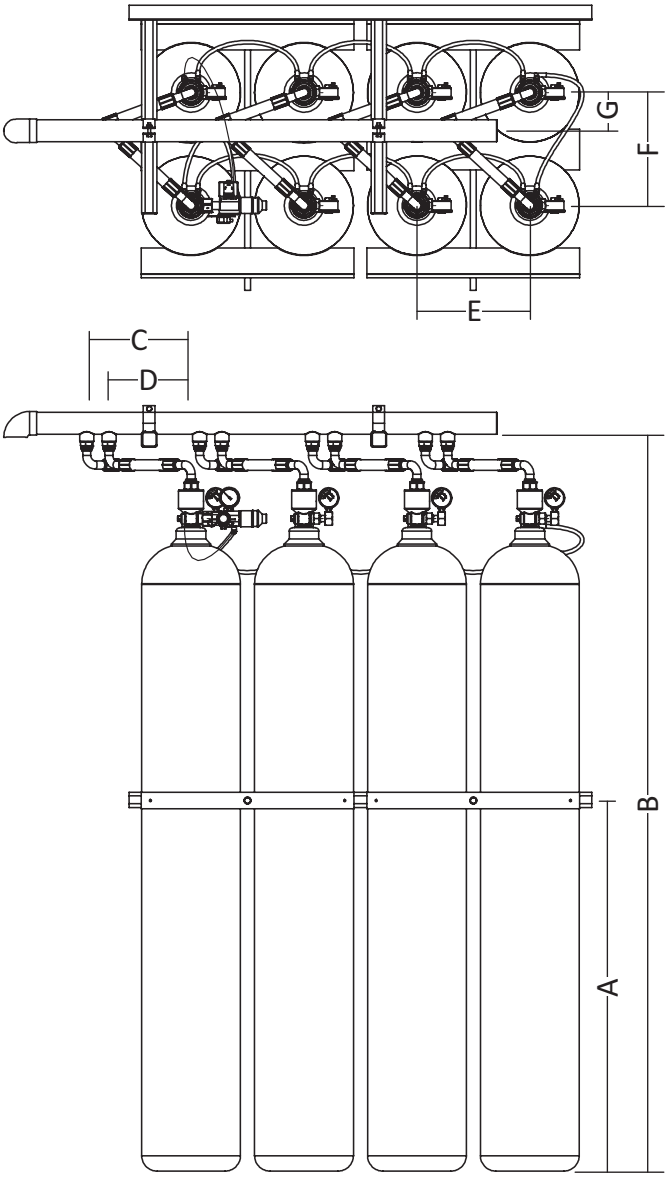
- Manifolds can be offset Front or rear of cylinder centre
- Manifolds can be offset to the left (as illustrated) or to the right of the cylinders.

Figure 4-5. Single Row Racking System with Clamps

Table 4-6. 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)	Centre 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)

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 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 Rear Cylinder to Manifold Check Valve	Center Front Cylinder to Manifold Check Valve	Cylinder Centers (Side to Side)	Cylinder Centers (Front to Back)	Centre 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)

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) to ensure the lone cylinder is held properly in the wooden bracket. The distance pipe is a sheath that goes over the clamping bolt.

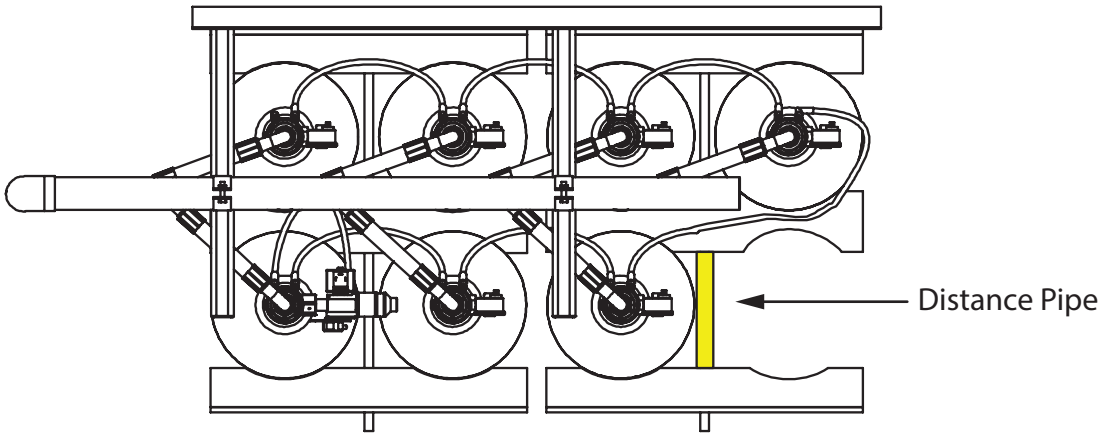


Figure 4-7. Installed Distance Pipe

4-5.2.4 Cylinder and Valve Installation Diagrams

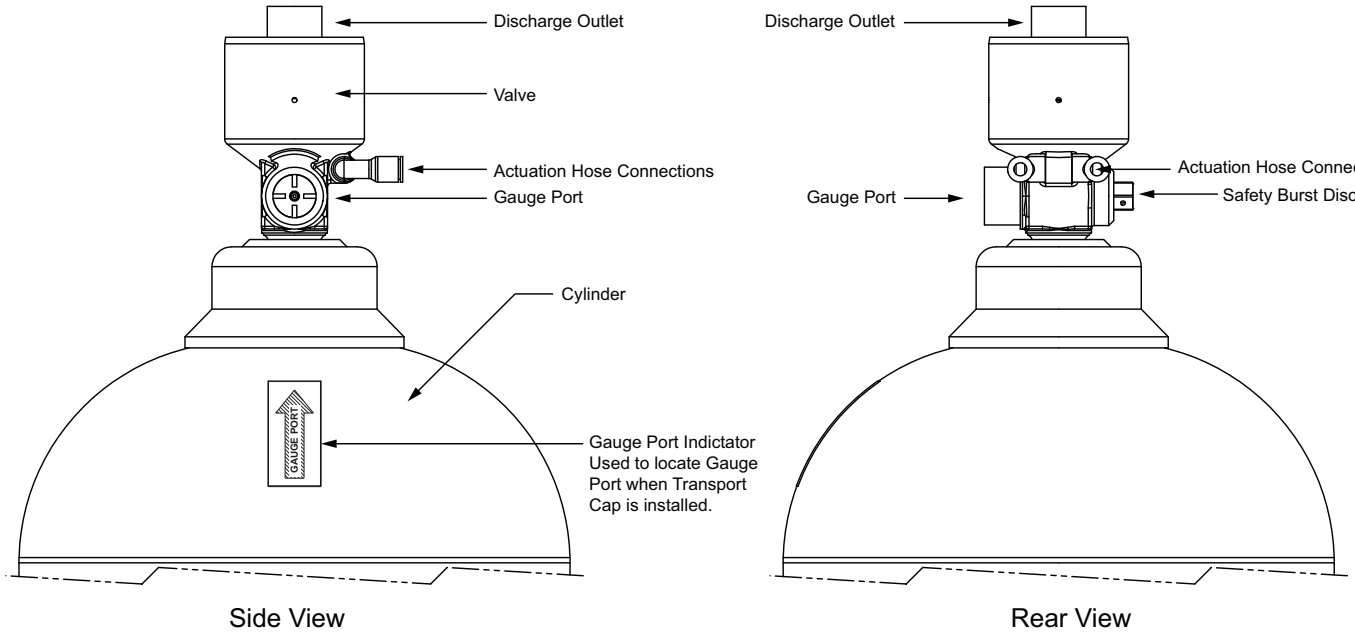


Figure 4-8. Cylinder Components

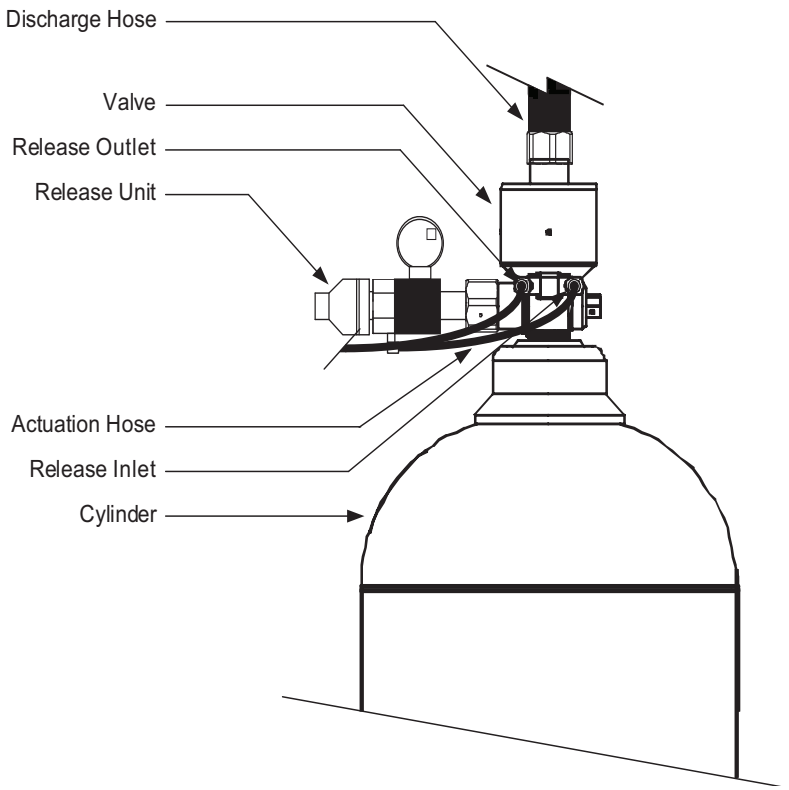


Figure 4-9. Typical Primary Cylinder/Valve Assembly (Rear View)

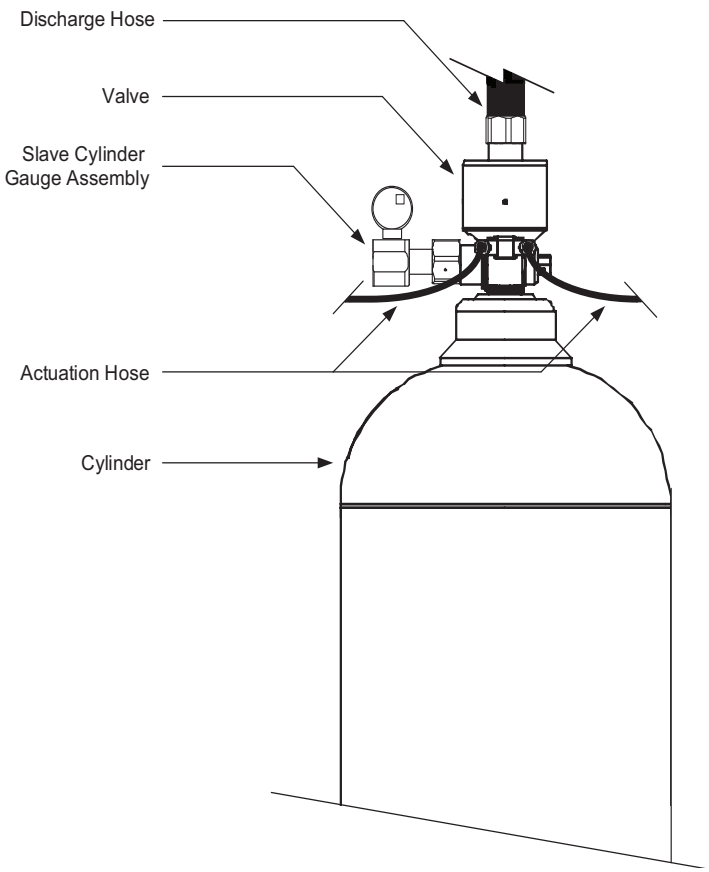


Figure 4-10. Typical Slave Cylinder/Valve Assembly (Rear View)

4-6 CYLINDER BANK ASSEMBLY

4-6.1 Securing 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 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 4-11 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.

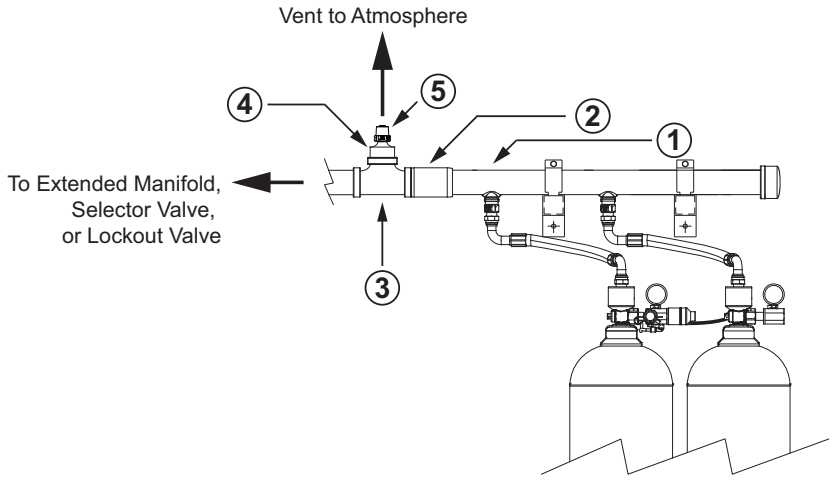


Figure 4-11. Manifold Safety Device Installation Example

Table 4-8. 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 01-8131-0000 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: When bolt and nuts in AISI316 are used, 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 wooden spacer on the clamping bolts (double row only).
7. Place cylinder into position.

WARNING

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.

8. 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.

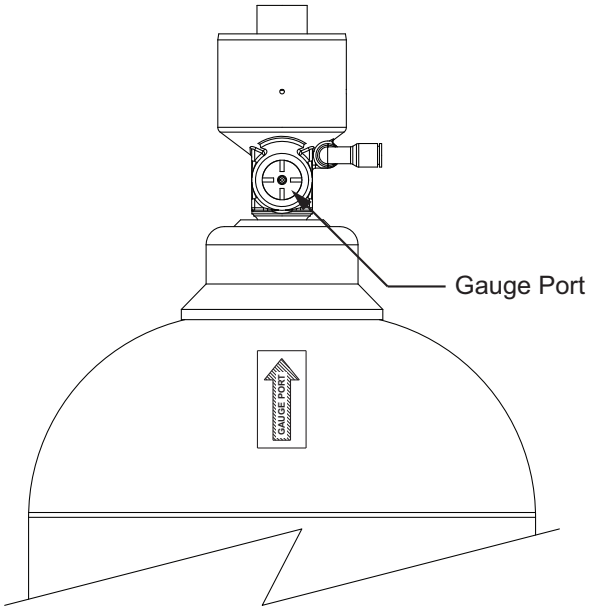


Figure 4-12. Cylinder Valve Gauge Port

Follow this procedure to install the cylinders after they have been secured in their brackets:

1. Remove the transport cap from the cylinder. Store the cap in a convenient place for future use.
2. Ensure that the gauge port is pointing to the right.
3. Remove the anti-recoil cap from the valve's discharge outlet.
4. Leak test the outlet port of the cylinder valve by means of ammonium-free leak detection liquid. If visible leakage occurs, replace the cylinder.
5. Connect the discharge hose to the discharge outlet on top of the cylinder valve. Do not tighten the swivels on hose at this stage.
6. Leak test gauge port of the cylinder valve by means of ammonium free leak detection liquid or spray, ensuring that there is no leakage.
7. Install the "quick connect" pilot hoses linking each cylinder. Use the longer hoses to link rows to each other.
8. Install the Pilot Line Bleed Valve to the pilot line on the last cylinder.
9. Tighten the nuts on the clamping bolts, securing the cylinders. Use 1" & 3/4" or equivalent fixed spanners and torque to 29.5-33.2 ft lb (40 – 45 N-m).

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

10. Install a protecting nut on the free thread end, tightening slightly.
11. 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).

WARNING **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

WARNING

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).

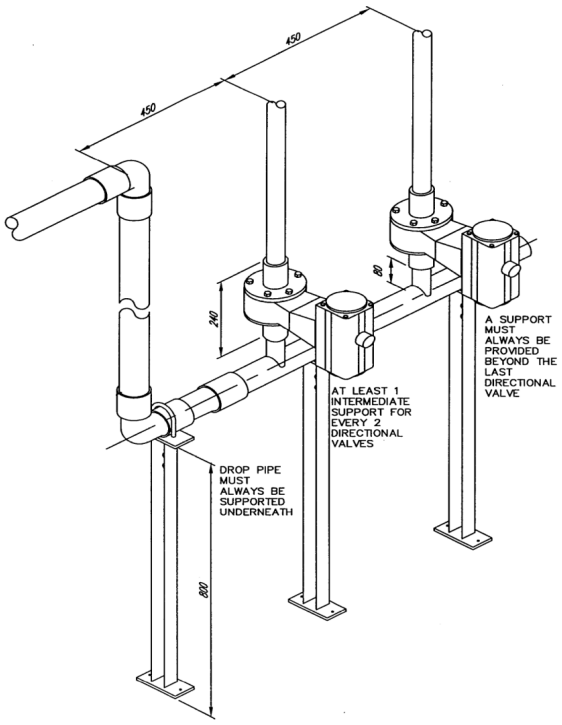


Figure 4-13. Selector Valve Installation

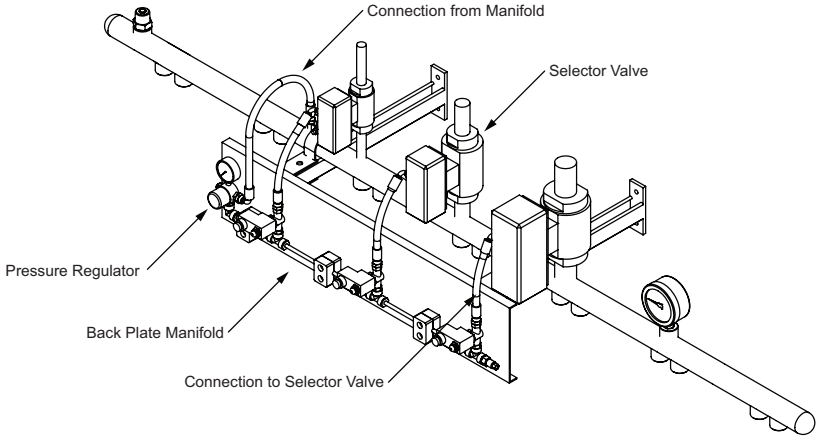


Figure 4-14. Back Plate Manifold Installation

4-6.7 Installing Release Units

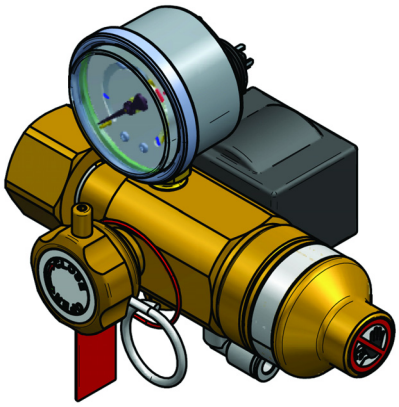


Figure 4-15. Release Unit

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

Table 4-9. Actuation Hose Usage

Connection Type	Actuation Hose Used
80 Liter Cylinders	
Release Unit to Cylinder Valve	38-401110-400
Interconnecting Valves in the same row (inline valve to valve)	38-401110-500
Interconnecting Valves in different rows (inbetween cylinder rows)	38-401130-600

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

Note: As the release unit seals against the cylinder valve with an O-ring, ensure the inlet port is free from dirt or other impurities and properly lubricated. Always use clean hands and tools.

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).

CAUTION

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.

CAUTION

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.

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 ± 0.75 ft lb (60 ± 1 N-m) on the unit. A counter hold may be required during tightening.
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

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.

CAUTION

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 festo connector and the release unit quick connect.

Figure 4-16. 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 outlet of each valve to the inlet of the next valve. Make sure to push the actuation hose in fully.

CAUTION

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 festo connector and the release unit quick connect.

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: If installing a multi-row cylinder bank, when first row has been installed then connect up the cables between each pressure gauge low pressure monitoring contacts 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.

WARNING

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 from service, handling, storage, or during shipment. Failure to follow these instructions could result in serious bodily injury, death, or property damage.

4-6.7.1 Aligning the Release Unit after Pressurization

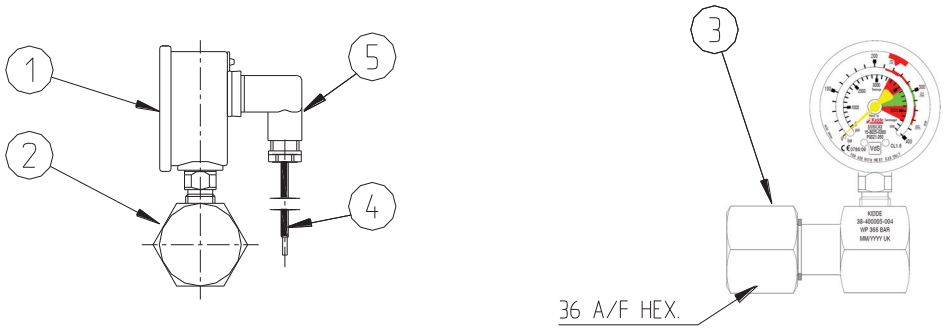
The construction of the release units allows for alignment/adjustment by hand until the swivel is tightened. After the swivel is tightened, do not attempt further alignment or adjustment.

4-6.8 Installing Slave Cylinder Gauge Assembly

Follow these steps to install the slave cylinder gauge assembly:

1. Make sure the O-ring in the connecting swivel of the slave cylinder gauge assembly is in place and properly lubricated. If lubrication is missing, use silicone spray (Würth Art no: 0893221 or similar).
2. Installing slave cylinder gauge assemblies as indicated on the bank assembly drawing. Apply a torque of 33.2 ± 0.75 ft lbf (45 ± 1N-m). A counter hold may be required.
3. Leak test all connections on the slave 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.



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 4-17. Contacts for Pressure Gauge

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 slave 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.

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.

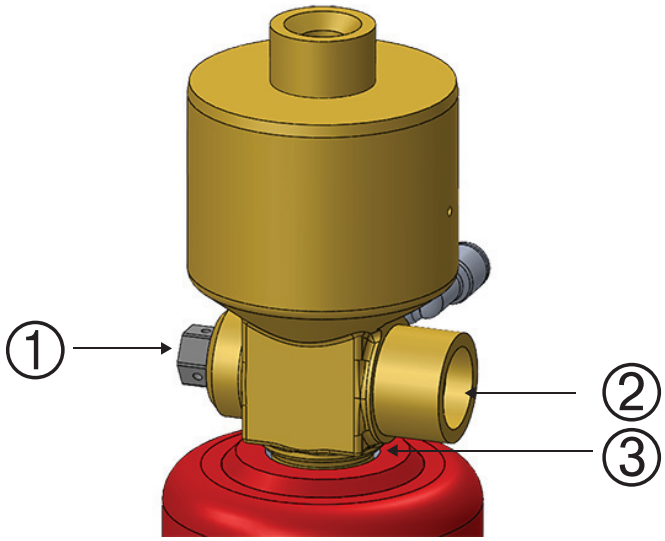


Figure 4-18. Valve Leak Test Locations

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 dismantled and returned for replacement.

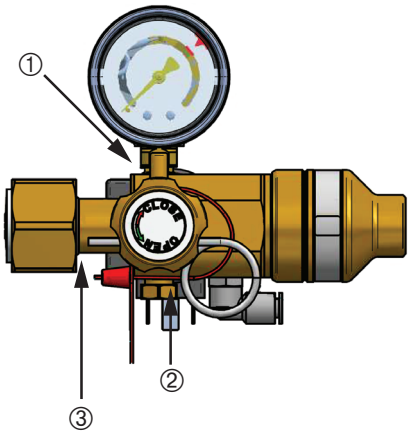


Figure 4-19. Release Unit Leak Test Locations

4-6.11 Venting Pressure from the Manifold Burst Discs

Some installations may requiring a method of venting agent if the manifold burst disc ruptures. Venting from the burst discs can be taken to atmosphere or to the distribution pipework for the largest area involved.

The outlet nozzle which vents to the atmosphere shall be installed in such a manner as to prevent the 'jet' from creating a hazard to any personnel outside the building. 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.

Relief openings shall include protection against ingress of dust, dirt, and such.

4-7 INSTALLATION OF HOSES

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

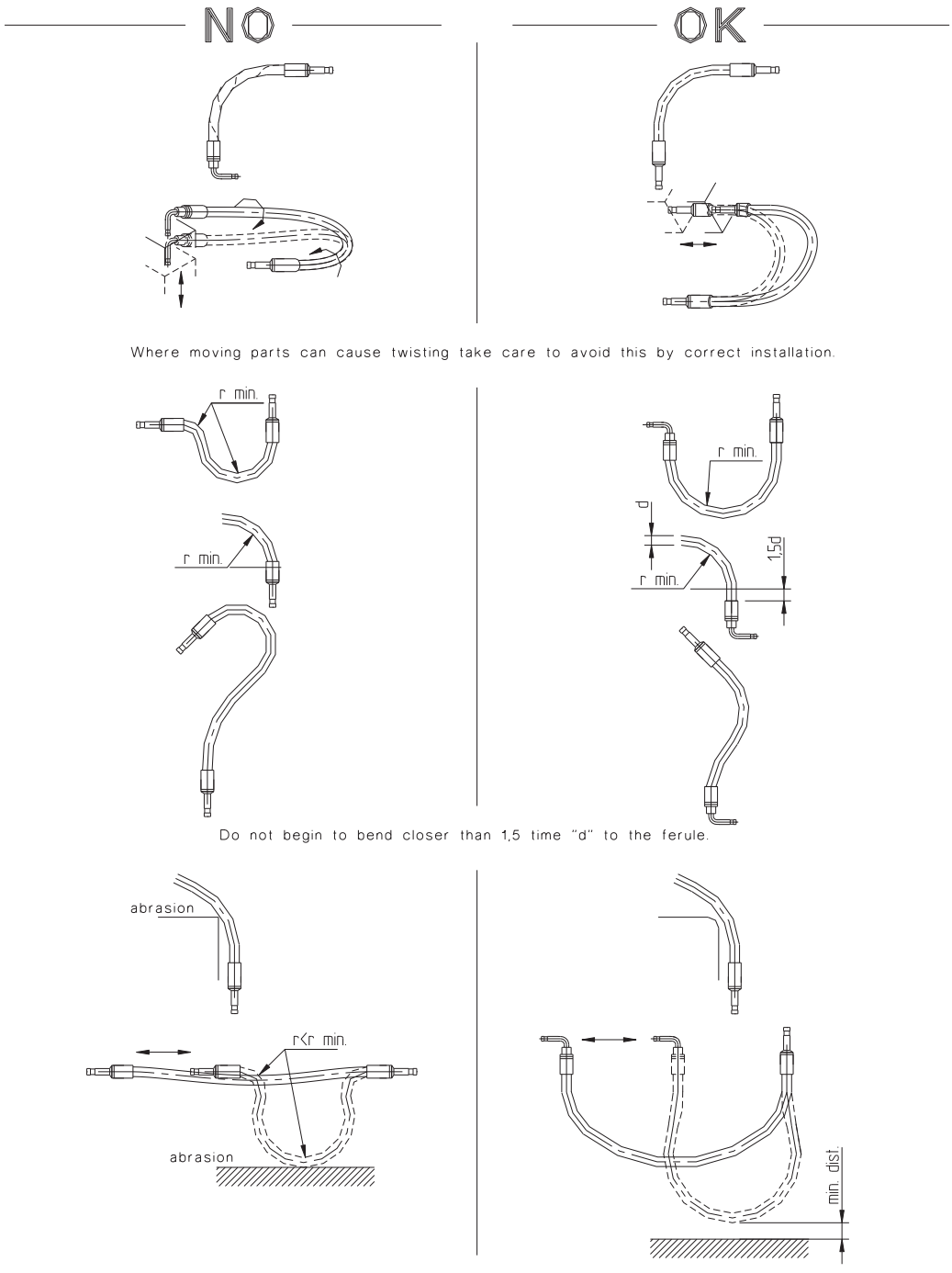


Figure 4-20. Hose Installation

Table 4-10. Minimum Hose Bend Radius

Hose	Minimum Bend Radius
Stainless Steel Actuation Hose	2.99” (76mm)
Discharge Hose	9.6” (240mm)
Backplate Manifold Rubber Hose	3.9” (100mm)

4-8 DISTRIBUTION PIPE & FITTINGS

Piping should be installed in accordance with good commercial practice. 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 4-11, Table 4-12 and Table 4-13.

CAUTION

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 4-11. Allowable Pipe Grade and Size for Use with Kidde IGS 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 4-12. Allowable Pipe Grade and Size for Use with Kidde IGS 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 4-13. Allowable Pipe Grade and Size for Use with Kidde IGS 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, 2015 Edition, Sections 2-2.3 and A-2-2.3.1. 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.

Concentric bell reducers are the only means for reducing pipe size under NFPA guidelines. For European systems, reducing bushes may be used. Reductions can be made after a tee or after a union. Where reducers are used at tees, the reducers must be downstream of each tee. Reductions made after a union are possible only if the next change in direction (tee split) is located a minimum of 10 nominal pipe diameters downstream of the concentric bell reducer. Gaskets for flanged fittings shall be neoprene impregnated or compliant with NFPA 2001, Edition 2015.

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.

CAUTION

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 4-14.

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 4-14. Pipe Support Distances

Nominal Pipe Diameter (in)	Max. Span (ft)	Max. Free End (ft)
1/2	4.500	2.500
3/4	5.500	3.000
1	6.500	3.500
1-1/4	7.500	4.000
1-1/2	8.500	4.250
2	11.000	5.500
2-1/12	11.250	5.500
3	12.000	6.000
4	14.000	6.500
5	15.500	6.500
6	17.500	6.500

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 ≤ 1”, Max distance ≤ 4”
- Nominal pipe diameter > 1”, Max ≤ 10”

4-8.4.3 Support Details

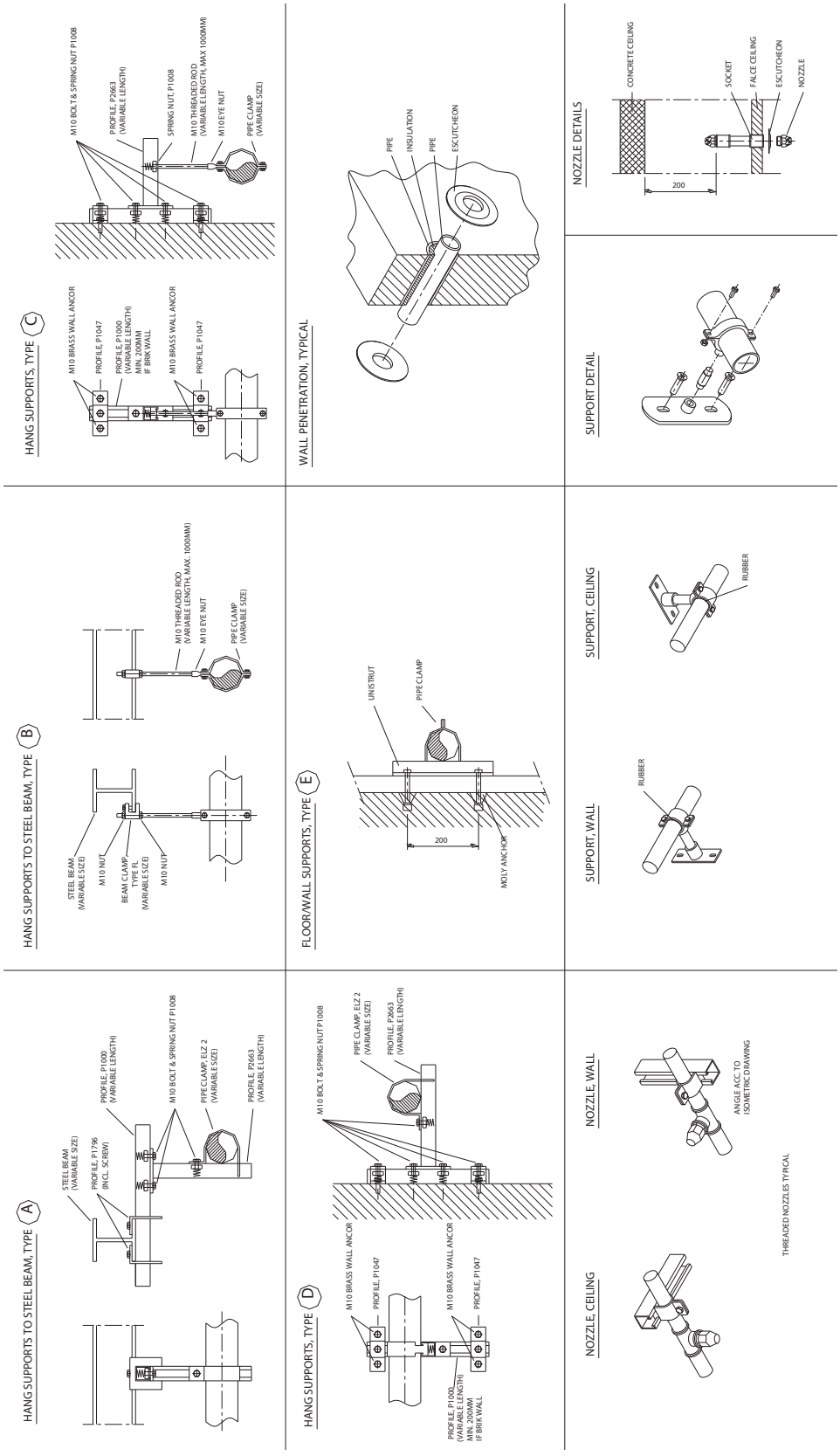


Figure 4-21. Pipe Support Details

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. Joint compound, tape or thread lubricant must be applied only to the male threads of the joint excluding the first two threads.

Threads shall be cut to the full cutting length as specified in Table 4-15 and Table 4-16 using a pipe-threading machine. After threading, the pipe shall be cleaned to remove excess cutting oil and any other particulates.

Table 4-15. 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″	14.50	0.570	13.56	0.533	0.94	0.037
3/4″	16.00	0.629	13.86	0.545	2.14	0.084
1″	19.00	0.748	17.34	0.682	1.66	0.065
1 1/4″	20.50	0.807	17.95	0.706	2.55	0.100
1 1/2″	20.50	0.807	18.38	0.723	2.12	0.083
2″	22.00	0.866	19.20	0.755	2.80	0.110
2 1/2″	31.00	1.220	29.00	1.141	3.00	0.118
3″	33.50	1.319	30.48	1.200	3.02	0.118

Table 4-16. 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″	14.50	0.570	13.0	0.511	1.50 mm	0.059
3/4″	16.00	0.629	15.0	0.590	1.00 mm	0.039
1″	19.00	0.748	17.0	0.669	2.00 mm	0.078
1 1/4″	20.50	0.807	19.0	0.748	1.50 mm	0.059
1 1/2″	20.50	0.807	19.0	0.748	1.50 mm	0.059
2″	22.00	0.866	20.0	0.787	2.00 mm	0.078
2 1/2″	31.00	1.220	27.0	1.062	4.00 mm	0.157
3″	33.50	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 x 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 Kidde IGS. 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 commercial 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 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.

CAUTION

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. These 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).

WARNING **Teflon tape and some pipe sealants are destructive to hydraulic components. Always use extreme caution and follow manufacturer's recommendations for proper application of any sealant in order to prevent contamination.**

3. Screw finger 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 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 acceptable engineering 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.

An Agent discharge nozzle consists the following

- 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, including runs which end in a nozzle.

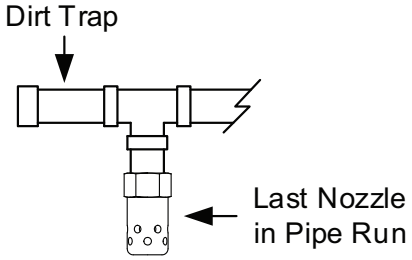


Figure 4-22. Nozzle with Dirt Trap

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 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 maintaining a safe distance from the pipe work. Evacuation of 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.

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.
- Transport label: Commonly referred to as a banana label which is curved and located on the cylinder shoulder

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 convey 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, 90º 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/Slave Cylinder Gauge Assembly Wiring

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

Connect the release unit/slave 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 slave cylinder gauge assembly should be connected in a single loop configuration (between cylinders) using the quick connect cable joiners provided.

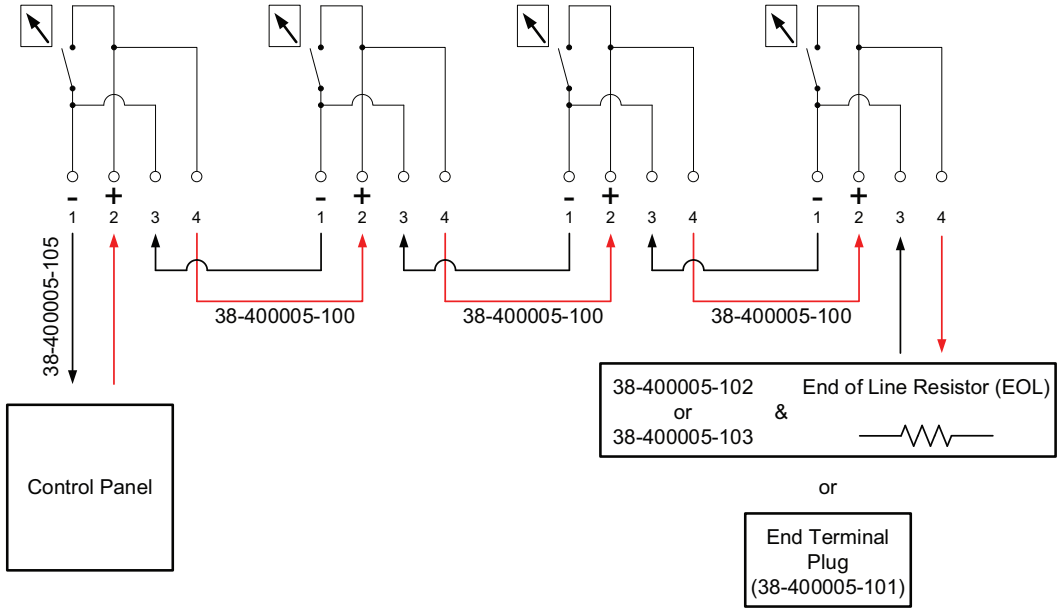


Figure 4-23. Quick Connect Wiring Example

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 / turning will cause the seal to break and result in a leak.

Cable(s) between the control panel and the cylinder bank should, at a minimum, be one pair cable 1.0 sq. mm 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 0.5 sq. mm 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)

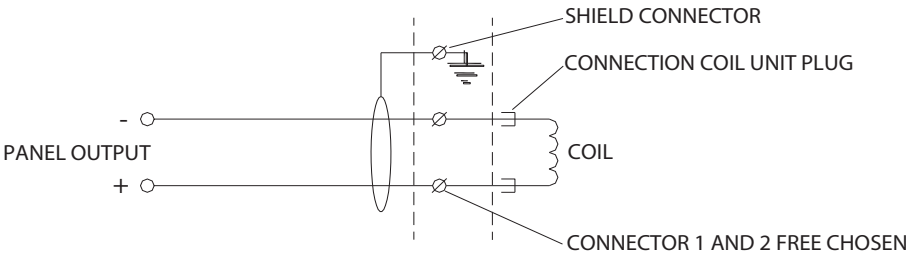
Junction boxes supplied by others recommended having terminals suitable for up to 0.004 sq. inch (2.5 sq. mm).

Junction boxes should be provided with an identification tag number in accordance with the system-wiring diagram or as otherwise agreed.

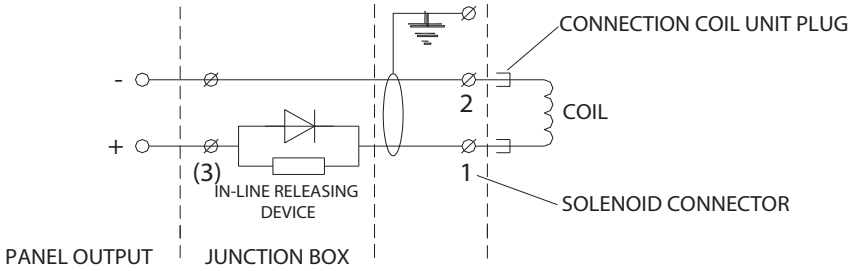
4-14 TYPICAL WIRING DETAILS

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 4-24. 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 4-25 and Figure 4-26. 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 either 1/2-inch conduit knockouts or 1-inch NPT fittings. The minimum operating pressure required is 50 PSI.

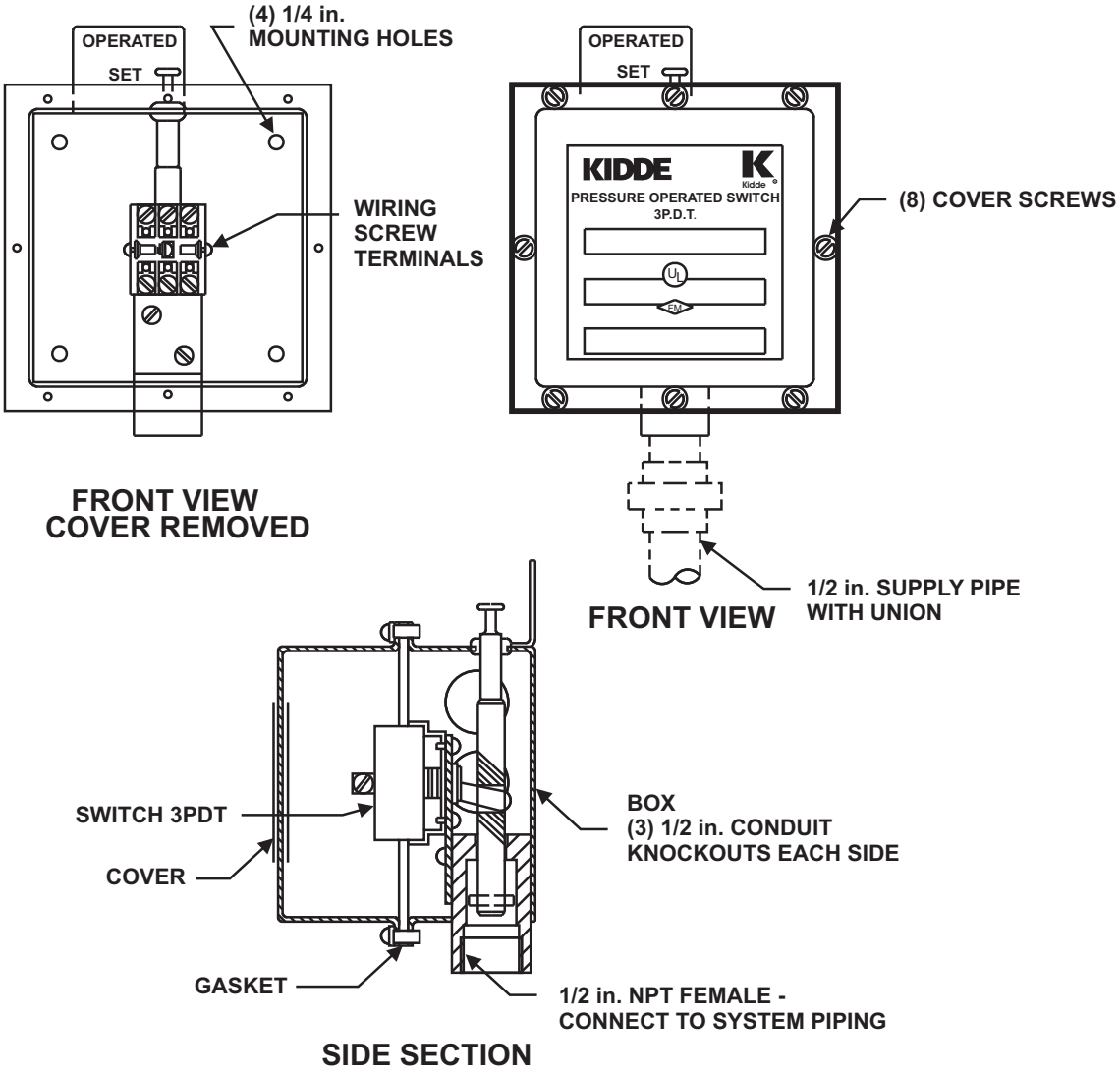


Figure 4-25. Pressure-Operated Switches

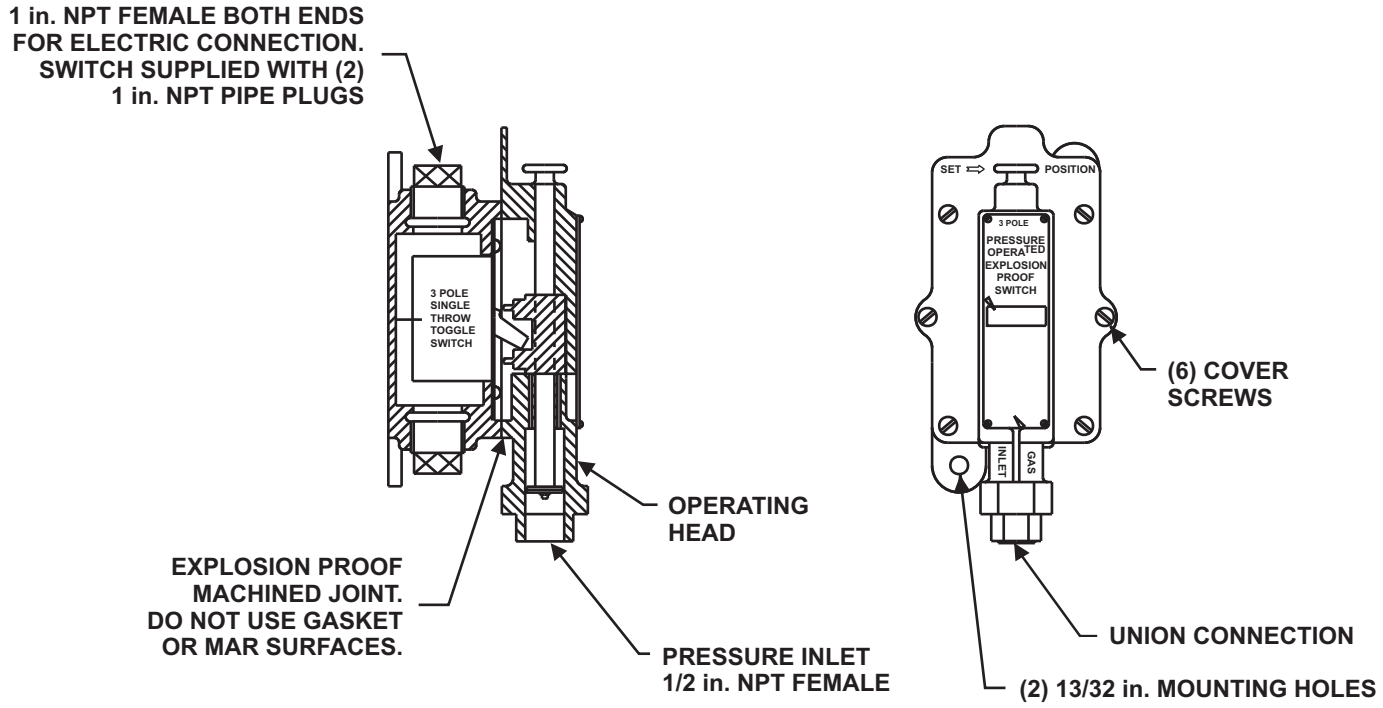


Figure 4-26. Pressure Operated Switches, Hazloc

4-16 PRESSURE OPERATED TRIP

Install the pressure operated trip as shown in Figure 4-27. 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.

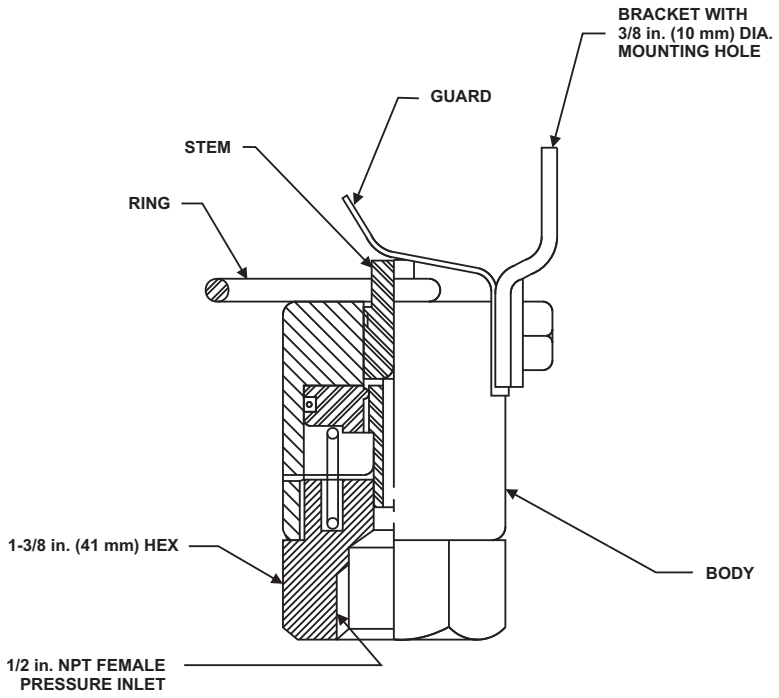


Figure 4-27. Pressure Operated Trip

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 WK-877940-000 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 cylinder valve 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 90-101040-000

WARNING

Nitrogen cylinders must not be moved unless the discharge and control heads have been removed and the protection caps are installed. Failure to follow these instructions could result in inadvertent discharge, serious bodily 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 4-28. See Table 4-17 for strap dimensions.

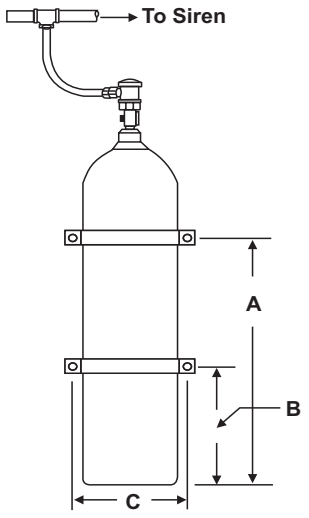


Figure 4-28. Typical 1040 cu. in. Nitrogen Pilot Cylinder Strap Installation

Table 4-17. 1040 cu. in. Nitrogen Pilot Cylinder Strap Installation Dimensions

Part Number	Description	A		B		C	
		in.	mm	in.	mm	in.	mm
90-101040-000	1040 cu. in.	21 to 22	533 to 559	6 to 8	152 to 203	10.4	264

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.

WARNING

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 N2 1040 cu. in. pilot cylinder (Type "I" Valve)
- Electric to N2 108 cu. in. pilot cylinder
- Lever/Pressure Operated to N2 pilot cylinder

4-17.3.1 Installation of Electric Control Heads to N2 1040 cu. in. Pilot Cylinder

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.

WARNING

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.

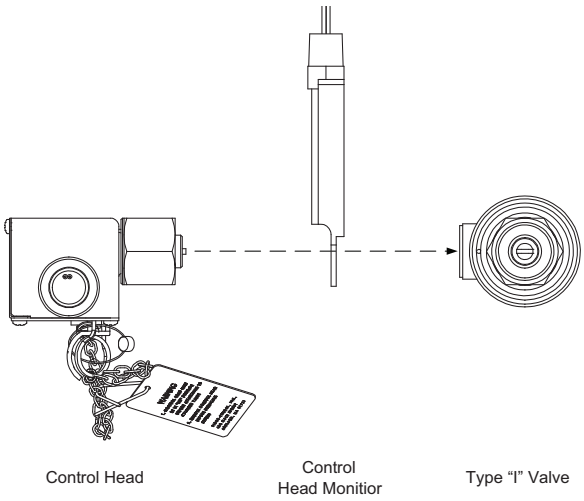


Figure 4-29. Control Head and Placements Supervision Component Installation to Type "I" Valve, Top View

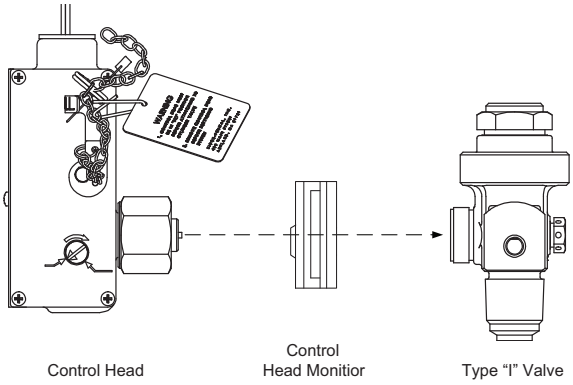


Figure 4-30. Control Head and Placements Supervision Component Installation to Type "I" Valve, Side View

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.

WARNING

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.

4. Make all electrical connections.

4-17.3.2 Installation of Electric Control Head to 108 cu. in. Nitrogen Pilot Cylinder

5. Remove the protective cap from the cylinder valve actuation port.

WARNING

Ensure the control head is in the SET position (that is, the actuating pin is in the fully retracted or SET position) before attaching it to the cylinder valve. If the control head is not in the SET position, agent will discharge accidentally.

6. Insert the Control Head Monitor between the control head and the valve actuation port.

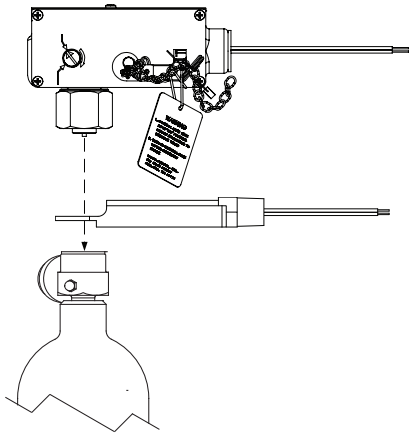


Figure 4-31. Order of Installation

7. Install the control head to the cylinder valve actuation port and tighten securely.

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.

WARNING

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.

8. Make all electrical connections.

4-17.3.3 Installation of Lever/Pressure Operated Control Head, P/N 82-878751-000

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. Connect the actuation line to the pressure port using the appropriate adapter.

WARNING

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 agent cylinder to discharge accidentally when the control head is installed on the cylinder valve.

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 time 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 4-18. Due to the wide operating temperature range of the units, the delay at 70°F is greater than the nominal value. The actual delay achieved in service is dependent on the ambient conditions.

Table 4-18. Nitrogen Discharge Delay Rating

Part Number	Cylinder	Nominal Rating (seconds)	Nominal Delay @ 70ºF (seconds)
81-871072-001	108 cu. in.	34	37
81-871072-002	108 cu. in.	61	68

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 x 1/4” NPT female bushing adapter to the outlet on the discharge delay.
2. Screw the 1/4” BSPP male x NPT male straight adapter into the bushing adapter.
3. Connect the straight adapter to the back-plate manifold hose (P/N 01-6017-0000).

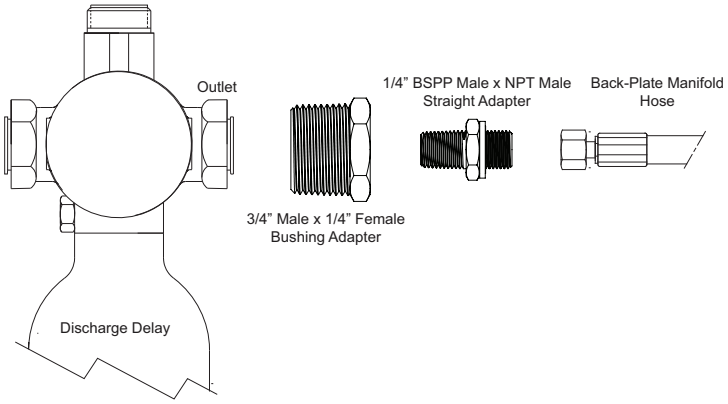


Figure 4-32. Discharge Delay Outlet Adapters and Hose

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.
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.

CAUTION

Ensure the actuation hose is fully inserted into the adapter. There should be a gap of no more than 1/4” (6 mm) between the end of the festo connector and the adapter quick connect.

10. Do not connect the actuation hose the cylinder valve at this time. That should be performed during final commissioning.

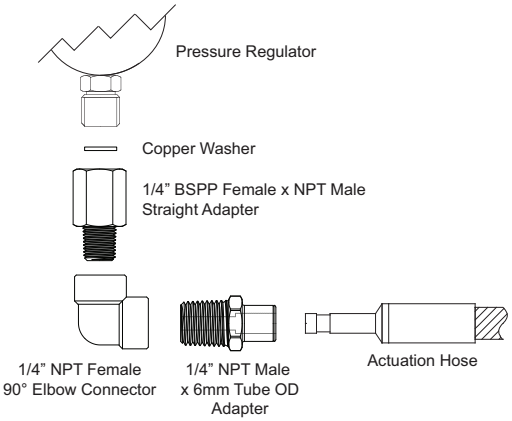


Figure 4-33. Pressure Regulator Outlet Adapters and Hose

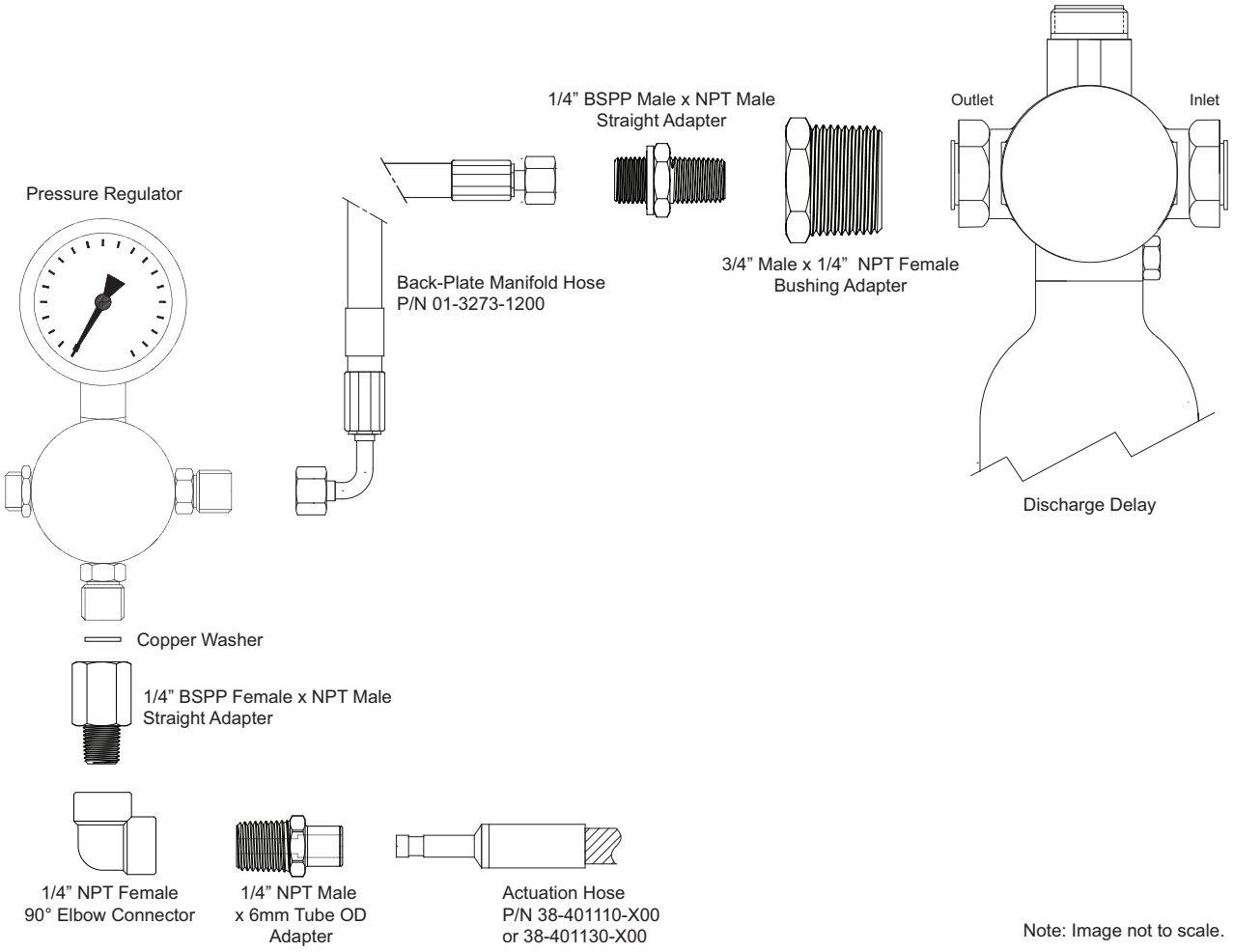


Figure 4-34. Discharge Delay and Pressure Regulator with Adapters and Hoses

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 4-19:

Table 4-19. 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.
- Typically located inside the protected space.
- Install a dirt trap and union as shown in Figure 4-35.

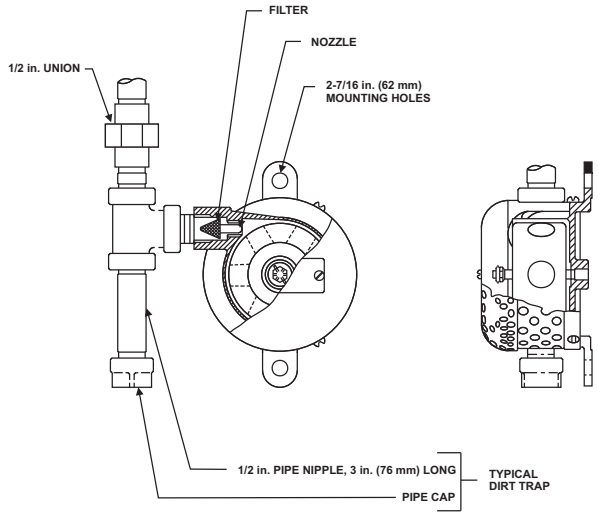


Figure 4-35. Pressure Operated Siren

4-17.5.1 Sample Siren Setups

The following show two possible examples for operating the siren.

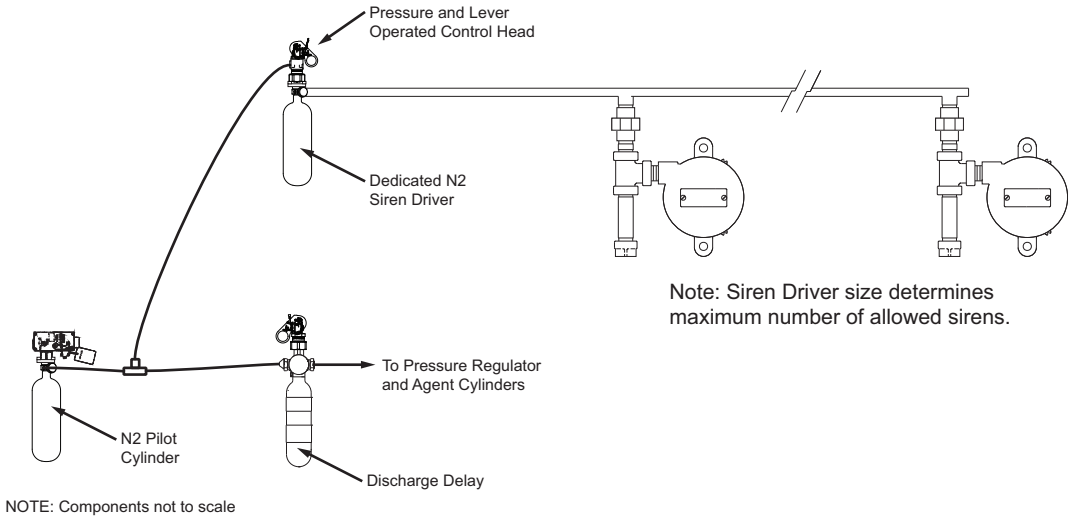


Figure 4-36. Siren with Pneumatic Activation

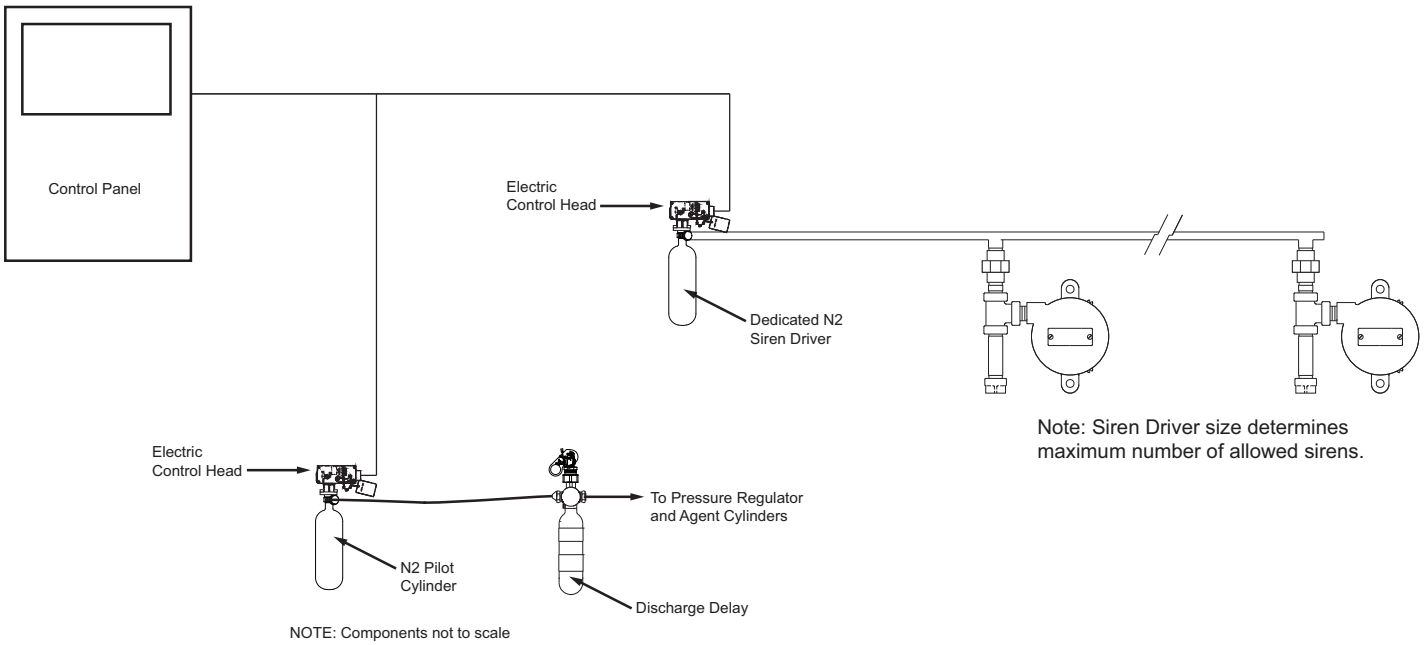


Figure 4-37. Siren with Electric Control Head Activation

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 75 psig (5.17 bar gauge). 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 assemble 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.

CAUTION

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 prior to any testing of the discharge piping.

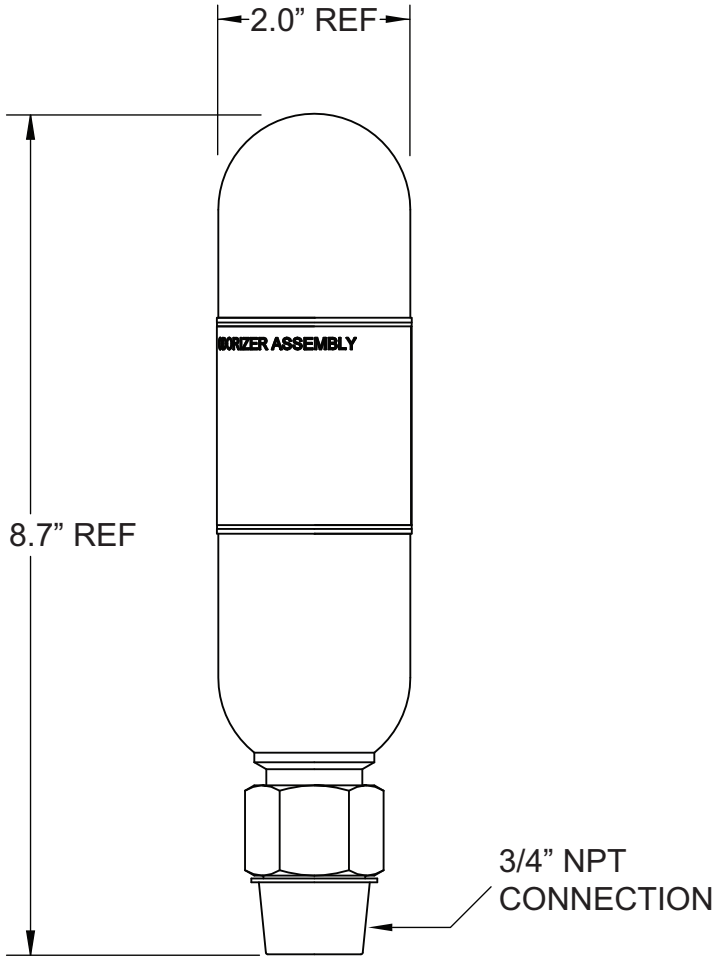


Figure 4-38. Odorizer Installation

4-21 SELECTOR VALVES

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. Kidde recommends installing union fittings before and after the valves to facilitate future service work.
3. Apply Teflon tape or pipe sealant to the piping male threads.

CAUTION **Do not drip sealant into the internal part of the valve.**

4. Valves can be installed horizontally or vertically.
5. Ensure the piping is properly supported with pipe hangers prior to installing the valves.
6. Use high pressure air, nitrogen, or CO_2 to verify the valves allow flow in the direction shown by the arrow on the valve body.

CAUTION **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_2 to verify the valves allow flow in the direction shown by the arrow on the valve body.

CAUTION **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 should 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 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 4-39 shows the lockout valve wiring diagram when the ball valve is in the fully open position.

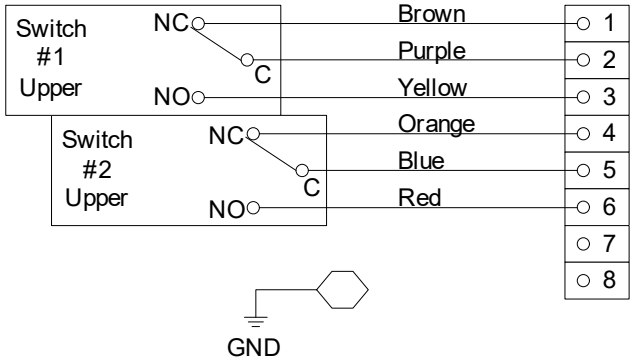


Figure 4-39. Wiring Diagram for Lockout Valve when Ball Valve is in Fully Open Position

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 reserved cylinders. For electrical wiring with a single electrical release unit, refer to Figure 4-40 and for two electrical release units, refer to Figure 4-41. 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

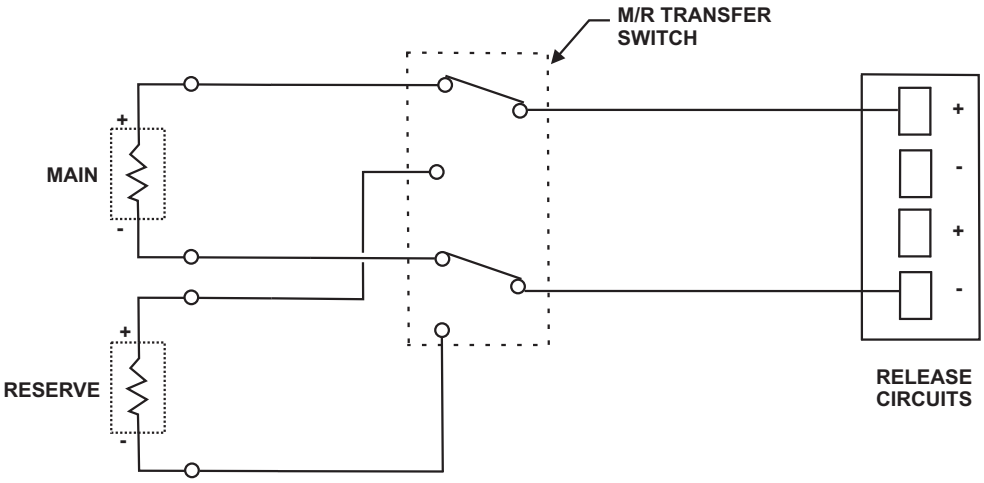


Figure 4-40. Wiring Diagram with Single Solenoid (Main and Reserve)

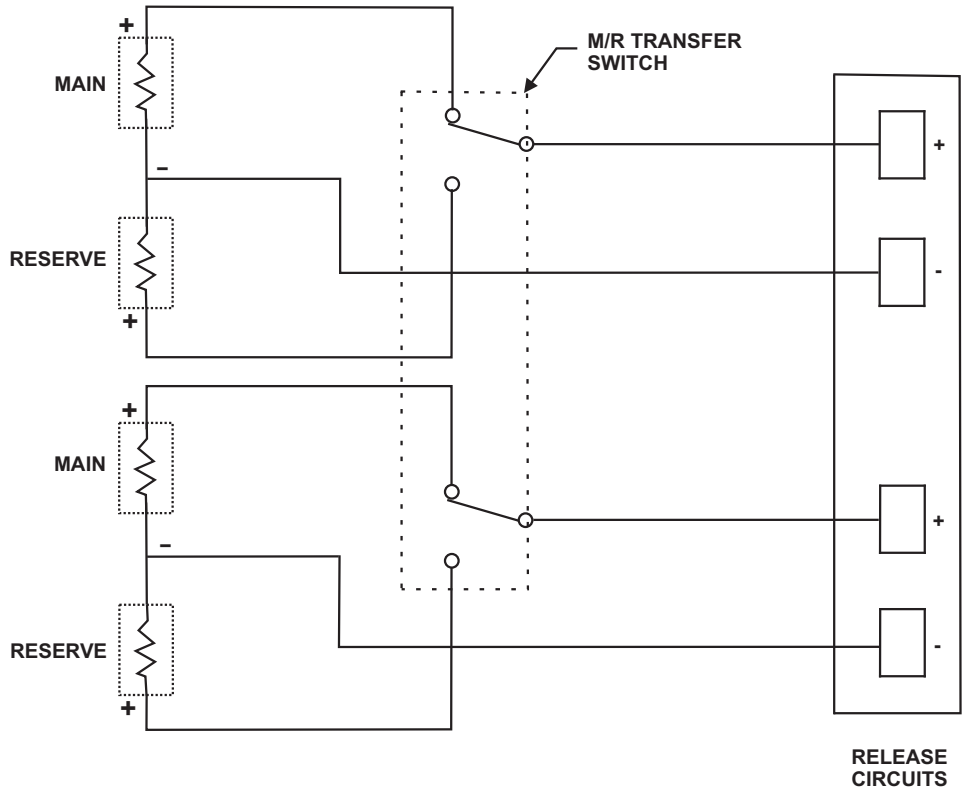


Figure 4-41. Wiring Diagram with Dual Solenoid (Main and Reserve)

4-24 POST-INSTALLATION PROCEDURES

After the Kidde IGS installation has been completed, perform theses 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, 2015 Edition or BS EN ISO 14520, design limitations within this manual and the computerized hydraulic calculations associated with each independent piping and nozzle configuration.
4. Check that the discharge manifold, discharge piping and actuation piping are securely fixed. 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, 2015 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. 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 Kidde IGS Systems should be properly identified as to their purpose. Particular care should be taken when multiple release units exists 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, 2015 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.

CAUTION

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 festo connector and the release unit quick connect.

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. Unscrew the discharge hoses from the top of each cylinder valve.
3. Fit anti-recoil cap (P/N 38-400011-001) to each cylinder valve discharge outlet, applying correct torque.
4. Operate the system manually either by manual electric release at the control panel or by the manual release on the release unit.
5. Make sure that the pins are now protruding out from the top of the anti-recoil caps on top of each cylinder valve.
6. Leak test all connections on the pilot line.
7. Reset manual release unit by turning lever to close position, insert pin, and fix new anti-tamper seal, or rest manual release at control panel.
8. De-pressurise pilot line by removing the Pilot Line Bleed Valve on the last cylinder valve.
9. Make sure the pins have fully retracted on the top of each anti-recoil cap. Once retracted, install the Pilot Line Bleed Valve. Make sure to push the actuation hose in fully.
10. Remove the anti-recoil caps from the top of each cylinder valve and reconnect the discharge hoses.
11. Place control panel back to automatic mode.

CHAPTER 5
OPERATION

5-1 INTRODUCTION

This chapter describes the controls or Kidde Fire Systems Inert Gas Engineered Fire Suppression System (Kidde® IGS) using IG-100 or IG-55 (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 Kidde IGS cylinder for the hazard.
2. Remove the safety pull pin from the cylinder release unit. This will also break the tamper proof 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 Kidde IGS selector valve for the hazard.
2. Attach the handle to the selector valve, and turn the valve open.
1. Proceed to appropriate Kidde IGS master cylinder release unit for the hazard.
2. Remove the safety pull pin from the cylinder release unit. This will also break the tamper proof 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 Kidde IGS 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.

WARNING

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

WARNING

The following procedures can be applied only when the reserve system has not been previously 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. Immediately contact a Kidde distributor for service.

5-4 LOCKOUT VALVES

If employing lock-out valves, it is recommended to lock-out the Kidde IGS 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 Kidde IGS cylinders and nitrogen pilot cylinders immediately after use. Return all cylinders to a Kidde Distributor or other qualified refill agency. Refill in accordance with the procedures outlined in Chapter 6 of this manual.

CHAPTER 6
MAINTENANCE

6-1 INTRODUCTION

This chapter contains maintenance instructions for the Kidde Fire Systems Inert Gas Engineered Fire Suppression System (Kidde® IGS) Series using IG-100 or IG-55 (herein refer to collectively as the "Agent"). These procedures must be performed in accordance with regulations.

Be aware of the following:

- Kidde Inert Gas Systems must be serviced by qualified personnel only.
- Any environmental or operating condition which causes shorting or grounding of system components can cause system malfunctions or actual discharge.
- Before commencing service isolate the system by removing 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 gauge at 15°C (4351 psig at 59°F) or 200 bar gauge 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 valve, 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

WARNING

Kidde IGS 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 A of this manual and "Safe Cylinder Handling Procedures" on page iii.

A program of systematic maintenance is essential for continuous, proper operation of all Kidde Inert Gas 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 Kidde IGS 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 Slave 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 IGS Distributor, perform preventative maintenance per Table 6-2.

Table 6-2. Authorized Kidde Fire Systems Distributor Preventive Maintenance Schedule

Schedule	Requirement	Paragraph
Semi-Annual	Perform Monthly inspection as outlined in Section 6-5 and the following additional tasks:	
	Check lockout valves	Section 6-6.1
	Check actuators on selector valves	Section 6-6.2
	Check distribution pipework and nozzles	Section 6-6.3
	Inspect the protected room	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 Kidde 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 Kidde IGS System Cylinder Pressure

Check the Kidde 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. Remove and recharge the cylinder as instructed in Section 7-5. Cylinders should have a pressure of either 300 bar gauge at 15 °C (4351 psig at 59 °F) or 200 bar gauge 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 gauge @ 21 °C).

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, 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.

CAUTION

Nozzles must never be painted. 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 Kidde IGS 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 Slave Gauge Assemblies

Inspect the Kidde IGS System cylinder release units and slave 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 slave 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 gauge at 15°C (4351 psig at 59°F) or 200 bar gauge 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.

WARNING

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 Kidde IGS 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 Kidde IGS 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 Kidde IGS 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 Kidde IGS 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, perform the following procedures semi-annually:

6-6.1 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.

6-6.2 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 Products Ltd or authorized representative.

Never attempt to modify the actuator assembly (i.e. never open the actuator).

6-6.3 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.

6-6.4 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 opening 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 original degree of protection.

Should additional equipment have been introduced resulting in a higher required concentration, pressure relief openings may have to be increased.

6-6.5 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 Kidde IGS 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.

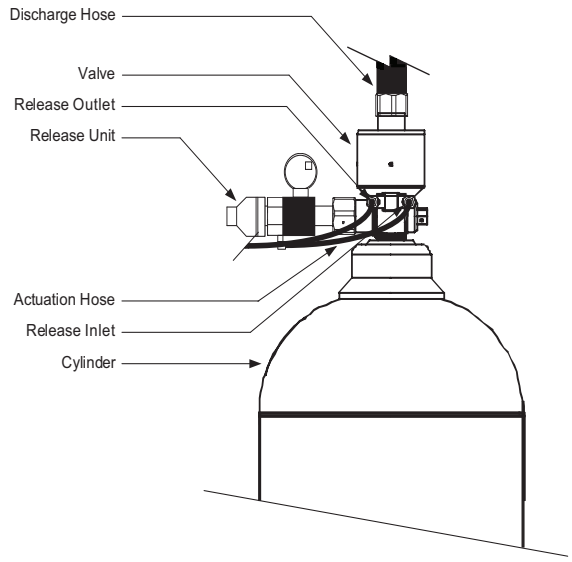


Figure 6-1. Typical Primary Cylinder/Valve Assembly (Rear View)

1. Remove the actuation line connecting the master cylinder with the release unit to the next slave cylinder. This is the actuation line installed in the release outlet.

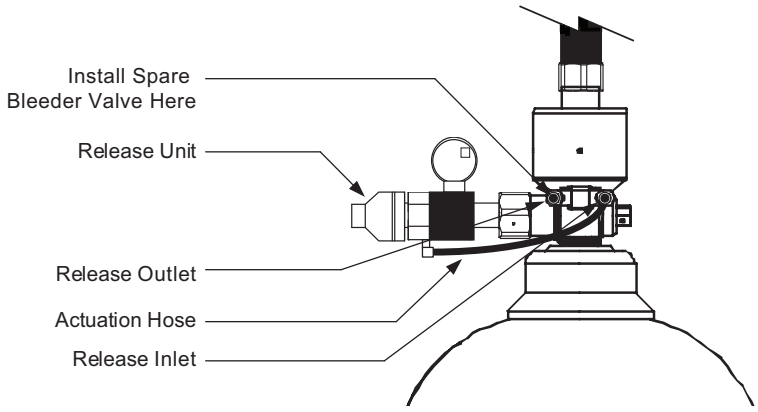


Figure 6-2. Spare Pilot Line Bleed Valve Location

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 Kidde IGS System electrically. This can be accomplished by actuation of the Kidde 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 Kidde IGS System nitrogen pilot cylinders. Test one hazard area at a time before proceeding to the next, as follows:

CAUTION **All control heads must be removed from the Kidde IGS nitrogen pilot cylinders prior to testing to prevent accidental cylinder discharge.**

1. Remove all electric control heads and control head monitors from all Kidde IGS nitrogen pilot cylinders serving the hazard area being tested. Let the electric control heads hang freely 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 Kidde IGS System electrically. This can be accomplished by actuation of the Kidde IGS System at the system control panel or by manual operation of an electric pull station.
4. Ensure all 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.

CAUTION **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 which fail to reset properly before reconnecting to pilot cylinders. Re-Install the Control Head Monitor between the control head and corresponding valve. Reattach 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 Kidde 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 Kidde IGS System nitrogen pilot cylinders. Test one hazard area at a time before proceeding to the next, as follows:

CAUTION

All control heads must be removed from the Kidde IGS nitrogen pilot cylinders prior to testing to prevent accidental cylinder discharge.

1. Remove all lever operated control heads from all Kidde IGS 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.

CAUTION

Lever Operated control heads must be reset manually before reconnecting to the pilot cylinder valves.

3. Reattach all Lever Operated control heads to the threaded port on the pilot cylinder valve. Tighten the swivel nut securely. Make certain each control head is in SET position before reconnecting to cylinders. Failure to follow this procedure will result in accidental Kidde IGS System discharge.

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 Kidde IGS System nitrogen pilot cylinders. Test one hazard area at a time before proceeding to the next, as follows:

CAUTION

All control heads must be removed from the Kidde IGS nitrogen pilot cylinders prior to testing to prevent accidental cylinder discharge.

1. Remove all lever/pressure operated control heads from all Kidde IGS 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.

CAUTION

The Lever on the Lever/Pressure Operated control heads must be reset manually and the pressure must be venteed before reconnecting to the pilot cylinder valves.

7. Reattach all the control heads to the threaded port on the pilot cylinder valve. Tighten the swivel nut securely. Make certain each control head is in SET position before reconnecting to cylinders. Failure to follow this procedure will result in accidental Kidde IGS System discharge.

6-6.8 Inspect Flexible Hoses

In accordance with NFPA 2001, 2015 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 which includes monthly and weekly inspection tasks, perform the following procedures annually:

6-7.1 Check Kidde IGS System Cylinder Pressure Gauges

Per NFPA 2001, Section 7.1.3.2, where container pressure gauges are used for fire suppression systems, the gauges shall be compared to a separate calibrated device annually. Check the Kidde IGS System agent cylinder pressure gauges against a separate calibrated pressure gauge to ensure the Kidde IGS gauges are accurate. If the Kidde IGS gauges are not accurate, replace the release unit or slave gauge assembly. This applies to agent cylinder gauges only.

6-8 INSPECTION PROCEDURES-2 YEAR

In addition to performing the semi-annual inspection, perform the following procedures every 2 years:

6-8.1 Distribution Piping Blow Out

Before blowing out the system, 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_2 to make sure there are no obstructions.

WARNING **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.

WARNING **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_2 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, 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 Kidde 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 Kidde 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, 2015 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, 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.

WARNING

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.

CAUTION

These guidelines only apply to cylinders containing the agent.

Kidde IGS cylinders 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 Discharge 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 Kidde IGS 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

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 3-15.2.1 for the correct nozzle placement and orientation.

6-11.3 Repairs

Replace all damaged parts found during inspection. Replacement procedures for Kidde IGS System cylinders are provided below. For other system components, refer to the installation drawings and Kidde IGS assembly drawings for guidance.

Kidde IGS 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 gauge at 15°C (4351 psig at 59°F) or 200 bar gauge at 15°C (2901 psig at 59°F) depending on cylinder starting pressure.

6-12 REMOVING A KIDDE IGS CYLINDER

Remove a Kidde IGS cylinder as follows:

WARNING

Do not disconnect the flexible discharge hose prior to removing release units from the Kidde IGS cylinders. Before replacing a Kidde IGS cylinder within a cylinder bank, ensure that the actuation line is completely vented of all pressure.

1. Remove all release units and slave 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 (UTC Cardinal Rules).

WARNING

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 Kidde IGS Cylinder

Reinstall following procedure as described in Section 6-12 in reverse order.

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CHAPTER 7
POST-DISCHARGE MAINTENANCE

7-1 INTRODUCTION

CAUTION **The information contained in this Chapter, Post Discharge Maintenance, is for limited distribution to Kidde approved Fill Stations only.**

Follow these procedures after the system has been activated and the Kidde Fire Systems Inert Gas Engineered Fire Suppression System (Kidde® IGS) using IG-100 or IG-55 (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 Kidde Agent cylinders as if they are fully charged. The Kidde cylinder valve is capable of producing dangerously high discharge forces from the valve outlet if not handled properly.

WARNING **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 Kidde IGS 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 15ºC) 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 can be expected.

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 Kidde IGS cylinder weighs approximately 331 to 662 lbs (150 to 300 kg) depending on cylinder size. 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 proof seal was removed, install a new tamper proof 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).

CAUTION

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.

CAUTION

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 ± 0.75 ft lb (60 ± 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.

CAUTION

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 festo connector and the release unit quick connect.

Figure 7-1. Actuation Hose Install

WARNING

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 SLAVE CYLINDER GAUGE ASSEMBLIES

Follow this procedure when re-installing the slave cylinder gauge assembly:

Note: Slave 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 slave 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).

CAUTION

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 slave cylinder gauge assemblies, applying a torque of 45 ± 1Nm. A counter hold may be required.
3. Leak test all connections on the slave 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 KIDDE 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

WARNING

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. Never dispose of liquefied nitrogen in an indoor work or storage area.

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

WARNING

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 gauge @ 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/

WARNING

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.

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 gauge @ 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	Fill Weight (lb.) Nominal
06-129773-001	108 cu. in. nitrogen cylinder	0.52
90-101040-000	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 gauge @ 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.

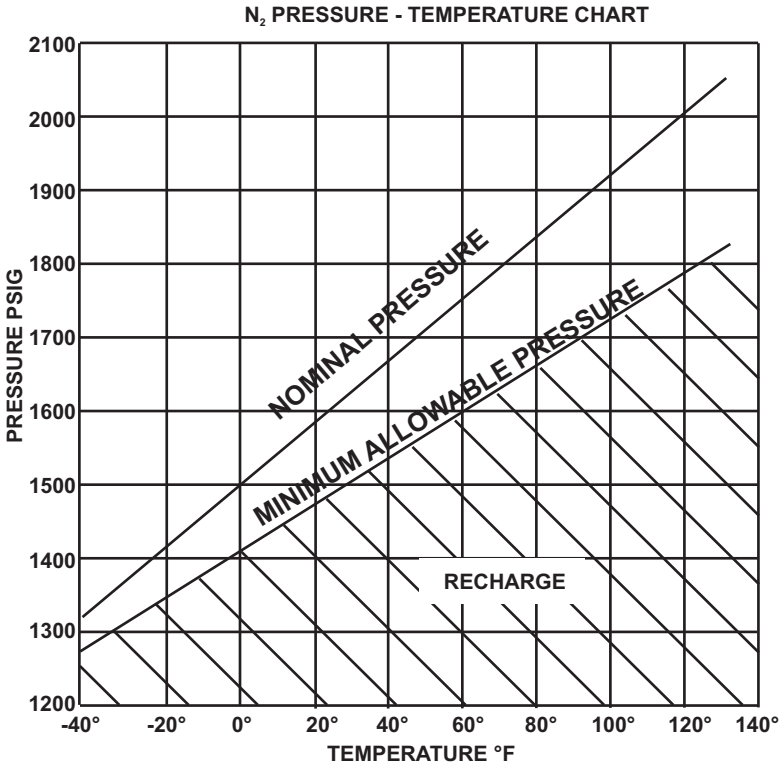

Figure 7-2. Nitrogen Temperature vs. Pressure Data

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.

WARNING

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).
5. Remove the main check and pilot check assemblies.

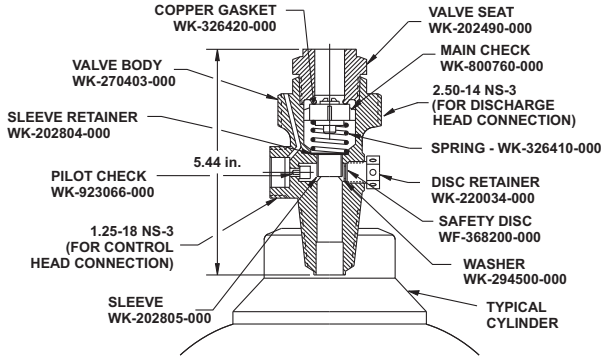

Figure 7-3. 5/8-inch I-Valve for Nitrogen Driver

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 siren 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 retainer, the new safety disc and the new safety disc washer to the valve body. Refer to Table 7-3 for torque values.

WARNING

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.

Never reinstall a used safety disc and/or washer. Once the retainer has been removed, the disc and washer must be replaced with new parts.

Table 7-3. Safety Disc Replacements for the I-Valve

Nitrogen Cylinder	Safety Disc and Washer P/N	Safety Disc Retainer Nut P/N	Torque Value	PSIG @ 70°F
90-101040-000	81-902048-000 (white)	WK-220034-000	350 ± 35 in. lb.	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. Remove top cap using a suitable wrench.
2. Remove and replace the packing O-ring (P/N WF-209180-000).
3. 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).
4. 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.
5. Apply lubricant to both O-rings prior to attaching to I-valve (refer to Table 7-5 for lubricant recommendations).

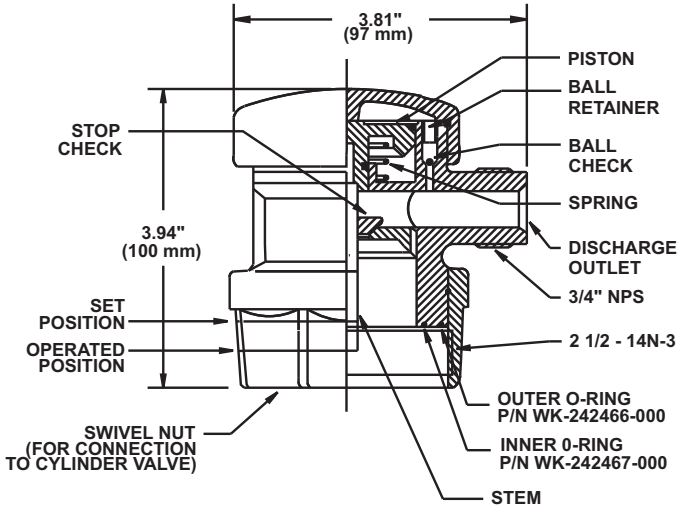

Figure 7-4. Plain Nut Discharge Head

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
WF-209180-000	Packing O-ring, Top Cap	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 Inert Gas Engineered Fire Suppression System (Kidde® IGS) using IG-100 or IG-55 (herein refer to collectively as the "Agent") parts and associated system equipment. Kidde 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, Slave 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 Kidde IGS. The part number for each cylinder shows the agent, cylinder size, fill temperature, fill pressure, and brand.

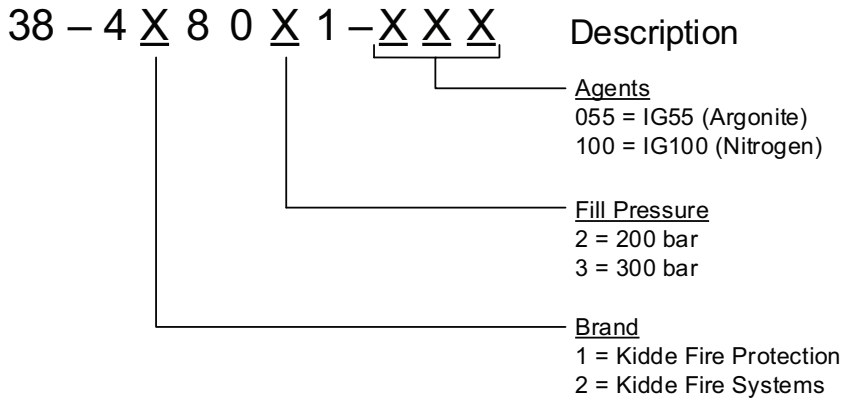

Figure 8-1. Kidde Inert Agent and Cylinder Part Number Breakdown

Table 8-1. Kidde Fire Systems Branded Cylinders

Description	Part Number
Kidde Fire Systems Branded Cylinders with IG-100	
Kidde Fire Systems Branded 80L Cylinder filled with IG-100 to 200 bar	38-428021-100
Kidde Fire Systems Branded 80L Cylinder filled with IG-100 to 300 bar	38-428031-100
Kidde Fire Systems Branded Cylinders with IG-55	
Kidde Fire Systems Branded 80L Cylinder filled with IG-55 to 200 bar	38-428021-055
Kidde Fire Systems Branded 80L Cylinder filled with IG-55 to 300 bar	38-428031-055

Table 8-2. Kidde IGS Cylinder Spare Parts

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

8-3 RELEASE UNITS

Table 8-3. Kidde IGS 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: • 1 x Pin • 1 x Seal • 10 x O-rings pack*	38-400001-010
*O-rings also fit Slave Cylinder Gauge Assemblies and Refill Adapters	

8-4 SLAVE CYLINDER GAUGE ASSEMBLIES

Table 8-4. Kidde IGS Slave Cylinder Gauge Part Numbers

Description	Part Number
Slave Cylinder Gauge Assembly - 200 Bar, N.O.	38-400005-001
Slave Cylinder Gauge Assembly - 300 Bar, N.O.	38-400005-003

8-5 QUICK CONNECT CABLES

Table 8-5. Kidde IGS 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 Terminal Plug (MALE)	38-400005-101
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 8-6. Kidde IGS Discharge Accessories Part Numbers

Description	Part Number
Manifold Check Valve 3/4”, BSP	38-400002-002
15.75” Actuation Hose with Quick Connect Fitting, Straight to Straight	38-401110-400
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
Discharge Hose 3/4" Dia., 11.8” (300 mm) Length, Straight to Straight Coupling	38-400110-300
Manifold Safety Device, BSP	38-400006-002
Manifold Pressure Gauge	01-7221-0300
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	84-802398-000
Name Plate - Main	WK-310330-000
Name Plate - Reserve	WK-310340-000
Odorizer Assembly	81-897600-000

8-7 SELECTOR VALVES

Table 8-7. Kidde Fire Protection IGS 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	01-3711-3000
1 1/2" BSPT (M) to NPT (F) Adapter	01-3711-4000
2" BSPT (M) to NPT (F) Adapter	01-3711-5000
Nipple 1/4" BSPP 60° - 1/4" BSPT M/M	15-8662-0042
Nipple 1/4" BSPP 60° x 1/8" BSPT M/M	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 8-8. Kidde IGS 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

WARNING **Only listed Kidde IGS nozzles are to be used on Kidde 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 8-10 and Table 8-12. For the full listed BSP nozzles with corresponding orifice areas, see Table 8-11 and Table 8-13.

Table 8-9. Kidde IGS 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

Kidde offers the 360 degree nozzle in brass for both NPT and BSP piping.

Table 8-10. Kidde IGS Listed 360 Degree NPT Nozzles

Orifice Diameter (mm)	Area		Orifice Area			
	mm^2	$in.^2$	0.5″	0.75″	1.00″	1.50″
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
19.5	298.6477	0.4629				38-407400-195
20	314.1593	0.4869				38-407400-200

Table 8-10. Kidde IGS Listed 360 Degree NPT Nozzles (Continued)

Orifice Diameter (mm)	Area		Orifice Area			
	mm^2	$in.^2$	0.5”	0.75”	1.00”	1.50”
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 8-11. Kidde IGS Listed 360 Degree BSP Nozzles

Orifice Diameter (mm)	Area		Orifice Area			
	mm^2	$in.^2$	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	
12	113.0973	0.1753		38-417200-120	38-417300-120	
12.5	122.7185	0.1902		38-417200-125	38-417300-125	

Table 8-11. Kidde IGS Listed 360 Degree BSP Nozzles (Continued)

Orifice Diameter (mm)	Area		Orifice Area			
	mm^2	$in.^2$	0.5″	0.75″	1.00″	1.50″
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

Kidde offers the 180 degree nozzle in brass for both NPT and BSP piping.

Table 8-12. Kidde IGS Listed 180 NPT Degree Nozzles

Orifice Diameter (mm)	Area		Orifice Area			
	mm^2	$in.^2$	0.5″	0.75″	1.00″	1.50″
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
19.5	298.6477	0.4629				38-407800-195
20	314.1593	0.4869				38-407800-200

Table 8-12. Kidde IGS Listed 180 NPT Degree Nozzles (Continued)

Orifice Diameter (mm)	Area		Orifice Area			
	mm^2	$in.^2$	0.5″	0.75″	1.00″	1.50″
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 8-13. Kidde IGS Listed 180 BSP Degree Nozzles

Orifice Diameter (mm)	Area		Orifice Area			
	mm^2	$in.^2$	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	
12	113.0973	0.1753		38-417600-120	38-417700-120	
12.5	122.7185	0.1902		38-417600-125	38-417700-125	

Table 8-13. Kidde IGS Listed 180 BSP Degree Nozzles (Continued)

Orifice Diameter (mm)	Area		Orifice Area			
	mm^2	$in.^2$	0.5”	0.75”	1.00”	1.50”
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 8-14. Kidde IGS 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	06-129773-001
1040 cu. in. Nitrogen Pilot Cylinder w/pressure switch	90-101040-200
30 Second Nitrogen Discharge Delay Kit which includes: • Nitrogen Discharge Delay for use with 108 cu. in. Pilot Cylinder (P/N 81-871072-001) • 3/4” Male x 1/4” NPT Female Bushing Adapter • 1/4” BSPP Male x NPT Male Straight Adapter • 1/4” BSPP Female x NPT Male Straight Adapter • 1/3” NPT Female 90° Elbow Connector • 1/4” NPT Male x 6mm Tube OD Adapter • Back-Plate Manifold Hose (P/N 01-3273-1200)	38-401140-030
60 Second Nitrogen Discharge Delay Kit which includes: • Nitrogen Discharge Delay for use with 108 cu. in. Pilot Cylinder (P/N 81-871072-002) • 3/4” Male x 1/4” NPT Female Bushing Adapter • 1/4” BSPP Male x NPT Male Straight Adapter • 1/4” BSPP Female x NPT Male Straight Adapter • 1/3” NPT Female 90° Elbow Connector • 1/4” NPT Male x 6mm Tube OD Adapter • Back-Plate Manifold Hose (P/N 01-3273-1200)	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	85-890181-000
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 8-15. Kidde IGS Fill Adapter Part Numbers

Description	Part Number
European 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 8-16. Kidde IGS Manifold Equipment Part Numbers

Description	Part Number
80 Liter 2 Stub 1 Row 2" Manifold BSP, with 2 manifold check valves	38-351000-004
80 Liter 3 Stub 1 Row 2" Manifold BSP, with 3 manifold check valves	38-351000-005
80 Liter 4 Stub1 Row 2" Manifold BSP, with 4 manifold check valves	38-351000-006
80 Liter 5 Stub 1 Row 2" Manifold BSP, with 5 manifold check valves	38-351000-007
80 Liter 6 Stub 1 Row 2" Manifold BSP, with 6 manifold check valves	38-351000-008
80 Liter 4 Stub 2 Row 2" Manifold BSP, with 4 manifold check valves	38-351000-009
80 Liter 6 Stub 2 Row 2" Manifold BSP, with 6 manifold check valves	38-351000-010
80 Liter 8 Stub 2 Row 2" Manifold BSP, with 8 manifold check valves	38-351000-011
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 (inc 2" Clamp)	01-8160-0200
Bracket for 80L Cylinder Manifold 2 Rows 520 mm (inc 2" Clamp)	01-8160-0520
Bracket for 80L Cylinder Manifold 3 Rows 830 mm (inc 2" Clamp)	01-8160-0830
2" Pipe Clamp ø58.7 - ø63.5 mm	01-8143-0000

8-13 CYLINDER RACKING KITS

Table 8-17. Kidde IGS Cylinder Accessories Parts List

Description	Part Number
Unistrut Cyl Wall Bracket - 400mm	01-8121-1000
Unistrut Cyl Wall Bracket - 650mm	01-8122-1000
Unistrut Cyl Wall Bracket - 950mm	01-8123-1000
Unistrut Cyl Wall Bracket - 1250mm	01-8124-1000
Unistrut Cyl Wall Bracket - 1550mm	01-8125-1000
Unistrut Cyl Wall Bracket - 1850mm	01-8126-1000
Clamping Bar 1 x 2 for 80 L Cyl (Front)	03-8266-0000
Clamping Bar 1 x 3 for 80 L Cyl (Front)	03-8267-0000
Wooden Spacer 1 x 2 for 80 L Cyl (Rear)	03-8162-0000
Wooden Spacer 1 x 3 for 80 L Cyl (Rear)	03-8163-0000
Wooden Spacer 2 x 2 for 80 L Cyl (Center)	03-8164-0000
Wooden Spacer 2 x 3 for 80 L Cyl (Center)	03-8165-0000
Single Clamp 80L Cyl Galvanized Steel	01-8131-0000
Clamping Bolt, 2 Row, 80L - 715mm Long	01-8337-0200
Clamping Bolt, 3 Row, 80L - 1030mm Long	01-8337-0300
Endcover, White PVC 34 X 40 mm	01-8131-0002
Distance Pipe 3/4" + Washers 80L	03-8331-0000

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APPENDIX A
SAFETY DATA SHEETS

SAFETY DATA SHEET
Nitrogen (Expellant)

1. IDENTIFICATION

Product Name	Nitrogen (Expellant)
Other Names	N_2
Recommended use of the chemical and restrictions on use	
Identified uses	Fire Extinguishing Expellant
Restrictions on use	Consult applicable fire protection codes
Company Identification	Kidde-Fenwal, Inc. 400 Main Street Ashland, MA 01721 USA
Customer Information Number	(508) 881-2000
Emergency Telephone Number	
Chemtrec Number	(800) 424-9300 (703) 527-3887 (International)
Issue Date	October 1, 2015
Supersedes Date	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: N_2
This product is a substance.

Component	CAS Number	Concentration
Nitrogen	7727-37-9	100%

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
All known extinguishing media can be used. Use extinguishing media appropriate for containers in the area.

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

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

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	No data available
pH	Not applicable
Gas Density	0.075 lb/ft^3 @70^{o}F as vapor
Boiling Range/Point (°C/F)	-196^{o}C/-321 ^{o}F
Melting Point (°C/F)	-210^{o}C/-346 ^{o}F
Flash Point (PMCC) (°C/F)	Not flammable
Vapor Pressure	No data available
Evaporation Rate (BuAc=1)	Not applicable
Solubility in Water	0.2 g/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

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.

11. TOXICOLOGICAL INFORMATION

Aspiration Hazard
Not an aspiration hazard.

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.

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.

DOT CFR 172.101 Data	Nitrogen, compressed, 2.2, UN1066
UN Proper Shipping Name	Nitrogen, compressed
UN Class	(2.2)
UN Number	UN1066
UN Packaging Group	Nitrogen, compressed, 2.2, UN1066
UN Packaging Group	Not Applicable
Classification for AIR Transportation (IATA)	Consult current IATA Regulations prior to shipping by air.
Classification for Water Transport IMDG	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

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.

16. OTHER INFORMATION

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.

SAFETY DATA SHEET
Argonite®
(Fire Extinguishing Agent and Expellant)

1. IDENTIFICATION

Product Name	Argonite®
Other Names	IG-55
Recommended use of the chemical and restrictions on use	
Identified uses	Fire Extinguishing Agent and Expellant
Restrictions on use	Consult applicable fire protection codes
Company Identification	Kidde-Fenwal, Inc. 400 Main Street Ashland, MA 01721 USA
Customer Information Number	(508) 881-2000
Emergency Telephone Number	
CHEMTREC Number	(800) 424-9300 (703) 527-3887 (International)
Issue Date	October 1, 2015
Supersedes Date	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.

Component	CAS Number	Concentration
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^3 at 70°F (1.41 kg/m^3 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)
UN Class	(2.2)
UN Number	UN1956
UN Packaging Group	Not applicable
Classification for AIR Transportation (IATA)	Consult current IATA Regulations prior to shipping by air.
Classification for Water Transport IMDG	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

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
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Changes made: Update to Section 14.

Information Source and References
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Prepared By: EnviroNet LLC.

16. OTHER INFORMATION

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www.kiddefiresystems.com

06-237619-001 Rev. AA