# Victaulic Vortex™ Hybrid Fire Extinguishing System

For Technical Questions, Scan QR Code for Contact Information for Your Region

victauliclocations.com

## ⚠ WARNING

Failure to follow instructions and warnings can cause system failure, resulting in death or serious personal injury and property damage.

- Read and understand all instructions before attempting to install, remove, adjust, or maintain any Victaulic products.
- Wear safety glasses, hardhat, and foot protection.
- Save this design, installation, and maintenance manual for future reference.

If you need additional copies of any literature, or if you have any questions concerning the safe installation and operation of this product, contact Victaulic.

# TABLE OF CONTENTS

# SECTION I
# SYSTEM OVERVIEW

## HAZARD IDENTIFICATION

Definitions for identifying the various hazard levels are provided below. When you see this symbol, be alert to the possibility of personal injury. Carefully read and fully understand the message that follows.

**DANGER**

- **The use of the word "DANGER" identifies an immediate hazard with a likelihood of death or serious personal injury if instructions are not followed.**

**CAUTION**

- **The use of the word "CAUTION" identifies possible hazards or unsafe practices that could result in personal injury and product or property damage if instructions are not followed.**

**WARNING**

- **The use of the word "WARNING" identifies the presence of hazards or unsafe practices that could result in death or serious personal injury if instructions are not followed.**

**NOTICE**

- **The use of the word "NOTICE" identifies special instructions that are important but not related to hazards.**

## DEFINITIONS FOR "SHOULD" AND "SHALL" REFERENCES USED THROUGHOUT THIS MANUAL

References to "should" within this manual indicate areas of importance that are to be taken under consideration, but are not a requirement.

References to "shall" within this manual indicate areas of critical importance that are a requirement.

## "VICTAULIC VORTEX™ SYSTEM" REFERENCES USED THROUGHOUT THIS MANUAL

Victaulic Vortex™ System, used throughout this manual, is an abbreviated reference to the Victaulic Vortex™ Hybrid Fire Extinguishing System.

## SAFETY REQUIREMENTS

**⚠ WARNING**

- **Victaulic Vortex™ System shall be designed only by competent and certified system designers that have successfully completed all appropriate Victaulic training. System designs shall be conducted per all applicable laws, codes, and industry standards.**
- **System designers shall use sound engineering judgment to design the Victaulic Vortex™ System in accordance with this I-VORTEX.IOM manual. A complete evaluation of the hazards, authority having jurisdiction (AHJ) requirements, applicable laws, codes, and industry standards shall be conducted.**
- **Always verify that the piping system has been completely depressurized and drained immediately prior to installation, removal, adjustment, or maintenance of any Victaulic products.**
- **Contractors shall be certified, per local code requirements, and shall successfully complete all Victaulic training before attempting to install the Victaulic Vortex™ System. Always reference this I-VORTEX.IOM manual and consult the local authority having jurisdiction (AHJ) for complete installation requirements. This manual contains important safety and operational information.**
- **Nitrogen cylinders contain stored energy that can discharge explosively. Transportation and installation shall be performed only by personnel that has been trained on the hazards and proper handling techniques. All nitrogen cylinder movement shall be done with appropriate material handling equipment. Always secure nitrogen cylinders during transport, storage, and use.**
- **All installer-supplied piping shall conform to and be installed in accordance with requirements of this manual, applicable laws, codes, and site-specific standards, and it shall be rated for the pressure and operating conditions to which it will be subjected.**
- **Use only Victaulic replacement parts when servicing the Victaulic Vortex™ System.**
- **Changes to hazard classifications or hazard zones may affect system performance. All changes shall be reported to the AHJ for approval.**

**Failure to follow these instructions could result in death or serious personal injury and property damage.**

### GENERAL SAFETY REQUIREMENTS

1. **Read and understand all instructions before proceeding with installation and maintenance of this Victaulic Vortex™ System.**
2. **Inspect the shipment.** Verify that all components are included in the shipment and that all necessary tools are available for installation.
3. **Use only recommended accessories.** Accessories and equipment that are not approved for use with this hybrid fire extinguishing system may cause improper system operation.
4. **Wear safety glasses, hardhat, foot protection, and hearing protection.** Wear hearing protection if you are exposed to long periods of noisy job-site operations.
5. **Prevent back injury.** Always practice proper lifting techniques.
6. **Avoid using electrically powered tools in dangerous environments.** When using electrically powered tools for installation, verify that the area is moisture-free. Keep the work area well lit, and allow enough space to accommodate installation of the hybrid fire extinguishing system.
7. **Keep work areas clean.** Cluttered areas, benches, and slippery floors can create hazardous working conditions.
8. **PROTECT THE SYSTEM FROM FREEZING CONDITIONS. THE WATER SUPPLY AND WATER SUPPLY PIPING SHALL BE PROTECTED FROM FREEZING TEMPERATURES AND MECHANICAL DAMAGE. COMBINATION, FLUID, AND ZONE PANELS ARE NOT RATED FOR OUTDOOR USE.**

### SAFETY REQUIREMENTS DURING MAINTENANCE AND TESTING

1. **Notify the authority having jurisdiction (AHJ).** Always notify the AHJ before performing any maintenance that takes the system out of service.
2. **Follow the requirements set forth in this manual and by the AHJ for system inspection schedules.** The facility or process owner or their representative is responsible for inspecting the system in accordance with the requirements set forth in this manual and by the local AHJ.
3. **Inform personnel of any testing or of the potential for a system discharge.** Vacate all personnel or provide appropriate personal protection for all personnel during testing or system discharge.
4. **Depressurize or isolate the water supply completely and isolate the nitrogen cylinders before performing any maintenance.**
5. **Protect the system from freezing temperatures, foreign matter, and corrosive atmospheres.** Any condition that might degrade the system or affect system performance shall be avoided.

### NITROGEN GAS SAFETY REQUIREMENTS

1. **A sudden release of high pressure from a nitrogen gas cylinder can result in death or serious personal injury.** Always verify that components, valves, and hoses are installed and in proper condition. All cylinder connections and bracing SHALL be installed and tightened.
2. **Cylinder caps shall be installed when transporting or storing nitrogen gas cylinders.** DO NOT use cylinder caps as a lifting point.
3. **Nitrogen gas cylinders shall be secured to prevent them from falling over.** Store nitrogen gas cylinders in a well-ventilated area. Verify that cylinder valves are safety tied closed.
4. **Cylinders containing compressed nitrogen gas are heavy and awkward to handle.** Improper handling of nitrogen gas cylinders could result in serious personal injury.

**NOTICE**

- **Adequate ventilation shall be provided in the nitrogen storage area in case of a nitrogen leak.**
- **Low nitrogen pressure at the cylinders may indicate low oxygen in the nitrogen storage area.**

5. **In the event of a nitrogen gas cylinder leak, personnel not wearing protective equipment shall leave immediately and be restricted from the area until it has been ventilated properly, the leak has been repaired, and oxygen levels have been restored.**
6. **Audible and visible discharge alarms shall be provided within the hazard zone to ensure prompt evacuation of the hazard zone and to prevent entry into the hazard zone in the event that the Victaulic Vortex™ System activates.** The system shall comply with applicable local and national codes. Safety items such as personnel training, warning signs, discharge alarms, self-contained breathing apparatus (SCBA), evacuation plans, and fire drills shall be considered.

## SYSTEM OVERVIEW

### NOTICE

- **For proper system installation and operation of the Victaulic Vortex™ System, qualified and trained individuals shall read and fully understand the contents of this manual and install the system in accordance with current National Fire Protection Association (NFPA) standards and local codes and standards.**
- **Training and licensing of contractors is required in some jurisdictions. It is the responsibility of the contractor/installer to comply with all licensing and certification requirements.**
- **Standard performance criteria is based upon testing conducted and parameters derived by Victaulic.**
- **Components with equivalent function or purpose shall not be used as a substitute for Victaulic Vortex™ System components.**
- **THIS SYSTEM IS NOT TESTED OR APPROVED FOR EXPLOSIVE ENVIRONMENT APPLICATIONS.**

The Victaulic Vortex™ System may be deployed as a total flooding or local application fire protection system. Hybrid systems may be used as an alternative to clean agent, $CO_2$, and watermist systems.

The Victaulic Vortex™ System is a hybrid fire extinguishing system that utilizes a combination of nitrogen and atomized water to extinguish fire. Nitrogen is an inerting agent, which displaces oxygen and is used to atomize water into small (<10 micron [0.00039 inch]) droplets. The high quantity of small water droplets has a large available total surface area that provides rapid heat absorption and blocks radiant heat transfer. The combination of nitrogen and 10 micron water droplets distributes uniformly throughout the protected space and works together to create an atmosphere that does not support combustion.

System layout, piping design, and nitrogen calculation information can be found within this manual.

The Environmental Protection Agency (EPA) has evaluated and approved the Victaulic Vortex™ System as meeting the requirements of SNAP* Regulations. The EPA has determined that the Victaulic Vortex™ System is an acceptable substitute, which reduces the overall risk to human health and the environment as compared to other systems impacting the environment (such as halocarbons).

### ⚠ WARNING

- **Changes to the hazard classification or to the hazard zone may affect system performance.**
- **All changes shall be reported to the authority having jurisdiction (AHJ) for review and approval.**

**Failure to follow these instructions could cause improper system operation, resulting in death or serious personal injury and property damage.**

## SYSTEM OPERATING TEMPERATURE

The Victaulic Vortex™ System shall be maintained at an ambient temperature between 40°F/4.4°C and 130°F/54°C. The water supply and water piping shall be protected from freezing temperatures.

**COMBINATION, FLUID, AND ZONE PANELS ARE NOT RATED FOR OUTDOOR USE.**

## BASIC SYSTEM DESIGN

The Victaulic Vortex™ System requires Victaulic Vortex™ hybrid emitters and panels, nitrogen storage, and a water source (refer to the drawing on the following page). The minimum required discharge time is dependent upon system design. Refer to the applicable VDM-VORTEX General Design Manual.

Hybrid emitters combine nitrogen at low pressure with a low volume of water to create hybrid media. Water flow is regulated by a water flow control cartridge. Refer to Section II for a listing of hybrid emitters and water flow control cartridges approved for each application.

Victaulic Vortex™ Panels contain an automatic regulating valve (ARV) that reduces pressure from the nitrogen cylinders using feedback from a pressure transducer located within the system piping. Nominal operating pressure supplied out of the ARV to the hybrid emitters is 25 – 50 psi/1.7 – 3.4 Bar, which is programmed depending on hybrid emitter selection, piping size, and system layout.

Victaulic Vortex™ Panels are available to implement single-zone systems or multi-zone systems. Single-zone systems will utilize a single Combination Panel (for regulating water and nitrogen to a single protected space). Multi-zone systems will utilize a single Fluid Panel to regulate nitrogen and a Zone Panel to direct water and nitrogen to each protected space. Typically, multi-zone systems are used when there are three or more spaces to be protected.

High-pressure nitrogen, when supplied by cylinders, will utilize at least one primary solenoid release assembly and several secondary release assemblies that are used to charge the nitrogen supply manifold. The Victaulic Vortex™ System may also use a bulk nitrogen supply, consisting of either high-pressure nitrogen tubes or a low-pressure nitrogen tank.

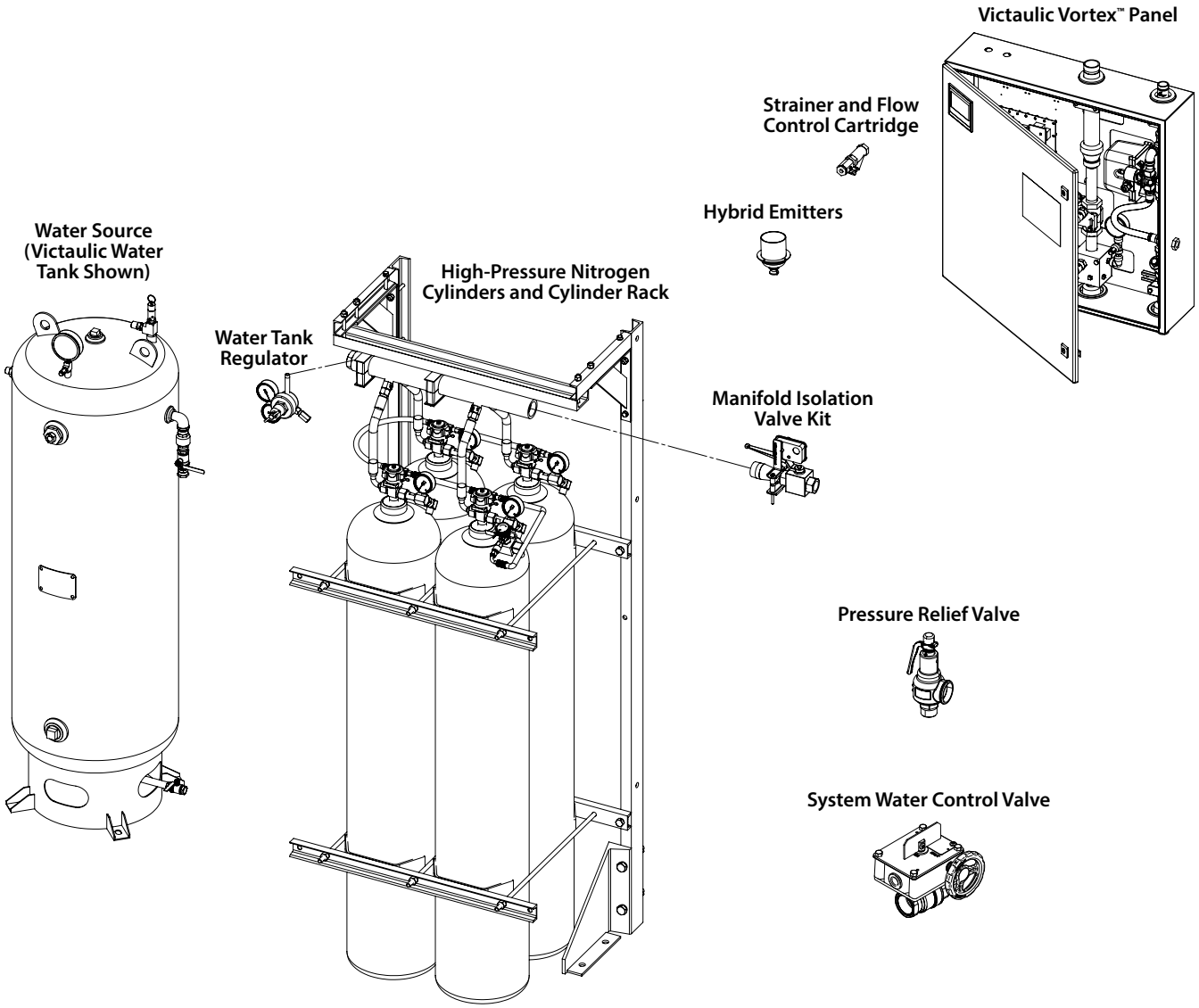
The water supply can be a stand-alone tank provided by Victaulic, an existing domestic water supply, or the facility's reagent-grade water supply. Water supply pressure, capacity, and flow rate shall be evaluated during the initial design process so that adequate water delivery times can be achieved. Proper supervision and maintenance shall be implemented to ensure a reliable water supply.

All nitrogen supply piping shall have a working pressure appropriate for the maximum nitrogen supply pressure. Low-pressure nitrogen piping to the hybrid emitters may consist of several different pipe materials, coatings, and schedules. Pressure relief valves are required in low-pressure nitrogen piping in multi-zone systems, and may be required in single-zone systems. Refer to the applicable VDM-VORTEX General Design Manual for when Victaulic requires pressure relief valves to be installed. Local codes and standards may have additional requirements for pressure relief valves.

Water supply and system piping shall be designed with criteria stated in this manual to ensure proper water delivery time and sustainability in hazardous environments. Refer to the applicable VDM-VORTEX General Design Manual for recommended pipe materials, coatings, and schedules.

Automatic door closures, electrical system shutdown, or other shutdown processes, if required, shall be controlled from the agent-releasing FACP in the event of actuation. Refer to the applicable VDM-VORTEX General Design Manual for guidance on minimum and maximum required openings.

* The Environmental Protection Agency's Significant New Alternatives Policy (SNAP) program




## SYSTEM DISCHARGE

**⚠ WARNING**

- **Caution shall be taken to avoid by-products created from the burning and extinguishment processes.**
- **Unprotected personnel shall not enter the space without self-contained breathing apparatus and personal protective equipment, unless the space has been ventilated and the fire department or their representative determines that the atmosphere is safe for reentry.**
- **Verify that there are no blockages between the Victaulic Vortex™ Panel and hybrid emitters prior to any system testing.**

**Failure to follow these instructions could result in death or serious personal injury.**

It is important to note that the room may contain fire by-products created from the burning and extinguishment processes. Typical by-products are carbon monoxide, carbon dioxide, soot, and reduced oxygen content. In addition, by-products of unburned fuel will be present. The Victaulic Vortex™ System provides cooling properties; however, the potential for re-ignition of fuel shall be evaluated.

**Noise -** Discharge of the Victaulic Vortex™ System can cause noise loud enough to be startling; however, the noise level is not high enough to cause permanent or traumatic injury.

**Turbulence -** Discharge of the Victaulic Vortex™ System can cause enough general turbulence to move unsecured, light objects.

**Temperature -** Discharge of the Victaulic Vortex™ System can cause reduction in temperature and visibility due to the condensation of water vapor.

**⚠ WARNING**

- **In the event of a significant fire, rapid heat release from the fire can cause excessive pressurization of the protected space. Additionally, activation of the Victaulic Vortex™ System can cause rapid cooling, resulting in depressurization of the protected space.**
- **In the event of system discharge, activation of the Victaulic Vortex™ System will release nitrogen into the protected space.**
- **The protected space and any ventilation shall be designed to prevent overpressurization.**

**Failure to follow these instructions could result in death or serious personal injury.**

## NITROGEN SUPPLY REQUIREMENTS

Victaulic may provide nitrogen cylinders or bulk tanks that may be high-pressure tubes or low-pressure tanks. Nitrogen supply shall be 99.9% purity or better

Per NFPA 770, pressure vessels intended to be transported while pressurized shall meet DOT/TC or equivalent national and local codes, standards, and requirements. All other nitrogen pressure vessels shall meet ASME Boiler and Pressure Vessel Code, Section VIII, or equivalent national and local codes, standards, and requirements.

Nitrogen supply containers shall be installed in secure, ventilated, and environmentally-controlled areas where the ambient temperature remains between 40°F/4°C minimum and 130°F/54°C maximum. Permanent nitrogen tanks shall be installed for easy access for refilling and maintenance, per local code requirements. Storage containers and accessories shall be installed so that inspection, testing, recharging, and maintenance requirements are facilitated and interruption to the fire protection provided by the Victaulic Vortex™ System is kept to a minimum. Storage containers shall be located as close as possible to the hazard protection area and shall not be exposed to fire or mechanical damage that could affect performance during system operation. Where excessive climatic exposure is expected, guards or enclosures shall be provided.

The Victaulic Vortex™ System is designed for operation at a nominal starting supply pressure of 2000 – 3000 psi/137.9 – 206.8 Bar. The nitrogen supply vessels used, hazard type, room volume, and other design details determine the supply pressure and refill pressure for a specific job. Always reference the system documentation for required quantity of nitrogen and fill pressure. **NOTE:** Contact Victaulic for requirements when operating at lower pressures (scan QR code on front cover for contact information for your region).

A change in climatic temperature may affect nitrogen pressure. **NOTE:** Upon a temperature-adjusted pressure loss greater than 5%, or as determined by the AHJ, the nitrogen supply shall be refilled.

### Bulk Nitrogen Supply

Victaulic can provide custom-sized ASME rated high-pressure manifolded tubes for the nitrogen supply. DOT tube packs may be used if approved by the AHJ, in accordance with applicable local codes and standards. Contact Victaulic for sizing and site-specific solutions (scan QR code on front cover for contact information for your region).

The building owner or installing contractor shall consult with a registered civil/structural engineer to provide a foundation design. The civil/structural engineer shall be familiar with the regulatory requirements at the installation site (including building codes, soil bearing pressure, seismic or wind criteria, extreme frost penetration, flooding, and other specific design requirements).

### Connected Nitrogen Reserve (Optional)

An extra, full complement of charged nitrogen cylinders manifolded and piped to feed into the automatic system shall be considered. The reserve supply maximizes system protection by restoring the system quickly to full ready condition and is desirable in instances where additional protection is required (re-flash occurrence, main bank malfunction, service or maintenance, excessive delivery time, or refilling of primary tanks).

### Nitrogen Gas Supply

**⚠ WARNING**

- **Only Victaulic-approved nitrogen gas cylinders shall be used for the Victaulic Vortex™ System.**

**Failure to follow this instruction could result in serious personal injury and/or property damage.**

Nitrogen gas supply facilities vary by location. The system design process shall include developing a plan to refill the system in the event of system discharge or maintenance. Refer to Section II, along with Victaulic publication 70.04, for nitrogen cylinder capacities and fill pressures.

## WATER SUPPLY REQUIREMENTS

Per NFPA 770, the water supply for a hybrid system shall be taken from a source that is equivalent in quality to a potable source with respect to particulate and dissolved solids.

The particular hazard being protected or the application may dictate a higher quality of water. In these cases, the storage of water and piping shall be compatible with the type of water being used.

All water supplies shall be supervised to ensure water is available for system demand.

### Standalone Water Supplies

Victaulic may supply pressure vessels for water storage that are designed, fabricated, inspected, certified, and stamped in accordance with ASME Section VIII, Div. 1 or equivalent national and local standards. Refer to the applicable VDM-VORTEX General Design Manual to determine water tank capacity.

### Water Main/Premise Supply

When connected to a water main or premise water supply, the required supply to the Victaulic Vortex™ System shall be evaluated by a qualified engineer and accepted by the AHJ.

## LISTED OR APPROVED AGENT-RELEASING FIRE ALARM CONTROL PANEL (FACP) OR AGENT-RELEASING MODULE

The Victaulic Vortex™ System is designed to be activated by a listed or approved agent-releasing FACP or agent-releasing module. The Victaulic trained integrator shall use controls, detectors, and releasing devices that are intended for the specific application. The designer and installer shall be trained in all aspects, including (but not limited to) design, installation, and maintenance of the fire alarm system.

## DETECTION

Detection shall be designed in accordance with all NFPA 72 requirements and any specific requirements established by stakeholders of the facility being protected and the AHJ.

**NOTICE**

- **All detection devices shall be listed or approved for their intended application.**
- **Detection devices (flame, heat, smoke, etc.) SHALL be compatible with the electronics of the agent-releasing FACP. Refer to the agent-releasing FACP manufacturer's instructions.**

## ALARMS

Audible and/or visible discharge alarms shall be utilized to ensure timely evacuation of the hazard zone in the event that the system activates. A means of egress from the hazard zone shall be provided to ensure proper evacuation.

**NOTICE**

- **All agent releasing fire alarm control panel, agent releasing module, alarm devices, and detection shall be FM Approved when designing an FM Approved system**

## AUXILIARY FUNCTIONS

Where applicable, the following components shall be tied into the detection and control system by qualified installers.

- Automatic door closures
- Electrical system shutdown
- Fuel and lubrication supply shutoff
- Ventilation system shutdown
- Containment for flammable liquid releases
- Extinguishment fluid protection of entire containment or hazard area

## AUXILIARY COMPONENTS

Auxiliary isolation valves shall be monitored (supervised) to prevent accidental shut-off.

## TOOLS AND SUPPLIES

The following section identifies tools and other equipment that are recommended for installing the Victaulic Vortex™ System.

**Discharge Pressure Verification Method:**

- 0–100-psi/0–6.9-Bar Pressure Gauge, Tee Adapter, Flexible Line

**Electrical Troubleshooting Device:**

- Auto Range Digital Multi-Meter (DMM)

**Oxygen Warning Device:**

While working in the same room with nitrogen cylinders, or while performing discharge tests, a personal oxygen meter is highly recommended. **NOTE:** Oxygen warning devices are sensitive equipment that require calibration and training for proper use.

**Review of Tools Recommended for Installation:**

- Various wrench sizes:
  - ¾ inch
  - 27 mm
  - 32 mm
  - 36 mm
  - 12-inch adjustable
  - 18-inch adjustable
- PH1 and PH2 Phillips*-Head Screwdrivers
- 3.5-mm Blade Width Flat-Head Screwdriver
- Personal Oxygen Meter
- Personal Protective Equipment
- Discharge or Testing Warning Signs
- Leak Detection Method
- Refill Adapter Assembly

## SAFETY SIGNAGE/PLACARDS

Signage and placards shall be in accordance with NFPA 770 or applicable codes and standards, and they shall be accepted by the AHJ. The installing contractor shall provide a permanently-marked system information sign.

**Victaulic Vortex™ Panel Nameplate**

Each Victaulic Vortex™ System will contain a nameplate that is affixed to the Victaulic Vortex™ Panel.

**Nitrogen Cylinder Rack Warning Placard**

Each Victaulic Vortex™ System will ship with a nitrogen cylinder rack warning placard that shall be attached to the cylinder rack.

**Hazard Zone Warning Placards**

Victaulic has hazard zone warning placards available for order. The system designer/integrator should consider the type and amount of hazard zone warning placards that are required. **NOTE:** Placards that are deemed necessary by the system designer/integrator, building owner, or AHJ may be used in lieu of the versions that Victaulic has available for order.

**Manual Pull Station Placard**

Victaulic has a manual pull station placard available for order. The system designer/integrator should consider the amount of manual pull station placards that are required. **NOTE:** A placard that is deemed necessary by the system designer/integrator, building owner, or AHJ may be used in lieu of the version that Victaulic has available for order.

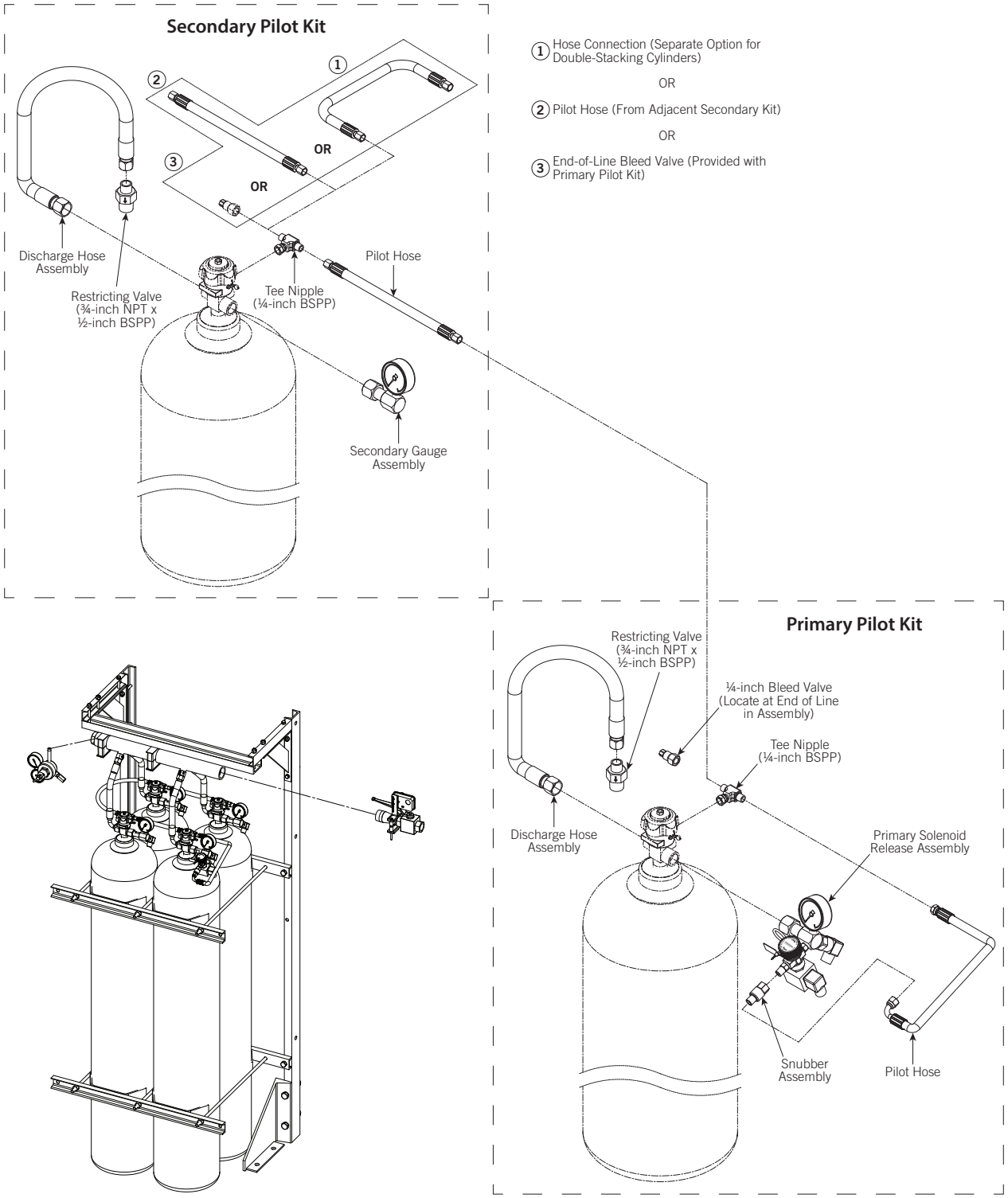
* Phillips is a registered trademark of Phillips Screw Company

# SECTION II
# COMPONENTS

## VICTAULIC VORTEX™ NITROGEN CYLINDER MANIFOLD SYSTEM

The Vortex nitrogen cylinder manifold system is comprised of a multi-cylinder assembly, interconnected hoses, a common manifold, and release solenoid(s). The manifold system is connected to a Victaulic Vortex™ Panel, which contains the ARV that maintains constant flow of nitrogen as the cylinders decrease in pressure.

A release signal from the agent-releasing FACP is routed through the Combination or Fluid Panel. The signal is then sent to the primary solenoid release assembly. The primary solenoid release assembly allows pressure from the primary cylinder into the connected pilot line, which provides a conduit for the pressure to enter the upper chambers of the remaining cylinder valves. When the upper chamber becomes pressurized, the cylinder valve opens (as indicated by the upward movement of the valve position indicator located on top of the cylinder valves). The open cylinder valves allow nitrogen gas to pressurize the manifold. The Victaulic Vortex™ System may be designed to begin discharge upon pressure being detected at the input to the panel, or upon application of a 24V release signal (refer to panel descriptions). When nitrogen flow starts, a downstream pressure transducer senses pressure within the system plumbing. The pressure transducer provides a continuous signal to the ARV during actuation to maintain constant system pressure.



## APPROVALS FOR COMPONENTS LISTED IN THIS SECTION

The components listed in the table below with "FM Approved" have been evaluated and approved as part of the FM Approved system.

| Item | Approval(s) |
|---|---|
| Cylinders | FM APPROVED |
| Primary Pilot Kit for 80-Liter Cylinders | FM APPROVED |
| Secondary Pilot Kit for 80-Liter Cylinders | FM APPROVED |
| Manifold | FM APPROVED |
| Manifold Isolation Valve Kit | FM APPROVED |
| Cylinder Rack | FM APPROVED |
| Combination Panel | FM APPROVED |
| Fluid Panel | FM APPROVED |
| Zone Panel | FM APPROVED |
| Pressure Transducer | FM APPROVED |
| Hybrid Emitters | Reference the "Hybrid Emitters" section in this manual. |
| Water Flow Kit | Reference the "Hybrid Emitters" section in this manual. |
| Pressure Relief Valve Requirement for Multi-Zone Systems | FM APPROVED |
| Low-Pressure Nitrogen Pressure Switch | FM APPROVED |
| System Water Control Valve | FM APPROVED |
| Water Tank Regulator Kit | FM APPROVED |
| High-Capacity Water Tank Regulator Kit | FM APPROVED |
| Water Tank Pressure Switch | FM APPROVED |
| Water Tanks | FM APPROVED |

## CYLINDERS

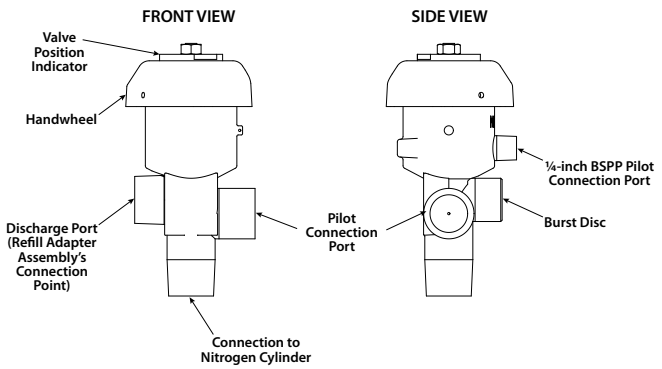
### Cylinder Valve Assembly

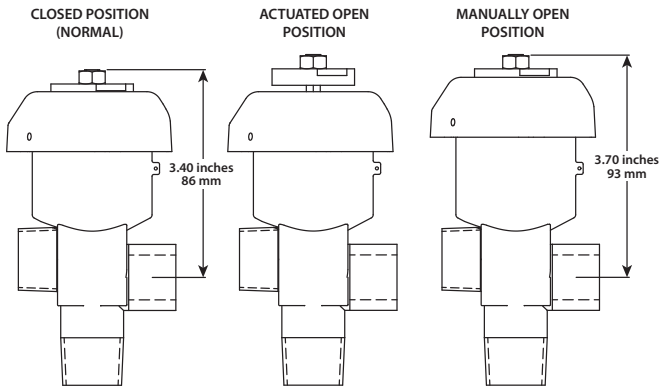
Cylinder valves are pneumatically operated, allowing the manifold to remain unpressurized until the system is discharged. When nitrogen pressure is applied to the pilot connection port, the valve opens and allows nitrogen to flow from the discharge port.

The cylinder valves operate on a 1-to-10 ratio and require a minimum of 300 psi/20.7 Bar for the 3000-psi/206.8-Bar system. Each valve is protected by a safety burst disc. The valves contain multiple connection points, providing a means for filling and activation.

Multiple cylinder valves may be operated off a single pilot line that is pressurized by the primary solenoid release assembly, using nitrogen pressure from the cylinder in which it is connected. Multiple solenoid release assemblies may be used for redundancy or in multi-zone systems. In addition, multiple solenoid release assemblies may be used for main and reserve discharges when designed accordingly.

The cylinder valve has the following connections: discharge port, pilot connection port, and a ¼-inch BSPP/Rp pilot connection port. All cylinder valve connections achieve a pressure-tight joint using an o-ring.




### Cylinder Valve Connections

Cylinder valves are shipped installed on the cylinders and contain a discharge port, pilot connection port, and a ¼-inch pilot connection port. **NOTE:** The discharge port is located higher than the pilot connection port.

Each cylinder group requires at least one primary solenoid release assembly. The primary solenoid release assembly contains a combination release solenoid with manual release, a pressure gauge, and a pressure switch.

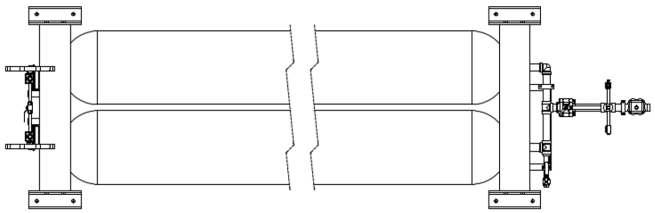
A pressure monitoring assembly (containing a pressure gauge and optional pressure switch, when configured accordingly) is mounted on all secondary cylinders.

The cylinder valve connections are provided in kit form and are referred to as the primary pilot kit and secondary pilot kit. The primary and secondary cylinder valves are connected using the associated kits.

### Bulk Tubes

**NOTICE**

- **Bulk tubes are not part of an FM Approved system.**

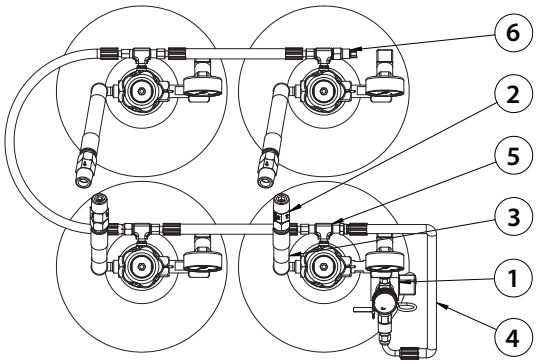


For large Victaulic Vortex™ System, Victaulic offers bulk nitrogen supply options as an alternative to multiple 80-liter DOT nitrogen cylinders. A bulk nitrogen storage tube pack is a practical solution for systems requiring more than approximately 50 nitrogen cylinders. However, this is determined by specific site and performance requirements. The diameter and length of the tubes, the number of tubes, the fill pressure, and the end of discharge determine nitrogen bulk tube capacity.

Victaulic offers ASME 24-inch/600-mm diameter tubes at 38 feet/125 meters long, with a typical fill pressure of 2400 psi/ 16547 kPa/165 bar. Correct sizing of the bulk tube requires specifying the end-of-discharge pressure at 70°F to ensure adequate nitrogen delivery through the end-of-discharge. The integrator is responsible for determining the appropriate end-of-discharge pressure based on pressure loss in the nitrogen piping, lowest ambient temperature, and appropriate safety factor.

Nitrogen storage bulk tubes are built-to-order per customer specifications. Always reference the nitrogen storage bulk tube specification drawings for dimensions, configuration details, and for codes and standards that apply. The standard pressure vessel is designed and constructed in accordance with ASME Sec. VIII Div 1, and the standard manifold piping is designed and constructed n accordance with ASME B31.1. Refer to the "Bulk Tube Order Form" for additional information.

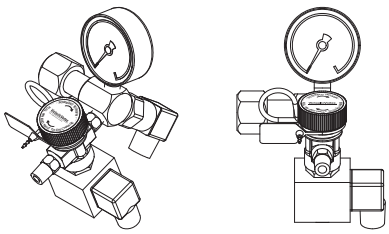
## PRIMARY PILOT KIT FOR 80-LITER CYLINDERS




**NOTE:** Manifold not shown for clarity of components.

| Item | Part Code | Description |
|---|---|---|
| 1 | S000950B22 | Primary Solenoid Release Assembly |
| 2 | S000950BA1 | Discharge Hose Restricting Valve |
| 3 | P000955A29 | Discharge Hose, DOT 80L, Right Angle, 13.5" Overall Length |
| 4 | S000950B08 | ¼" Primary Pilot Hose, Right Angle, 17.7" Overall Length |
| 5 | S000950BA2 | ¼" BSPP/Rp Pilot Line Tee Nipple |
| 6 | S000950BA4 | ¼" End-of-Pilot-Line Bleed Valve with Crush Washer |
| Part Code for Entire Primary Pilot Kit - S0009500PP | | |

**Primary Solenoid Release Assembly (Item 1 Above)**



The primary solenoid release assembly includes a pressure gauge, a solenoid with manual release, and a pressure switch. A coil position monitoring switch is available. Every primary solenoid release assembly provides a means to electrically (24VDC) and manually release the system. One primary solenoid release assembly can release up to 24 cylinders. **NOTE:** If redundant primary solenoid release assemblies are required, a second primary solenoid release assembly may be added to the pilot line.

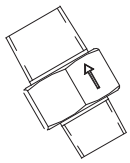
The pressure switch may be adjusted, as required by the AHJ and the specific nitrogen cylinders and refill pressures within the system (factory set point for the pressure switch is 2100 psi/144.8 Bar +/-100 psi/6.9 Bar). To adjust the pressure setting of the switch, apply a known pressure and monitor the electrical contacts. Clockwise turns of the adjustment screw at the back of the pressure switch will increase the set point and counterclockwise turns will decrease the set point.

The pressure switch shall be used in addition to the pressure gauge. Prescribed reading of the pressure gauge shall still be performed, as required by NFPA 770 and other applicable codes. The pressure switch set point may be adjusted in accordance with all applicable laws, codes, and industry standards to avoid nuisance tripping.

### NOTICE

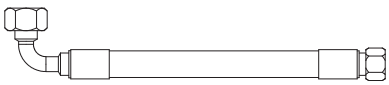
- **The AHJ may require a second primary solenoid release assembly with fewer cylinders.**
- **Refer to Section VIII for instructions on how to manually operate the system. In a zoned system, the Zone Panels shall be released prior to manually releasing nitrogen.**
- **Verify that the threaded nut of the primary solenoid release assembly is tightened completely to the pilot connection port of the cylinder valve during installation.**

**Discharge Hose Restricting Valve (Item 2 Above)**



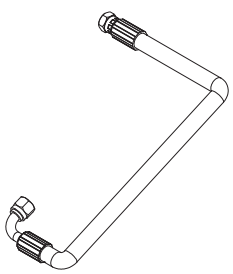
The supplied discharge hose restricting valves are installed between the discharge hoses and manifold and are specially designed to provide controlled nitrogen flow. The discharge hose restricting valves allow for full nitrogen flow from the cylinder to the manifold and restricted flow from the manifold to the cylinder. This restricts the flow of unintended nitrogen release from the manifold in the event a nitrogen discharge hose is disconnected. Although flow direction is marked, the discharge hose restricting valve has a ½-inch BSPT inlet and a ¾-inch NPT outlet to prevent reverse installation. For reverse flow, $C_v$ = 0.028. For forward flow, $C_v$ = 3.34.

**Discharge Hose (Item 3 Above)**



The discharge hose has ¾-inch BSPP/Rp x ½-inch BSPP/Rp connections and is used to transmit nitrogen gas from the cylinder valves to the manifold.

**Primary Pilot Hose (Item 4 Above)**



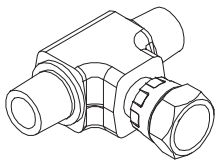
The primary pilot hose is a ¼-inch ID reinforced rubber hose with a 90° elbow and ¼-inch BSPP/Rp connections; this hose is used to connect the outlet of the releasing solenoid to the tee connection used on the cylinder valve.

To connect from front to rear cylinder rows, use the 27.5-inch/700-mm pilot hose (ordered separately) to connect the cylinder valves.

To connect the cylinder valves of the same cylinder row on adjacent cylinder racks, use the 19.7-inch/500-mm pilot hose (ordered separately).

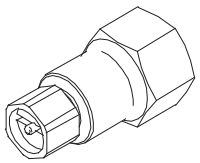
Refer to the "Pilot Hose Options" section on the following page for additional information.

**Pilot Line Tee Nipple (Item 5 on Previous Page)**



The pilot line tee nipple has ¼-inch BSPP/Rp connections and attaches to the cylinder valve's pilot connection port; this pilot line tee nipple is used to interconnect the pilot hoses. Depending on the cylinder configuration, the pilot line tee nipple may contain a ¼-inch bleed valve (end-of-line) or an additional pilot hose when used in succession (interconnected) with additional cylinder valve assemblies.

**End-of-Pilot-Line Bleed Valve (Item 6 on Previous Page)**



The end-of-pilot-line bleed valve is installed on the last tee connection and shall be used on the last cylinder valve connection. During normal operation, this bleed valve seals and captures pressure within the pilot line, which actuates the cylinder valves open. The bleed valve contains a Schrader* valve that, when depressed, releases captured pressure and allows the cylinder valves to close/reset after actuation.

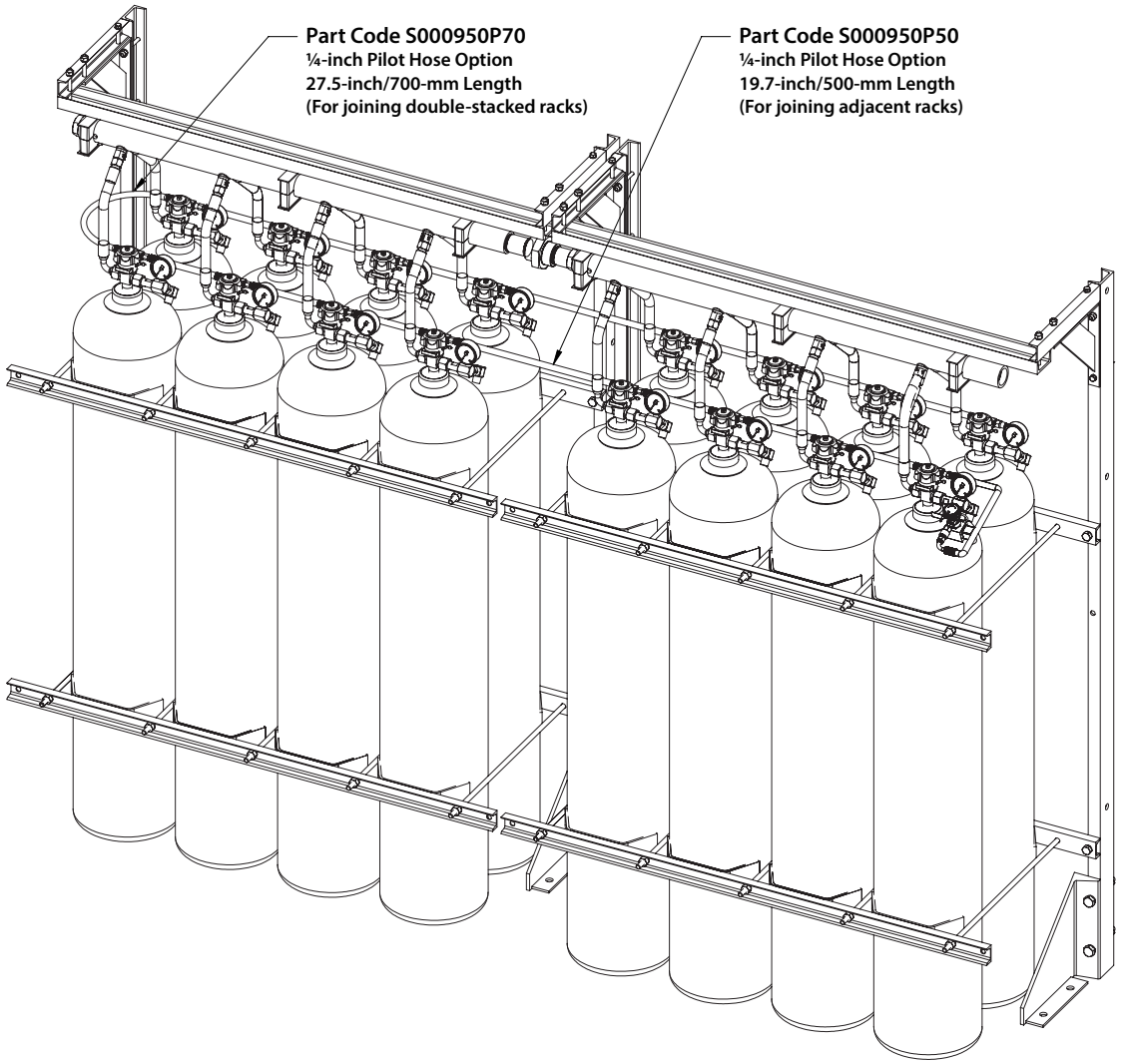
* Schrader is a registered trademark of Schrader International, a Tomkins Company

**⚠ CAUTION**

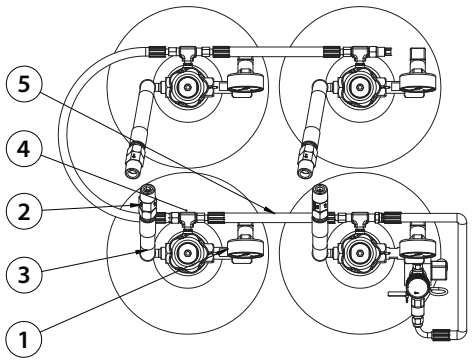
- **Care shall be taken when installing the copper washer and when depressing the pin on the pilot line bleed valve.**
- **A sharp noise and release of pressure will occur when the pin on the pilot line bleed valve is depressed.**
- **DO NOT use your finger to manually depress the pin on the pilot line bleed valve.**
- **Wear personal protective equipment (hearing protection, safety glasses, etc.) when working around the pilot line bleed valve.**

**Failure to follow these instructions could result in personal injury.**

**Pilot Hose Options**



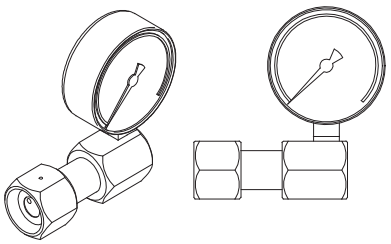
## SECONDARY PILOT KIT FOR 80-LITER CYLINDERS




| Item | Part Code | Description |
|---|---|---|
| 1 | P000951135 | Secondary Gauge Assembly with Pressure Switch |
| 2 | S000950BA1 | Discharge Hose Restricting Valve |
| 3 | P000955A29 | Discharge Hose, DOT 80L, Right Angle, 13.5" Overall Length |
| 4 | S000950BA2 | ¼" BSPP/Rp Pilot Line Tee Nipple |
| 5 | S000950P32 | ¼" Pilot Hose for Adjacent Cylinders, 11.8" Overall Length |
| Part Code for Entire Secondary Pilot Kit - S000950PSP | | |

**NOTE:** Manifold not shown for clarity of components.

**Secondary Gauge Assembly with Pressure Switch (Item 1 Above)**



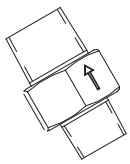
The secondary gauge assembly attaches to the pilot connection port and includes a pressure gauge and pressure switch. The gauge displays the pressure within the cylinder. The pressure switch provides a supervisory output for each cylinder. To adjust the pressure setting of the switch, apply a known pressure and monitor the electrical contacts.

Clockwise turns of the adjustment screw at the back of the pressure switch will increase the set point and counterclockwise turns will decrease the set point. The pressure switch is adjustable (factory set point for the optional pressure switch is 2100 psi/144.8 Bar +/-100 psi/6.9 Bar).

### NOTICE

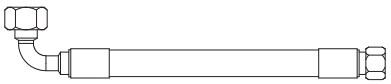
- **Verify that the threaded nut of the secondary gauge assembly is tightened completely to the pilot connection port of the cylinder valve during installation.**

**Discharge Hose Restricting Valve (Item 2 Above)**



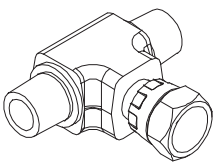
The supplied discharge hose restricting valves are installed between the discharge hoses and manifold and are specially designed to provide controlled nitrogen flow. The discharge hose restricting valves allow for full nitrogen flow from the cylinder to the manifold and restricted flow from the manifold to the cylinder. This restricts the flow of unintended nitrogen release from the manifold in the event a nitrogen discharge hose is disconnected. Although flow direction is marked, the discharge hose restricting valve has a ½-inch BSPT inlet and a ¾-inch NPT outlet to prevent reverse installation. For reverse flow, $C_v$ = 0.028. For forward flow, $C_v$ = 3.34.

**Discharge Hose (Item 3 Above)**



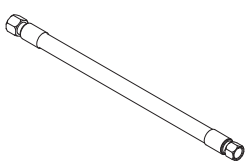
The discharge hose has ¾-inch BSPP/Rp x ½-inch BSPP/Rp connections and is used to transmit nitrogen gas from the cylinder valves to the manifold.

**Pilot Line Tee Nipple (Item 4 Above)**



The pilot line tee nipple has ¼-inch BSPP/Rp connections and attaches to the cylinder valve's pilot connection port; this pilot line tee nipple is used to interconnect the pilot hoses. Depending on the cylinder configuration, the pilot line tee nipple may contain a ¼-inch bleed valve (end-of-line) or an additional pilot hose when used in succession (interconnected) with additional cylinder valve assemblies.

**Pilot Hose for Adjacent Cylinders (Item 5 Above)**

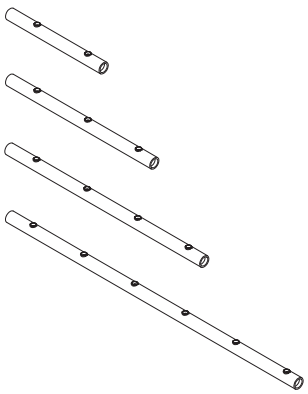


The pilot hose for adjacent cylinders is a ¼-inch ID reinforced rubber hose that is used to connect the tee connections on the cylinder valves. The standard pilot hose is 11.8 inches/300 mm in length and is provided to accommodate connection of cylinders. An optional pilot hose, approximately 27.5 inches/ 700-mm long, is used to interconnect rows (ordered separately).

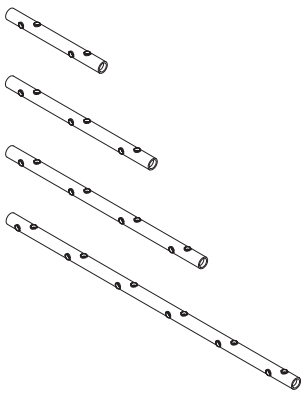
Refer to the "Pilot Hose Options" section on the previous page for additional information.

## MANIFOLD

**Part Code S00M950PM2 for Two-Cylinder Manifold, (2x1)**
**Part Code S00M950PM3 for Three-Cylinder Manifold, (3x1)**
**Part Code S00M950PM4 for Four-Cylinder Manifold, (4x1)**
**Part Code S00M950PM6 for Six-Cylinder Manifold, (6x1)**
**Part Code S00M950PP4 for Four-Cylinder Manifold, (2x2)**
**Part Code S00M950PP6 for Six-Cylinder Manifold, (3x2)**
**Part Code S00M950PP8 for Eight-Cylinder Manifold, (4x2)**
**Part Code S00M95PP12 for Twelve-Cylinder Manifold, (6x2)**

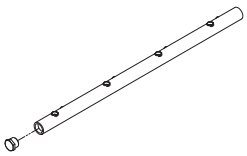


2-, 3-, 4-, and 6-Port Manifold



4-, 6-, 8-, and 12-Port Manifold

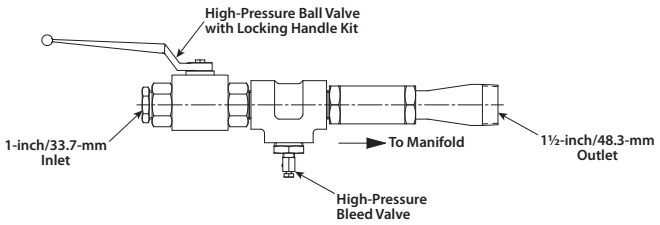
The manifold is specially manufactured from Schedule 160 carbon steel pipe with inlets to match the primary discharge hoses. The manifold is specially coated and features ¾-inch NPT connections for the discharge hose and 1 ½-inch NPT connections on each end, providing design flexibility.



Multiple manifolds may be interconnected with piping and fittings with pressure ratings of the maximum expected pressure from the inert gas source.

## MANIFOLD FILL ASSEMBLY (OPTIONAL)

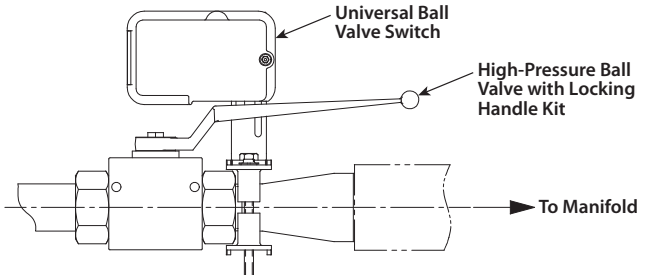
**Part Code S000950015**



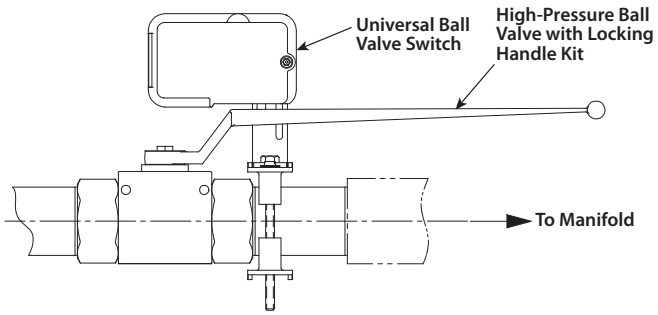

The optional manifold fill assembly provides access for refilling nitrogen cylinders from a high-pressure nitrogen source, such as a nitrogen tube trailer, without having to remove the cylinders from the manifold. The manifold fill assembly requires customer-supplied provisions to connect a high-pressure nitrogen source, such as high-pressure piping, to an accessible location outside the building for a nitrogen tube trailer. The optional manifold fill assembly features a 1-inch/33.7-mm high-pressure ball valve with locking handle, a high-pressure bleed valve, and applicable piping for connecting to the manifold.

**Manifold Isolation Valve Kit**

**Part Code S000950010 for 1-inch Manifold Isolation Valve Kit**
**Part Code S014950121 for 1 ½-inch Manifold Isolation Valve Kit**




Manifold Isolation Valve Kit with 1-inch/33.7-mm NPT Ball Valve

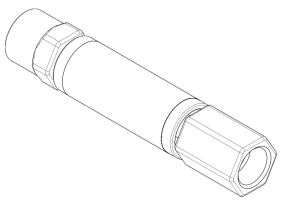



Manifold Isolation Valve Kit with 1½-inch/48.3-mm NPT Ball Valve

The manifold isolation valve kit isolates the manifold assembly from the Combination or Fluid Panel and includes a high-pressure ball valve with locking handle kit and a universal ball valve switch. **NOTE:** Assembly of the universal ball valve switch shall be performed by the integrator.

## REFILL ADAPTER ASSEMBLY

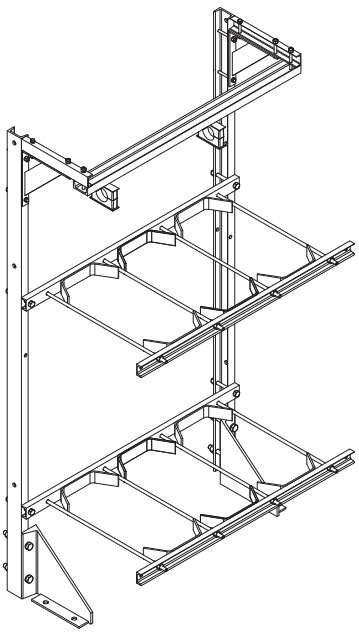
**Part Code S002950000 for Single-Cylinder Refill Adapter, CGA-580 Inlet**
**Part Code S002950401 for Single-Cylinder Refill Adapter, CGA-677 Inlet**

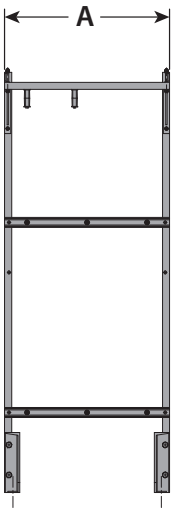


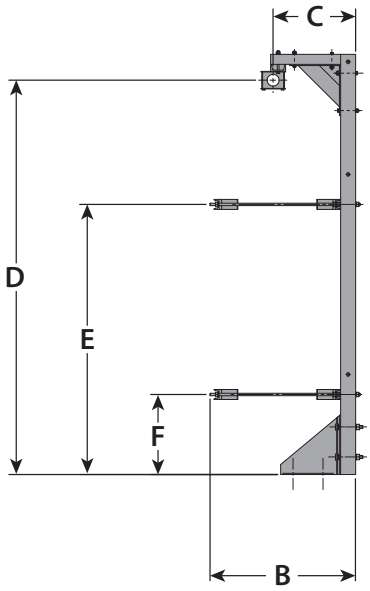
The refill adapter assembly is used for refilling individual nitrogen cylinders. Refer to Section IX for complete instructions on how to use the refill adapter assembly.

## CYLINDER RACK DIMENSIONS – RED PAINTED STRUCTURAL STEEL

**Part Code K800950002 for Cylinder Rack, 80L, Structural, Red Painted (2 cylinder 2x1)**
**Part Code K800950003 for Cylinder Rack, 80L, Structural, Red Painted (3 cylinder 3x1)**
**Part Code K800950104 for Cylinder Rack, 80L, Structural, Red Painted (4 cylinder 4x1)**
**Part Code K800950106 for Cylinder Rack, 80L, Structural, Red Painted (6 cylinder 6x1)**
**Part Code K800950004 for Cylinder Rack, 80L, Structural, Red Painted (4 cylinder 2x2)**
**Part Code K800950006 for Cylinder Rack, 80L, Structural, Red Painted (6 cylinder 3x2)**
**Part Code K800950008 for Cylinder Rack, 80L, Structural, Red Painted (8 cylinder 4x2)**
**Part Code K800950012 for Cylinder Rack, 80L, Structural, Red Painted (12 cylinder 6x2)**






| 80-Liter Cylinder Arrangements | Dimensions - inches/mm | | | | | | |
|---|---|---|---|---|---|---|---|
| | A | B Single Row | B Double Row | C | D | E | F |
| 2 to 4 Cylinders | 33.00<br>838.2 | 21.25<br>540.0 | 30.50<br>776.0 | 16.50<br>419.0 | 78.83<br>2002.3 | 54.00<br>1371.6 | 16.00<br>406.4 |
| 3 to 6 Cylinders | 45.00<br>1143.0 | | | | | | |
| 4 to 8 Cylinders | 57.00<br>1447.8 | | | | | | |
| 6 to 12 Cylinders | 81.00<br>2057.4 | | | | | | |

## COMBINATION PANEL (SINGLE-ZONE OR MULTI-ZONE)

The Combination Panel is IP 52/NEMA 12 rated and houses the ARV and water supply/control valves. Combination Panels are available with 1-inch/33.7-mm or 1 ½-inch/48.3-mm ARVs, and corrosion-resistant water line options. ARV size is chosen based upon total required hybrid emitter nitrogen flow. CPVC and stainless steel material options are available for the water valve and water piping.

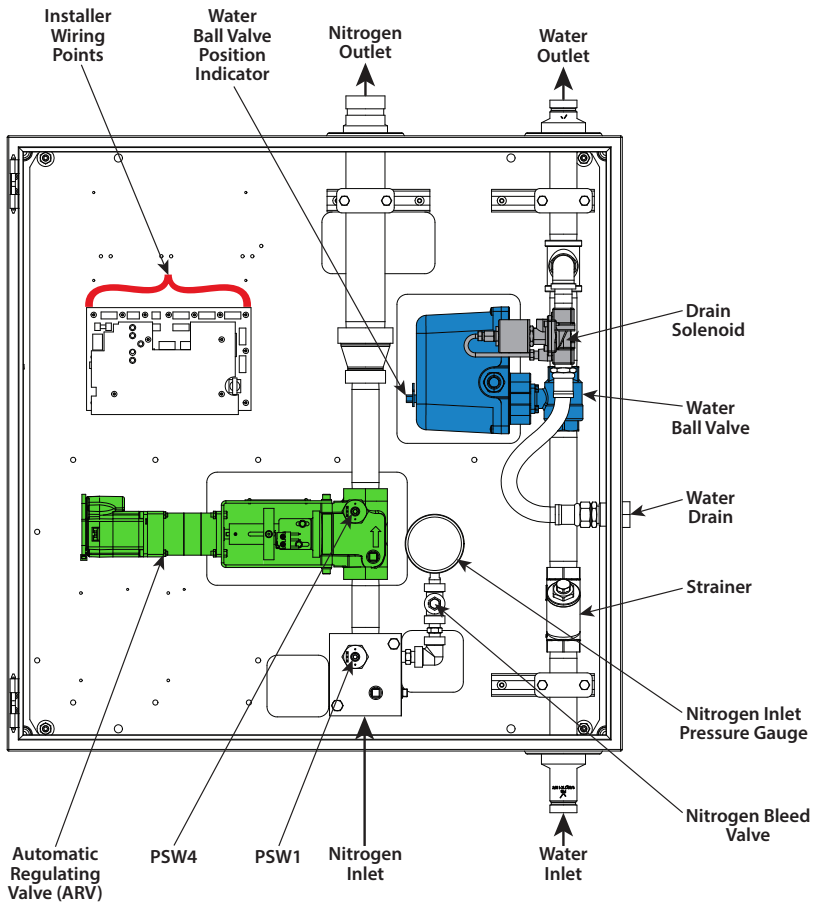
Combination Panels are available as Active Release or Dry Contact Release. Active Release Panels begin opening the ARV when nitrogen pressure is detected at the inlet to the panel. Dry contact release panels begin opening the ARV when a release signal is received at the Victaulic Vortex™ Panel.

An Active Release Combination Panel requires, at minimum, one 24VDC release signal from the agent-releasing FACP to operate the primary solenoid release assembly. A Dry Contact Release Panel requires a minimum of two 24VDC release signals (one to operate the primary solenoid release assembly and one for the release input on the panel).

Active release panels are generally used for all applications, except when multiple panels are installed on a common manifold and are required to discharge independently.

When manual discharge is required, Active Release Panels will begin discharging when nitrogen pressure is detected at the inlet. Dry contact panels will require an electrical release input signal.

Power is required for the panel to operate, even when nitrogen is manually released. A battery-backed-up power supply is recommended.




**Victaulic Vortex™ Combination Panel, Dry Contact Release, Water Ball Valve, 1-inch/33.7-mm Assembly Shown Above**

| 1-inch Combination Panel Description | Part Code |
|---|---|
| Victaulic Vortex™ Combination Panel, Dry Contact, Ball Valve | S010951CD2 |
| Victaulic Vortex™ Combination Panel, Active Release, Ball Valve | S010951CA2 |

| 1 ½-inch Combination Panel Description | Part Code |
|---|---|
| Victaulic Vortex™ Combination Panel, Dry Contact, Ball Valve | S014951CD2 |
| Victaulic Vortex™ Combination Panel, Active Release, Ball Valve | S014951CA2 |

## FLUID PANEL (MULTI-ZONE)

The Fluid Panel is utilized in conjunction with Zone Panels in a multi-zone system and houses the ARV, which controls nitrogen flow to the Zone Panel.

The Fluid Panel is IP 52/NEMA 12 rated and houses the ARV. Fluid Panels are available with 1-inch/33.7-mm or 1 ½-inch/48.3-mm ARVs. ARV size is based upon total required hybrid emitter nitrogen flow.

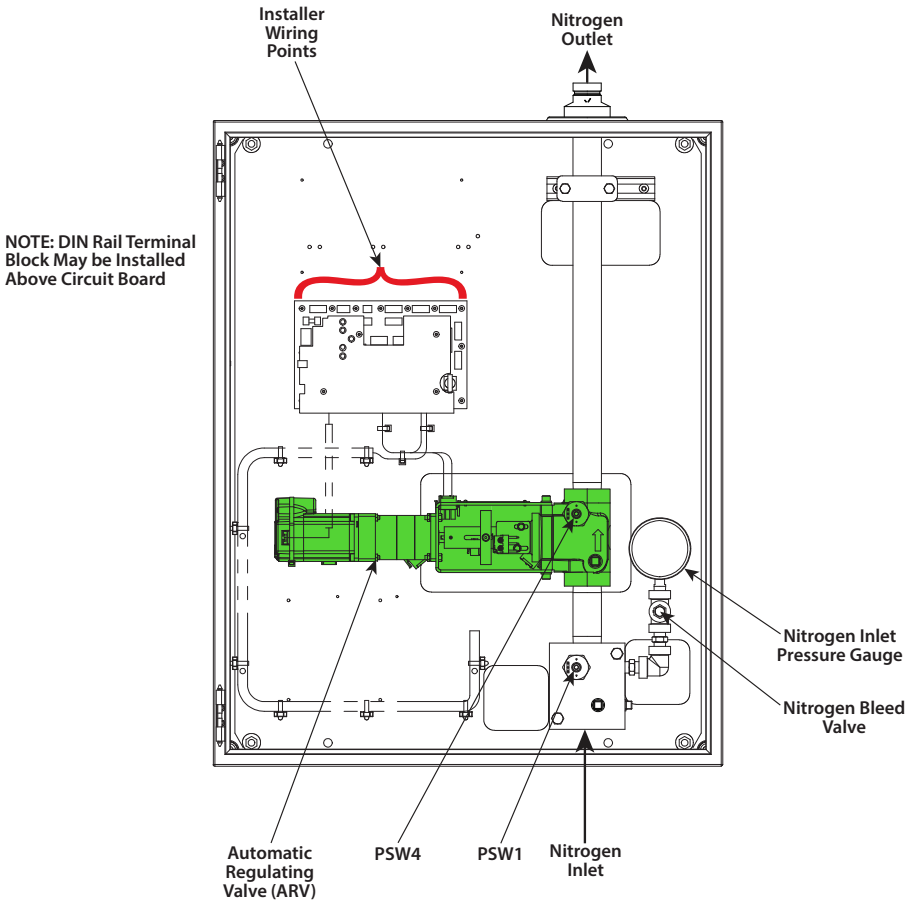
Fluid Panels are available as Active Release or Dry Contact Release. Active release panels begin opening the ARV when nitrogen pressure is detected at the inlet to the panel. Dry contact release panels begin opening the ARV when a release signal is received at the Victaulic Vortex™ Panel.

A zoned system that uses the Active Release Fluid Panel requires, at minimum, one 24VDC release signal for the Fluid Panel and one 24VDC release signal for each Zone Panel. One release signal is used to activate the Zone Panel and one is used to operate the primary solenoid release assembly.

A zoned system that uses a Dry Contact Release Fluid Panel requires a minimum of two 24VDC release signals for the Fluid Panel/primary solenoid release assembly, plus one release signal for each Zone Panel.

When manual discharge is required for a multi-zone system, an electrical signal to the Zone Panels is required. Active release panels will begin discharging when nitrogen pressure is detected at the inlet. Dry contact panels require an electrical release input signal.

Power is required for the panel to operate, even when nitrogen is manually released. A battery-backed-up power supply is recommended.




**Victaulic Vortex™ Fluid Panel, Dry Contact Release, 1 ½-inch/48.3-mm Assembly Shown Above**

| 1-inch Fluid Panel Description | Part Code |
|---|---|
| Victaulic Vortex™ Fluid Panel, Dry Contact | S010951FD4 |
| Victaulic Vortex™ Fluid Panel, Active Release | S010951FA4 |

| 1 ½-inch Fluid Panel Description | Part Code |
|---|---|
| Victaulic Vortex™ Fluid Panel, Dry Contact | S014951FD4 |
| Victaulic Vortex™ Fluid Panel, Active Release | S014951FA4 |

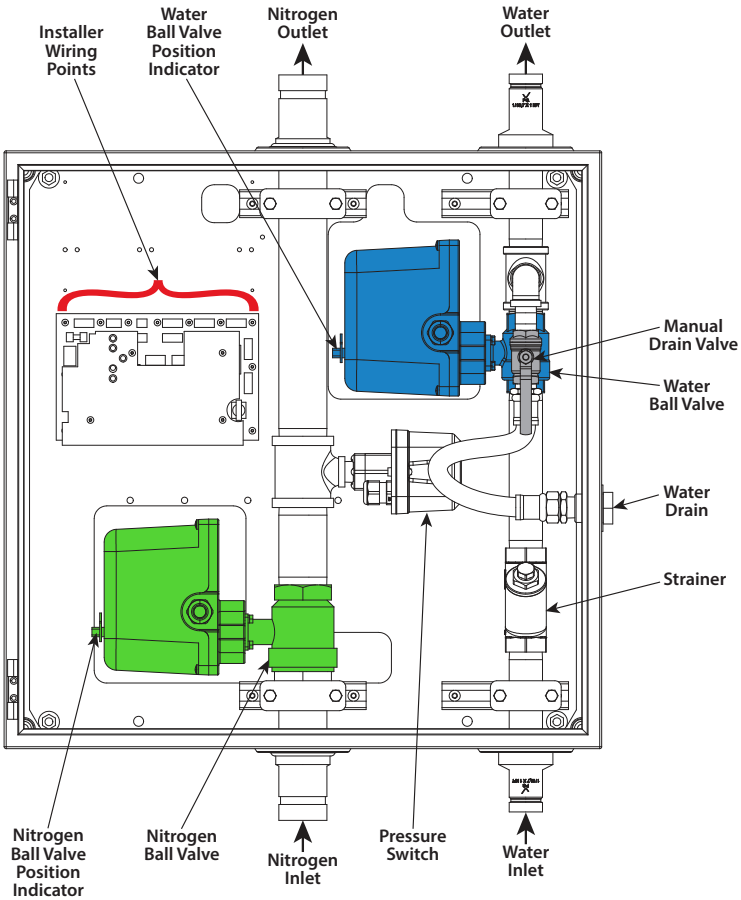
## ZONE PANEL (MULTI-ZONE)

**Zone Panel –** Each Zone Panel contains a nitrogen and water control valve. When the Zone Panel is activated by an approved agent-releasing FACP, the nitrogen and water are discharged into the active protected area. At least one Zone Panel is required for each individual protected space.

The Zone Panel utilizes an actuated ball valve to control nitrogen gas flow. Sizing is based upon the total required nitrogen flow for the zone.

When manual discharge is required for a multi-zone system, an electrical signal to the Zone Panels is required.

Power is required for the panel to operate, even when nitrogen is manually released. A battery-backed-up power supply is recommended.



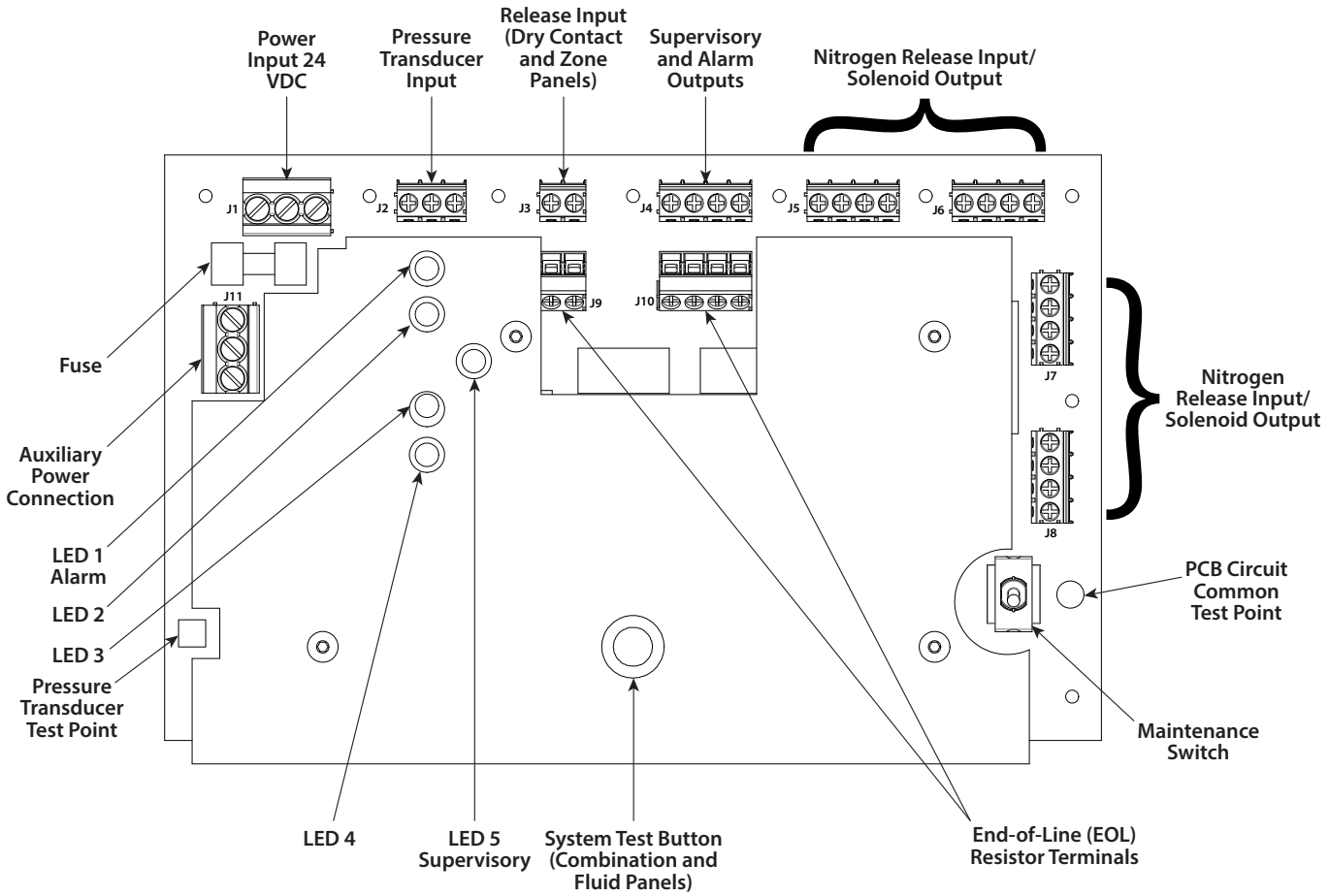

Victaulic Vortex™ Zone Panel, Dry Contact Release, Water Ball Valve, 2-inch/60.3-mm Assembly Shown Above

| 1 ½-inch Zone Panel Description | Part Code |
|---|---|
| Victaulic Vortex™ Zone Panel, Dry Contact, Ball Valve | S014951ZD2 |

| 2-inch Zone Panel Description | Part Code |
|---|---|
| Victaulic Vortex™ Zone Panel, Dry Contact, Ball Valve | S020951ZD2 |

## VICTAULIC VORTEX™ PANEL COMPONENTS

**Printed Circuit Board (PCB)**

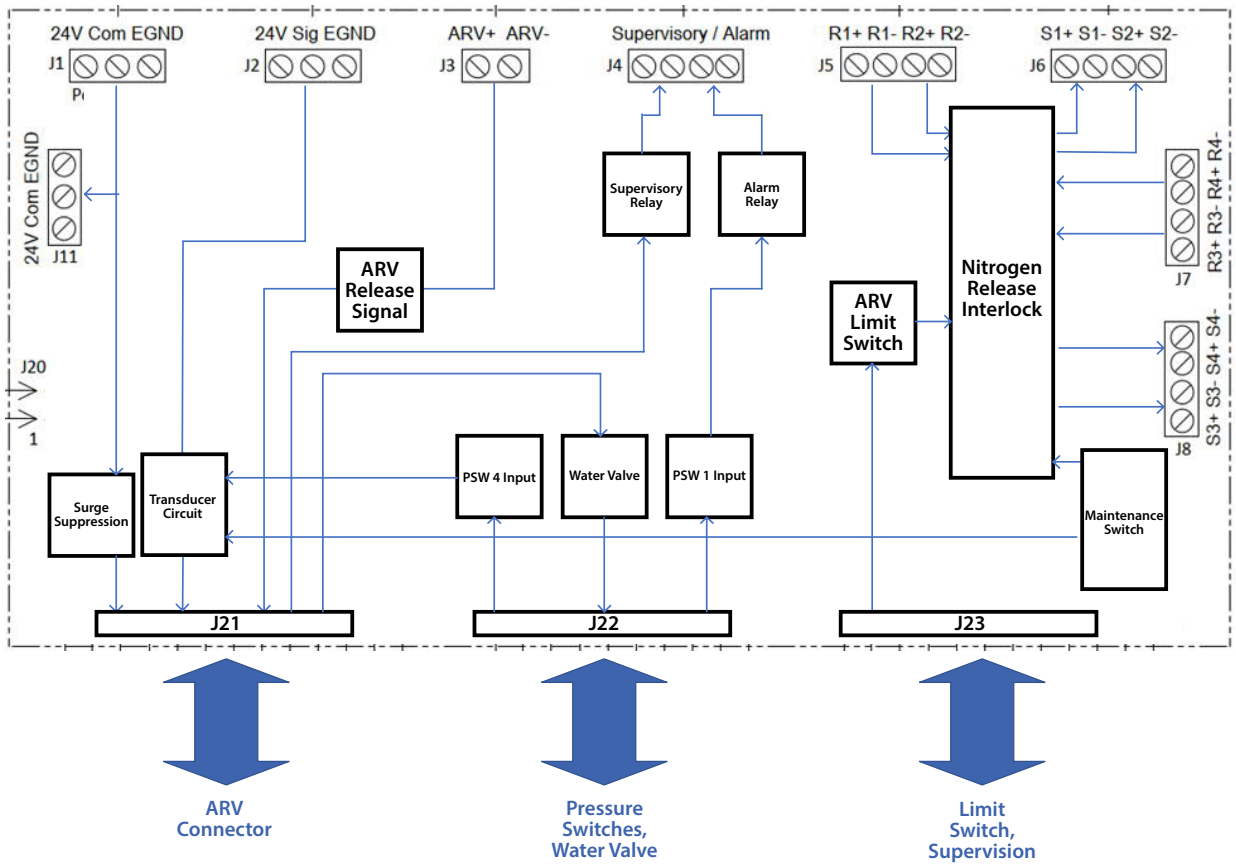



The printed circuit board (PCB) is located within Victaulic Vortex™ Panels and provides user wiring connection points, LED diagnostics, and the logic to operate components in the Victaulic Vortex™ Panel. This PCB is designed for use with Victaulic-recommended 24-volt DC power supplies. A plastic cover protects components against accidental contact during system installation.

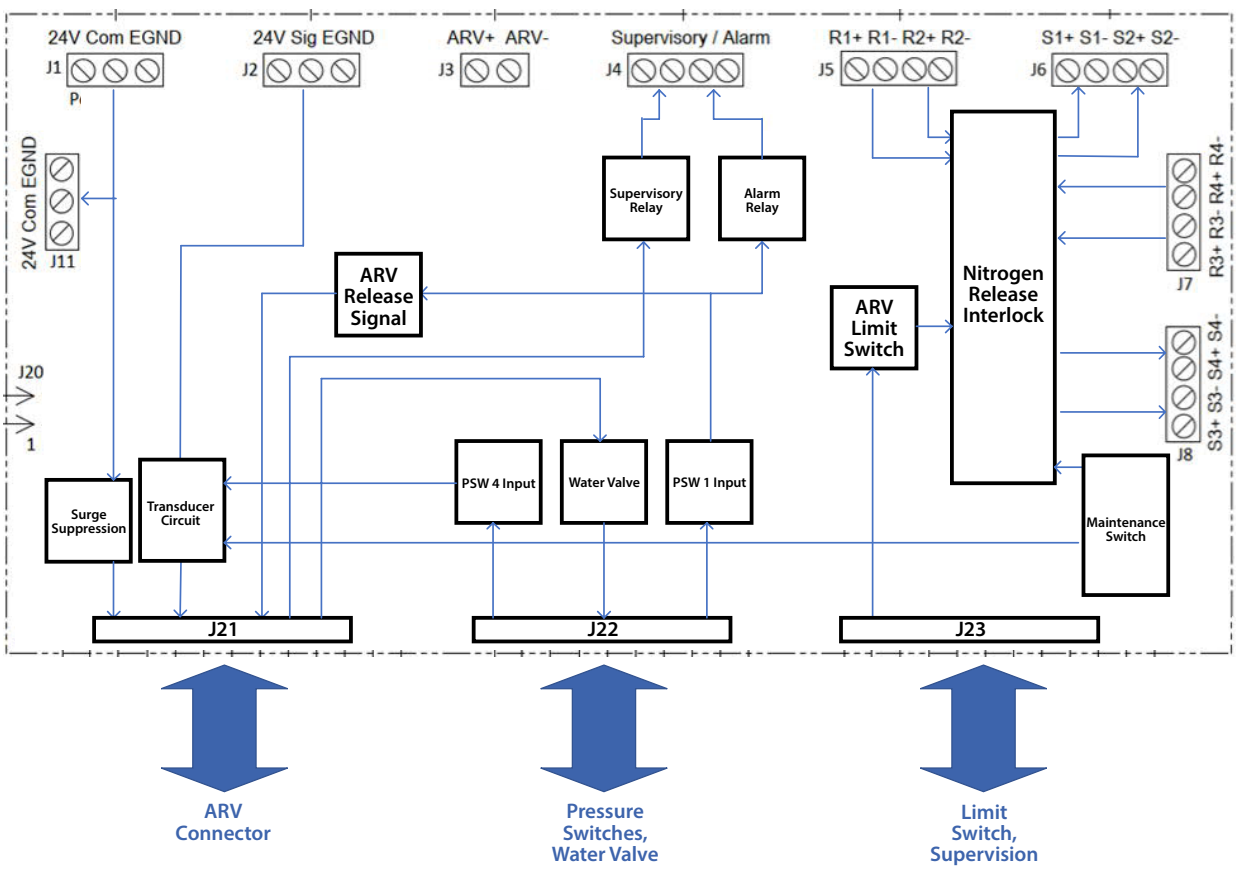
Not all connectors are used in every installation. Refer to Section V for specific wiring and connection details for each Victaulic Vortex™ Panel type. Dedicated connectors for additional end-of-line (EOL) resistors are provided to facilitate use with different agent-releasing FACPs. The PCB is protected by a 4A fuse. An unfused auxiliary power output connector is located in the upper-left-hand side of the PCB to allow daisy-chaining power from one panel to another.

In the normal system ready state, Combination and Fluid Panels should display three green LEDs (LED 2, LED 3, and LED 4). In a normal system ready state, Zone Panels will display two green LEDs (LED 2 and LED 3). The top LED (LED 1) is red, which indicates an alarm condition. The offset LED (LED 5) is yellow, which indicates a supervisory condition.

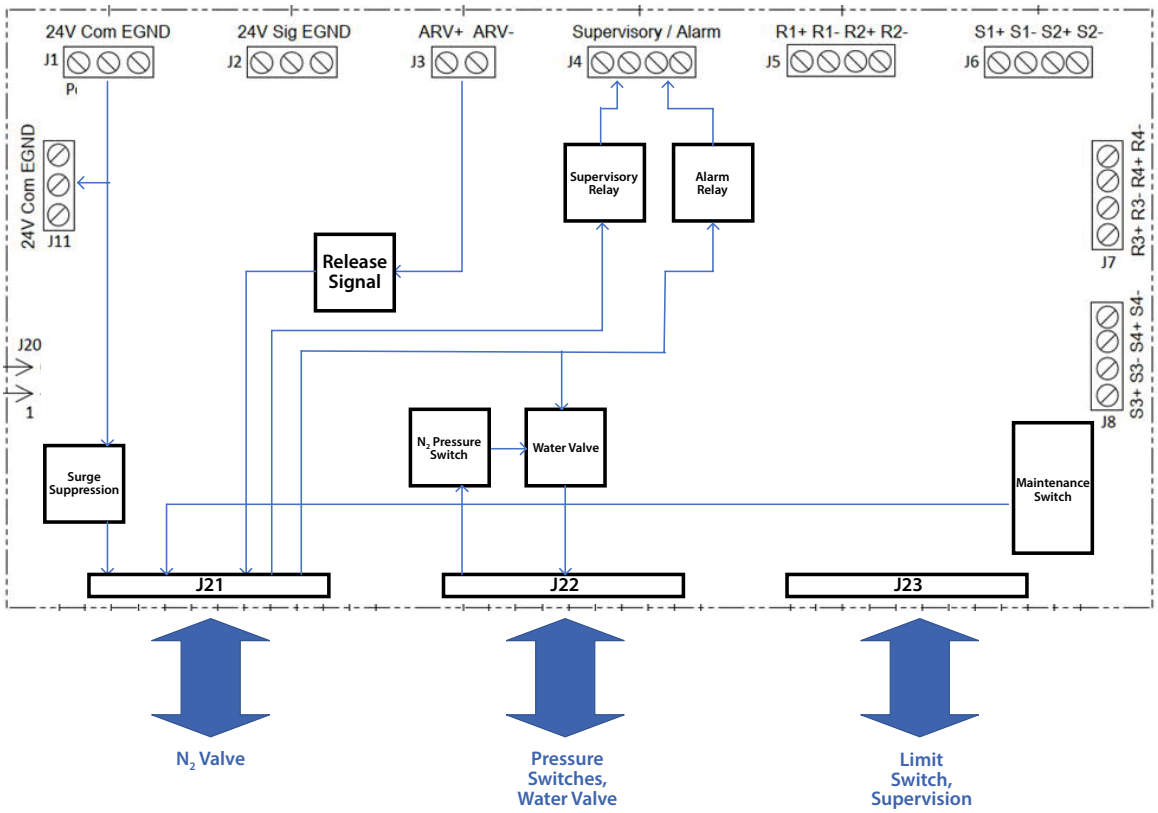
**Block Diagram for Dry Contact Combination and Fluid Panels**



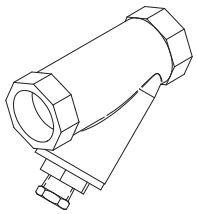

**Block Diagram for Active Release Combination and Fluid Panels**



**Block Diagram for Zone Panels**

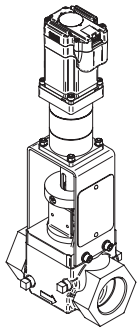


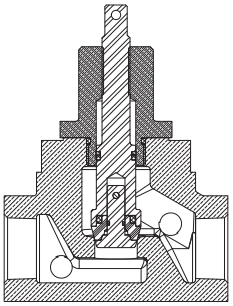

**System Water Strainer**



The system water strainer is a 100-mesh "Y" strainer and is a standard component in each Combination and Zone Panel (except with corrosion-resistant CPVC and stainless steel panel options). Piping size is 1-inch NPT.

**ARV**



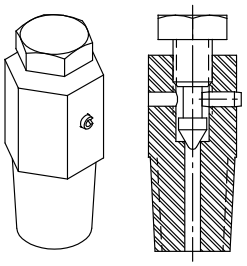


The ARV is located in the Combination and Fluid Panels and consists of a main valve body, gear box, and programmable drive motor (programmed at factory). The inlet to the valve is connected to the main nitrogen gas supply at high pressure (approximately 2640 - 3000 psi/ 182.0 - 206.8 Bar). A Programmable Logic Controller (PLC) allows the motor to continuously monitor and adjust downstream pressure during discharge. The motor is connected electrically to the pressure transducer in a feedback loop configuration. The ARV maintains pressure to the hybrid emitters based upon the programmed set point.

The 1-inch ARV has a needle valve seat diameter of 0.855 inches/22 mm and a flow area minimum cross section of 0.45 inches$^2$/290 mm$^2$.

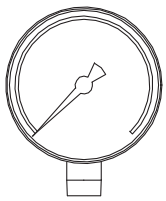
The 1 ½-inch ARV has a needle valve seat diameter of 1.48 inches/38 mm and a flow area minimum cross section of 1.15 inches$^2$/742 mm$^2$.

**Nitrogen Bleed Valve**



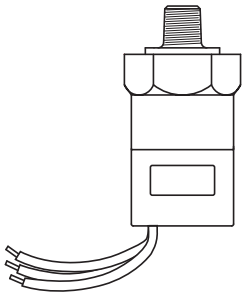
The nitrogen bleed valve is located in the Combination and Fluid Panels at the pressure gauge near the inlet side of the ARV. The hex-head screw of the nitrogen bleed valve can be used to bleed nitrogen from the manifold and nitrogen inlet piping.

**Pressure Gauge**



The pressure gauge is located at the inlet side of the ARV in Combination and Fluid Panels and is used to monitor nitrogen pressure at the ARV.

**Inlet and Outlet Pressure Switches**

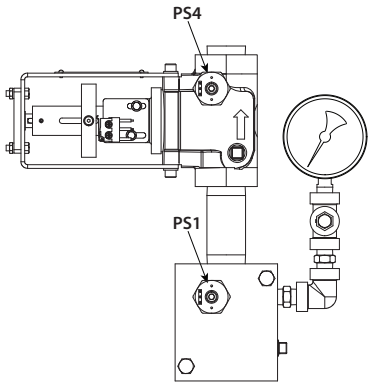


Pressure switches are used on the nitrogen inlet and outlet lines to control operation of the Victaulic Vortex™ Panel and provide feedback signals to the agent-releasing FACP. The pressure switch (PS1) on the inlet side of the Victaulic Vortex™ Panel is set to respond to nitrogen pressures exceeding 150 psi/10.3 Bar. For Victaulic Vortex™ Active Release Panels, the inlet pressure switch (PS1) provides a release signal to the ARV, signaling to the ARV that nitrogen is available at the panel inlet. The ARV will begin opening to start system discharge.

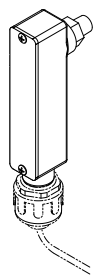
The "Discharge Active" supervisory output is used to indicate to the agent-releasing FACP that nitrogen has been released from the cylinders and is available at the panel inlet.

The pressure switch (PS4) installed on the nitrogen outlet is factory set to 150 psi/10.3 Bar and provides a signal to the ARV to stop travel in the event that discharge pressure exceeds 150 psi/10.3 Bar. Where there are long runs of piping, it may be necessary to run high discharge pressures from the Victaulic Vortex™ Panel in order to have sufficient nitrogen pressure at the hybrid emitters. The outlet pressure switch (PS4) may be adjusted to higher or lower settings, provided it does not allow a condition where the working pressure in the system is greater than the working pressure in the pipe.

To adjust the pressure setting of the switch, apply a known pressure and monitor the electrical contacts. Using a ⅛-inch hex key wrench, turn the adjustment screw clockwise to increase the set point and counterclockwise to decrease the set point. Verify the new set point by slowly increasing and decreasing the pressure while monitoring the electrical contacts. Repeat the adjustment, if necessary, to obtain the desired set point.




**Pressure Transducer**
**Part Code P000951134 for Standard, 0 – 100 psi**
**Part Code P000951TRM for Special Applications, Explosion Proof**

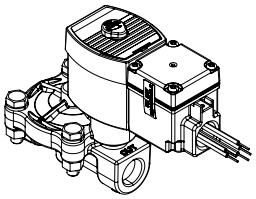


The pressure transducer monitors nitrogen discharge pressure and provides operating signals to the ARV. One pressure transducer is required per ARV.

The pressure transducer shall be centrally located within the hybrid emitter piping for a single-zone system or between the Fluid and Zone Panels for a multi-zone system. Refer to the applicable VDM-VORTEX General Design Manual for detailed information on pressure transducer location.

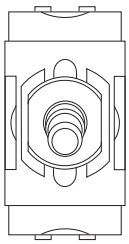
Explosion-proof pressure transducers are available. Contact Victaulic for specific dimensions and wiring requirements (scan QR code on front cover for contact information for your region).

**Drain Valve**
**Part Code S004N69106**



The drain valve provides additional drainage of water lines after system discharge. The valve is a ½-inch normally closed 24VDC/9W solenoid with a fire protection surveillance switch. In installations where it is not possible to slope water piping from the hybrid emitters back to the Victaulic Vortex™ Panel, or in cases where Zone Panels with manual drain valves are used, it may be necessary to include an additional drain valve at the low point in the water piping. The drain valve can be activated (opened) by a 24VDC signal from the agent-releasing FACP to drain water piping from the hybrid emitters after discharge is complete.

**Maintenance Switch**



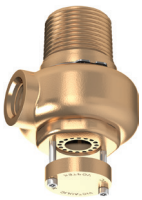
The maintenance switch and yellow supervisory indicator light are provided on each Combination or Fluid Panel. The maintenance switch is designed to prevent the ARV from operating during testing situations. Additionally, the maintenance switch will reset or close the ARV when its end-of-stroke is reached after a discharge.

When the maintenance switch is in the ready position, the yellow supervisory indicator light will be off. When the maintenance switch is in the maintenance position, the yellow supervisory indicator light will be on.

The yellow supervisory indicator light will operate whenever the ARV is not in the normal, ready condition. Possible causes for the yellow supervisory indicator light to be on are: pressure transducer or wiring trouble, power loss, system discharge, or when the ARV is in motion.

When either the maintenance switch or yellow supervisory indicator light is on, a corresponding supervisory contact is closed so that proper monitoring of system status can be performed. The normally-open contact on the supervisory output is a dry-type contact and will be open, unless any of the conditions described above are met.

## HYBRID EMITTERS



Standard Hybrid Emitter

Escutcheon Hybrid Emitter

PVDF Hybrid Emitter

### NOTICE

- **Fluid supply pressure is dependent upon system piping configurations.**
- **Typical systems require pressure settings 1 – 3 psi/0.07 – 0.21 Bar higher than the hybrid emitter requirements to accommodate for pressure drop between the pressure transducer and hybrid emitter.**
- **Verify that the proper size hybrid emitter and water flow control cartridge are specified in the system design.**
- **Verify that the water flow control cartridge and strainer are installed in the proper orientation.**
- **Refer to the applicable VDM-VORTEX General Design Manual for typical applications.**

**Series 953 Standard Hybrid Emitter**

| Victaulic Vortex™ Hybrid Emitter Size | Escutcheon | Part Codes | Approvals | |
|---|---|---|---|---|
| ⅝-inch | None | Brass - S006953500 | – | Reference Victaulic publication 70.12 for complete material specifications and dimensional information |
| | | Stainless - S006953X50 | – | |
| ½-inch | None | Brass - S006953400 | FM Approved | |
| | | **Stainless - S004953513 | – | |
| ⅜-inch | None | Brass - S003953131 | – | |
| | | **Stainless - S003953034 | – | |
| ¼-inch | None | Brass - S002953101 | – | |
| | | Stainless - S002953X02 | – | |
| ⅛-inch | None | **Brass - S001953100 | – | |
| | | **Stainless - S00195310X | – | |

**Series 953 Escutcheon Hybrid Emitter**

| Victaulic Vortex™ Hybrid Emitter Size | Escutcheon | Part Codes | Approvals | |
|---|---|---|---|---|
| ½-inch | 4-inch Stainless Steel Tube | **Stainless - S004953511 | – | Reference Victaulic publication 70.12 for complete material specifications and dimensional information |

**Series 953 PVDF Hybrid Emitter**

| Victaulic Vortex™ Hybrid Emitter Size | Escutcheon | Part Codes | Approvals | |
|---|---|---|---|---|
| ½-inch | None | PVDF - S006953406 | – | Reference Victaulic publication 70.12 for complete material specifications and dimensional information |

**Series 954 Standard Hybrid Emitter**

| Victaulic Vortex™ Hybrid Emitter Size | Escutcheon | Part Codes | Approvals | |
|---|---|---|---|---|
| ⅝-inch | None | Brass - S006953501 | – | Reference Victaulic publication 70.12 for complete material specifications and dimensional information |
| | | **Stainless - S006953514 | – | |
| ⅜-inch | None | **Stainless - S003953033 | – | |
| ¼-inch | None | Brass - S002953100 | – | |
| | | Stainless - S002953X01 | – | |

**Series 954 Escutcheon Hybrid Emitter**

| Victaulic Vortex™ Hybrid Emitter Size | Escutcheon | Part Codes | Approvals | |
|---|---|---|---|---|
| 1-inch | 4-inch Stainless Steel Tube | **Stainless - S010953511 | FM Approved | Reference Victaulic publication 70.12 for complete material specifications and dimensional information |
| ⅝-inch | 4-inch Stainless Steel Tube | **Stainless - S006953512 | FM Approved | |
| ⅜-inch | 4-inch Stainless Steel Tube | **Stainless - S003953031 | FM Approved | |
| ¼-inch | 3-inch Stainless Steel Tube | **Stainless - S00295310A | – | |

**Series 954 PVDF Hybrid Emitter**

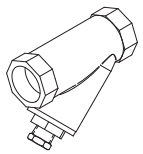
| Victaulic Vortex™ Hybrid Emitter Size | Escutcheon | Part Codes | Approvals | |
|---|---|---|---|---|
| ⅝-inch | None | **PVDF - S006953503 | – | Reference Victaulic publication 70.12 for complete material specifications and dimensional information |
| ¼-inch | None | **PVDF - S003953170 | FM Approved | |
| ⅛-inch | None | **PVDF - S003953105 | – | |

***It is the customer's responsibility to verify hybrid emitter material compatibility (**refer to the applicable VDM-VORTEX General Design Manual **for design guidelines and instructions).**

Escutcheon hybrid emitters are shipped with a black PVC cap; this cap may be left on the hybrid emitter in environments where additional protection is required. Standard hybrid emitters are shipped with an orange polymer cap to protect the hybrid emitter during shipping. Refer to the "Hybrid Emitter Water Piping" section in this manual for additional information.

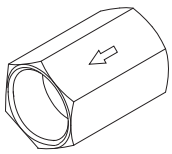
****Female NPT nitrogen port**

**Hybrid Emitter Water Strainer**



The hybrid emitter water strainer is a 100-mesh "Y" strainer. Piping size is ¾-inch FNPT.

**Water Flow Control Cartridge**



The water flow control cartridge controls the amount of water flow to each hybrid emitter and contains a ¾-inch NPT female inlet and outlet. The water flow control cartridge limits water output to each hybrid emitter when the inlet water pressure is between 30-psi/2.1-Bar minimum and 125-psi/8.6-Bar maximum.

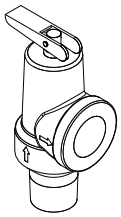
Water flow control cartridges are available with various flow ratings (Reference Victaulic publication 70.16). Flow rating shall be matched to the hybrid emitter and hazard type. Refer to the "Hybrid Emitters" section on this and the previous page. Refer to Section IV for details and limitations on water flow control cartridge installation. The flow arrow on the water flow control cartridge shall point toward the hybrid emitter. Contact Victaulic for water flow control cartridge size availability (scan QR code on front cover for contact information for your region).

**Water Flow Kit (Contains Hybrid Emitter Water Strainer, Water Flow Control Cartridge, and Hybrid Emitter Trim Kit)**

| Part Code | Description | Approvals |
|---|---|---|
| K000953013 | Water Flow Kit Containing 0.13 GPM Water Flow Control Cartridge, Brass, ¾-inch NPT | FM Approved |
| K000953X13 | Water Flow Kit Containing 0.13 GPM Water Flow Control Cartridge, Stainless, ¾-inch NPT | FM Approved |
| K000953026 | Water Flow Kit Containing 0.26 GPM Water Flow Control Cartridge, Brass, ¾-inch NPT | FM Approved |
| K000953X26 | Water Flow Kit Containing 0.26 GPM Water Flow Control Cartridge, Stainless, ¾-inch NPT | FM Approved |
| K000953053 | Water Flow Kit Containing 0.53 GPM Water Flow Control Cartridge, Brass, ¾-inch NPT | FM Approved |
| K000953X53 | Water Flow Kit Containing 0.53 GPM Water Flow Control Cartridge, Stainless, ¾-inch NPT | FM Approved |
| K000953079 | Water Flow Kit Containing 0.79 GPM Water Flow Control Cartridge, Brass, ¾-inch NPT | – |
| K000953X79 | Water Flow Kit Containing 0.79 GPM Water Flow Control Cartridge, Stainless, ¾-inch NPT | – |
| K000953106 | Water Flow Kit Containing 1.06 GPM Water Flow Control Cartridge, Brass, ¾-inch NPT | FM Approved |
| K000953X06 | Water Flow Kit Containing 1.06 GPM Water Flow Control Cartridge, Stainless, ¾-inch NPT | FM Approved |
| K000953153 | Water Flow Kit Containing 1.59 GPM Water Flow Control Cartridge, Brass, ¾-inch NPT | – |
| K00095315X | Water Flow Kit Containing 1.59 GPM Water Flow Control Cartridge, Stainless, ¾-inch NPT | – |
| K000953211 | Water Flow Kit Containing 2.11 GPM Water Flow Control Cartridge, Brass, ¾-inch NPT | – |
| K000953X11 | Water Flow Kit Containing 2.11 GPM Water Flow Control Cartridge, Stainless, ¾-inch NPT | – |
| K000953423 | Water Flow Kit Containing 4.23 GPM Water Flow Control Cartridge, Brass, ¾-inch NPT | – |
| K000953X23 | Water Flow Kit Containing 4.23 GPM Water Flow Control Cartridge, Stainless, ¾-inch NPT | – |

## LOW-PRESSURE PIPING

**Pressure Relief Valve Requirement for Multi-Zone Systems**
**Part Code S010951RLV for Pressure Relief Valve, 0.85-inch Orifice, 1 ½-inch Inlet**
**Part Code S020951RLV for Pressure Relief Valve, 1.39-inch Orifice, 2-inch Inlet**



Relief valves shall be acceptable to the AHJ, and they shall be sized and installed in accordance with all applicable laws, codes, and site-specific requirements. Victaulic offers two relief valves, which are available with a 1 ½-inch MNPT inlet (0.85-inch/22-mm orifice) and 2-inch FNPT outlet, or a 2-inch MNPT inlet (1.39-inch/35-mm orifice) and 2 ½-inch FNPT outlet.

At minimum, relief valves shall be used for each Fluid Panel in all multi-zone systems, and they shall be used in single-zone systems when the total flow capacity of the emitters is less than 150 SCFM. The pressure relief valve is installed in the low-pressure nitrogen piping and shall be vented to outside the building (or to a space sufficiently large enough to prevent a low-oxygen condition during relief valve operation). Specific sites may have additional requirements that require larger or additional relief valves.

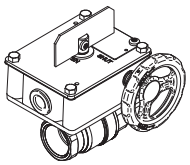
## NITROGEN DISCHARGE PRESSURE SWITCH (OPTIONAL)

**Part Code S000760044**

The field-adjustable, low-pressure nitrogen pressure switch can be installed in the nitrogen piping downstream of the Combination or Zone Panel, and it can be adjusted to alarm when low-pressure nitrogen piping is pressurized during a discharge. The switch has a ½-inch MNPT inlet and an opening for a ½-inch conduit fitting, and it can be field adjusted to operate at increasing pressure from 10 – 100 psig/0.7 - 6.9 Bar. In addition, the pressure switch can be connected as a Form C dry contact (pressure switch electrical specification rating is 2.5 Amp DC @ 6/12/24 VDC).

## SYSTEM WATER CONTROL VALVE

**Part Code V010728CT0**



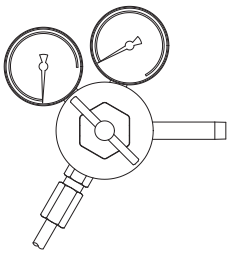
A supervised Victaulic FireLock™ Ball Valve is available and may be used to turn the water supply on or off to all system hazard zones.

## WATER TANK REGULATOR KIT

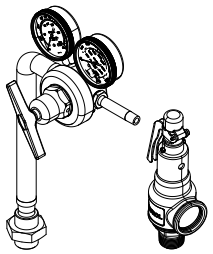
**Part Code P000950065**

## HIGH-CAPACITY WATER TANK REGULATOR KIT

**Part Code S000950HCW**



Standard

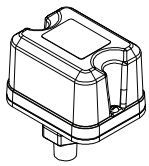


High-Capacity

The water tank regulator kit pressurizes the water tank with nitrogen from the manifold. The kit contains a nitrogen gas regulator, a length of braided stainless steel hose, and fittings to connect to the water tank. The water tank regulator should be set to a pressure that ensures adequate water delivery based on the water piping design. Typically, the regulator will need to be set to 80 – 120 psi/5.5 – 8.3 Bar. The water tank regulator setting should not exceed the rating of the water tank and piping, or 125 psi/8.6 Bar. **NOTE:** For steady state water flow greater than 32 GPM/121 LPM, use the high-capacity water tank regulator kit. The high-capacity water tank regulator kit ships with a 1-inch MNPT x 1 ¼-inch FNPT pressure relief valve.

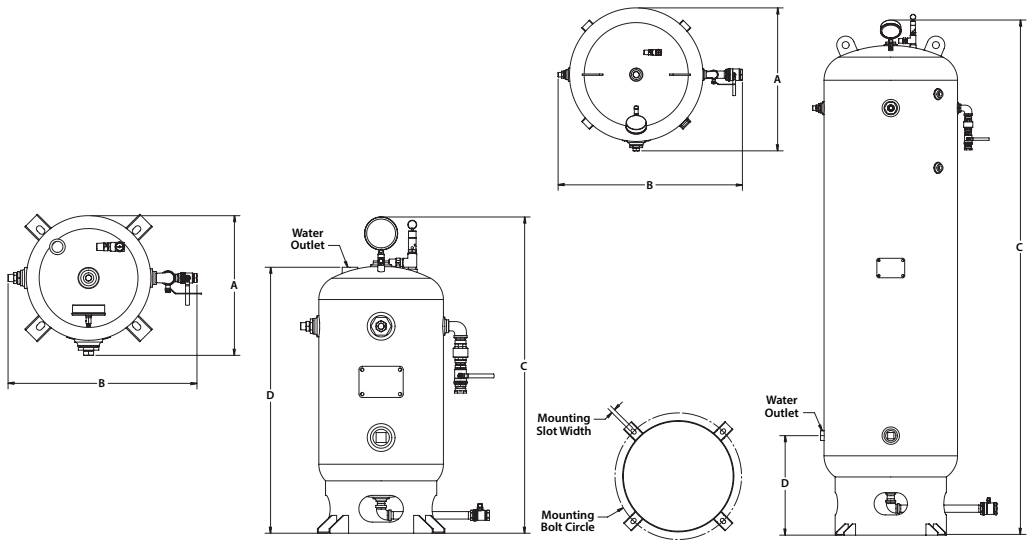
## WATER TANK PRESSURE SWITCH (OPTIONAL)

**Part Code S000760044**



The field-adjustable water tank pressure switch can be installed in the water tank, and it can be adjusted to alarm when pressure decreases to a specific value. The switch has a ½-inch MNPT inlet and an opening for a ½-inch conduit fitting, and it can be field adjusted to operate at decreasing pressure from 10 – 100 psig/0.7 - 6.9 Bar. In addition, the pressure switch can be connected as a Form C dry contact (pressure switch electrical specification rating is 2.5 Amp DC @ 6/12/24 VDC).

## WATER TANK




| Nominal Size gallons/liters | Part Codes for Red Tank with Trim |
|---|---|
| 10<br>38 | S100950140 |
| 30<br>114 | S300950140 |
| 30*<br>114 | S300950141 |
| 60<br>227 | S600950140 |

| Nominal Size gallons/liters | Part Codes for Red Tank with Trim |
|---|---|
| 80<br>303 | S800950140 |
| 120<br>454 | S120950140 |
| 200<br>757 | S200950140 |
| 400<br>1514 | S400950140 |

* Stainless steel CE/ASME water tank

A Victaulic-supplied carbon steel, epoxy-lined (ASME BPVC Sec VIII, Div 1) water tank is recommended. The water tank shall be sized properly to accommodate system water requirements. **NOTE:** The water tank is pressurized by nitrogen pressure. A regulator, which connects to the Victaulic High-Pressure Manifold, pressurizes the water tank.

A supervised float switch and sight glass are provided on the water tank to aid in monitoring fluid level. The float switch may be connected as a Form C dry contact (float switch electrical specification rating is 0.3 Amp DC @ 0-30 Volts [20 VA]).

The water outlet is taken from a siphon tube. The water outlet for the 10-gallon/38-liter tank is located at the top of the tank. For all other tank sizes, the water outlet is located on the lower-left-hand side. A connection is provided at the bottom outlet of the water tank for drain accommodations.

Refer to the “Water Tank Filling Procedure” in Section VIII for complete filling instructions. Refer to Victaulic publication 70.05 for dimensions and performance.

**⚠ WARNING**

- **Adequate water supply shall be available and shall be supervised by the agent-releasing FACP.**

**Failure to follow this instruction could result in serious personal injury and/or property damage.**

## SPARE PARTS LIST

| Description | Part Code |
|---|---|
| Emitter Cap, ¼ - ½-inch, Standard-Style Emitter | P002953260 |
| Emitter Cap, ⅝-inch Standard-Style Emitter | P006953560 |
| Emitter Cap, Escutcheon-Style Emitter | P006953522 |
| O-Ring Kit, Primary/Secondary | K000950KIT |
| Discharge Hose, 49L/50L, Rt. Angle, 22.25-inch OAL | P000955B29 |
| Discharge Hose, DOT 80L, Rt. Angle, 13.50-inch OAL | P000955A29 |
| Discharge Hose Restricting Valve | S000950BA1 |
| ¼-inch Pilot Hose, 300 mm, for Adjacent Cylinders | S000950P32 |
| ¼-inch Pilot Hose, 450 mm, Rt. Angle, for Primary | S000950B08 |
| ¼-inch BSPP/Rp Pilot Line Tee Nipple | S000950BA2 |
| ¼-inch End-of-Pilot-Line Bleed Valve with Crush Washer | S000950BA4 |
| Copper Crush Washer for Bleed Valve | P000950018 |
| Copper Crush Washer For Primary/Secondary Gauge | P000950001 |
| Primary Solenoid Release Assembly | S000950B22 |

| Description | Part Code |
|---|---|
| Snubber Assembly with Crush Washer | P000955035 |
| Copper Crush Washer for Snubber Assembly | P000950034 |
| Secondary Gauge Assembly | S000950B03 |
| Secondary Gauge Assembly with Pressure Switch | P000951135 |
| Replacement Fuse for PCB Board, 4AMP | P000951RFP |
| ¼-inch MNPT x 36-inch S.S. Hose for Water Tank Regulator | P002745X03 |
| ½-inch MNPT x 36-inch S.S. Hose for Water Tank Regulator | P004950010 |
| 12V 12 Ah Replacement Battery for Power Supply (2 Required) | P000950017 |
| Inside Zone Warning Placard | Z111278LBL |
| Outside Zone Warning Placard | Z111277LBL |
| Manual Pull Station Placard | Z000950004 |
| Cylinder Rack Warning Placard | Z000950030 |
| Water Tank Regulator Tamper-Resistant Kit | K000950WTR |

# SECTION III
# ELECTRICAL

## ELECTRICAL WIRING INTRODUCTION

**⚠ WARNING**

- **For proper installation and operation of the Victaulic Vortex™ System, qualified and trained individuals shall read and fully understand the contents of this manual.**
- **Installation shall be in accordance with current National Electrical Codes (NEC), National Fire Protection Association (NFPA) standards, and local standards.**
- **Training and licensing of contractors is required in most jurisdictions.**

**Failure to follow these instructions could cause system failure, resulting in death or serious personal injury and property damage.**

### Electrical Specifications

Victaulic Vortex™ Panels require a constant 24VDC power supply. Refer to the "Power Supply/Charger Information" section for alarm and standby currents. Two supervisory contacts are provided to monitor the panel alarm and supervisory conditions.

Depending on design criteria, at least one primary solenoid release assembly will be used in each system. The solenoid mounted to the valve requires a 24VDC signal to activate the valve, charge the manifold, and start the Combination and/or Fluid Panel. At the discretion of the AHJ, multiple primary solenoid release assemblies may be used, and a separate release circuit (or addressable) may be incorporated for redundancy.

An FM Approved agent release panel shall be used to activate the Victaulic Vortex™ System.

**Combination Panel - Electrical Specifications**
- Operating voltage: 24VDC continuous power supply (20.4-27VDC), polarity sensitive
- Supervisory connections: 500 mA @ 30 VDC resistive load
- Reference Victaulic publication 70.03 for detailed current draws and electrical specifications

**Fluid Panel - Electrical Specifications**
- Operating voltage: 24VDC continuous power supply (20.4-27VDC), polarity sensitive
- Supervisory connections: 500 mA @ 30 VDC resistive load
- Reference Victaulic publication 70.03 for detailed current draws and electrical specifications

**Zone Panel - Electrical Specifications**
- Operating voltage: 24VDC continuous power supply (20.4-27VDC), polarity sensitive
- Supervisory connections: 500 mA @ 30 VDC resistive load
- Reference Victaulic publication 70.03 for detailed current draws and electrical specifications

**Pressure Transducer - Electrical Specifications**
- Used with Combination and Fluid Panels
- Operating voltage: 24VDC nominal, polarity sensitive
- Output: 4-20 mA (0 – 100 psi/0 – 6.9 Bar)
- Connections: 18 AWG shielded, twisted pair
- 3.8 – 4.2 mA at atmospheric pressure

**NOTICE**

- **The following information provides a general overview of the electrical circuits.**
- **The design engineer is responsible to verify compliance with all requirements.**
- **Wiring installation shall comply with NEC standards, NFPA standards, and local standards and requirements.**

**DC Power - J1 Combination, Fluid, and Zone Panels**
- Operating voltage input
- Supervised by system fault contact
- 24VDC + Earth Ground Polarity Sensitive

**Pressure Transducer - J2 Used for Combination and Fluid Panels Only (Not Used for Zone Panels)**
- Polarity sensitive
- Shield connection terminated at panel only
- Operation and wiring supervised by system fault contact

**ARV/Release - J3 Used for Dry Contact Combination and Fluid Panels and Zone Panels**
- 650 Ω
- Panel input signal to open ARV or nitrogen valve
- Shall be activated on at least one Zone Panel before nitrogen is released
- Polarity sensitive

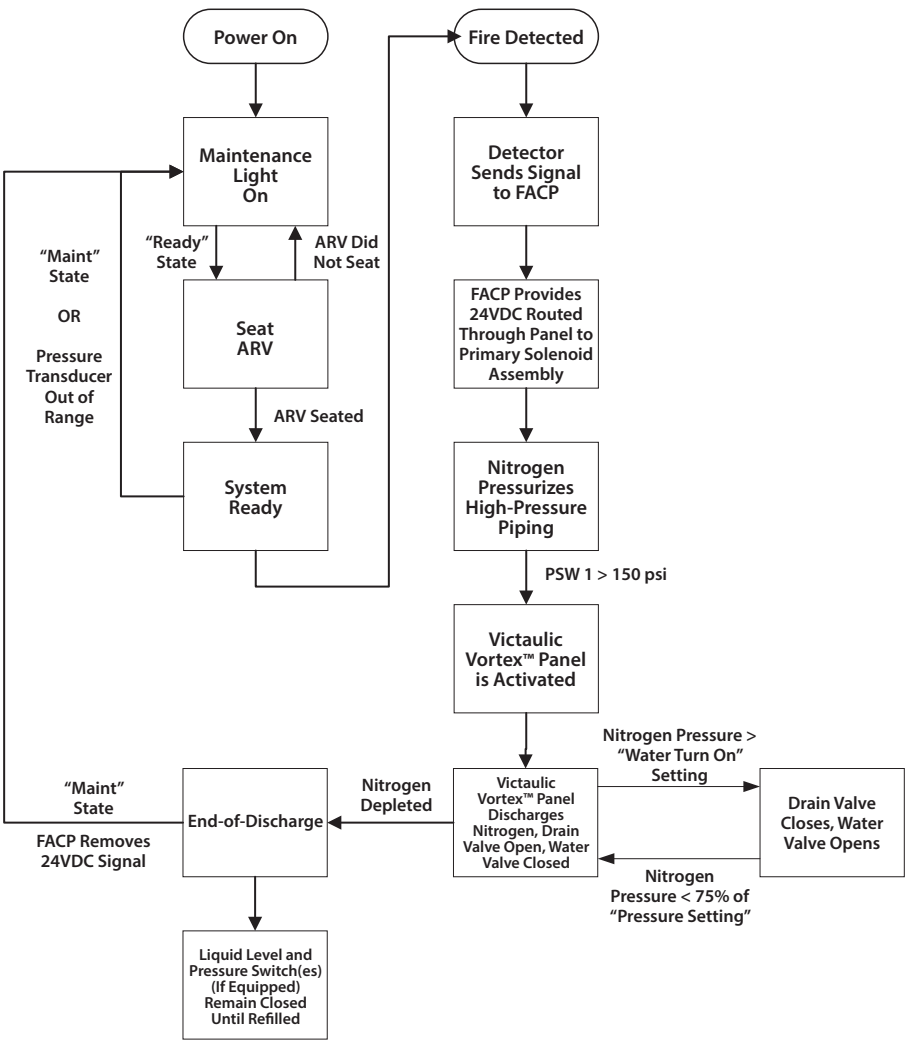
**Supervisory Output - J4**
- System fault output monitors 24V power, pressure transducers, and internal panel components
- Discharge active output indicates discharge is active
- 500 mA @ 300 VDC resistive dry contacts
- Non-latching

**Nitrogen Release - J5, J6, J7, J8 Used for Combination and Fluid Panels Only (Not Used for Zone Panels)**
- Refer to primary solenoid release assembly electrical specifications
- Passes through interlock switch to nitrogen solenoid output
- Shall be activated after Zone Panel release (if used)
- Release signal (R+, R1) is input from agent-releasing FACP
- Solenoid output (S+, S-) is output to primary solenoid release assembly
- Four pairs of release inputs/solenoid outputs

**Order of Operation for Single-Zone System (Active Release Combination Panel)**

1. A detector in the zone protected by the Victaulic Vortex™ System sends a signal to the agent-releasing FACP.
2. The agent-releasing FACP provides a 24VDC release signal routed through the Combination Panel to one or more primary solenoid release assemblies. **NOTE:** One primary solenoid release assembly can open a total of 24 cylinders, including the primary cylinder.
3. The primary solenoid release assembly is energized with 24VDC. The solenoid opens, allowing compressed nitrogen to flow into the pilot lines connecting each cylinder.
4. Each cylinder connected to the pilot lines opens and pressurizes the high-pressure piping upstream of the Combination Panel.
5. The water tank is pressurized through the water tank regulator kit connected to the cylinder manifold.
6. Active release panels begin discharging when pressure greater than 150 psig is detected at the nitrogen inlet to the panel. Pressure switch 1 (PSW1) closes to activate the ARV and begin the discharge sequence. The Combination Panel will send a supervisory signal to the FACP.
7. The drain solenoid valve closes at the beginning of the discharge.
8. The water valve opens when the pressure transducer downstream of the Combination Panel reaches the “Water Turn On” setting.
9. The water valve closes when the pressure transducer downstream of the Combination Panel decays below 75% of the “Pressure Setting”.
10. The end-of-discharge occurs when the water valve closes, the drain valve opens, the ARV fully opens, and the remaining nitrogen is expelled.
11. The system will stay in the above condition until the maintenance switch is flipped to the maintenance position.
12. When the maintenance switch is returned to the ready position, the ARV will begin to close and seat.
13. After the valve has stopped and no system fault is found, the yellow supervisory indicator light will turn off and the supervisory contact will open.
14. Cylinder pressure switch(es) (if equipped) and water tank level switch (if equipped) are closed until the system is refilled.

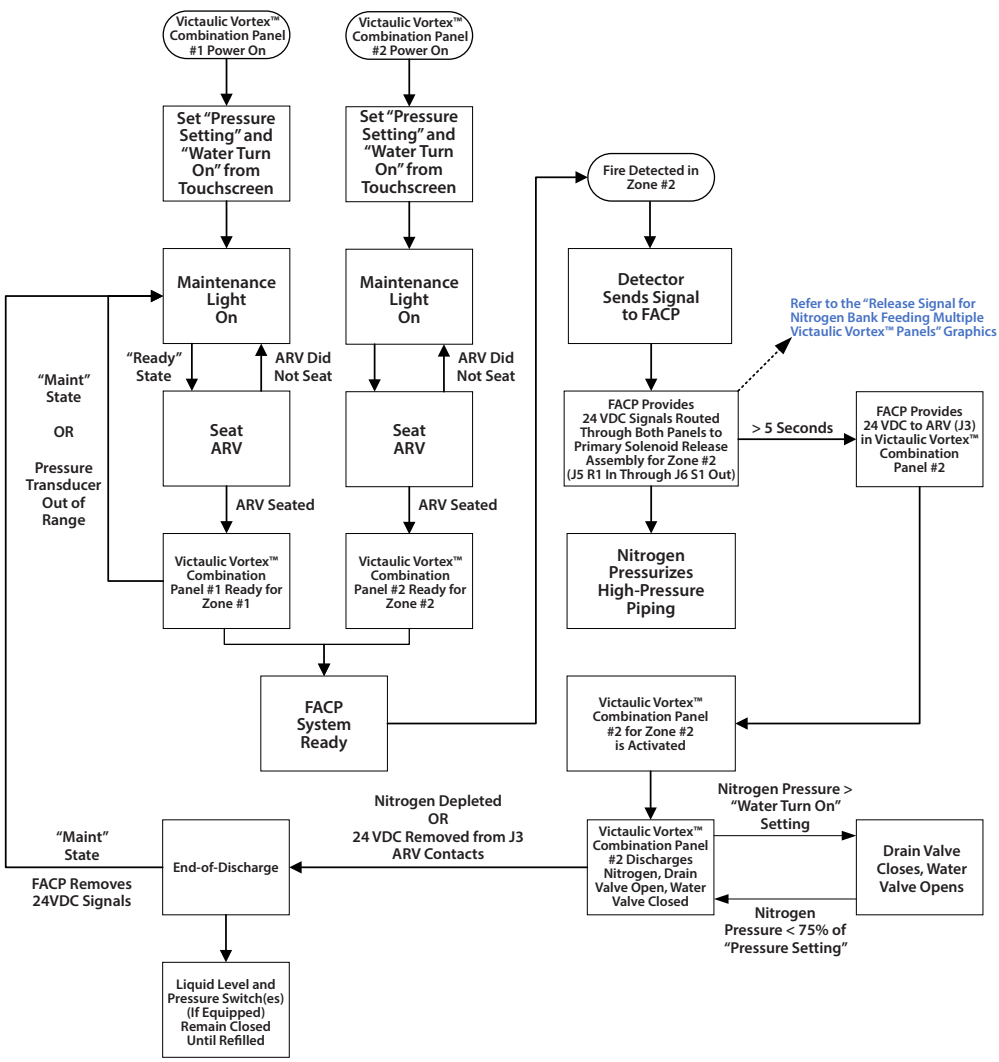
**System Operation - Active Release Combination Panel**



**Order of Operation for Multi-Zone System (Multiple Dry Contact Combination Panels)**

1. A detector in one of the zones protected by the Victaulic Vortex™ System sends a signal to the agent-releasing FACP.
2. The agent-releasing FACP provides the first 24VDC release signal routed through the specific Combination Panel for that zone to one or more primary solenoid release assemblies. **NOTE:** One primary solenoid release assembly can open a total of 24 cylinders, including the primary cylinder. Refer to the "Release Signal Example for Nitrogen Bank Feeding Multiple Victaulic Vortex™ Panels" graphics on the following page.
3. The primary solenoid release assembly is energized with 24VDC. The solenoid opens, allowing compressed nitrogen to flow into the pilot lines connecting each cylinder.
4. Each cylinder connected to the pilot lines opens and pressurizes the high-pressure piping upstream of the Combination Panel.
5. The water tank is pressurized through the water tank regulator kit connected to the cylinder manifold.
6. The agent-releasing FACP provides a second 24VDC release signal, routed to the specific Combination Panel for that zone, to the "ARV Release" contacts 5 seconds after the first release signal was provided. Refer to the "Release Signal Example for Nitrogen Bank Feeding Multiple Victaulic Vortex™ Panels" graphics on the following page.
7. Dry contact panels begin discharging when a 24VDC release signal is provided to the "ARV Release" contacts. The Combination Panel will send a supervisory signal to the FACP.
8. The drain solenoid closes at the beginning of the discharge.
9. The water valve opens when the pressure transducer downstream of the Combination Panel reaches the "Water Turn On" setting.
10. The water valve closes when the pressure transducer downstream of the Combination Panel decays below 75% of the "Pressure Setting".
11. The end-of-discharge can occur two different ways:
    a. The water valve closes, the drain valve opens, the ARV fully opens, and the remaining nitrogen is expelled.
    b. The 24VDC release signal provided to the "ARV Release" is removed, closing the ARV, closing the water valve, opening the drain valve, and stopping the flow of nitrogen.
12. The ARV will remain open until the 24VDC release signal provided to the "ARV Release" is removed. Once the signal is removed, the ARV will close and seat.
13. The maintenance switch will need to be flipped to the maintenance position and then back to the ready position.
14. After no system fault is found, the yellow supervisory indicator light will turn off and the supervisory contact will open.
15. Cylinder pressure switch(es) (if equipped) and water tank level switch (if equipped) are closed until the system is refilled.

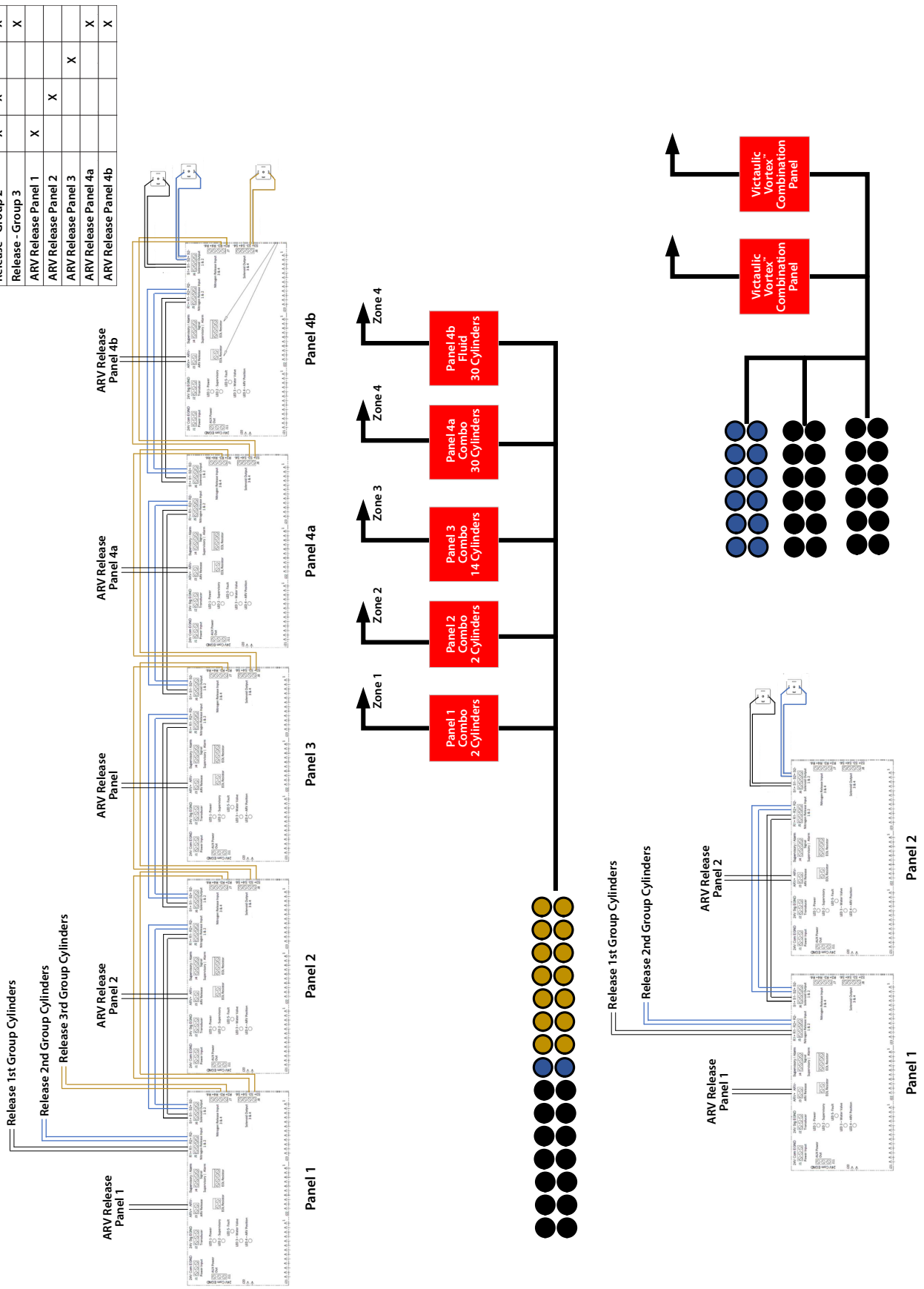
**System Operation - Dry Contact Multiple Combination Panels (Multi-Zone)**



## RELEASE SIGNAL EXAMPLE FOR NITROGEN BANK FEEDING MULTIPLE VICTAULIC VORTEX™ PANELS

**NOTE:** Where a nitrogen cylinder bank feeds multiple Victaulic Vortex™ Panels, route the release signals to prevent releasing nitrogen cylinders when any ARV is not properly seated. After start of system discharge, DO NOT release additional nitrogen cylinders until all ARVs have been fully seated.

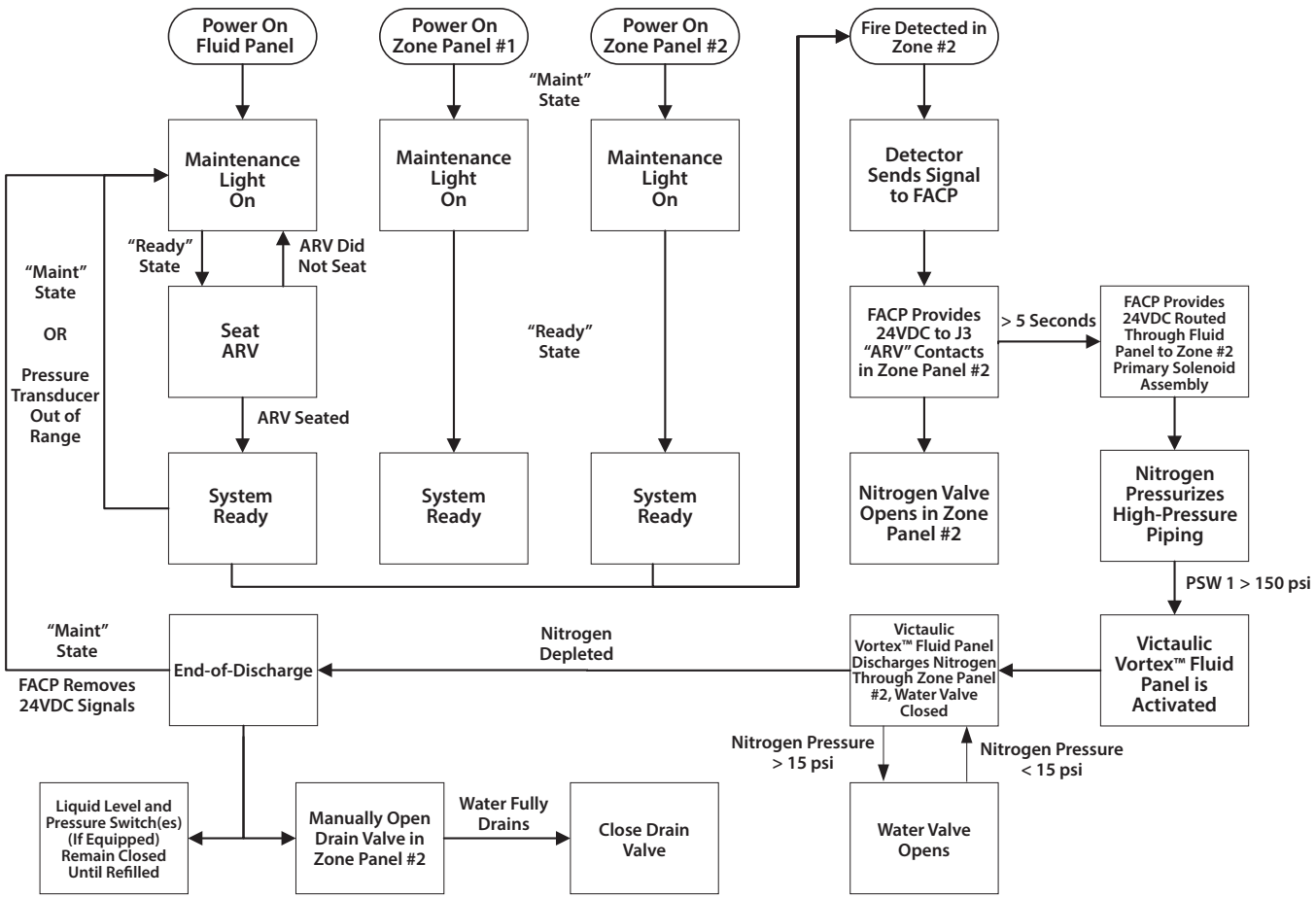
| | Detection | | | |
|---|---|---|---|---|
| | Zone 1 | Zone 2 | Zone 3 | Zone 4 |
| Release - Group 1 | | | X | X |
| Release - Group 2 | X | X | | X |
| Release - Group 3 | | | | X |
| ARV Release Panel 1 | X | | | |
| ARV Release Panel 2 | | X | | |
| ARV Release Panel 3 | | | X | |
| ARV Release Panel 4a | | | | X |
| ARV Release Panel 4b | | | | X |



**Order of Operation for Multi-Zone System (Active Release Fluid to Zone Panels)**

1. A detector in the zone #2 protected by the Victaulic Vortex™ System sends a signal to the agent-releasing FACP.
2. The agent-releasing FACP provides the first 24VDC release signal to the Zone Panel #2 "J3 ARV".
3. The nitrogen ball valve in Zone Panel #2 begins to open.
4. The agent-releasing FACP provides the second 24VDC release signal routed through the specific Fluid Panel to one or more primary solenoid release assemblies 5 seconds after the first release signal is provided. **NOTE:** One primary solenoid release assembly can open a total of 24 cylinders, including the primary cylinder.
5. The primary solenoid release assembly is energized with 24VDC. The solenoid opens, allowing compressed nitrogen to flow into the pilot lines connecting each cylinder.
6. Each cylinder connected to the pilot lines opens and pressurizes the high-pressure piping upstream of the Fluid Panel.
7. The water tank is pressurized through the water tank regulator kit connected to the cylinder manifold.
8. Active release panels begin discharging when pressure greater than 150 psig is detected at the nitrogen inlet to the panel. Pressure switch 1 (PSW1) closes to activate the ARV and begin the discharge sequence. The Fluid Panel will send a supervisory signal to the FACP.
9. Nitrogen begins to discharge through the Fluid Panel and Zone Panel #2 to the Hybrid emitters
10. The water valve in Zone Panel #2 opens when the pressure switch in the Zone Panel #2 is greater than 15 psig.
11. The water valve in Zone Panel #2 closes when the pressure switch in the Zone Panel #2 decays below 15 psig.
12. The end-of-discharge occurs when the water valve closes, the ARV fully opens, and the remaining nitrogen is expelled.
13. Zone Panel #2 drain valve will need to be manually opened to drain the water remaining in the system.
14. The Fluid Panel will stay in the above condition until the maintenance switch is flipped to the maintenance position.
15. When the maintenance switch is returned to the ready position, the ARV will begin to close and seat.
16. After the ARV has seated and no system fault is found, the yellow supervisory indicator light will turn off and the supervisory contact will open.
17. Cylinder pressure switch(es) (if equipped) and water tank level switch (if equipped) are closed until the system is refilled.

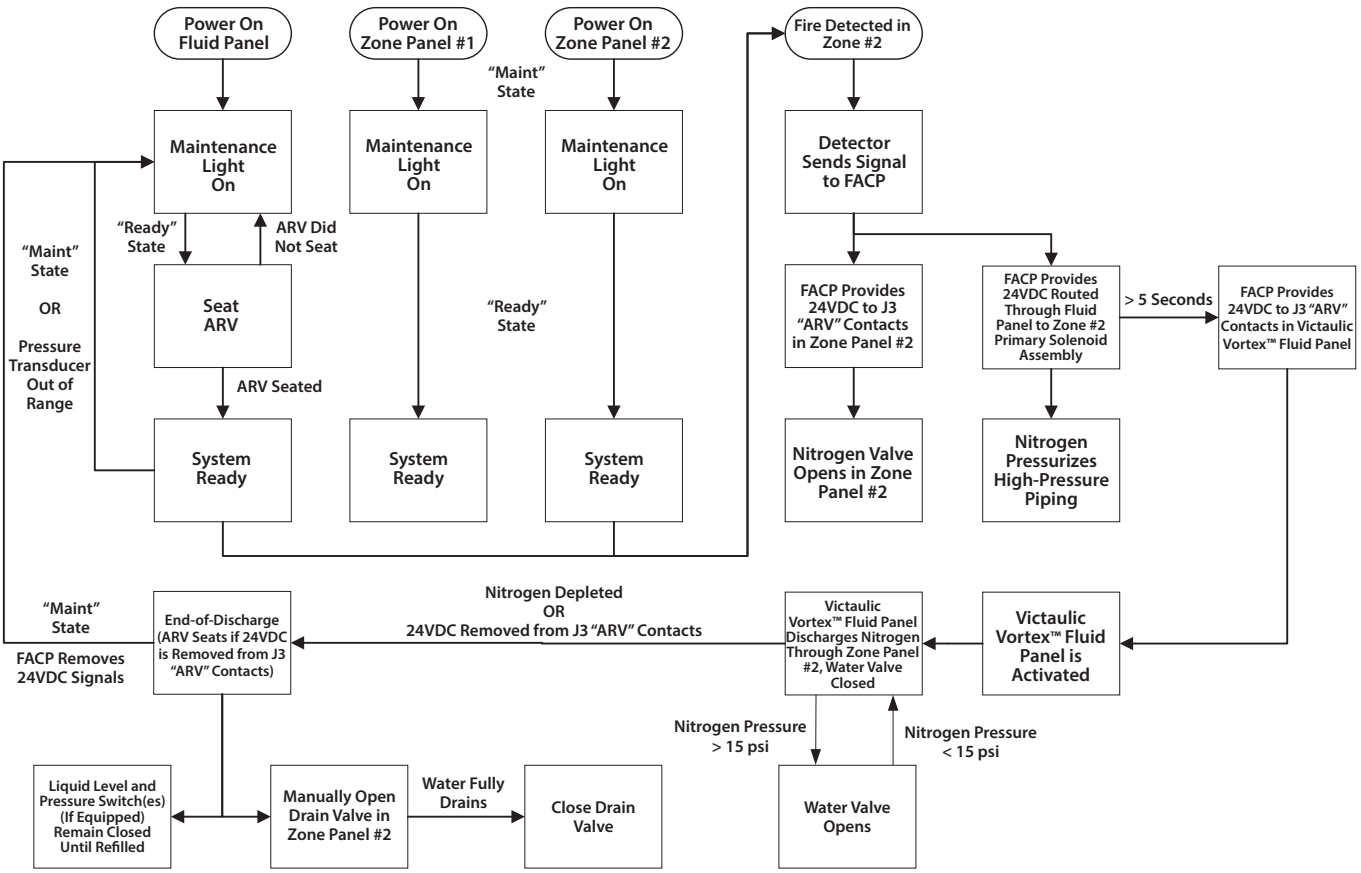
**System Operation - Active Release Fluid Panel to Zone Panel (Multi-Zone)**



**Order of Operation for Multi-Zone System (Dry Contact Fluid to Zone Panels)**

1. A detector in zone #2 protected by the Victaulic Vortex™ System sends a signal to the agent-releasing FACP.
2. The agent-releasing FACP provides the first 24VDC release signal to the Zone Panel #2.
3. The nitrogen ball valve in Zone Panel #2 begins to open.
4. The agent-releasing FACP provides the second 24VDC release signal routed through the specific Fluid Panel to one or more primary solenoid release assemblies. **NOTE:** One primary solenoid release assembly can open a total of 24 cylinders, including the primary cylinder.
5. The primary solenoid release assembly is energized with 24VDC. The solenoid opens, allowing compressed nitrogen to flow into the pilot lines connecting each cylinder.
6. Each cylinder connected to the pilot lines opens and pressurizes the high-pressure piping upstream of the Fluid Panel.
7. The water tank is pressurized through the water tank regulator kit connected to the cylinder manifold.
8. The agent-releasing FACP provides a third 24VDC release signal routed to the Fluid Panel to the “ARV Release” contacts 5 seconds after the first and second release signals are provided.
9. Dry contact panels begin discharging when a 24VDC release signal is provided to the “ARV Release” contacts. The Fluid Panel will send a supervisory signal to the FACP.
10. Nitrogen begins to discharge through the Fluid Panel and Zone Panel #2 to the hybrid emitters
11. The water valve in Zone Panel #2 opens when the pressure switch in the Zone Panel #2 is greater than 15 psig.
12. The water valve in Zone Panel #2 closes when the pressure switch in the Zone Panel #2 decays below 15 psig.
13. The end-of-discharge can occur two different ways.
    a. The water valve closes, the ARV fully opens, and the remaining nitrogen is expelled.
    b. The 24VDC release signal provided to the “ARV Release” is removed, closing the ARV, closing the water valve, and stopping the flow of nitrogen.
14. The ARV will remain open until the third 24VDC release signal provided to the “ARV Release” is removed. Once the signal is removed, the ARV will close and seat.
15. Zone Panel #2 drain valve will need to be manually opened to drain the water remaining in the system.
16. The Fluid Panel will stay in the above condition until the maintenance switch is flipped to the maintenance position.
17. The maintenance switch will need to be flipped to the maintenance position and back to the ready position.
18. After no system fault is found, the yellow supervisory indicator light will turn off and the supervisory contact will open.
19. Cylinder pressure switch(es) (if equipped) and water tank level switch (if equipped) are closed until the system is refilled.

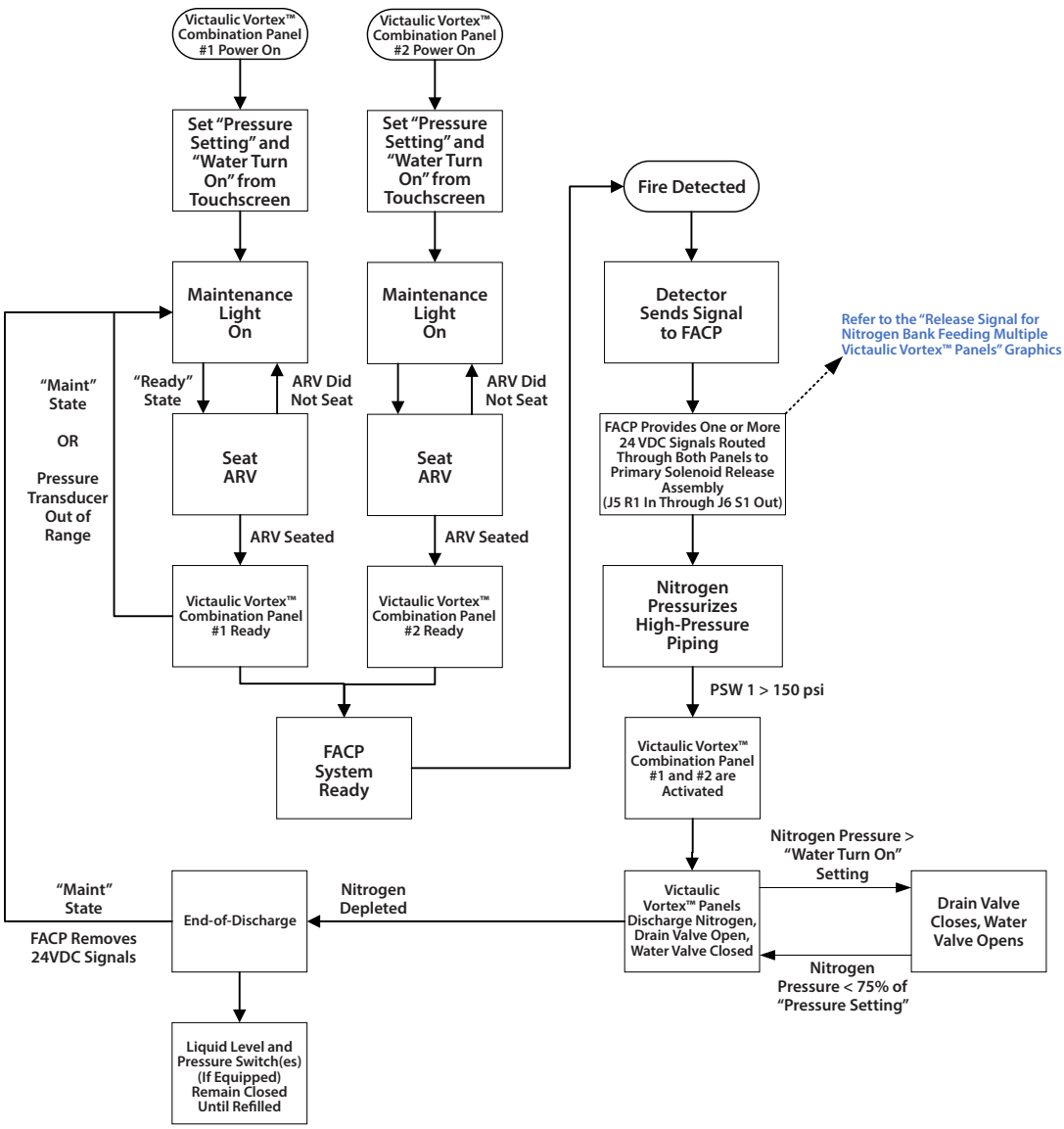
**System Operation - Dry Contact Fluid Panel to Zone Panel (Multi-Zone)**



**Order of Operation for Single-Zone System (Multiple Active Release Combination Panels)**

1. A detector in the zone protected by the Victaulic Vortex™ System sends a signal to the agent-releasing FACP.
2. The agent-releasing FACP provides a 24VDC release signal routed through each of the Combination Panels to one or more primary solenoid release assemblies. **NOTE:** One primary solenoid release assembly can open a total of 24 cylinders, including the primary cylinder. Refer to the "Release Signal Example for Nitrogen Bank Feeding Multiple Victaulic Vortex™ Panels" graphics.
3. The primary solenoid release assembly is energized with 24VDC. The solenoid opens, allowing compressed nitrogen to flow into the pilot lines connecting each cylinder.
4. Each cylinder connected to the pilot lines opens and pressurizes the high-pressure piping upstream of the Combination Panel.
5. The water tank is pressurized through the water tank regulator kit connected to the cylinder manifold.
6. Active release panels begin discharging when pressure greater than 150 psig is detected at the nitrogen inlet to each of the panels. Pressure switch 1 (PSW1) closes on each of the panels to activate the ARVs and begin the discharge sequence. Each of the Combination Panels will send a supervisory signal to the FACP.
7. The drain solenoid valve closes at the beginning of the discharge.
8. The water valves open when the pressure transducers downstream of each of the Combination Panels reach the "Water Turn On" setting.
9. The water valve closes when the pressure transducer downstream of each of the Combination Panels decays below 75% of the "Pressure Setting".
10. The end-of-discharge occurs when the water valve closes, the drain valve opens, the ARV fully opens, and the remaining nitrogen is expelled.
11. The system will stay in the above condition until the maintenance switch is flipped to the maintenance position.
12. When the maintenance switch is returned to the ready position, the ARV will begin to close and seat.
13. After the valve has stopped and no system fault is found, the yellow supervisory indicator light will turn off and the supervisory contact will open.
14. Cylinder pressure switch(es) (if equipped) and water tank level switch (if equipped) are closed until system is refilled.

**System Operation - Active Release Multiple Combination Panels (Single-Zone)**



### Voltage Drop Calculations

| Resistance Chart - DC Voltage* | | |
|---|---|---|
| **Wire Size** | **Type** | **Ohm/kFT** |
| 18 | Solid | 7.77 |
| 18 | Stranded | 7.95 |
| 16 | Solid | 4.89 |
| 16 | Stranded | 4.99 |
| 14 | Solid | 3.07 |
| 14 | Stranded | 3.14 |
| 12 | Solid | 1.93 |
| 12 | Stranded | 1.98 |

* The information in this table is referenced from Table 8 of The National Electrical Code (2002 Edition). **NOTE:** For AC Voltage, refer to Table 9 of The National Electrical Code (2002 Edition)
**FORMULA:** Voltage Drop = 2 (DC Resistance) x (Length/1000) x (Current)
**EXAMPLE:** Solenoid Water Release, 14 AWG Solid Wire, 50 from Supply
Voltage Drop = 2 (3.07) x (50/1000) x (2A)
Voltage Drop = .614V

### Typical Power Supply and Battery Sizing

Refer to Victaulic publication 70.03 for detailed specifications.

| | Alarm Current | Standby Current |
|---|---|---|
| Combination Panel | 3A | 210 mA |
| Fluid Panel | 2A | 210 mA |
| Zone Panel | 3.2A | 45 mA |

Calculate battery backup time based on number of panels and system configuration Victaulic-supplied PSU/charger can accommodate 2-12 Ah batteries; therefore, any two Combination Panels can be used with one PSU/charger. In a zone configuration, any 10 Zone Panels plus one Fluid Panel can be used with one PSU/charger where only one Zone Panel will operate at a single event.

**EXAMPLE**

**24-Hour Protection Combination Panel:**

Standby Current = 0.210 A x 24 hr = 5.04 Ah
Alarm = 3A x 0.168 hr = 0.504 Ah
TOTAL = 5.04 Ah+ 0.504 Ah = 5.544 Ah (PS-1250 - Std. Battery Size)

**NOTE:** Required backup protection determined by applicable codes. Some areas may require 72-hour backup.

## POWER SUPPLY/CHARGER INFORMATION

Victaulic Vortex™ Panels require a 24VDC power supply. Victaulic offers a power supply that converts line voltage to battery-backed-up 24VDC. Models with 115 VAC or 240 VAC input voltages are available.

Models offered for sale by Victaulic have the following specifications. **NOTE:** Except as allowed by the AHJ, power supply shall be on a dedicated circuit breaker.

**Input**
- Input 115 VAC, 60Hz, 4.2 amps
- Input fuse rated @ 3.5 amps/250 volts

**Output**
- 24VDC output
- 8 amps of continuous supply current for fire alarm applications
- Filtered and electronically regulated output
- Short circuit and thermal overload protection

**Battery Backup**
- Built-in charger for sealed lead acid or gel-type batteries
- Automatic switchover to stand-by battery when AC fails
- Maximum charge current 3.6 amps

**Supervision**

Supervisory outputs are available on the power supply board and can be monitored by the agent-releasing FACP if required by code.
- AC fail supervision (form “C” contacts)
- Low battery supervision (form “C” contacts)
- Battery presence supervision (form “C” contacts)

**Visual Indicators**
- AC input and DC output LED indicators

**Electrical**
- Operating temperature: 32° F/0° C to 120° F/49° C ambient
- 122.84 BTU per hour
- System AC input VA requirement: 483 VA

**Panel**
- Wall-mount panel for indoor use
- Accommodates up to two 12VDC/12AH batteries
- 15.5 inches high x 12.25 inches wide x 4.5 inches deep/ 394 mm high x 311 m wide x 114 mm deep
- 1.125-inch/29-mm and 1.375-inch/35-mm combination knockouts.

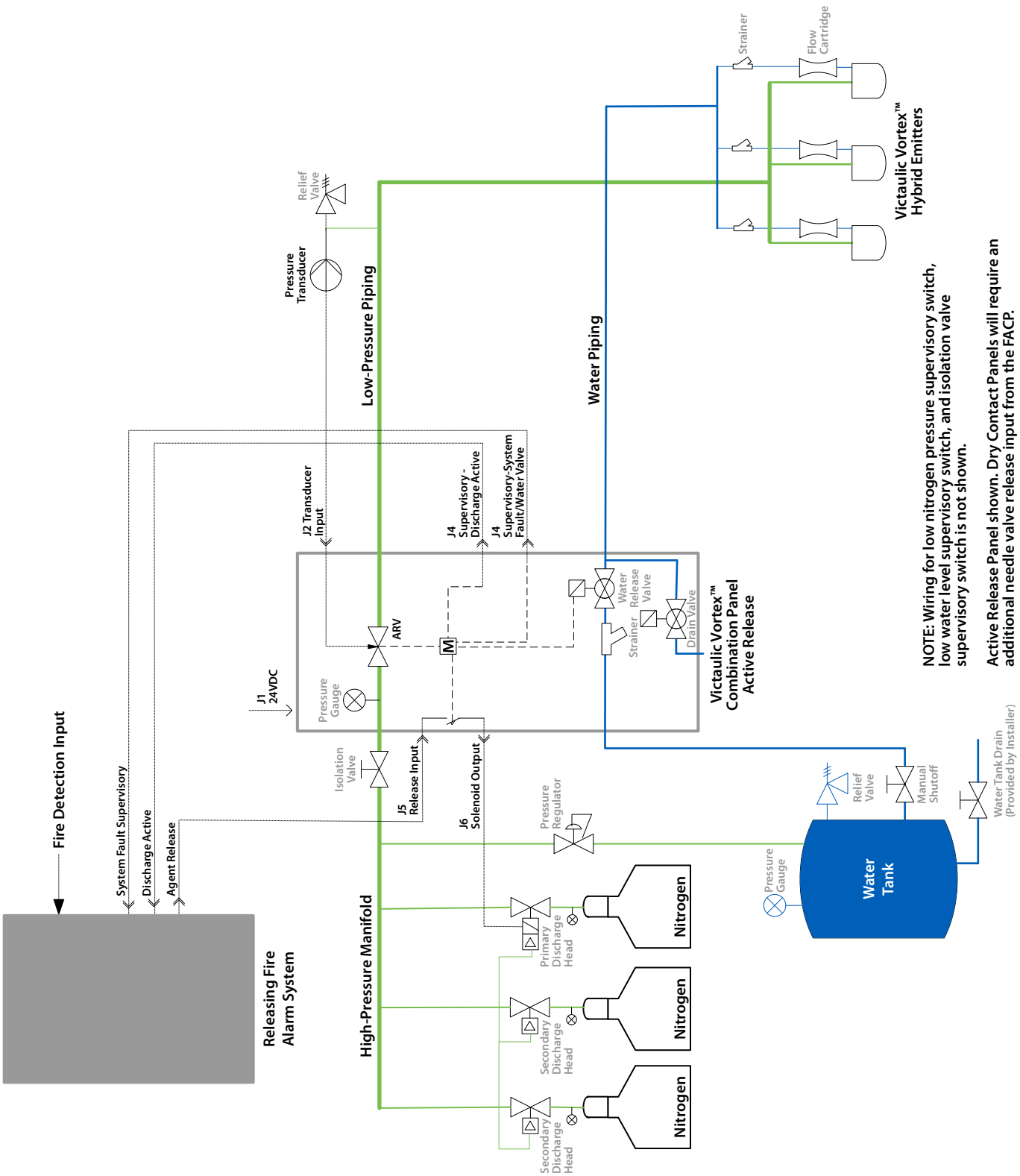
**Weight**
- 10 lbs/5 kg (approximate)

**Approvals**
- UL Listed (Access Control System Units [UL294] and Power Supplies for Fire Protective Signaling Systems [UL1481])
- FM Approved
- California State Fire Marshal Approved (CSFM)
- NYC Department of Buildings Approved (MEA)

## SYSTEM SUPERVISORY POINTS

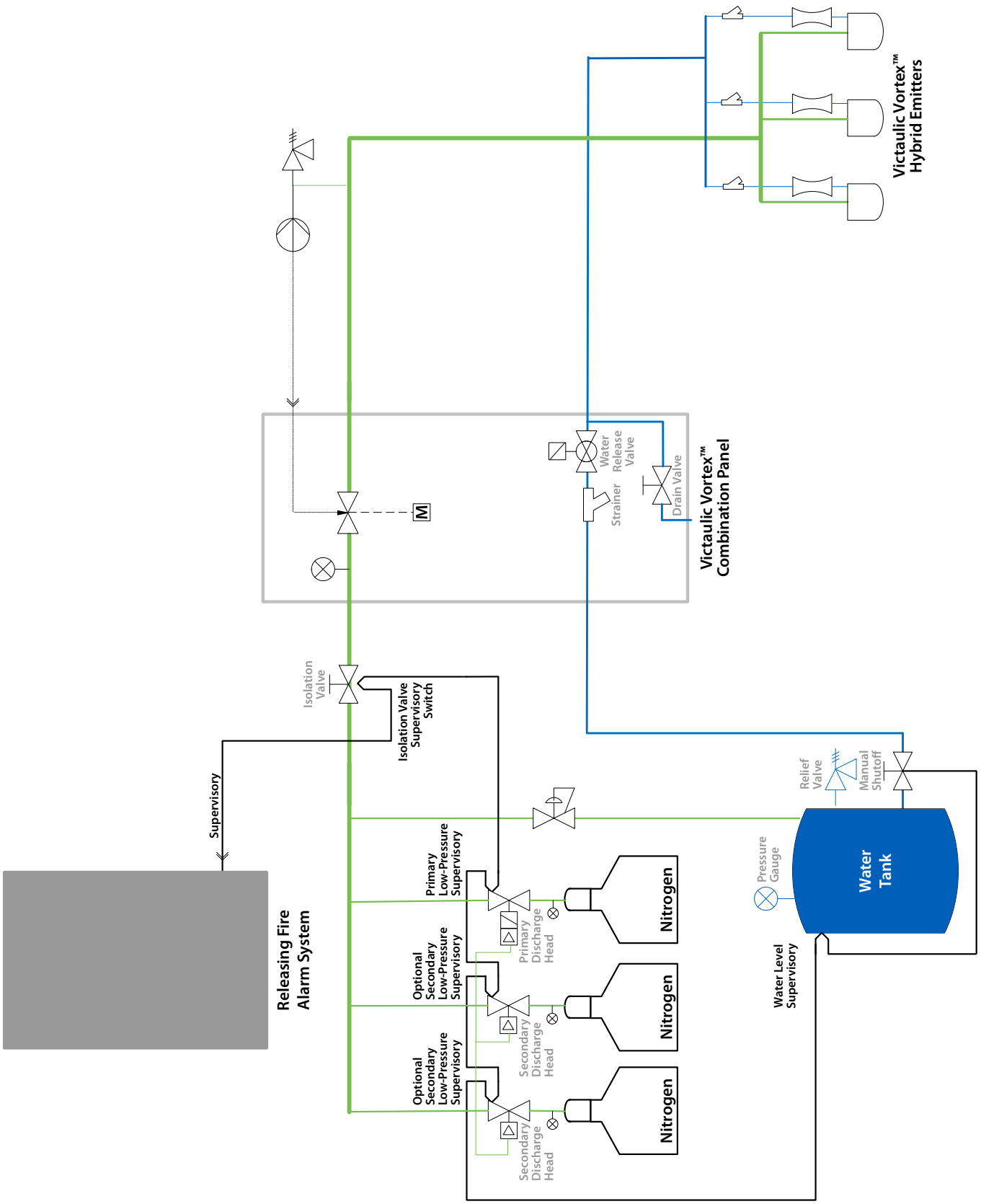
| Supervisory Point | Location | Purpose |
|---|---|---|
| Combination Panel Supervisory | Combination Panel | Indicates System Fault |
| Combination Panel Alarm Output | | Indicates Nitrogen Pressure at Input to Panel |
| Fluid Panel Supervisory | Fluid Panel | Indicates System Fault |
| Fluid Panel Alarm | | Indicates Nitrogen Pressure at Input to Panel |
| Zone Panel Supervisory | Zone Panel | Indicates System Fault |
| Zone Panel Alarm | | Indicates Nitrogen Valve is Open |
| Power Supply AC Fail | Power Supply | Indicates Loss of AC Power |
| Power Supply Battery Fail | | Indicates Low Battery Condition |
| Primary Solenoid Release Assembly Low Pressure | Primary Solenoid Release Assembly on Nitrogen Cylinders | Indicates Low Pressure in Primary Nitrogen Cylinder |
| Primary Solenoid Coil Position | | Indicates Solenoid Coil has been Removed from the Primary Solenoid Release Assembly |
| Secondary Gauge Assembly Low Pressure (Optional) | Secondary Gauge Assembly on Nitrogen Cylinder | Indicates Low Pressure in Secondary Nitrogen Cylinders |
| Water Tank Level Switch | Water Tank | Indicates Low Water in Water Tank |
| Nitrogen Isolation Valve Position | Integrator Installed Piping Between Nitrogen Supply and Victaulic Vortex™ Panel | Indicates Nitrogen Isolation Valve is Open |
| Manual Water Control Valve | Integrator Installed Piping Between Water Supply and Victaulic Vortex™ Panel | Indicates Water Control Valve is Open |

## SINGLE-ZONE SYSTEM DIAGRAM WITH ELECTRICAL INPUTS (ACTIVE RELEASE)

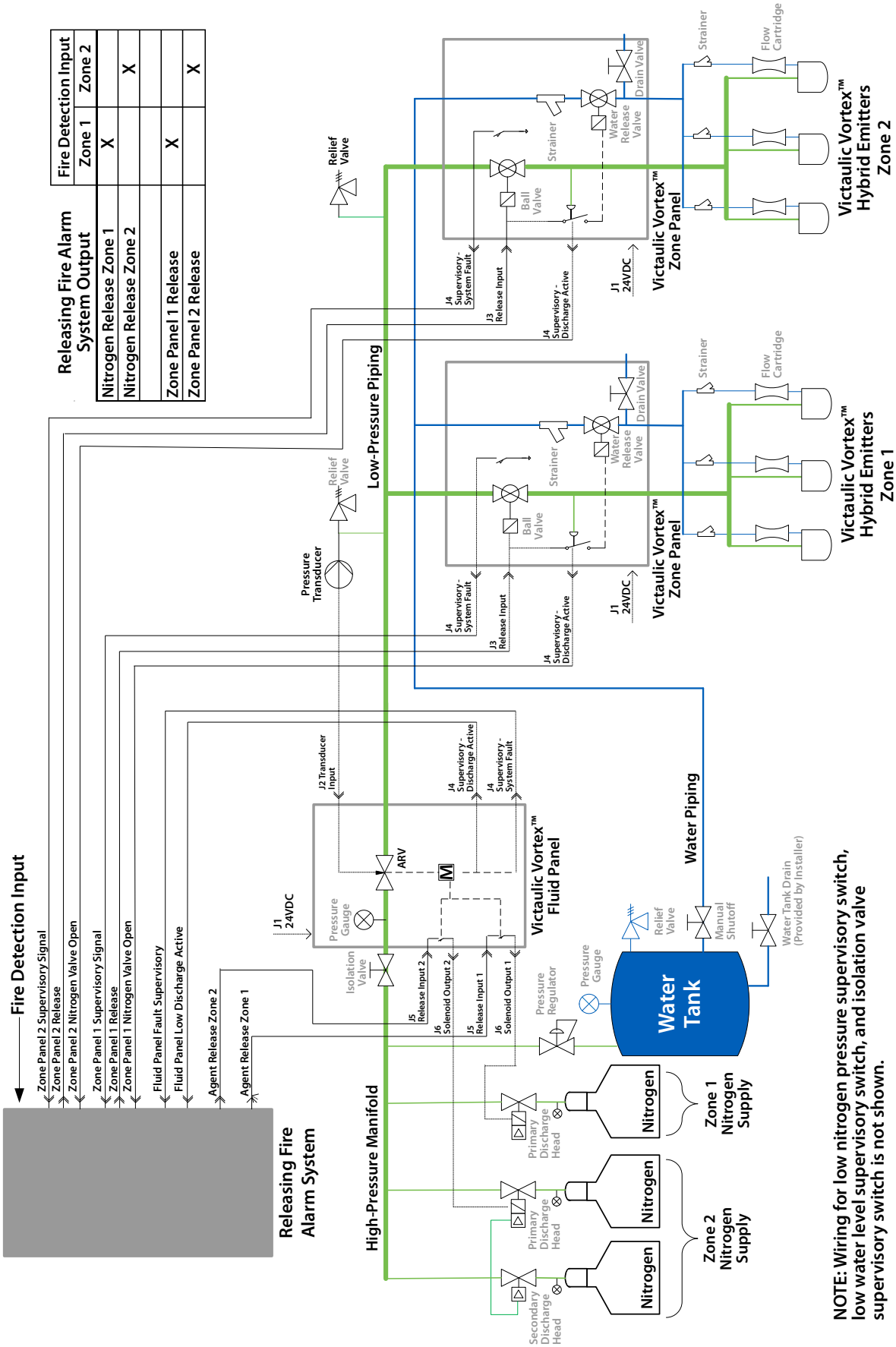


## EXTERNAL SUPERVISORY CONNECTIONS

The following diagram shows supervisory switches for the isolation valve, nitrogen cylinder low pressure, and water tank level.



## MULTI-ZONE SYSTEM DIAGRAM WITH ELECTRICAL INPUTS (ACTIVE RELEASE)




NOTE: Wiring for low nitrogen pressure supervisory switch, low water level supervisory switch, and isolation valve supervisory switch is not shown.

Active release panel shown. Dry contact panels will require an additional needle valve release input from the FACP.

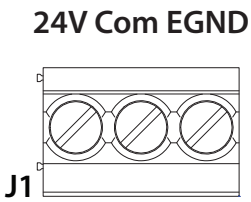
Zone Panels must be released before nitrogen release.

## ELECTRICAL CONNECTIONS

**NOTICE**

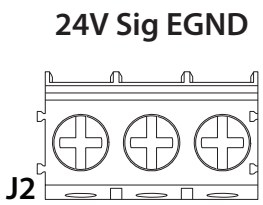
- **J2 – J10 terminal block screws should be tightened to 3.1 – 3.5 in-lbs/0.35 – 0.40 N•m**
- **J1 and J11 terminal block screws should be tightened to 4.4 – 5.3 in-lbs/0.50 – 0.60 N•m**
- **J1 and J11 are rated for use with 10-20 AWG solid or stranded wire**
- **J2 – J8 are rated for use with 14-24 AWG wire**

### Power Input



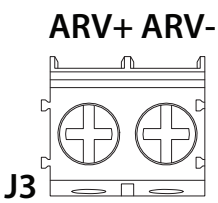

The Victaulic Vortex™ Panel requires a constant non-resettable, 24-volt DC power source (Victaulic offers a 24-volt DC power source). Refer to the "Electrical Specifications" section for the current requirements. The power supply shall provide a means for reporting an AC failure, DC power loss, and loss of battery connection in accordance with NFPA 72. Charging rates and battery capacities shall be configured to meet NFPA 72 guidelines. Proper wire size calculations shall be performed to ensure minimum voltage requirements are met. DO NOT make or break any connections with power applied to the Combination Panel. The power input is polarity sensitive; therefore, the Combination Panel will not power up if the polarity is reversed.

### Pressure Transducer Input



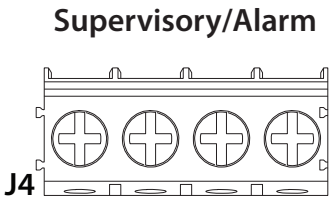

The pressure transducer input is used in the Combination and Fluid Panels, but is left unused in Zone Panels. The Victaulic Vortex™ System utilizes a 4-20mA pressure transducer that terminates inside the Victaulic Vortex™ Panel with a signal, power, and ground (shield) wire. For distances up to 1000 feet/305 meters, shielded twisted pair wire (no less than 18 AWG) should be used (Belden* 5300FE meets this requirement). Connect the shield at the PCB only. Do not connect the shield at the pressure transducer end of the cable. The pressure transducer is polarity sensitive (refer to the system connection diagrams for wiring details).

### Panel Release Input




Dry contact Combination and Fluid Panels and all Zone Panels require a 24VDC signal to start a discharge. This terminal block is left unused on Active Release Panels. When a 24-volt signal is applied to the release input, a Combination or Fluid Panel will begin the discharge sequence. When releasing a multi-zone system, always release at least one Zone Panel first, prior to applying a release signal to the nitrogen supply's primary discharge head or the Fluid Panel release signal. The 24-volt signal should be maintained for the entire discharge and until the system is manually reset by qualified personnel. Removal of the 24-volt signal from a Dry Contact Combination or Fluid Panel will result in the panel closing, which will stop the discharge sequence. The nitrogen valve on Zone Panels will remain open until manually reset after the 24-volt signal is removed. Contact Victaulic for alternate Zone Panel configurations that close upon removal of the release signal (scan QR code on front cover for contact information for your region).

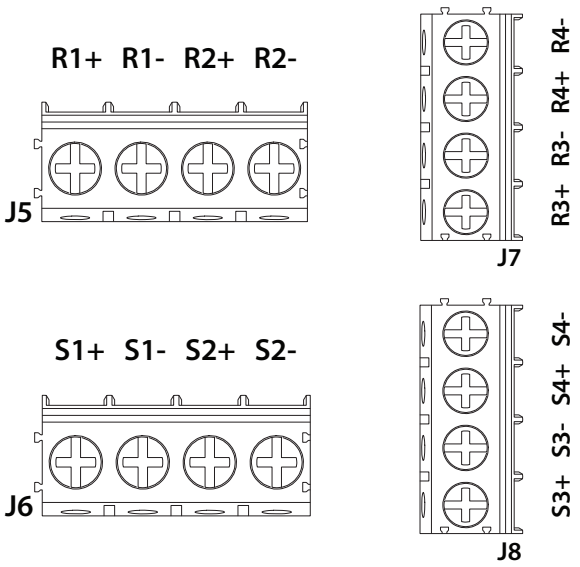
### Supervisory/Alarm Signals




Two ½-amp @ 30VDC normally-open dry contact outputs are provided to monitor system status. Terminal block J10 is provided as a connection point for an EOL resistor on each of the two supervisory signals, when the Victaulic Vortex™ System is connected to agent-releasing FACPs that require a resistor. The contacts will be open when the panel is in the normal, ready state. The contacts will be closed if the panel is in an alarm or supervisory condition or if power is removed from the panel. The red alarm indicator light (LED 1) is on when the alarm contacts are closed. The yellow supervisory indicator light (LED 5) is on when the supervisory connection is closed.

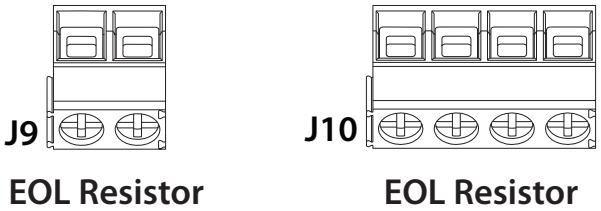
## ELECTRICAL CONNECTIONS (CONTINUED)

### Nitrogen Release Input/Solenoid Output




The nitrogen release input/solenoid output connections are used in all Combination and Fluid Panels, but is left unused in Zone Panels. A 24VDC signal from the agent-releasing FACP is routed into the PCB through the release input (R+,R-) and out to primary discharge solenoid through the solenoid output (S+, S-). Four pairs of release input/solenoid output connection points are available, allowing for use with up to four groups of cylinders. Each release input/solenoid output pair can power up to two primary solenoid release assemblies. The connection between the release input and solenoid output is interlocked with the maintenance switch and needle valve position switch to prevent nitrogen release when the needle valve is not fully seated or when the system is in maintenance. When the maintenance switch is placed in the maintenance position, the release input signal will be interrupted. The agent-releasing FACP should be configured to supervise the release signal.

### EOL Resistors

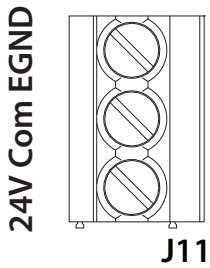



When the agent-releasing FACP requires EOL resistors to supervise the panel release input or supervisory contacts, terminal blocks J9 and J10 may be used as connection points for the EOL resistors.

Terminal block J9 is used for EOL resistors required on the panel release input and is interlocked with the maintenance switch. Placing the maintenance switch in the maintenance position will open the connection to an EOL resistor installed in terminal block J9.

Terminal block J10 is used for EOL resistors installed on the supervisory contacts.

### Auxiliary Power Output




When multiple panels are required to power from the same power supply, the auxiliary power output connection may be used to daisy-chain wiring to additional Victaulic Vortex™ Panels. Do not exceed 4A draw from the auxiliary power connector. The auxiliary power connector is not protected by the fuse on the printed circuit board (PCB).

# SECTION IV
# INSTALLATION

## VICTAULIC VORTEX™ PANEL INSTALLATION

Victaulic Vortex™ Panels shall be fastened securely to the wall at the mounting hole locations shown in Section II, as required by applicable codes. Bolt holes (5⁄16 inch) are provided in each corner of the panel, and a ½-inch knockout is provided for wire entry.

Combination and Zone Panels have a drain outlet for draining the emitter water piping after discharge. Refer to Section II for panel dimensions and pipe locations. **NOTE:** Some installations will require an increase in pipe diameter on the nitrogen inlet and outlet ports of the Victaulic Vortex™ Panel. Verify that there is enough space from the wall to accommodate the required nitrogen piping.

Combination and Fluid Panels have a manifold block to thread high-pressure piping into the inlet of the panel. A proper hold-back shall be applied to the manifold block when tightening the pipe.

Refer to Section II for Victaulic Vortex™ Panel mounting hole locations.

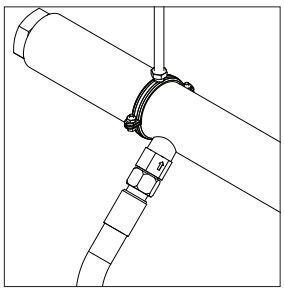
## CYLINDER AND MANIFOLD INSTALLATION

**⚠ WARNING**

- **All connections and bracing SHALL be installed and tightened before the manifold is pressurized and before attempting to test or operate the system.**
- **Use only hoses, valves, and components provided with the Victaulic Vortex™ System.**
- **DO NOT attempt to tighten or loosen any pressurized connections.**
- **During inspection and maintenance, any damaged components shall be replaced.**
- **Transportation and installation of nitrogen cylinders shall be performed only by individuals that have been trained on proper handling techniques. Nitrogen cylinders contain stored energy that can discharge explosively.**
- **NEVER TRANSPORT NITROGEN CYLINDERS WITHOUT THE CYLINDER CAP INSTALLED.**
- **For additional safety and handling information, always reference the applicable I-VORTEX Design, Installation, and Maintenance Manual; the local AHJ requirements; and the following codes/ standards:**
  - **Code of Federal Regulation (49 CFR 171-179 and 14 CFR 103)**
  - **OSHA 1910.101**
  - **Compressed Gas Association (C-6-1968, C-8-1962, and P-1)**
  - **NFPA 55**

**Failure to follow these instructions can cause unexpected, violent movement of nitrogen cylinders, resulting in death or serious personal injury and property damage.**

- Secure cylinder rack to floor and wall with appropriate fasteners, in accordance with applicable local codes and standards.
- Install manifold into cylinder rack and secure with pipe hangers provided.



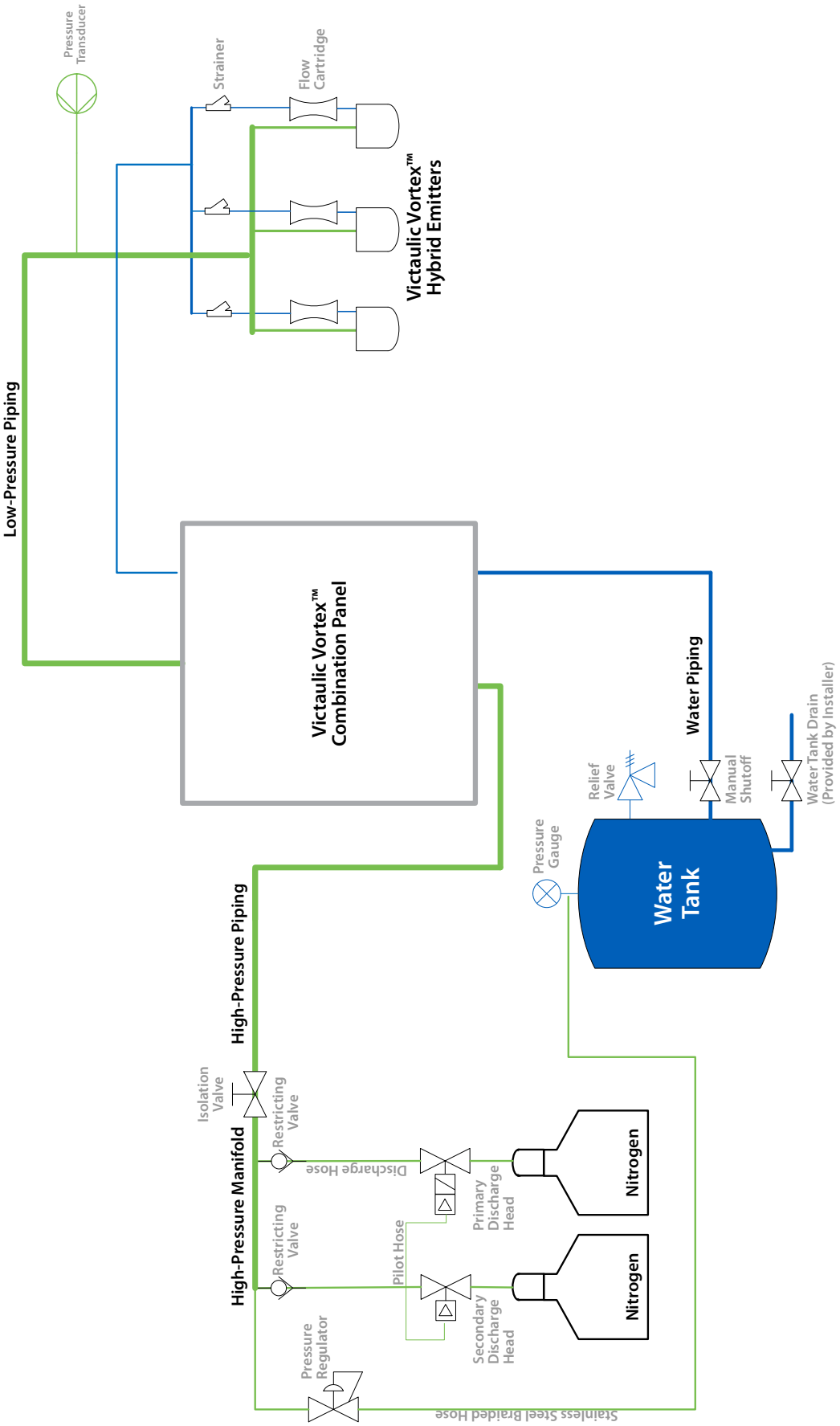
- Install discharge hose restricting valves into manifold using thread sealant. Typically, a properly tightened discharge hose restricting valve will have 3-4 threads visible. If this is a double-row rack being used with an odd number of cylinders, a plug shall be installed in one of the outside holes of the manifold. Use only plugs that are rated to the appropriate pressure.
- Install cylinders in rack. Typically, cylinders are oriented so that the discharge port is to the installer's left-hand side. It may be helpful to test fit a discharge hose to verify that the cylinder is rotated correctly in the rack. **DO NOT REMOVE PROTECTIVE CYLINDER CAPS UNTIL CYLINDERS HAVE BEEN SECURED COMPLETELY WITH THE CYLINDER RETAINING STRAPS.**
- Secure inner row of cylinders with cylinder retaining straps prior to installing outer row of cylinders.
- Install outer cylinder retaining straps to secure cylinders in rack.
- Connect discharge hoses to cylinders and manifolds. **NOTE:** Hoses contain an o-ring seal. Verify that sealing surfaces are clean. Avoid rotating the hose when it is tightened against the sealing surfaces. Start threads on each end of hose before tightening either end. Typically, properly tightened hoses have 1-2 threads visible.
- Begin tightening primary solenoid release and secondary gauge assemblies onto cylinder valves. A single primary solenoid release assembly can operate up to 24 cylinder valves. In multi-zone systems, or systems with large numbers of cylinders, multiple primary solenoid release assemblies can be used.
  **NOTE:** To make hose routing easier, it is preferable to have the primary solenoid release assembly on the right-most cylinder in the group of cylinders.
- Install the primary solenoid release assembly last, after all secondary assemblies are installed.
- Attach primary solenoid release assembly to pilot release gauge port. **NOTE:** Primary solenoid release assembly contains wrench flats on inlet to prevent assembly from rotating during tightening. **DO NOT** hold assembly by gauge or pressure switch during tightening. The primary solenoid release assembly engages a Schrader* valve as it is tightened. When the Schrader* valve is engaged, it will take more torque to tighten the assembly. Typically, the Schrader* valve engages with 2-3 threads visible and, when tightened properly, the assembly will have 0-1 thread visible.
- Verify that all discharge hoses are tight at both ends.
- Install ¼-inch BSPP/Rp pilot connection port on rear of cylinder valves. **NOTE:** To ease installation, leave this connection loose until all pilot hoses are connected.
- Determine pilot hose routing if multiple primary solenoid release assemblies are being used. **NOTE:** An 11.8-inch/300-mm length pilot hose is provided with secondary pilot kits to connect adjacent cylinders. A 17.7-inch/450-mm length pilot hose is provided with primary pilot kits to connect the primary solenoid release assembly to the tee on back of cylinder valves. Longer pilot hoses are available when it is necessary to run the primary pilot line between rows of cylinders or to adjacent cylinder racks. A 27.5-inch/ 700-mm length pilot hose can be used to connect cylinders between two rows.

## HIGH-PRESSURE NITROGEN PIPING

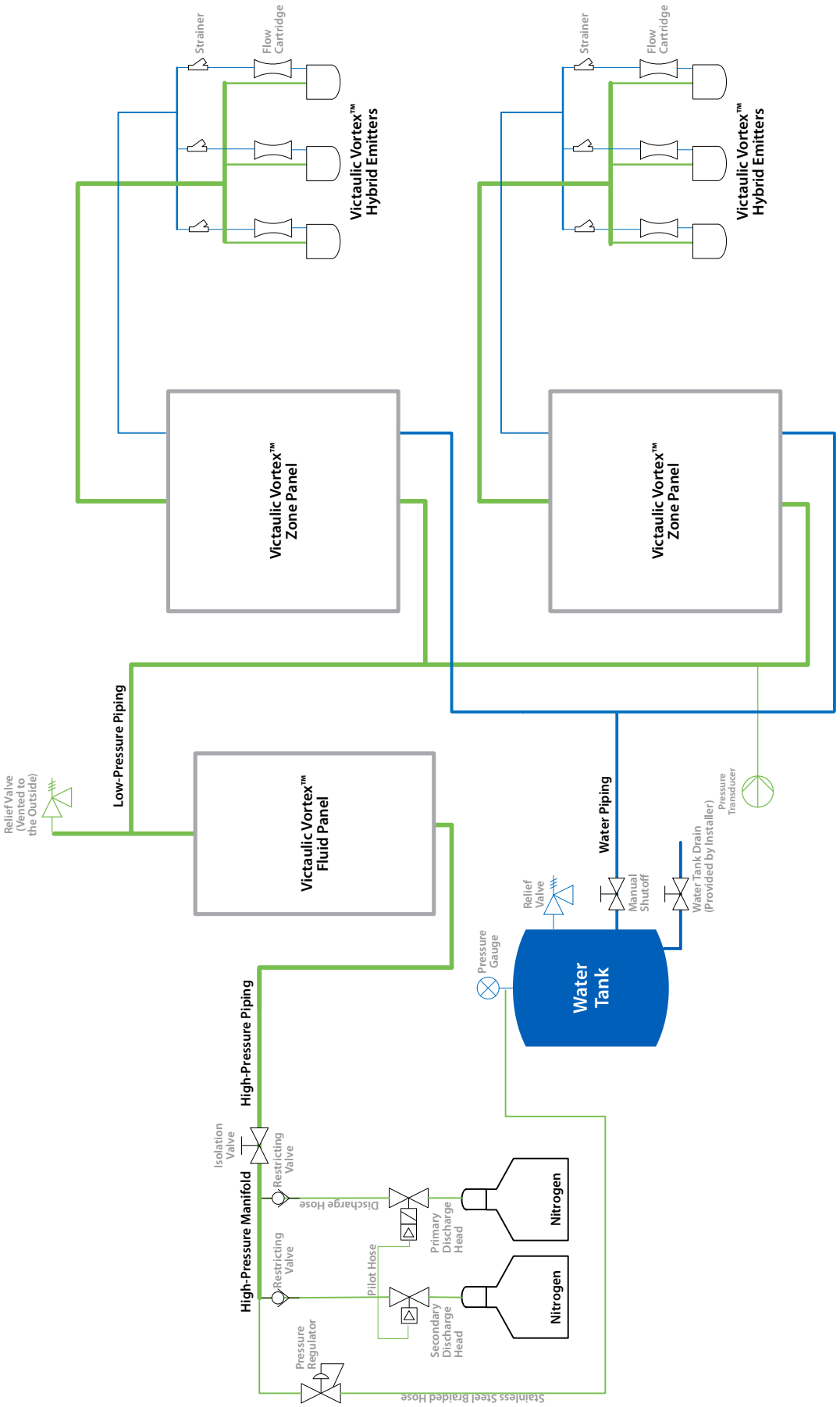
- All piping shall be cleaned internally prior to installation.
- The nitrogen supply, either from the high-pressure manifold or from a bulk nitrogen supply, connects to the nitrogen inlet at the bottom of the Combination or Fluid Panel.
- High-pressure nitrogen supply lines and fittings shall meet ASME B31.1 and all applicable codes and shall be rated to at least 3000 psi/206.8 Bar or the maximum supply pressure of the nitrogen supply.
- A minimum of 1-inch diameter piping shall be used to supply nitrogen to 1-inch Combination and Fluid Panels.
- A minimum of 1 ½-inch diameter piping shall be used to supply nitrogen to 1 ½-inch Combination and Fluid Panels.
- Where long runs of piping exist between the nitrogen supply and Victaulic Vortex™ Panels, or where there are several changes in direction, it may be necessary to increase the nitrogen supply piping size. Refer to the applicable VDM-VORTEX General Design Manual.
- A supervised nitrogen valve or "isolation valve" shall be installed between the Victaulic Vortex™ Panel and nitrogen supply.
- An adapter is provided to transition from the internal threads of the high-pressure manifold to a 1-inch MNPT fitting.
- Thread sealant, designed to work with high-pressure gas connections operating above 3000 psi/206.8 Bar, shall be used on all threaded connections. Thread sealant is not required on manifold hoses that contain o-rings.

* Schrader is a registered trademark of Schrader International, a Tomkins Company

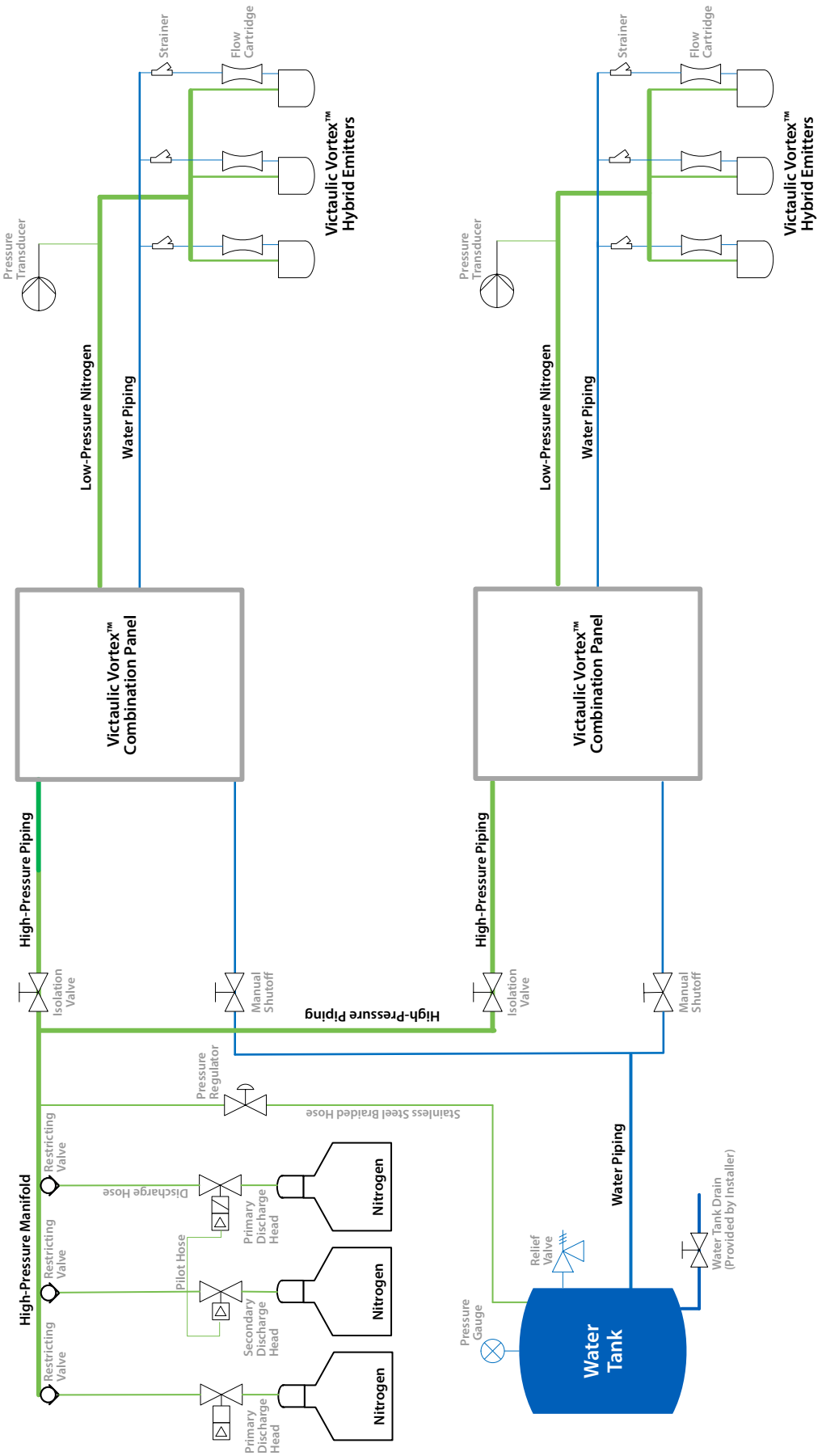
## SINGLE-ZONE SYSTEM PLUMBING



## MULTI-ZONE SYSTEM PLUMBING – FLUID AND ZONE PANELS



## MULTI-ZONE SYSTEM PLUMBING – COMBINATION PANELS



## WATER TANK INSTALLATION

- The water tank supplies water to the Combination Panel in a single-zone system or Zone Panels in a multi-zone system. The water tank is pressurized through a regulator connected to the high-pressure manifold.
- Locate water tank where sight glass and pressure gauge will be visible. Water tank shall be in close proximity to Victaulic Vortex™ Panels that it will be supplying.
- Avoid excessive piping lengths between water tank and Victaulic Vortex™ Panels in order to minimize water delivery time during system discharge.
- Secure water tank to floor with appropriate fasteners, in accordance with applicable local codes and standards. Refer to Section II for mounting hole dimensions.
- Connect water tank nitrogen feed from regulator installed on nitrogen supply piping or manifold.
- During discharge, a mechanical regulator will regulate nitrogen to a lower 40 – 150-psi/2.8 – 10.3-Bar pressure and will pressurize the water tank.
- For systems using high-pressure cylinders, a regulator threads into a ¼-inch NPT port of the Victaulic Vortex™ high-pressure manifold and pressurizes the water tank.
- For systems using a bulk nitrogen supply, a regulator shall be connected to a ¼-inch NPT fitting in the high-pressure piping.
- Install the regulator in the high-pressure manifold or piping. Use thread tape or sealant on the threads.

## WATER TANK TO COMBINATION OR ZONE PANEL CONNECTION

- Water tanks contain a 1-inch FNPT outlet at the top (for the 10-gallon/38-liter size) or side (for most other sizes) of the tank. The 400-gallon/1514-liter size water tank contains a 2-inch FNPT outlet at the side of the tank. Plumb the water tank outlet to the inlet of the Combination or Zone Panel. Use thread tape or sealant, as appropriate. **NOTE:** During a system discharge, the water tank may be pressurized up to 150 psi/10.3 Bar.
- Combination and Zone Panels contain a manual water shutoff valve.
- A drain valve is provided at the bottom of the tank.
- The factory-installed, 150-psi/10.3-Bar relief valve shall be installed.
- Before pressure is applied to the high-pressure manifold or nitrogen piping for the first time, turn the adjustment knob counterclockwise to verify that the regulator outlet pressure is set to zero.
- A length of braided stainless steel hose is provided to connect the regulator to the water tank. If the water tank is located farther than the braided stainless steel hose will reach, the distance may be made up by using piping that is rated for a working pressure greater than 200 psi/13.8 Bar.

## FLUID PANEL TO ZONE PANEL (MULTI-ZONE SYSTEM) – NITROGEN PIPING

- In a multi-zone system, the Fluid Panel reduces and regulates the high-pressure gas to the Zone Panels. Zone Panels then direct this lower-pressure nitrogen to a specific zone in the Victaulic Vortex™ System.
- In most cases, the outlet of one Fluid Panel will connect to the inlets of three or more Zone Panels. Fluid-to-Zone Panel piping shall be rated to a minimum working pressure of 175 psi/12.1 Bar. Refer to the applicable VDM-VORTEX General Design Manual for acceptable pipe materials.
- A pressure transducer and pressure relief valve shall be installed in the Fluid-to-Zone Panel piping.
- In a multi-zone system, the pressure transducer is provided as an assembly and has a ¼-inch MNPT connection. Unless specified otherwise by the system designer/integrator, the pressure transducer shall be located in the Fluid-to-Zone Panel piping, just prior to the furthest Zone Panel.
- A pressure relief valve shall be installed in the piping between the Fluid Panel and Zone Panels. Victaulic offers two sizes of pressure relief valves:
  1 ½-inch MNPT inlet with a 2-inch FPT outlet
  2-inch MNPT inlet with a 2 ½-inch FPT outlet
- The pressure relief valve shall be vented to outside the building or into a space where activation of the pressure relief valve cannot lower oxygen to an unsafe level.
- Nitrogen piping from the top of the Fluid Panel connects to the nitrogen inlet at the bottom of each Zone Panel. Typically, the nitrogen piping will increase in size to permit better nitrogen flow. The 1-inch Victaulic Vortex™ Panels will typically use 2 – 3-inch piping between the Fluid and Zone Panels. The 1 ½-inch Victaulic Vortex™ Fluid Panels will typically use 3 – 4-inch piping between Zone Panels. Refer to the applicable VDM-VORTEX General Design Manual for how to calculate the required nitrogen pipe sizes.

## COMBINATION OR ZONE PANEL TO HYBRID EMITTER – NITROGEN PIPING

- Combination and Zone Panel outlet piping is designed to operate at pressures below 175 psi/12.1 Bar.
- Hybrid emitters deliver high nitrogen flow rates at 25 - 50 psi/1.7 - 3.4 Bar. The system designer/integrator shall specify pipe sizes in accordance with the piping design requirements listed in this manual.
- Combination and Zone Panels usually require 2 – 4-inch system piping to minimize friction losses.
- Avoid the use of back-to-back 90° elbows. Use 45° elbows to change direction, whenever possible.
- The majority of hybrid emitters contain ¾-inch MNPT or ¾-inch FNPT threads. The step down to ¾-inch pipe shall be as close to the hybrid emitter as possible. DO NOT use ¾-inch 90° elbows with these hybrid emitters; instead, use a 1-inch elbow and bell reducer within 12 inches/305 mm of the hybrid emitter.

## HYBRID EMITTER WATER PIPING

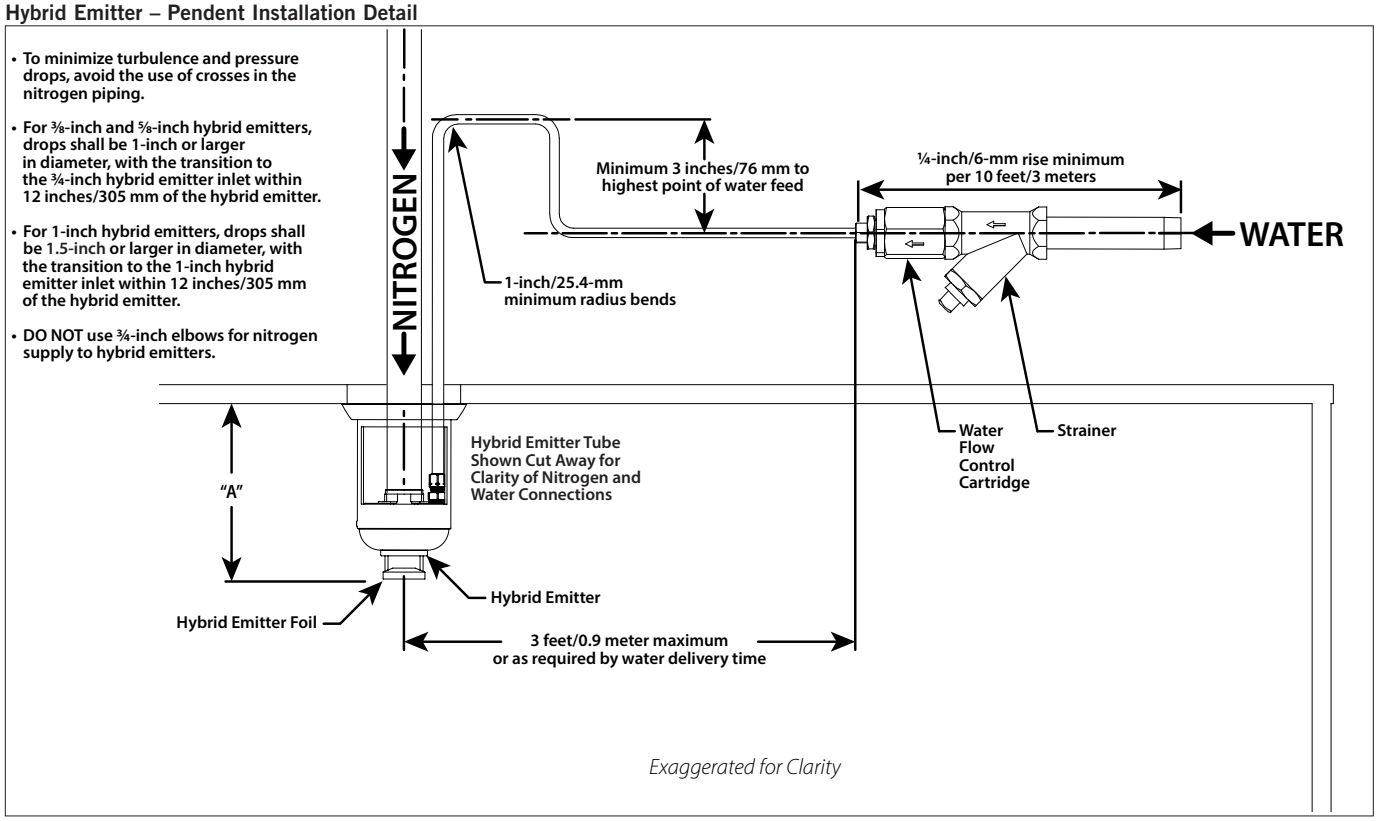
- Hybrid emitter water piping shall be designed to minimize water delivery time. Oversizing the water piping will increase water delivery time due to the extra volume that needs to be filled within the piping.
- A strainer and water flow control cartridge shall be installed close to each hybrid emitter (within 3 feet/0.9 meter or less of each hybrid emitter). Typically, the hybrid emitter connects to the water flow control cartridge with ¼-inch or ⅜-inch tubing to allow for ease of connection and alignment (hard piping is acceptable). **NOTE:** When 0.26 GPM/1.0 LPM and smaller water flow control cartridges are used, ¼-inch tubing shall be installed to improve water delivery time.
- The water flow control cartridge is marked with a direction arrow and shall be installed with the flow arrow pointing toward the hybrid emitter. Maximum installation torque for the water flow control cartridge and for the hybrid emitter's nitrogen inlet is 22 ft-lbs/30 N•m.
- Piping shall be pitched downward from the hybrid emitter to minimize water from dripping after discharge.
- Escutcheon hybrid emitters are shipped with a black PVC cap to protect the hybrid emitter from dust/debris, when required. Standard hybrid emitters are shipped with an orange polymer cap to protect the hybrid emitter during shipping; this orange cap may also be used to provide protection from dust/debris. Hybrid emitters caps shall be removed if the hybrid emitters will be exposed to temperatures of 125° F/52° C and above. Hybrid emitter caps are not a part of a FM Approved System
- Seal threaded connections with appropriate sealant, pipe tape, or pipe dope, in accordance with NFPA 770. DO NOT allow sealant to get on the first threads of the pipe or to be carried into the strainer/flow control cartridge during water flow.

## HYBRID EMITTER PLACEMENT

The piping system shall be designed to minimize pressure differences between hybrid emitters and minimize pressure losses between the Victaulic Vortex™ Panel and hybrid emitters. The allowable pressure difference at each hybrid emitter is -10%/+20% of the rated pressure.

- Hybrid emitters shall be distributed throughout the protected space to provide even distribution of hybrid media.
- Hybrid emitters may be angled to optimize distribution and minimize obstruction in front of the hybrid emitter
- Hybrid emitters may be aimed at specific equipment, if required
- Avoid direct impingement on or installation directly above electrical or other moisture-sensitive equipment where dripping after discharge could result in damage
- Large, flat surfaces (such as equipment cabinets and furniture) directly in the path of hybrid emitter discharge may collect water. A minimum clearance of 18 inches/457 mm is recommended. The preferred method is to position hybrid emitters to use the full height (pendent) or full width (sidewall) of the enclosure.
- Avoid configurations where discharge of the hybrid emitter could cause splashing of flammable materials.

**Hybrid Emitter – Pendent Installation Detail**

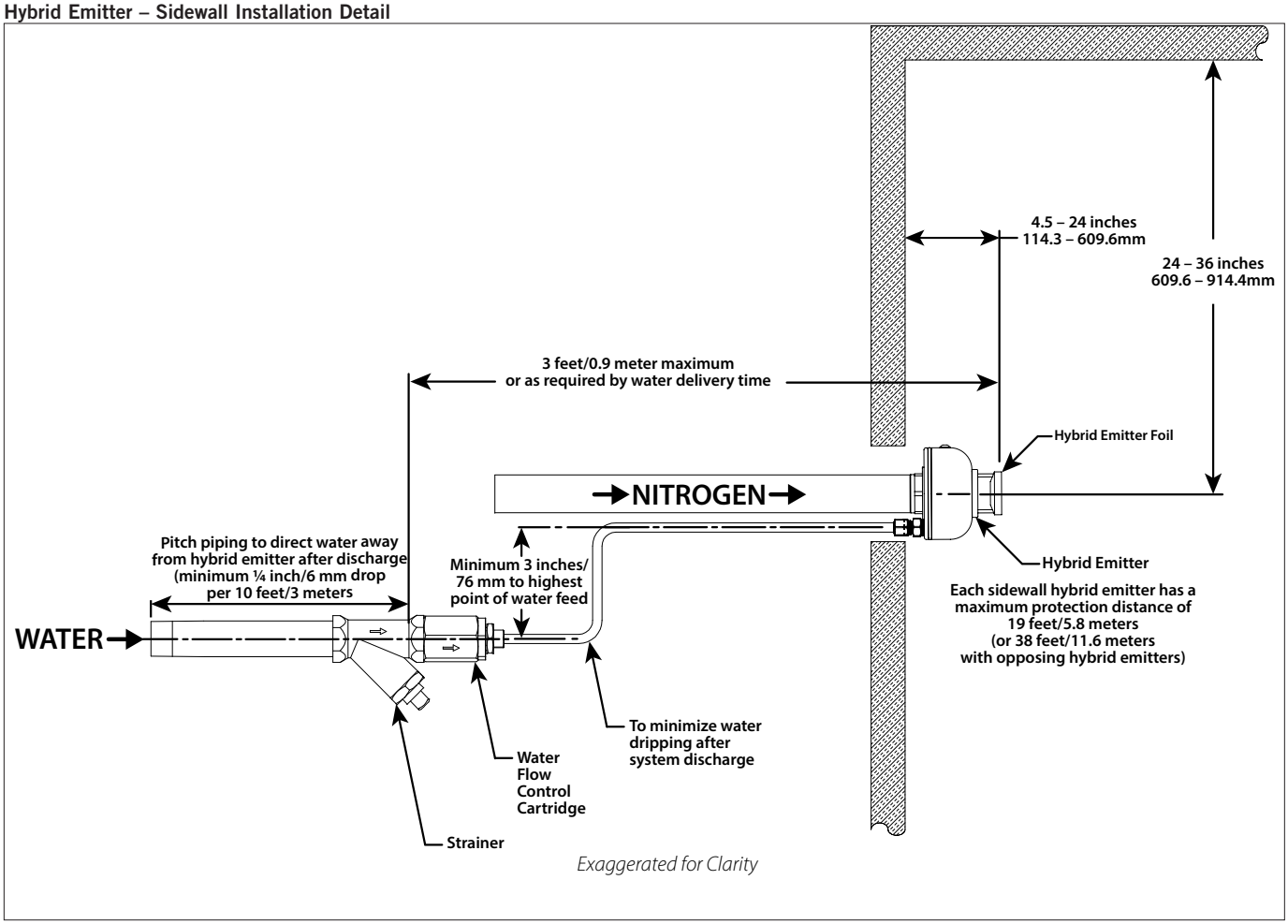



**Spacing Requirements for Pendent Emitters**

| Hybrid Emitter | Minimum Distance to Wall | Foil Distance to Ceiling (A) |
|---|---|---|
| ⅛ inch | 1 feet<br>0.3 meters | 4.5 - 24 inches<br>114 - 609 millimeters |
| ¼ inch | 1 feet<br>0.3 meters | 4.5 - 24 inches<br>114 - 609 millimeters |
| ⅜ inch | 2 feet<br>0.6 meters | 4.5 - 24 inches<br>114 - 609 millimeters |
| ½ inch | 2.5 feet<br>0.8 meters | 4.5 - 24 inches<br>114 - 609 millimeters |
| ⅝ inch | 3 feet<br>0.9 meters | 4.5 - 24 inches<br>114 - 609 millimeters |
| 1 inch | 5 feet<br>1.5 meters | 6 - 24 inches<br>152 - 609 millimeters |

**NOTE:** Installing hybrid emitters less than the minimum distance values may cause excessive wetting.

**Hybrid Emitter – Sidewall Installation Detail**



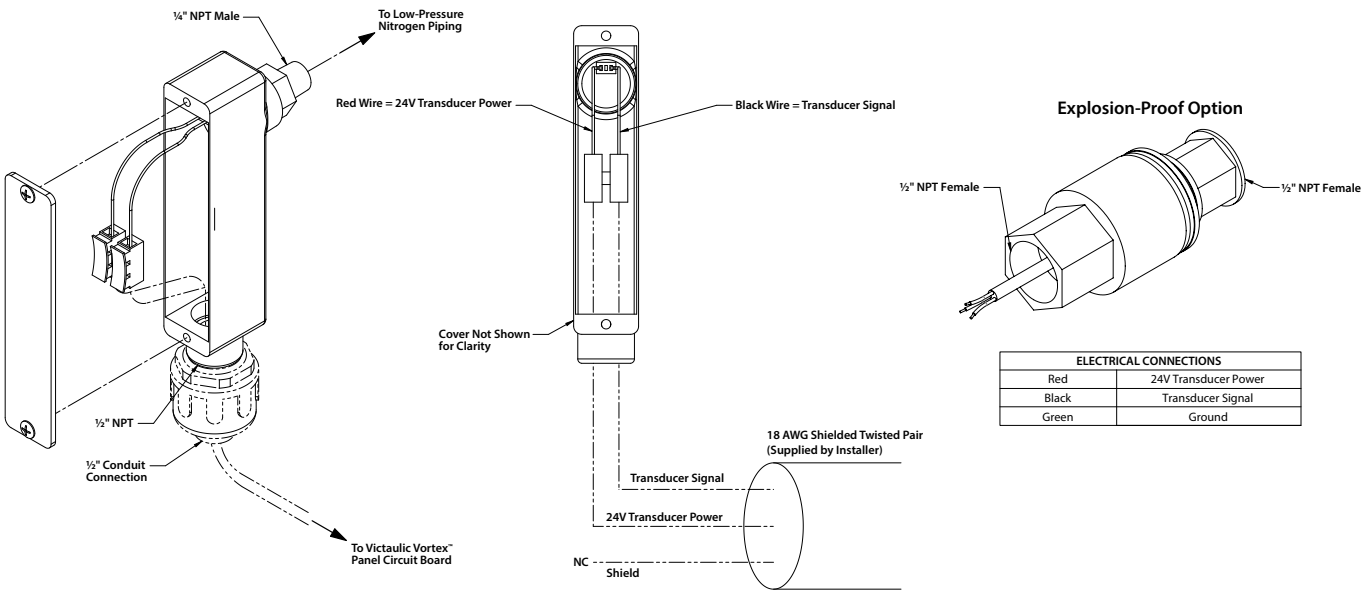
# SECTION V
# WIRING

## PRESSURE TRANSDUCER WIRING

**⚠ CAUTION**

- **The pressure transducer shall be installed into the pipe network prior to wiring.**
- **Wiring shall be pulled prior to making electrical connections.**
- **Polarity shall be observed.**
- **During installation, DO NOT apply a wrench to the cover of the pressure transducer.**

**Failure to follow these instructions could result in product damage.**




| ELECTRICAL CONNECTIONS | |
|---|---|
| Red | 24V Transducer Power |
| Black | Transducer Signal |
| Green | Ground |

**NOTICE**

- **The pressure transducer shall be centrally located within the hybrid emitter piping for a single-zone system or between the Fluid and Zone Panels for a multi-zone system.**
- **Refer to the applicable VDM-VORTEX General Design Manual for detailed information on pressure transducer location.**

- Shielded, twisted pair, 18 American Wire Gauge (AWG) electrical wiring is required to prevent signal noise degradation. The distance shall not exceed a maximum of 1000 feet/305 meters (Belden* 5300FE meets these specifications).
- Wiring shall be protected and installed per National Electrical Code and local guidelines.
- Pressure transducer wiring can be run in the same conduit as supervisory and primary release signals and 24-volt DC power for the panel, as allowed by applicable electrical codes.
- Do not run pressure transducer wiring in the same conduit as AC power wiring.

**Prior to Servicing the System**

**⚠ CAUTION**

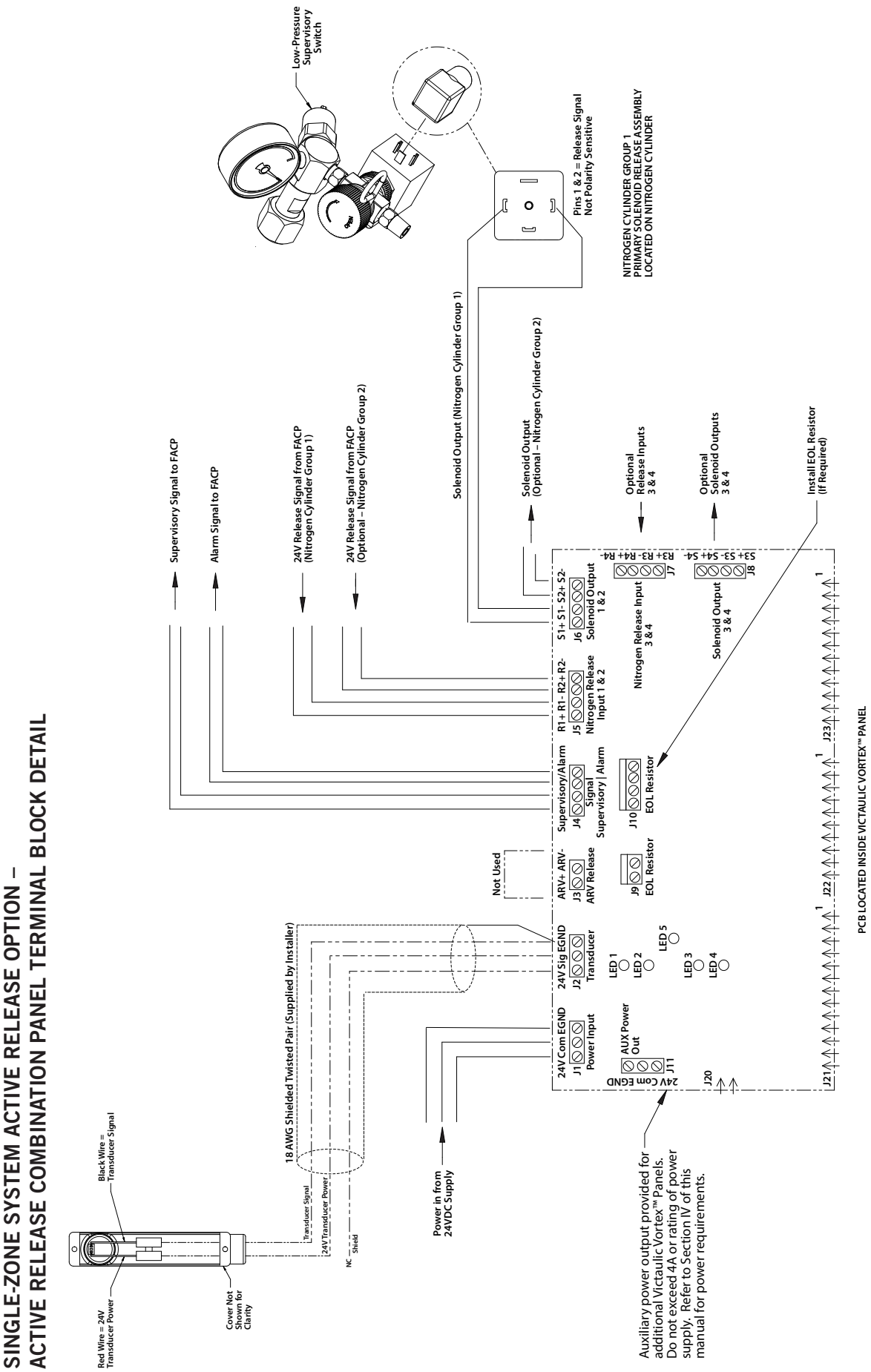
- **The nitrogen isolation valve and water supply valves shall remain closed to prevent accidental discharge of the system.**

**Failure to follow this instruction could result in property damage.**

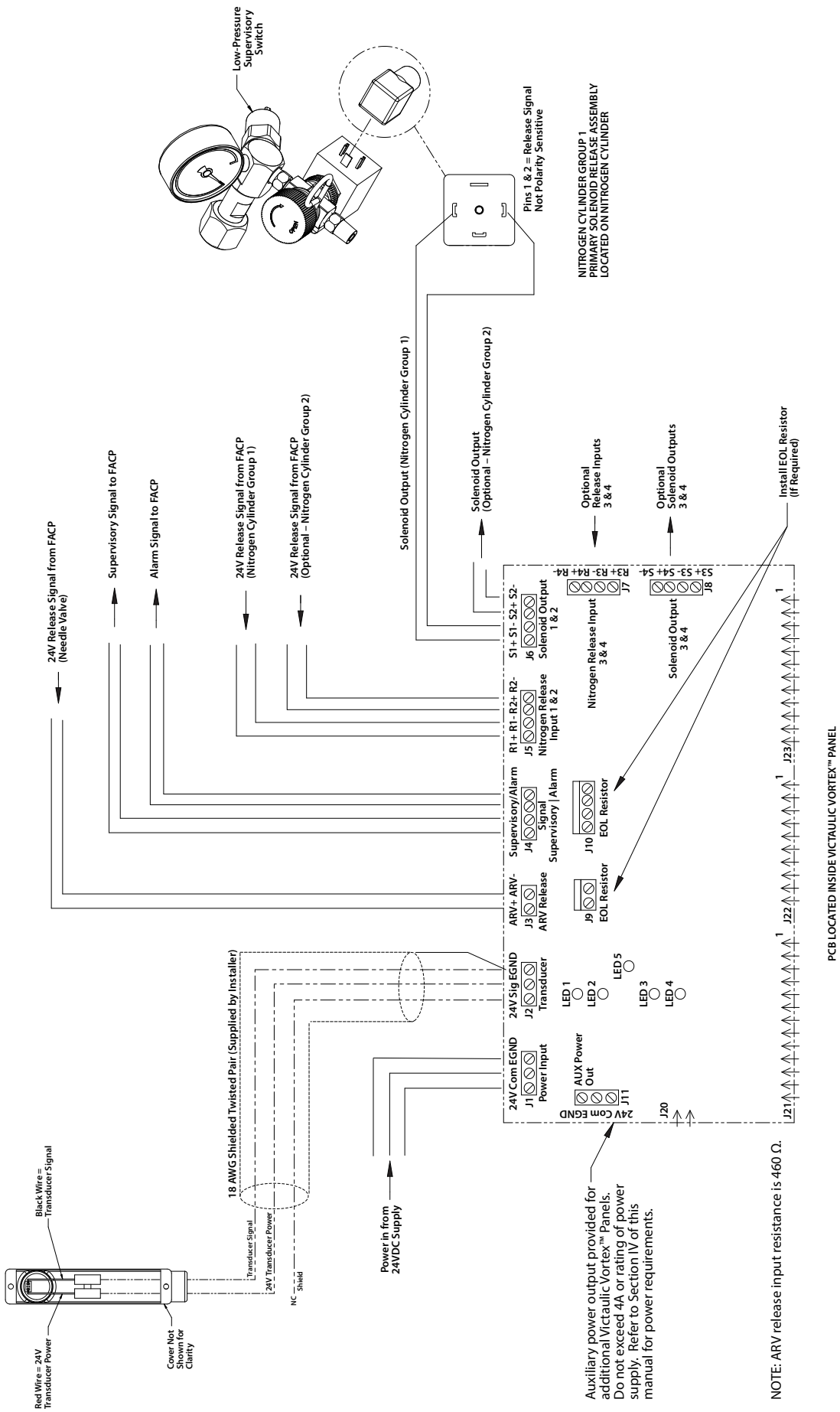
1. Remove all solenoids from the primary solenoid release assemblies before any connections take place. As a final step, and after all circuits are tested for functionality, the solenoids can be placed onto the release heads.
2. Place the maintenance switch in the maintenance position to prevent the valve from opening in case of accidental discharge. Reset the maintenance switch as a final step when the system is ready to become active.
3. Turn off all water isolation valves until the system is ready to become active.

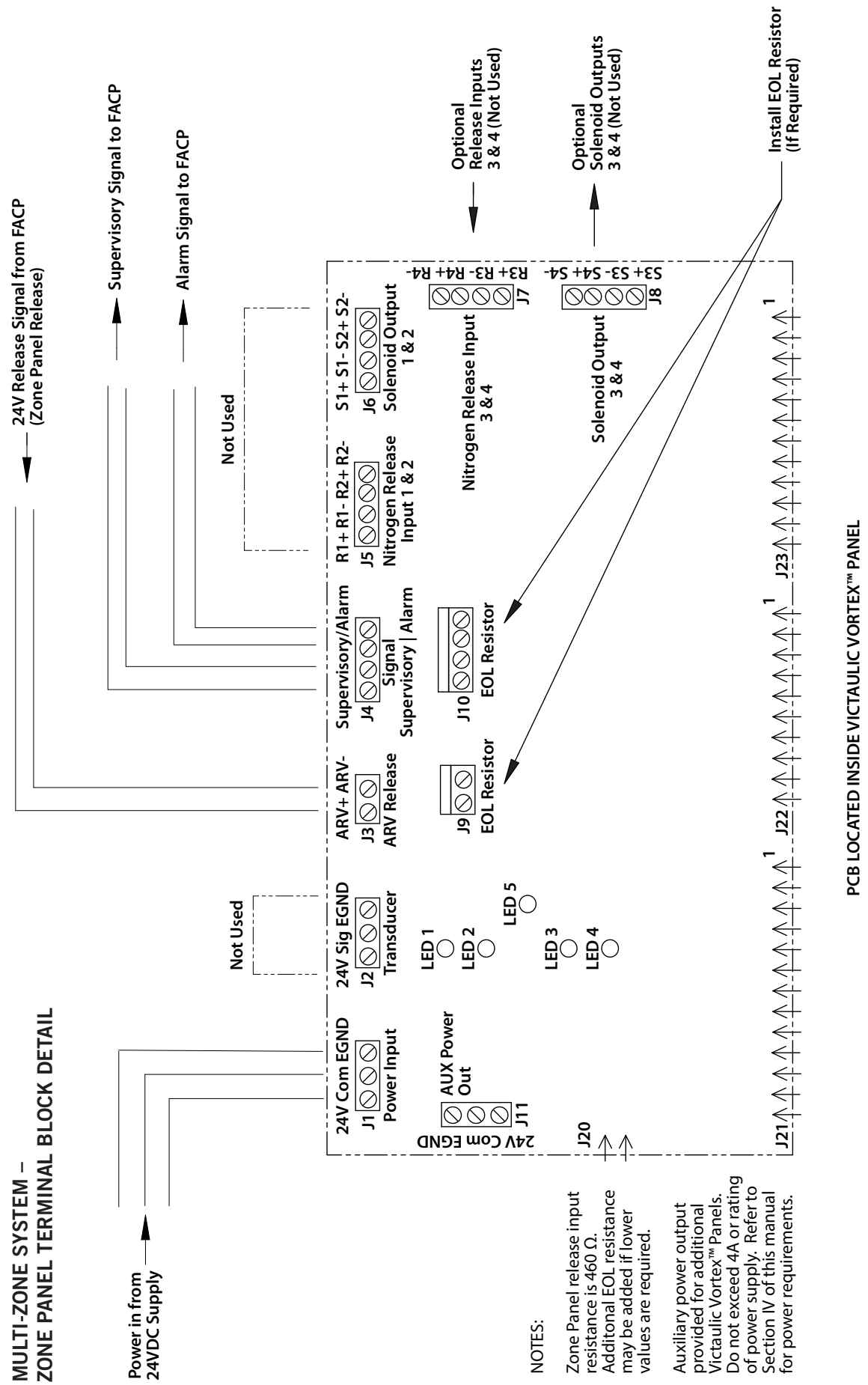
* Belden is a registered trademark of Belden Inc.

## SINGLE-ZONE SYSTEM ACTIVE RELEASE OPTION – ACTIVE RELEASE COMBINATION PANEL TERMINAL BLOCK DETAIL



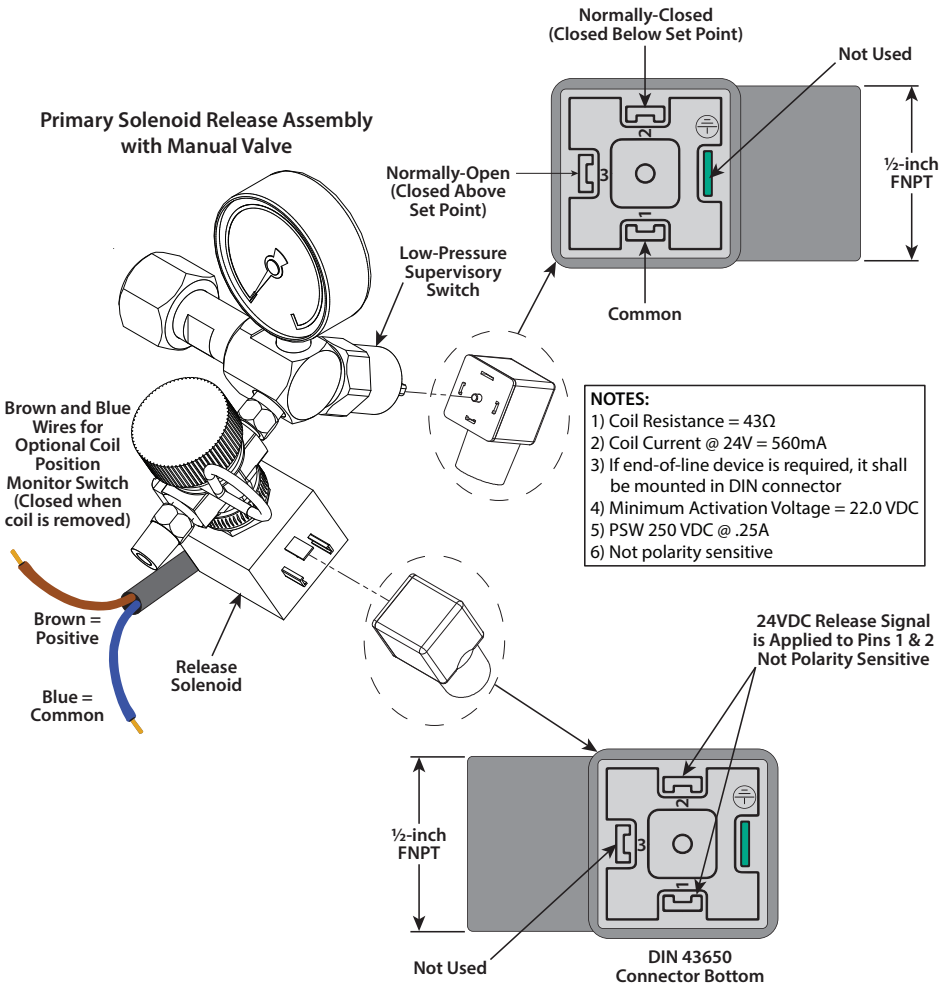
## SINGLE-ZONE SYSTEM DRY CONTACT OPTION – DRY CONTACT COMBINATION PANEL TERMINAL BLOCK DETAIL



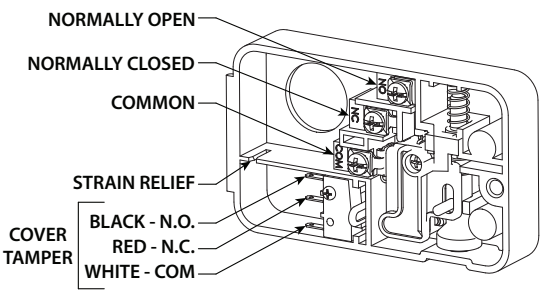

MULTI-ZONE SYSTEM –
ZONE PANEL TERMINAL BLOCK DETAIL
Power in from
24VDC Supply
24V Release Signal from FACP
(Zone Panel Release)
Supervisory Signal to FACP
Alarm Signal to FACP
Not Used
Not Used
Optional
Release Inputs
3 & 4 (Not Used)
Optional
Solenoid Outputs
3 & 4 (Not Used)
Install EOL Resistor
(If Required)
24V Com EGND
J1
Power Input
24V Sig EGND
J2
Transducer
ARV+ ARV-
J3
ARV Release
Supervisory/Alarm
J4
Signal
Supervisory | Alarm
R1+ R1- R2+ R2-
J5
Nitrogen Release
Input 1 & 2
S1+ S1- S2+ S2-
J6
Solenoid Output
1 & 2
R3+ R3- R4+ R4-
J7
Nitrogen Release Input
3 & 4
S3+ S3- S4+ S4-
J8
Solenoid Output
3 & 4
J9
EOL Resistor
J10
EOL Resistor
AUX Power
Out
J11
24V Com EGND
LED 1
LED 2
LED 3
LED 4
LED 5
J20
J21
J22
J23
PCB LOCATED INSIDE VICTAULIC VORTEX™ PANEL
NOTES:
Zone Panel release input resistance is 460 Ω. Additonal EOL resistance may be added if lower values are required.
Auxiliary power output provided for additional Victaulic Vortex™ Panels. Do not exceed 4A or rating of power supply. Refer to Section IV of this manual for power requirements.

## PRIMARY SOLENOID RELEASE ASSEMBLY ELECTRICAL CONNECTIONS (WITH MANUAL VALVE)

Victaulic Vortex™ System discharge begins with a 24VDC release signal from a control module or release circuit to the solenoid (non-polarity sensitive). Either circuit shall be programmed as continuous. Connection to the solenoid is made through a female DIN 43650 connector with a ½-inch NPTF fitting on Terminals 1 and 2. Any end-of-line devices shall be installed inside the DIN connector. Proper wire size calculations shall be performed to ensure a minimum voltage of 22 VDC with a 13-watt load.

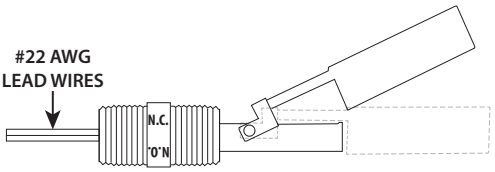



## NITROGEN ISOLATION VALVE ELECTRICAL CONNECTIONS (WIRE TO AGENT-RELEASING FACP SUPERVISORY INPUT)




## WATER TANK FLOAT SWITCH INSTALLATION AND WIRING (WIRE TO AGENT-RELEASING FACP SUPERVISORY INPUT)

The water tank float switch is installed, as shown, with contacts open when tank is filled above the level of the switch. This float switch is not polarity sensitive.



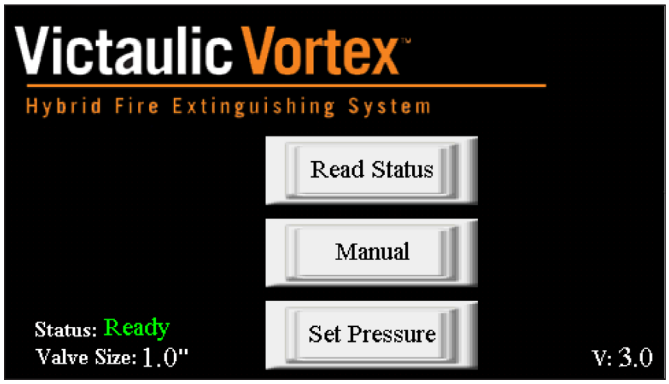
# SECTION VI
# TOUCH-SCREEN INTERFACE

## TOUCH-SCREEN INTERFACE

### Home Screen

The Victaulic Vortex™ touch-screen interface is a display that provides a view of the system operation. The touch-screen interface does not store information or operate the system.

The Automatic Regulating Valve stores software and controls pressure regulation; the touch-screen interface can be used to update this software. In addition, the touch-screen interface provides a means to supervise, view, and log certain system information. The touch-screen interface can be used to modify factory-set values, when necessary, and can be used to cycle and test various valves.




The touch-screen interface is normally in the sleep mode (screen will be blank). Touch the display to refresh/view the home screen. **NOTE:** The display will automatically go to sleep after approximately 90 seconds of screen inactivity.

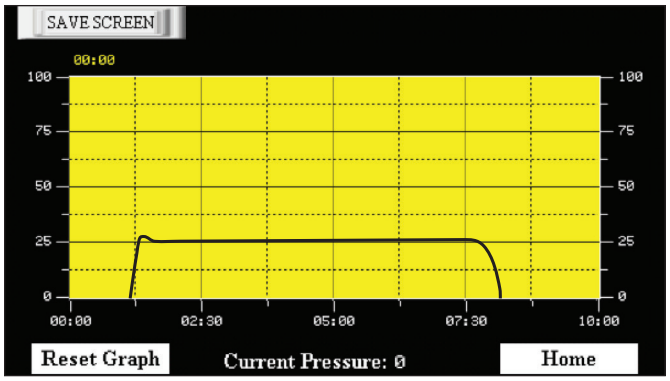
The home screen provides the following:

- System Status
- ARV Size
- Program Version
- Access to Touch Controls (Read Status, Manual, and Set Pressure)

### Read Status Screen

The “Current Pressure” is the real-time value of the pressure at the pressure transducer. The ARV regulates nitrogen flow based on the pressure signal from the pressure transducer. During discharge, pressure shall be maintained within -10%/+20% of the set pressure.

A pressure reading of -24 or "open" indicates that the maintenance switch is in the off position, or that there is a fault in the pressure transducer wiring or in the pressure transducer itself.




The “Graph” button, accessed from the bottom, left-hand side of the “Read Status” screen, allows the user to display and/or log system pressure during final checkout. Just before a discharge, the “Reset Graph” button may be pressed to zero the time counter. The counter will read for 10 minutes, then data will stop being logged. Multiple discharges can be performed during logging, but the discharges shall be logged within this 10-minute window in order to capture each discharge on one graph. A red vertical line tracks the waveform and displays the time and pressure at its intercept with the waveform. To record the waveform, insert a USB flash drive in the back of the unit and press “Save Screen”. The file will be time and date stamped for multiple file referencing.

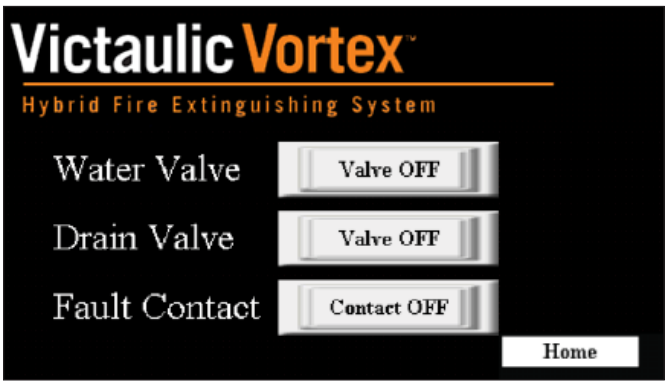
**⚠ WARNING**

- **Prepare the area being protected before any system testing occurs. Vacate all personnel or verify that approved, self-contained breathing apparatus and personal protective equipment is provided.**

**Failure to follow these instructions could result in death or serious personal injury.**

Manual operation and change of pressure requires a user password to access the “Manual” and “Set Pressure” screens. Touch the “Enter Password” button in the center of the screen to access the keypad and enter the password.

**Manual Screen**




The “Manual” screen provides the user with the capability of electronically operating the water valve, drain valve, and fault contact relay. Touch the corresponding button to toggle between the off and on states.

The ARV takes precedence; therefore, the ARV will have priority in the event of a discharge. When the contact is considered to be on, the corresponding indicator will flash green (a “Fault” indicator will flash red).

Touch the “Home” button to return to the home page.

## NOTICE

- **The manual control screen has the capability to operate water valves and fault outputs, which could result in either water discharge from the system or indication of a fault at the agent-releasing FACP.**

**Set Pressure Screen**

Verify that changes to the set pressure on the screen result in the hybrid emitters operating within their specified operating pressure range. Refer to Section II for the hybrid emitter operating pressure requirements.

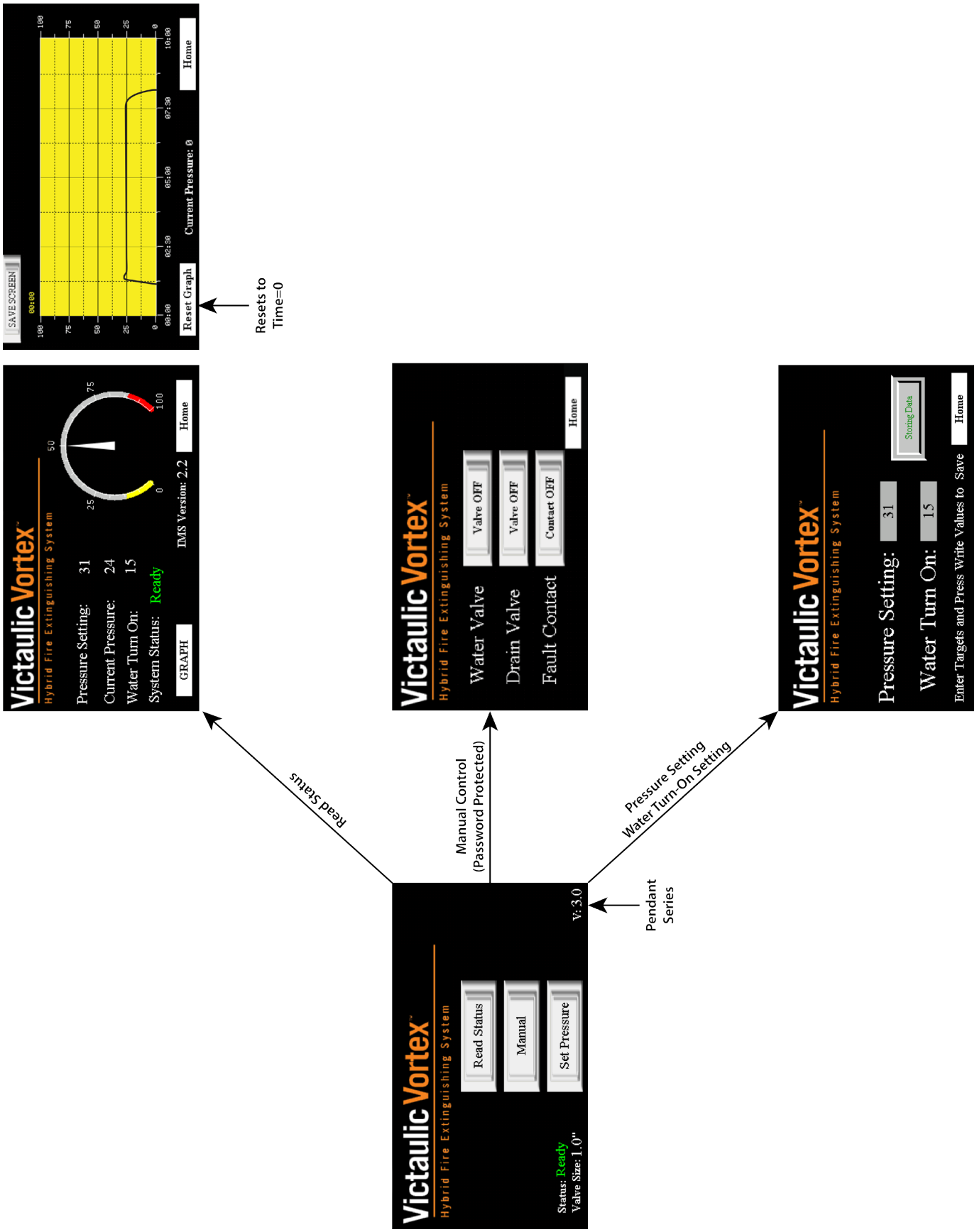
A pressure gauge located near an emitter may be used to verify its operating pressure.

Some Combination Panels include an option to adjust the water turn-on pressure. If this feature is supported, the set pressure screen will include a "Water Turn On" setting. Typically, the water valve is programmed to open when the emitter pressure reaches 12 psi/ 0.8 Bar, which allows time for water to reach the emitters as discharge begins. When the calculated water delivery time is high because of long- or high-volume water piping, the turn-on pressure may be lowered to allow more time for water delivery at the beginning of discharge. Water valve closing is not affected by this setting.

## NOTICE

- **The set pressure value is representative of the pressure transducer, not the hybrid emitter output. These values will differ.**
- **The panel may need to be changed from the default pressure setting. Refer to Section II for hybrid emitter specifications and appropriate pressure settings.**
- **A gauge installed at the hybrid emitter is required to record the actual value prior to adjusting the pressure setting value.**

**Touch-Screen Interface Navigation**



# SECTION VII
# SYSTEM ACCEPTANCE

## SYSTEM ACCEPTANCE

**⚠ DANGER**

- **Before performing maintenance on any Victaulic Vortex™ System components, verify that nitrogen and water valves are fully closed and locked out.**
- **Prior to disconnecting any hoses from the manifold or cylinder valve, verify that the manifold is depressurized to prevent a release of high-pressure nitrogen.**
- **All lines shall be depressurized and drained, and all electrical circuits shall be locked and tagged to prevent accidental activation.**
- **Inform personnel of any testing or of the potential for a system discharge. Safety items such as personnel training, warning signs, discharge alarms, self-contained breathing apparatus, evacuation plans, and fire drills shall be considered.**
- **To avoid pressurization, verify that there are no blockages between the panel and hybrid emitters prior to any system testing.**
- **DO NOT attempt to tighten or loosen any pressurized connections.**
- **For proper regulation, the ARV shall be closed when nitrogen pressure is applied. Before opening nitrogen isolation valves, verify that the ARV on all Fluid and Combination Panels is fully seated and that the panel is in maintenance state.**
- **The nitrogen ball valve on at least one Zone Panel shall be open to allow a Fluid Panel to properly regulate nitrogen pressure. DO NOT allow a Fluid Panel to be discharged without verifying that at least one Zone Panel will be open throughout the discharge. Use isolation valves, as required, to prevent unintended nitrogen discharge.**

**Failure to follow these instructions could result in death or serious personal injury.**

**NOTICE**

- **Inspection, testing, and maintenance shall be implemented in accordance with procedures that meet or exceed those established in this document and in accordance with applicable requirements of FM Global Property Loss Prevention Data Sheet 4-6, NFPA, and the local AHJ.**
- **Installation, acceptance, testing, and maintenance procedures shall be conducted only by a qualified contractor or by a qualified representative of the building owner.**
- **Always follow all Victaulic and local safety guidelines when installing, inspecting, maintaining, or testing any Victaulic Vortex™ System.**
- **Any impairments to the system shall be corrected in a timely manner.**

Victaulic recommends that system acceptance review and testing be conducted prior to placing a Victaulic Vortex™ System into service. Acceptance testing should follow the recommendations of applicable standards, and a complete acceptance test procedure should be developed prior to performing acceptance testing. Acceptance testing shall be documented in a test report.

Victaulic does not require a system discharge as part of the acceptance testing. Where the Victaulic Vortex™ System operates in conjunction with other building systems, functions, or components, the final testing shall be conducted with those systems, as appropriate. Where there is concern related to introduction of water into the protected space, acceptance testing utilizing the water test connection (refer to the applicable VDM-VORTEX General Design Manual) or without utilizing water (water isolation valve closed) shall be considered.

**Review of Mechanical Components**

1. For a total flooding system, the protected enclosure should be reviewed to determine that it is in general conformance with construction documents and that the number and size of openings are in accordance with working plans.
2. The piping system shall be inspected to determine that it is in compliance with design and installation documents.
3. Hybrid emitters and pipe size shall be in accordance with approved working plans.
4. The means of pipe size reduction and pipe fitting size and arrangement shall be checked for conformance to design and installation documents.
5. Piping joints, hybrid emitters, and piping supports shall be restrained to prevent unacceptable vertical or lateral movement during discharge.
6. Hybrid emitters shall be installed in such a manner that piping cannot become detached during discharge.
7. Hybrid emitters, piping, and mounting brackets shall be installed in such a manner that they do not cause injury to personnel.
8. All water and gas storage containers shall be located in accordance with an approved set of system drawings.
9. All containers and mounting brackets shall be fastened in accordance with the manufacturer's requirements.
10. All filters and strainers shall be inspected for proper location.
11. Hybrid emitters shall be inspected for minimum clearances to obstructions, per the manufacturer's requirements.
12. Hybrid emitters shall be inspected to verify that they are not clogged.

**Review of Electrical Components**

1. All wiring systems shall be checked for proper installation in conduit and in compliance with approved drawings.
2. Confirm that AC and DC wiring are not combined in a common conduit or raceway, unless shielded and grounded properly.
3. All wiring systems shall be checked for grounding and shielding, in accordance with the design and installation working plans.
4. All field circuits shall be confirmed to be free from ground faults and short circuits.
5. Hybrid system branch piping shall be verified that it is not being used as an electrical ground.
6. Detection devices shall be checked for proper type and location, as specified on system drawings.
7. Manual pull stations, if installed, shall be confirmed as accessible, accurately identified, and properly protected to prevent damage.

**Functional Tests**

If the system is connected to an alarm-receiving office, the alarm-receiving office shall be notified that the fire system test is being conducted and that an emergency response by the fire department is not desired.

### Supervisory Output Verification

1. Victaulic Vortex™ Panel Supervisory – located in the Victaulic Vortex™ Panels and indicates water isolation valve position (if applicable), power good, maintenance switch, pressure transducer signal good (if applicable)
2. Water Level – located on the Victaulic Vortex™ water tank and indicates water level is above the water level switch
3. Manifold Isolation Valve Position – located on the piping between the manifold and the Combination or Fluid Panel and indicates valve position
4. Nitrogen Cylinder Low Pressure – located on the primary discharge assembly and indicates nitrogen pressure is below the set point indicated in Section II
5. Optional Secondary Nitrogen Cylinder Low-Pressure Switch – located on the secondary gauge assembly and indicates nitrogen pressure is below the set point indicated in Section II
6. Optional Water Tank Pressure Switch – located on the water tank and indicates pressure is below approximately 25 psi/1.7 Bar
7. The optional coil position monitor located on the primary solenoid release assembly indicates that the coil has been removed from the primary solenoid release assembly
8. Proper operation of auxiliary devices, such as pressure switches, flow alarms, and pressure trips, shall be verified
9. Proper operation of the agent-releasing FACP and all connected devices, such as detectors, manual stations, time delays, alarms, remote annunciators, and releasing devices, shall be verified.

### Operational Testing

1. Confirm basic operation of the Victaulic Vortex™ Panel(s) by cycling the maintenance switch from the maintenance position to the ready position. In Combination and Fluid Panels, the ARV will attempt to seat the needle valve, and the yellow supervisory indicator light will go out.
2. Confirm operation of the water and drain valves in the Combination Panel. With the manual water valve closed, the touch-screen interface may be used to manually cycle the water and drain valves. The flag on top of the water valve may be observed to verify operation. Movement of the drain solenoid can be heard and felt.
3. Confirm operation of the supervisory contacts in Combination and Fluid Panels. The touch-screen interface may be used to manually actuate the supervisory contact.
4. The nitrogen valve in Zone Panels may be verified by supplying 24VDC to the panel release input, either using the agent-releasing FACP or by manually connecting 24VDC to the release input.
5. The water tank regulator, if used, should be adjusted to the required pressure during system acceptance testing.
6. For Combination and Fluid Panels, needle valve operation may be tested using the test button on the PCB. Verify that the nitrogen isolation valve is closed and that there is no pressure in the nitrogen inlet piping. Close the manual water shut-off valve. Push and hold the yellow test button, and the needle valve will open. When the yellow test button is released, the needle valve will begin closing. After testing, cycle the maintenance switch to the maintenance position and then back to the ready position to seat the needle valve and bring the panel back to the ready state.
7. During operational testing, confirm the proper timing, sequencing, and operation of valves that are controlled by the FACP and that are necessary for proper operation of the Victaulic Vortex™ System (i.e. automated ball valves on nitrogen bulk tubes and automated drain valves).

### Leak Testing

The water and nitrogen piping systems should be verified to be connected completely and properly. Where the piping system is visible and accessible, a visual inspection may be conducted to verify that all piping is connected and terminated correctly. If there are sections that are not visible and accessible, or if required by the AHJ, a pressure test may be conducted as part of the nitrogen and water piping system verification.

**⚠ WARNING**

- **DO NOT attempt to pressure test or close low-pressure nitrogen piping while high-pressure gas piping or Victaulic Vortex™ Panel inlet is pressurized.**
- **Lock out high-pressure inert gas supply prior to plugging emitter outlets for pressure testing.**
- **Remove plugs prior to removing lockout device.**

**Failure to follow these instructions could result in death or serious personal injury and property damage.**

### High-Pressure Piping

If the high-pressure nitrogen piping cannot be visually inspected satisfactorily, these systems may be pressurized using nitrogen gas for verification (the high-pressure manifold has a ¼-inch NPT and 1 ½-inch NPT port to allow pressurization of the high-pressure manifold piping). Alternatively, a pressurization test without discharge, as described later in this section, may be utilized.

**⚠ WARNING**

- **DO NOT exceed 3000 psi/206.8 Bar or the rated working pressure of the piping system and components.**

**Failure to follow this instruction could result in death or serious personal injury and property damage.**

1. If the system is a multi-zone system, verify that at least one Zone Panel has been released and that the Zone Panel's nitrogen valve is open.
2. If the system is a multi-zone system, verify that the pressure relief valve is sized and installed correctly in the piping between the Fluid and Zone Panels.
3. Verify that the low-pressure piping is not obstructed.
4. Verify the ARV in the Combination or Fluid Panel is seated and closed.
5. Place the maintenance switch in the Combination or Fluid Panel in the maintenance position. Confirm that the yellow supervisory indicator light is on.
6. The manifold nitrogen isolation valve may be left open, with the Victaulic Vortex™ Panel in maintenance mode; this will apply nitrogen pressure to the ARV and allow the bleed valve in the Victaulic Vortex™ Panel to release nitrogen pressure after testing is complete.
7. Apply nitrogen gas supply to the high-pressure piping system. The Victaulic Vortex™ manifold has ¼-inch and 1 ½-inch NPT ports that may be used to apply the nitrogen gas supply.
8. When the required test pressure is reached, close the valve for the nitrogen source, and verify that pressure is maintained. The nitrogen leakage rate should not exceed 5% of the system nitrogen requirement over the discharge time of the system (or an amount determined by the AHJ). For most systems, the pressure in the high-pressure manifold piping should maintain at least 90% of test pressure for 10 minutes.

9. The water tank regulator, if used, may be adjusted as needed to supply the required pressure to the water tank.
10. Release the nitrogen pressure from the manifold after testing by using the bleed valve in the Victaulic Vortex™ Panel (or other appropriate method).
11. Remove the testing equipment and return the system to service.

**Low-Pressure Piping**

If the low-pressure nitrogen piping and water piping cannot be visually inspected, these systems may be pressurized using nitrogen gas as a verification method.

1. Verify that the nitrogen supply isolation valve is closed.
2. Verify that the ARV in the Combination or Fluid Panel is seated and closed.
3. Place the maintenance switch in the Combination or Fluid Panel in the maintenance position. Confirm that the yellow supervisory indicator light is on.
4. Testing of low-pressure hybrid emitter nitrogen or water piping will require removal of hybrid emitters and plugging of piping. Remove plugs after testing is complete. Verify that the low-pressure piping is not obstructed and that a means of depressurization is available.
5. Apply nitrogen or other dry gas to the low-pressure piping system by using an appropriate regulator and pressure relief valve. The low-pressure nitrogen and water piping systems are field installed and will require a field-installed port to allow for pressurization and depressurization during testing.
6. Low-pressure nitrogen piping shall be tested at no less than the system working pressure and shall not exceed the pressure rating of the pipe and fittings in the system.
7. Water piping shall be tested at no less than the system working pressure and shall not exceed the pressure rating of the pipe and fittings in the system.
8. When the required test pressure for the high-pressure manifold is reached, close the valve for the nitrogen source and verify that pressure is maintained. The nitrogen leakage rate should not exceed 5% of the system nitrogen requirement over the discharge time of the system (or an amount determined by the AHJ). For most systems, pressure in the high-pressure manifold piping should maintain at least 90% of test pressure for 10 minutes.
9. Release the nitrogen pressure from the low-pressure piping after testing.
10. Remove the testing equipment and return the system to service.

## SYSTEM DISCHARGE TESTS

### NOTICE

- **The building owner or occupant shall contact all required personnel (contractors, emergency response, facility manager) prior to performing system discharge tests and shall advise as to the sequence and operation of the testing procedure.**
- **Prepare the area being protected before any system testing occurs. To prevent unnecessary exposure to the hybrid fire extinguishing system discharge, vacate all personnel from the area being protected. Inform all personnel that a discharge test will be conducted. Everyone shall be aware that various equipment will shut off or turn on.**
- **All required personnel shall be advised upon completion of testing and when the system is returned to service.**

Victaulic does not require a discharge test as part of system acceptance testing. Discharge testing may be used as part of the final system check; however, discharge testing may not reveal all possible deficiencies in the system design or installation. Where practical, a pressure test without discharge is recommended. Alternatively, when there are concerns about loss of nitrogen, pressurization testing of the high-pressure piping may be conducted with an external nitrogen source, as described earlier in this section.

When required by the AHJ, the Victaulic Vortex™ System may be tested in one of three ways: pressurization test without discharge, abbreviated discharge, or full discharge. Abbreviated discharge and full discharge tests may be conducted with the manual water shutoff valve on or off. A test connection for water piping, as described in Section III, may be utilized to verify water flow. Potential damage to items in the protected space shall be evaluated as part of the decision to conduct a discharge test using water.

Verify correct system application, design, installation, and use as described in this manual.

Pressurization Test Without Discharge – may be used to verify high-pressure piping to the Victaulic Vortex™ Panel, pneumatic operation of cylinder valves, discharge active output of the Victaulic Vortex™ Panel, and discharge solenoid operation

Abbreviated Discharge Test – may be used to verify high-pressure piping to the Victaulic Vortex™ Panel, pneumatic operation of cylinder valves, discharge active output of the Victaulic Vortex™ Panel, discharge solenoid operation, ARV operation, water valve and drain valve operation, and Zone Panel operation

Full Discharge Test – may be used to verify high-pressure piping to the Victaulic Vortex™ Panel, pneumatic operation of cylinder valves, discharge active output of the Victaulic Vortex™ Panel, discharge solenoid operation, ARV operation, water valve and drain valve operation, Zone Panel operation, hybrid emitter operating pressure, and approximate final oxygen level

When a discharge test is required, a minimum of one cylinder is required for each ½-inch and ⅝-inch hybrid emitter. Nitrogen flow requirements that exceed 250 SCFM/425 $m^3$/hr per cylinder may prevent the Victaulic Vortex™ Panel and hybrid emitters from reaching the set system pressure before the nitrogen supply is exhausted.

Testing may be conducted using solenoid operation through the agent-releasing FACP. Active release panels may be tested manually by using the handwheel on the primary solenoid release assembly. Prior to any testing on a multi-zone system, verify at least one Zone Panel is open prior to releasing nitrogen.

**Pre-Test (All Discharge Tests)**

1. Review applicable sections of this manual for relevant warnings and cautions related to system design, installation, and use.
2. Contact all required personnel and agencies prior to performing supervisory switch tests.
3. Prepare the area being protected before any system testing occurs. Vacate all personnel from the area or verify that approved self-contained breathing apparatus and personal protective equipment is provided, as required.
4. Personnel involved in testing shall be qualified to perform testing.
5. Means of monitoring oxygen level may be required.
6. Inspect piping completely, especially high-pressure piping and cylinder hose connections, to verify all connections are secure.
7. In some applications, it may be helpful to slowly pressurize the high-pressure piping by manually opening the handwheel of one nitrogen cylinder. The nitrogen released into the manifold can then be used for an abbreviated discharge, or it can be released through the bleed valve in the Victaulic Vortex™ Panel.

**Pressurization Test Without Discharge**

1. Close the water supply isolation valve.
   a. Closing the water supply valve will generate a supervisory output signal, indicating a closed water valve
2. Close the nitrogen supply isolation valve between the manifold and the Victaulic Vortex™ Panel.
3. Place the maintenance switch in the Combination or Fluid Panel in the maintenance position. Confirm that the yellow supervisory indicator light is on.
4. For a multi-zone system, verify that at least one Zone Panel has been released and that the Zone Panel's nitrogen ball valve is open.
5. Release nitrogen at the primary solenoid release assembly.
   a. For solenoid release, actuate the solenoid via the agent-releasing FACP
   b. For manual release, rotate the handwheel on the primary solenoid release assembly in the indicated open direction
6. Verify release of nitrogen from the primary solenoid release assembly has:
   a. Pressurized the manifold
   b. Actuated all cylinder valves (raised cylinder valve plungers)
   c. The water tank regulator, if used, may be adjusted as needed to supply the required pressure to the water tank
   d. For a multi-zone system, or if multiple primary solenoid assemblies are used, the primaries may also be activated to verify cylinder valve actuation in each group of cylinders
7. Close all primary solenoid release assemblies in a multi-zone system by removing the solenoid release signal from the agent-releasing FACP or by rotating the handwheel on the primary solenoid release assembly in the indicated closed direction.
   a. The pilot line will remain pressurized, and the cylinder valve plungers will remain raised

**⚠ CAUTION**

- **Care shall be taken when depressing the pin on the pilot line bleed valve. A sharp noise and release of pressure will occur when the pin on the pilot line bleed valve is depressed.**
- **DO NOT use your finger to manually depress the pin on the pilot line bleed valve.**
- **Wear personal protective equipment (hearing protection, safety glasses, etc.) when working around the pilot line bleed valve.**

**Failure to follow these instructions could result in personal injury.**

8. Relieve pressure from the pilot line by depressing the pin on the pilot line bleed valve with the appropriate tool.
   a. Relieving pilot line pressure will cause all of the cylinder valve plungers to lower - the manifold will remain pressurized
   b. In multi-zone systems, or where multiple groups of cylinders are used, relieve pressure from every pilot line
9. Open the nitrogen supply isolation valve, pressurizing the input to the Victaulic Vortex™ Panel.
   a. Pressure at the input of the Victaulic Vortex™ Panel will cause a discharge active supervisory output signal from the Panel
10. Return the system to service.
    a. Bleed trapped pressure from the manifold and high pressure piping by opening the bleed valve in the Victaulic Vortex™ Panel.
    b. Close bleed valve
    c. Return the maintenance switch to the ready position. Verify that the yellow supervisory indicator light remains off.
    d. Leave the manifold isolation valve in the open position
    e. Return the Zone Panel to the normal, ready state
    f. Turn water supply isolation valve back to open position
    g. Verify that there are no supervisory outputs at the agent-releasing FACP

**Abbreviated Nitrogen Discharge**

1. This test may be conducted with or without water discharge. If the test is to be conducted without water discharge, close the water supply isolation valve.
   a. Closing the water supply valve will generate a supervisory output signal from the Victaulic Vortex™ Panel, indicating a closed water valve
2. Close the nitrogen supply isolation valve between the manifold and the Victaulic Vortex™ Panel.
3. Place the maintenance switch in the Combination or Fluid Panel in the maintenance position. Confirm that the yellow supervisory indicator light is on.
4. For a multi-zone system, verify that at least one Zone Panel has been released and that the Zone Panel's nitrogen ball valve is open.
5. Release nitrogen at the primary solenoid release assembly.
   a. For solenoid release, actuate the solenoid via the agent-releasing FACP
   b. For manual release, rotate the handwheel on the primary solenoid release assembly in the indicated open direction
6. Verify release of nitrogen from the primary solenoid release assembly has:
   a. Pressurized the manifold
   b. Actuated all cylinder valves (raised cylinder valve plungers)
   c. The water tank regulator, if used, may be adjusted as needed to supply the required pressure to the water tank.
7. Close the primary solenoid release assembly by removing the solenoid release signal from the agent-releasing FACP or by rotating the handwheel on the primary solenoid release assembly in the indicated closed direction.
   a. The pilot line will remain pressurized, and the cylinder valve plungers will remain raised

**⚠ CAUTION**

- **Care shall be taken when depressing the pin on the pilot line bleed valve. A sharp noise and release of pressure will occur when the pin on the pilot line bleed valve is depressed.**
- **DO NOT use your finger to manually depress the pin on the pilot line bleed valve.**
- **Wear personal protective equipment (hearing protection, safety glasses, etc.) when working around the pilot line bleed valve.**

**Failure to follow these instructions could result in personal injury.**

8. Relieve pressure from the pilot line by depressing the pin on the pilot line bleed valve with the appropriate tool.
   a. Relieving pilot line pressure will cause all of the cylinder valve plungers to lower - the manifold will remain pressurized
9. Return the maintenance switch to the ready position. Verify that the yellow supervisory indicator light remains off.
10. Open the isolation valve, pressurizing the input to the Victaulic Vortex™ Panel.
    a. Pressure at the input of an Active Release Panel will cause the ARV needle valve to begin opening, sending nitrogen to the hybrid emitters
    b. Dry Contact Panels require an electrical signal at the needle valve release input to begin opening the ARV needle valve and sending nitrogen to the hybrid emitters
    c. Pressure at the input of the Victaulic Vortex™ Panel will cause a discharge active supervisory output from the Panel
11. Return the system to service.
    a. Cycle maintenance switch to maintenance position and then back to ready position - the ARV will re-seat, and the yellow supervisory indicator light will remain off
    b. Turn water supply isolation valve back to open position
    c. Leave the manifold isolation valve in the open position
    d. Verify that there are no supervisory outputs at the agent-releasing FACP
    e. Verify that the remaining nitrogen cylinder pressure is adequate for protection of the space
    f. Verify that the water level in the water tank is adequate for protection of the space
    g. Return the Zone Panel to the normal, ready state

**Full Nitrogen Discharge**

1. This test may be conducted with or without water discharge. If the test is to be conducted without water discharge, close the water supply isolation valve.
   a. Closing the water supply valve will generate a supervisory output signal from the Victaulic Vortex™ Panel, indicating a closed water valve
2. For a multi-zone system, verify that at least one Zone Panel has been released and that the Zone Panel's nitrogen ball valve is open.
3. Close the nitrogen supply isolation valve between the manifold and the Victaulic Vortex™ Panel.
4. Release nitrogen at the primary solenoid release assembly.
   a. For solenoid release, actuate the solenoid via the agent-releasing FACP
   b. For manual release, rotate the handwheel on the primary solenoid release assembly in the indicated open direction
5. Verify release of nitrogen from the primary solenoid release assembly has:
   a. Pressurized the manifold
   b. Actuated all cylinder valves (raised cylinder valve plungers)
   c. The water tank regulator, if used, may be adjusted as needed to supply the required pressure to the water tank.
6. Place the maintenance switch in the Combination or Fluid Panel in the ready position. Verify that the yellow supervisory indicator light remains off.
7. Open the isolation valve, pressurizing the input to the Victaulic Vortex™ Panel.
   a. Pressure at the input of an Active Release Panel will cause the ARV needle valve to begin opening, sending nitrogen to the hybrid emitters
   b. Dry Contact Panels require an electrical signal at the needle valve release input to begin opening the ARV needle valve and sending nitrogen to the hybrid emitters
   c. Pressure at the input of the Victaulic Vortex™ Panel will cause a discharge active supervisory output from the Panel
   d. Water discharge will occur within 30 seconds from the start of the discharge
   e. Nitrogen pressure at the hybrid emitters will reach 85% of the operating pressure within 30 seconds
8. Return the system to service.
   a. Cycle maintenance switch to maintenance position and then back to ready position - the ARV will re-seat, and the yellow supervisory indicator light will remain off
   b. Turn the water supply isolation valve to the open position
   c. Leave the manifold isolation valve in the open position
   d. Verify that there are no supervisory outputs at the agent-releasing FACP
   e. Refill the nitrogen cylinders, as indicated by the refill instructions in this manual
   f. Refill the water tank, as indicated by the refill instructions in this manual
   g. Return the Zone Panel to the normal, ready state

# SECTION VIII
# OPERATION AND MAINTENANCE

## MANUAL DISCHARGE PROCEDURE

Power is required to the Victaulic Vortex™ Panels to discharge the system. Active release Combination Panels may be discharged manually by following this procedure. The primary solenoid release assembly provides a handwheel for manual pressurization of the pilot line and release of nitrogen from the cylinders.

Multi-zone systems require an electrical release signal that is provided to the Zone Panel to cause it to open.

Dry contact release Combination and Fluid Panels require an electrical signal to the ARV needle valve release input to start opening the ARV.

1. For a multi-zone system, verify that at least one Zone Panel has been released (nitrogen ball valve open).
   - This may be accomplished by providing a release input signal to the Zone Panel.
2. Verify that the maintenance switch is in the ready position.
3. Release nitrogen at the primary solenoid release assembly by rotating the handwheel on the primary solenoid release assembly in the indicated open direction.
4. Pressure at the input of an Active Release Panel will cause the ARV needle valve to begin opening, sending nitrogen to the hybrid emitters.
   - Dry contact panels require an electrical signal at the needle valve release input to begin opening the ARV needle valve and sending nitrogen to the hybrid emitters

## RETURNING THE SYSTEM TO SERVICE AFTER DISCHARGE

1. Following a system discharge, perform a complete inspection of the system, as described in the "Maintenance and Inspections" section on the following page.
2. Drain the water piping completely to prevent formation of rust or corrosion that could be released during subsequent discharges.
3. Clean the strainers in the Combination and Zone Panels and at each water flow control cartridge.
4. Reset the Victaulic Vortex™ Panels by cycling the maintenance switch to the maintenance position for several seconds and then back to the ready position. This will reseat the ARV.
5. Refill the water tank (if used), in accordance with the refill instructions in this manual.
6. Refill the nitrogen cylinders, in accordance with the refill instructions in this manual.
7. Verify all cylinders and hoses are re-connected and connections are tightened.
8. Consider performing a pressurization test without discharge.
9. Verify that all supervisory alarms are no longer active.

## MAINTENANCE AND INSPECTIONS

**⚠ DANGER**

- **Before performing maintenance on any Victaulic Vortex™ System components, verify that nitrogen and water valves are fully closed and locked out.**
- **Prior to disconnecting any hoses from the manifold or cylinder valve, verify that the manifold is depressurized to prevent a release of high-pressure nitrogen.**
- **All lines shall be depressurized and drained, and all electrical circuits shall be locked and tagged to prevent accidental activation.**
- **Inform personnel of any testing or of the potential for a system discharge. Safety items such as personnel training, warning signs, discharge alarms, self-contained breathing apparatus, evacuation plans, and fire drills shall be considered.**
- **To avoid pressurization, verify that there are no blockages between the panel and hybrid emitters prior to any system testing.**

**Failure to follow these instructions could result in death or serious personal injury.**

### Inspections

Before performing any inspections, place the maintenance switch in the maintenance position. The yellow supervisory indicator light will illuminate and a supervisory signal will be sent to the agent-releasing FACP. To reset the system after inspections are complete, place the maintenance switch in the ready position, and the yellow supervisory indicator light will turn off.

### Weekly Visual Inspection

1. Inspect the nitrogen and water supply lines per NFPA 770.
2. Review annunciator panel history (if applicable). Verify that the FACP and Victaulic Vortex™ Panels are in the normal, ready condition.
3. Per NFPA 770, inspect hybrid emitters to verify that they are not damaged or obstructed.
4. Verify that hybrid emitter protective caps are still in place
5. Verify that hybrid emitters are not obstructed.
6. Inspect the water tank on a weekly basis to verify that valves are in their normal operating positions and to confirm that there is adequate water supply available in the event of system activation.
7. Verify that system isolation valves, auxiliary drains (if used), and test connections (if used) are locked in the correct position.

### Semi-Annual Inspection

1. Complete all steps outlined in the “Weekly Visual Inspection” section above.
2. Inspect the nitrogen tank pressure levels for low pressure. If low pressure condition exists, check for root cause and repair. Recharge cylinders, as required. Where container pressure gauges are used for this purpose, readings shall be compared to a separate, calibrated device at least annually.
3. Inspect the water storage tank level (if applicable) and fill or replace, as required.

### Annual Inspection

1. Complete all steps outlined in the “Weekly Visual Inspection” and “Semi-Annual Inspection” sections above.
2. Cycle the nitrogen and water valves and verify proper operation (discharge test is not required).
3. Replace water in storage containers. Drain and inspect interior of water tanks. Clean (flush) water tanks to remove debris. Refill water tanks.
4. Inspect all system hoses. If visual examination shows any damage or deterioration, the affected hoses shall be replaced immediately.
5. Verify that all warning placards are installed in their proper locations and that they are not obstructed from view.
6. Check the water tank and nitrogen cylinders for signs of damage.
7. Verify operation of primary discharge solenoid coil.
8. Inspect and cycle auxiliary valves, including auxiliary drain valves, test connections, and automated ball valves on nitrogen bulk tubes.

### Five-Year Inspection

1. Complete all steps outlined in the “Annual Inspection” section on this page.
2. Nitrogen cylinders that are continuously in service without being discharged shall be given a complete external visual inspection a minimum of every 5 years. Per NFPA 770, "The visual inspection shall be in accordance with Section 3 of CGA C-6, except that the cylinders need not be emptied or stamped while under pressure. Inspections shall be made only by competent personnel, and the results recorded on both of the following: (1) A record tag permanently attached to each cylinder (2) A suitable inspection report."
3. All hoses shall be tested or replaced a maximum of every 5 years, per the following instructions.
   - 3a. All system hoses shall be tested at 1½ times the maximum container pressure at 130°F/54°C. **NOTE:** Victaulic manifold hoses are not full metal construction.
   - 3b. Remove the hose from any attachment.
   - 3c. Place the hose into a protective enclosure designed to permit visual observation of the test.
   - 3d. Fill the hose completely with water prior to testing.
   - 3e. Apply pressure at a rate-of-pressure rise to reach the test pressure within a minimum of 1 minute. Maintain the test pressure for one full minute. Note any distortion or leakage that occurs during the test.
   - 3f. If the test pressure has not dropped, or if the couplings have not moved, release the pressure in the hose. If no permanent distortion has occurred, the hose has passed the hydrostatic test.
   - 3g. A hose that passes the hydrostatic test shall be dried completely. If heat is used in the drying process, the temperature shall not exceed the hose manufacturer’s specifications.
   - 3h. A hose that passes a hydrostatic test shall be marked as “passed” and shall contain the date of the test.
   - 3i. A hose that fails a hydrostatic test shall be marked as “failed” and destroyed. A new assembly shall be installed in its place.

Most jurisdictions will require inspection or testing of cylinders prior to refilling. For DOT rated cylinders requiring refilling, refer to the Code of Federal Regulations (CFR). Title 49, parts 100-199 allows for a 12-year requalification of cylinders used as a fire extinguisher (part 180). For additional guidance on marking, testing, recharge, requalification, and shipment, refer to the Fire Suppression Systems Association's (FSSA's) Test Guide for Use with Special Hazard Fire Suppression Systems Containers. It is the responsibility of the building owner or their representative to maintain the system in accordance with all applicable local codes and requirements, including those of the AHJ.

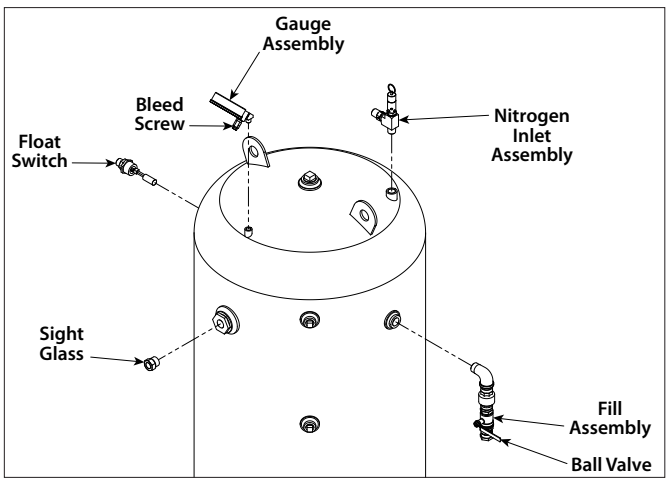
### Records

Records of inspections, tests, and system maintenance shall be made available to the AHJ, upon request.

Records shall indicate the procedures performed, the organization that performed the work, the results, and the date.

Records shall be maintained in accordance with requirements of the local AHJ.

## WATER TANK FILLING PROCEDURE




1. Depressurize the water tank. This can be accomplished by unscrewing the bleed screw located on the gauge assembly.
2. Attach the water line to the fill assembly.
3. Open the ball valve located on the fill assembly.
4. Fill the tank with at least the required volume of water, as calculated in Section III.
5. Close the ball valve and remove the water line from the fill assembly.
6. Close the bleed screw that was opened in Step 1. **NOTE:** The float switch is normally open when the tank is full.
7. Nitrogen will pressurize the water tank through the water tank regulator after the manifold is pressurized with nitrogen. In applications where it is desirable to have nitrogen pressure on the tank, a pressurization test without discharge may be performed, as described in Section VIII.

# SECTION IX
# INDIVIDUAL CYLINDER REFILL PROCEDURE

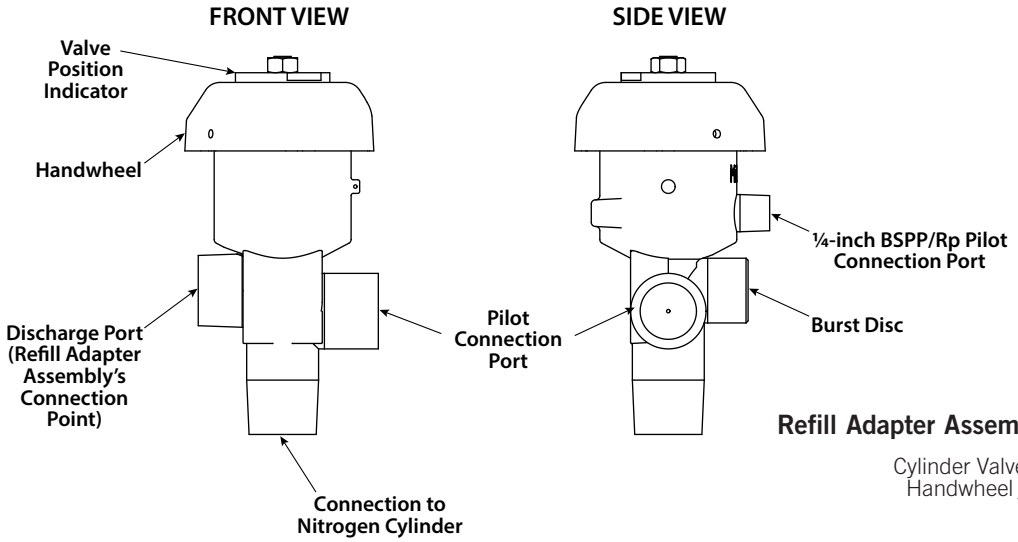
## NOTICE

**Several options are available for refilling cylinders after a discharge. The choice of refill method is dependant upon locally available facilities and equipment. Refilling cylinders shall always be done in accordance with any applicable codes and standards.**

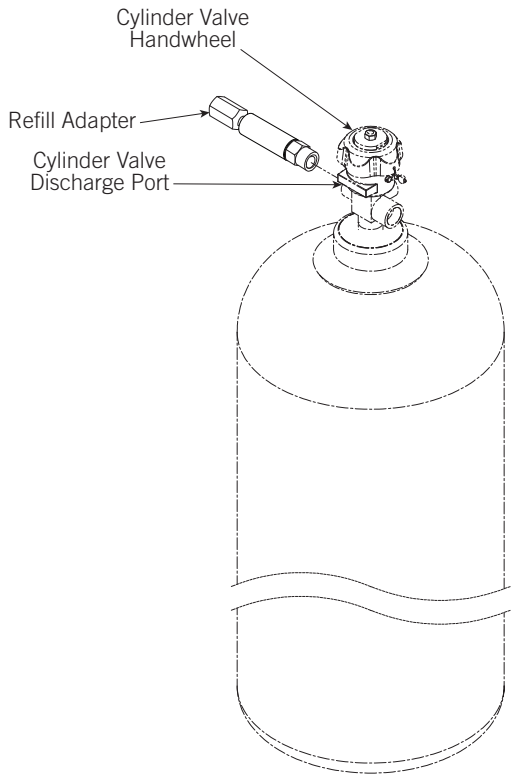
- **Individual cylinders may be removed from the rack and taken to a gas supplier.**
- **A bank of cylinders may be filled in place from a high-pressure nitrogen source, such as a tube trailer.**

## INSTRUCTIONS FOR REFILLING INDIVIDUAL VICTAULIC VORTEX™ NITROGEN CYLINDERS USING THE REFILL ADAPTER ASSEMBLY

### Cylinder Valve Assembly

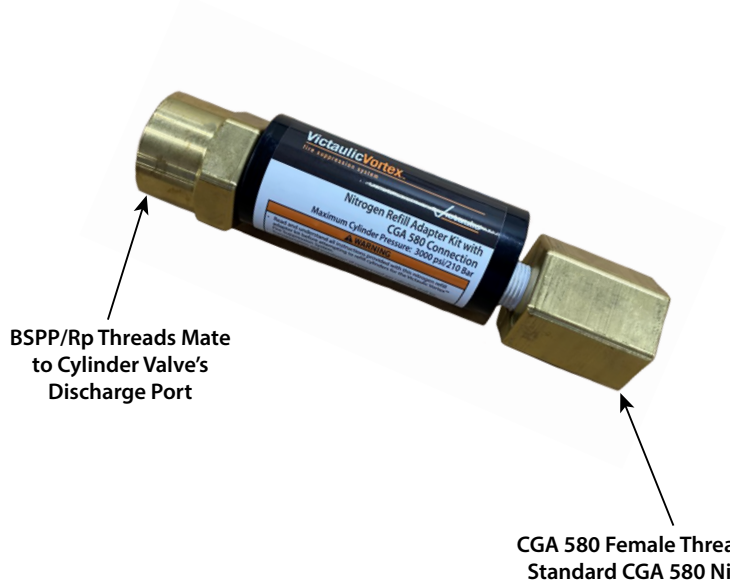



### Refill Adapter Assembly Connection Point




** The ¼-inch BSP/Rp Tee Nipple is shown removed from the cylinder valve for clarity.*

### Refill Adapter Assembly



**Removing Nitrogen Cylinders from the Storage Rack**

**⚠ WARNING**

- **Each cylinder valve is secured in the closed position with a safety wire tie.**
- **Safety wire ties shall not be removed unless the cylinder valve is being opened for refilling.**

**Failure to follow these instructions could result in death or serious personal injury and property damage.**

Cylinder valve assemblies are opened by either applying pressure to the pilot connection port or by using the handwheel to raise the valve position indicator. During the refilling process, the cylinder valve will need to be opened manually by using the handwheel.

**⚠ CAUTION**

- **Care shall be taken when depressing the pin on the pilot line bleed valve. A sharp noise and release of pressure will occur when the pin on the pilot line bleed valve is depressed.**
- **DO NOT use your finger to manually depress the pin on the pilot line bleed valve.**
- **Wear personal protective equipment (hearing protection, safety glasses, etc.) when working around the pilot line bleed valve.**

**Failure to follow these instructions could result in personal injury.**

Before removing the nitrogen cylinders from the rack, the primary solenoid release assembly shall be disabled by either removing the electrical connection from the solenoid or by removing the coil from the solenoid release assembly.

1. Verify that there is no trapped nitrogen acting on the cylinder valve's valve position indicator. Relieve pressure from the pilot line by depressing the pin on the pilot line bleed valve with the appropriate tool. **DO NOT ATTEMPT TO DEPRESS THE SCHRADER* VALVE LOCATED ON THE CYLINDER VALVE.**
2. Disconnect and remove each tee and pilot line connection from the cylinder valves.
3. Disconnect the discharge hose from the cylinder valve's discharge port.
4. Remove the primary solenoid release assembly(s) and the pressure gauge assembly(s). **NOTE:** The cylinder valve assembly is equipped with a Schrader* Valve on the pilot connection port that closes when the pressure gauge assembly is removed. It is normal for a puff of nitrogen to be released as the pressure gauge assembly is removed.
5. Immediately install the protective cap onto the cylinder valve assembly before removing any cylinder restraints.
6. Remove the cylinder(s) from the storage rack for transport.

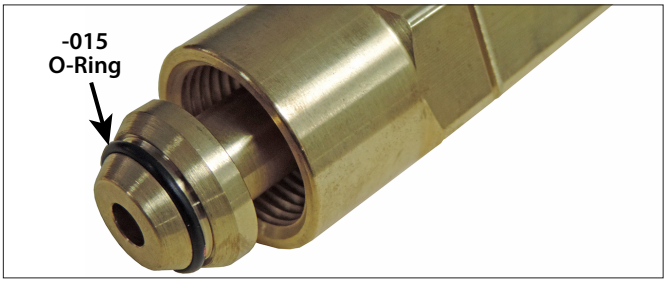
**⚠ WARNING**

- **Transportation and installation of nitrogen cylinders shall be performed only by individuals that have been trained on proper handling techniques. Nitrogen cylinders contain stored energy that can discharge explosively.**
- **NEVER TRANSPORT NITROGEN CYLINDERS WITHOUT THE CYLINDER CAP INSTALLED.**
- **For additional safety and handling information, always reference the applicable I-VORTEX Design, Installation, and Maintenance Manual; the local AHJ requirements; and the following codes/ standards:**

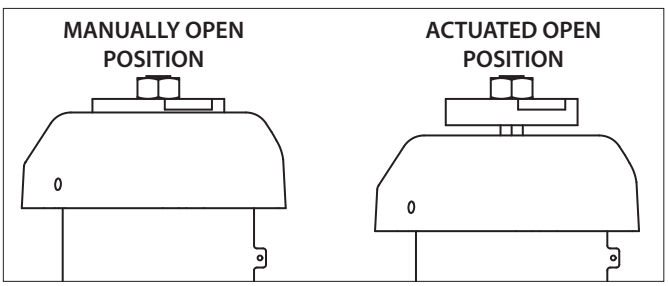
  **- Code of Federal Regulation (49 CFR 171-179 and 14 CFR 103)**
  **- OSHA 1910.101**
  **- Compressed Gas Association (C-6-1968, C-8-1962, and P-1)**
  **- NFPA 55**

**Failure to follow these instructions can cause unexpected, violent movement of nitrogen cylinders, resulting in death or serious personal injury and property damage.**

**Cylinder Filling Procedure**




1. Check the o-ring of the refill adapter for damage. Do not use the refill adapter if any damage to the o-ring is present. Verify that the o-ring is seated properly. Using a 36-mm wrench, install the BSPP/Rp threaded end of the refill adapter assembly to the cylinder valve's discharge port, as shown in the drawing on the previous page.
2. Attach the nitrogen source to the CGA 580 connection of the refill adapter assembly.
3. Remove the safety wire tire from the cylinder valve assembly.




4. Fully open the cylinder valve manually by turning the handwheel counterclockwise. This will raise the valve position indicator to the top of the handwheel, as shown in the graphic above.

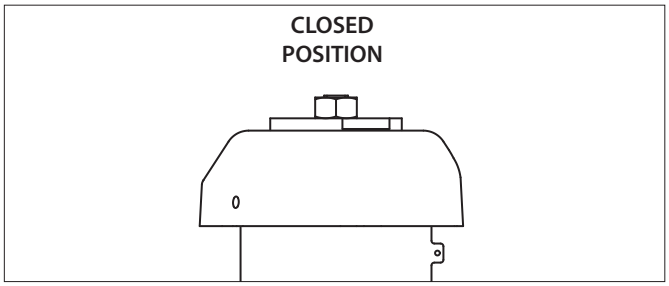
* Schrader is a registered trademark of Schrader International, a Tomkins Company

**⚠ WARNING**

- **DO NOT refill cylinders at a rate higher than 300 psi/20.7 Bar per minute.**

**Failure to follow this instruction could cause cylinders to overheat, resulting in death or serious personal injury and property damage.**

5. Refill the cylinder in accordance with nitrogen supplier guidelines. **NOTE:** Filling at a high rate poses a risk of overheating the cylinder. A maximum of 300 psi/20.7 Bar per minute is an acceptable refill rate. Refer to the label applied to the cylinder for nominal and maximum filling pressures.
6. When the cylinder is refilled, stop the flow of source nitrogen.




7. Fully close the cylinder valve manually by turning the handwheel clockwise. The actuator plunger is spring-loaded and will travel downward with the handwheel, as shown in the graphic above.

7a. Visually verify that the valve position indicator is seated. There will be one to one-and-a-half additional turns of the handwheel after the valve position indicator seats.

8. Remove the source connection from the CGA 580 connection of the refill adapter assembly.
9. Using a 36-mm wrench, remove the refill adapter assembly from the discharge port of the cylinder valve.

**Cylinder valve shown above is safety wire tied in the closed position**

10. Reinstall the safety wire tie on each cylinder valve. Safety wire shall meet the requirements of ASTM A580 and/or ASTM A555.

**Reinstalling Nitrogen Cylinders into the Cylinder Rack**

**⚠ WARNING**

- **All connections and bracing SHALL be installed and tightened before the manifold is pressurized and before attempting to test or operate the system.**
- **DO NOT attempt to tighten or loosen any pressurized connections.**
- **During inspection and maintenance, any damaged components shall be replaced.**
- **Transportation and installation of nitrogen cylinders shall be performed only by individuals that have been trained on proper handling techniques. Nitrogen cylinders contain stored energy that can discharge explosively.**
- **NEVER TRANSPORT NITROGEN CYLINDERS WITHOUT THE CYLINDER CAP INSTALLED.**
- **For additional safety and handling information, always reference the applicable I-VORTEX Design, Installation, and Maintenance Manual; the local AHJ requirements; and the following codes/ standards:**
  - **Code of Federal Regulation (49 CFR 171-179 and 14 CFR 103)**
  - **OSHA 1910.101**
  - **Compressed Gas Association (C-6-1968, C-8-1962, and P-1)**
  - **NFPA 55**

**Failure to follow these instructions can cause unexpected, violent movement of nitrogen cylinders, resulting in death or serious personal injury and property damage.**

1. Re-install the cylinder into the storage rack.
2. Remove the protective cap that was used during transport.
3. Reconnect the discharge hose to the cylinder valve's discharge port.
4. Reconnect the pilot charge line's tee fitting to the cylinder valve.
5. Reconnect the optional secondary gauge assembly or the primary solenoid release assembly.
6. Reset the system by referring to the instructions in this manual.

# SECTION X
# BULK CYLINDER REFILL PROCEDURE

**⚠ WARNING**

- **Read and understand all instructions before attempting to install, remove, adjust, or maintain any Victaulic products.**
- **These installation instructions are intended for an experienced, trained installer. The user shall understand the purpose of these products, common industry standards for safety, and the potential consequences of improper product installation.**
- **Wear safety glasses, hardhat, and foot protection.**
- **All connections and bracing SHALL be installed and tightened before the manifold is pressurized and before attempting to test or operate the system.**
- **DO NOT attempt to tighten or loosen any pressurized connections.**
- **During inspection and maintenance, any damaged components shall be replaced.**
- **Transportation and installation of nitrogen cylinders shall be performed only by individuals that have been trained on proper handling techniques. Nitrogen cylinders contain stored energy that can discharge explosively.**
- **NEVER TRANSPORT NITROGEN CYLINDERS WITHOUT THE CYLINDER CAP INSTALLED.**
- **For additional safety and handling information, always reference the applicable I-VORTEX Design, Installation, and Maintenance Manual; the local Authority Having Jurisdiction's (AHJ's) requirements; and the following codes/standards:**
  - **Code of Federal Regulation (49 CFP 171-179 and 14 CFR 103)**
  - **OSHA 1910.101**
  - **Compressed Gas Association (C-6-1968, C-8-1962, and P-1)**
  - **NFPA 55**

**Failure to follow these instructions can cause unexpected, violent movement of nitrogen cylinders, resulting in death or serious personal injury and property damage.**

The following instructions describe how to refill the Victaulic Vortex™ nitrogen cylinder manifold system (80-liter/4893 $in^3$ cylinders) on-site without having to remove the cylinders.

## NITROGEN DELIVERY CONSIDERATIONS

Due to numerous factors that relate individually to each jobsite, the following on-site refill may not be the most economical, fastest, or most efficient option.

**Refill Option 1** - A liquid nitrogen truck with on-board evaporation and pumping capabilities. Liquid nitrogen trucks shall provide a minimum 3000-psi/206.8-Bar rated hose to connect to a high-pressure fill point.

**Refill Option 2** - Typically, tube trailers are delivered at approximately 2200 – 2400 psi/151.7 – 165.5 Bar. **NOTE:** The filled system will only reach approximately 200 psi/13.8 Bar below the tube trailer pressure. Contact your nitrogen gas supplier to determine the pressure at which the tube trailer will be delivered and the fill pressure that will be achieved.

Reference the nitrogen supplier's documentation and supply capabilities when evaluating these options, and determine the required fill pressure based on the specific Victaulic Vortex™ system design.

Refer to the original system design documentation to determine designed fill pressures. Filling to a higher-than-designed fill pressure may exceed the ratings of the piping or cause oxygen levels to be reduced beyond design limits during discharge. Filling to a lower-than-designed fill pressure may prevent the system from functioning as intended.

## EQUIPMENT REQUIREMENTS

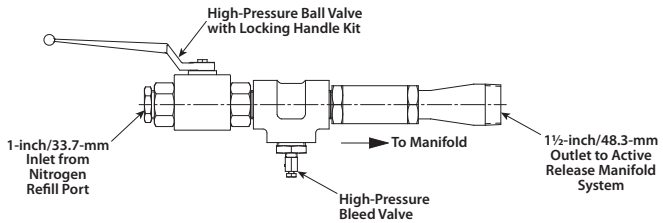
- A high-pressure fill line (3000-psi/206.8-Bar minimum rating) with 3000-pound fittings shall be provided from the manifold fill assembly to the exterior building access point for nitrogen truck connection (nitrogen refill port). Construction shall be Schedule 80 steel pipe (1-inch/25-mm nominal diameter) or an equivalent pressure-rated material.

- The nitrogen refill port (using piping rated for the highest system pressure) shall be capped (1-inch NPT female coupling is recommended), and the placard shown to the right **SHALL** be placed around the pipe to identify the nitrogen refill port.

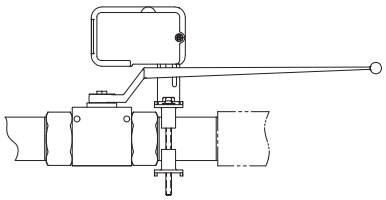

**⚠ WARNING**

- **Verify that pressure has been relieved from the nitrogen refill port before attempting to remove the nitrogen refill port plug.**
- **Pressure shall be relieved by opening the high-pressure bleed valve first to remove all pressure from the manifold piping, then by opening the ball valve to relieve pressure between the ball valve and the nitrogen refill port plug.**

**Failure to follow these instructions could result in death or serious personal injury and property damage.**




- The manifold fill assembly, shown above, provides access for recharging the nitrogen supply. The assembly features a 1-inch/33.7-mm high-pressure ball valve with locking handle, a high-pressure bleed valve, and applicable piping for connecting to the manifold. The manifold fill assembly shall be installed prior to the manifold.



- The Victaulic Vortex™ manifold shall have provisions to isolate the high-pressure refill gas from the downstream Combination or Fluid Panel (refer to drawing above for isolation valve/switch assembly).

**⚠ WARNING**

- **Unless the system is designed and configured with a reserve bank of cylinders, during servicing of the Victaulic Vortex™ System, the hazard area will not be fully protected.**
- **Provisional fire protection shall be in place during servicing of the Victaulic Vortex™ System. The Victaulic Vortex™ System is incapable of operating when the pilot line is removed.**
- **Before performing maintenance on any Victaulic Vortex™ System components, ensure nitrogen and water valves are fully closed and locked out.**
- **All lines shall be depressurized and drained, and all electrical circuits shall be locked and tagged to prevent accidental activation.**
- **Prior to disconnecting any hoses from the manifold or cylinder valve, make sure the manifold is depressurized to prevent a release of high-pressure nitrogen.**
- **Prepare the area being protected before any system testing occurs. Vacate all personnel from the area, or ensure that approved, self-contained breathing apparatus and personal protective equipment are provided.**

**Failure to follow these instructions could result in death or serious personal injury and property damage.**

## PREPARATIONS FOR REFILLING CYLINDERS

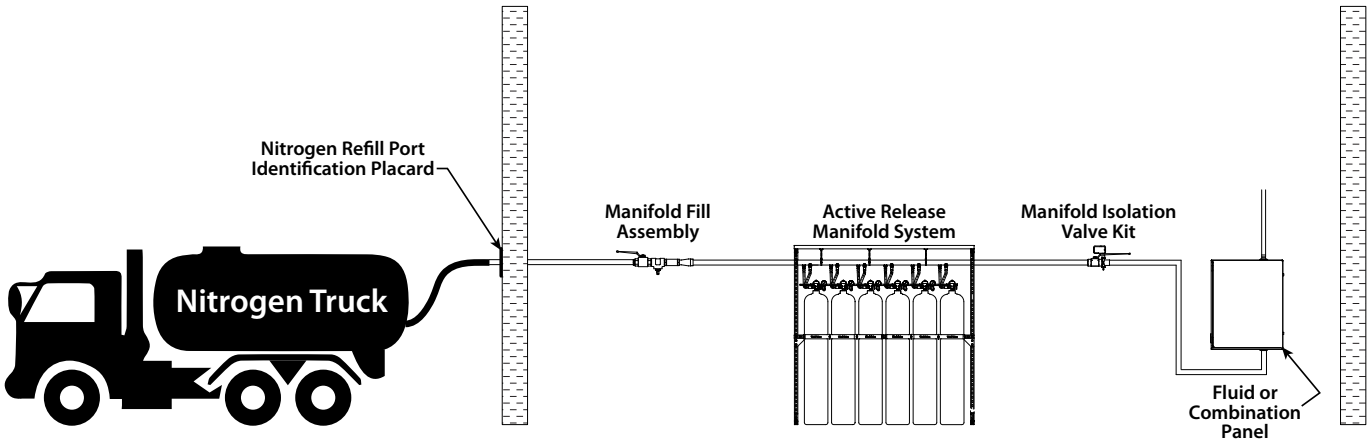
Estimate the amount of nitrogen to be delivered to the cylinders (number of cylinders x 600 SCF per cylinder). Contact the nitrogen gas supplier to arrange for delivery, and notify them of the target cylinder refill pressure. **NOTE:** Fill pressure may vary upon customer requirements.

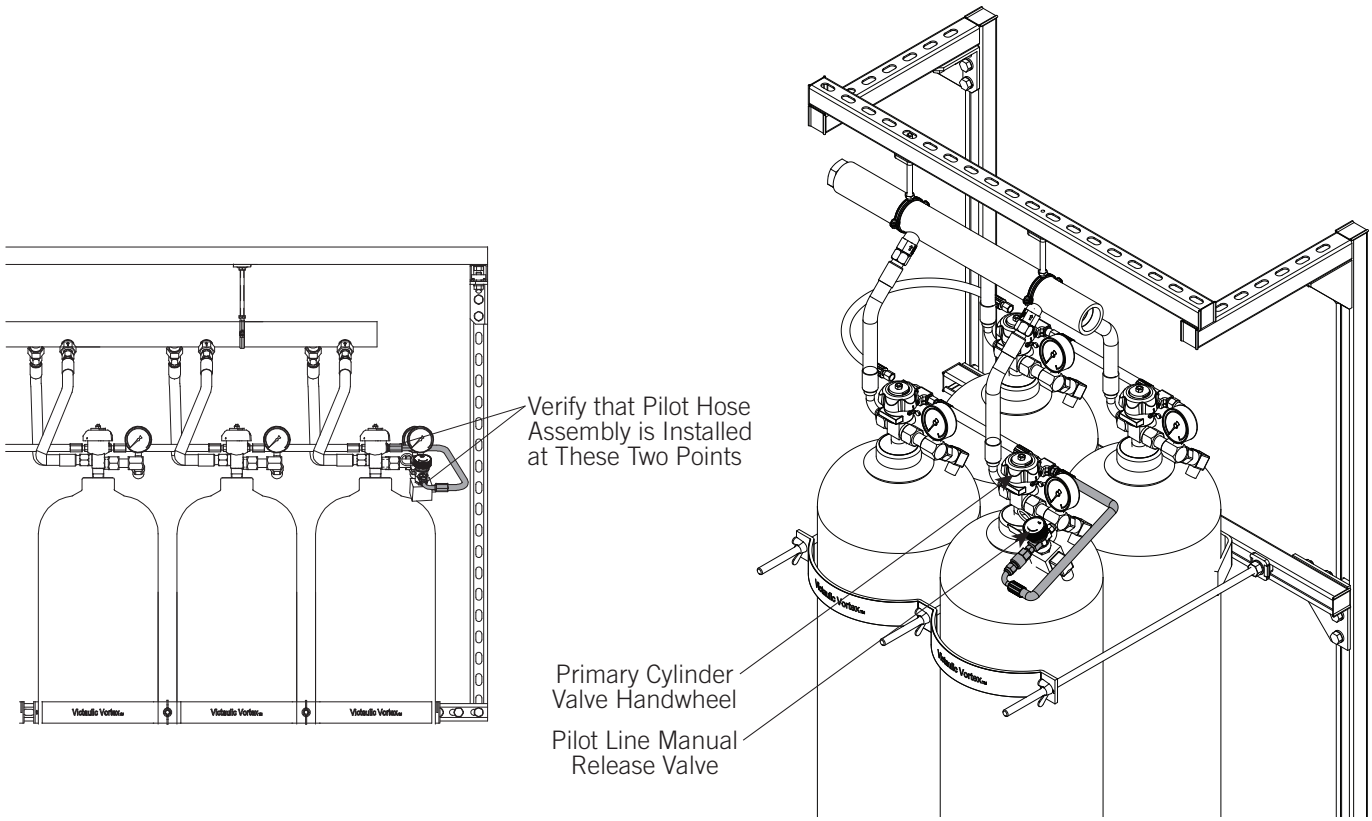
## CYLINDER INSPECTION

Per NFPA 770, DOT, TC, or similar regulatory bodies, compressed gas cylinders that are continuously in service without discharging shall be given a complete external visual inspection every 5 years or more frequently, if required. The visual inspection shall be in accordance with Section 3 of CGA C-6, except that the cylinders need not be emptied or stamped while under pressure. The results of the inspection shall be recorded on both of the following:

(1) A record tag permanently attached to each cylinder
(2) A suitable inspection report

**NOTE:** Industry practice dictates that cylinders found to be within compliance of the inspection may be filled at a slow rate to prevent excessive heat (approximately 300 psi/20.7 Bar or less per minute).


Nitrogen Refill Port
Identification Placard
Nitrogen Truck
Manifold Fill
Assembly
Active Release
Manifold System
Manifold Isolation
Valve Kit
Fluid or
Combination
Panel


Verify that Pilot Hose
Assembly is Installed
at These Two Points
Primary Cylinder
Valve Handwheel
Pilot Line Manual
Release Valve

## INSTRUCTIONS FOR REFILLING CYLINDERS

The following procedures shall be conducted in accordance with all applicable laws, codes, and industry standards set forth for the local jurisdiction where the cylinders are being refilled.

1. The system shall be locked out to prevent accidental activation. Lockout can be accomplished at the agent-releasing FACP, by disconnecting the electric solenoid, or by removing the primary solenoid release assembly from the designated primary nitrogen cylinder. **NOTE:** During this process, the nitrogen cylinders will be opened manually and will pressurize the manifold and piping up to the manifold isolation valve. **The Victaulic Vortex™ Panel shall be placed in maintenance mode to prevent system discharge.**
2. Place the maintenance switch in the Combination or Fluid Panel in the maintenance position. Confirm that the yellow supervisory indicator light is on.
3. Isolate the Combination or Fluid Panel(s) by closing the manifold isolation valve.
4. Connect the nitrogen supply truck to the manifold, as shown in the diagram above.
5. Pull the pin on the pilot line manual release valve located on the primary solenoid release assembly. Keep this pin for reinstallation in later steps.
6. Open the primary cylinder valve by turning the handwheel. This will ensure that if the primary cylinder is too low to pressurize the pilot line and pneumatically open the cylinder valves, that the nitrogen from the manifold can fill the primary cylinder.
7. Open the pilot line manual release valve. This will pressurize the pilot line, opening all of the cylinder valves, and allowing a path for the nitrogen in the manifold to fill the cylinders.

**NOTICE**

- **Cylinder valves operate on a 10-to-1 ratio. For 3000-psi/206.8-Bar service, a minimum of 300-psi/20.7-Bar pressure is required to open the cylinder valve.**
- **As pressure builds in the manifold and primary cylinder, it flows through the pilot line manual release valve. Pressure continues to build and opens the cylinders within the banks, thus allowing manifold pressure to fill the remaining cylinders.**

8. The nitrogen gas supplier will connect to the high-pressure fill line (provided by the installing contractor).
9. Slowly open the high-pressure ball valve of the manifold fill assembly to release any stored pressure.

**⚠ WARNING**

- **DO NOT refill cylinders at a rate higher than 300 psi/20.7 Bar per minute.**

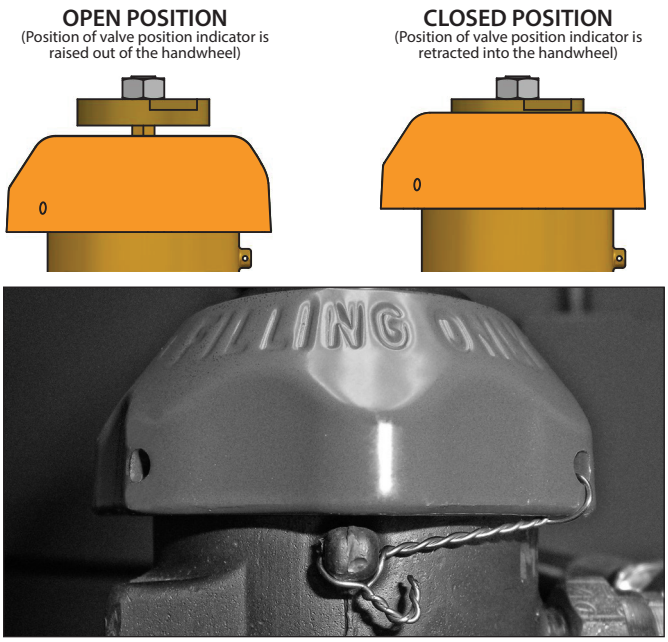
**Failure to follow this instruction could cause cylinders to overheat, resulting in death or serious personal injury and property damage.**

10. Open the nitrogen supply valve from the truck to start the flow of nitrogen into the manifold. If a tube trailer is being used as the nitrogen source, cascade fill by opening only one cylinder at a time, using each cylinder on the tube trailer to reach a higher pressure at the manifold and Victaulic Vortex™ cylinders.
11. **WHEN ALL OF THE CYLINDERS HAVE REACHED THE REQUIRED FILL PRESSURE:** Close the high-pressure ball valve and open the high-pressure bleed valve located on the manifold fill assembly. By opening the bleed valve, any trapped pressure between the truck connection and the manifold fill assembly check valve will be released. Disconnect the truck. **REPLACE THE PIN ON THE PILOT LINE MANUAL RELEASE VALVE.**
12. Close the primary cylinder valve by turning the handwheel. Ensure all pilot line manual release valves are closed and pinned.
13. Using a tool, depress the pin on the pilot line manual release valve to release trapped nitrogen pressure. DO NOT use your finger to depress the pin on the pilot line manual release valve.

**⚠ CAUTION**

- **A sharp noise and release of pressure will occur when the pin on the pilot line manual release valve is depressed.**
- **DO NOT use your finger to manually depress the pin on the pilot line manual release valve.**
- **Wear personal protective equipment (hearing protection, safety glasses, etc.).**

**Failure to follow these instructions could result in personal injury.**




14. Confirm that the cylinder valves close and that each valve position indicator retracts into the handwheel. **NOTE:** When retracted, the cylinder valve position indicator may not be flush with the top of the handwheel. Verify that the safety wire tie is intact on each cylinder valve. Safety wire shall meet ASTM A580 and/or ASTM A555 requirements.
15. When all pressure has been bled from the manifold and pilot lines, open the manifold isolation valves to all Combination or Fluid Panels.
16. Bleed any residual manifold pressure by using the bleed valves located in the Combination or Fluid Panel.

**⚠ WARNING**

- **All cylinder connections and bracing SHALL be installed and tightened. Nitrogen cylinders contain stored energy, which can discharge explosively.**
- **All hose connections shall be tightened before attempting to test/operate the system.**

**Failure to secure cylinders and cylinder connections can cause unexpected, violent movement in the event of an accidental discharge, resulting in death or serious personal injury and property damage.**

17. Reset the agent-releasing FACP or reconnect the lockout used in Step 1.
18. Place the maintenance switch in the Combination or Fluid Panel in the ready position. Verify that the yellow supervisory indicator light remains off.

# SECTION XI
# TROUBLESHOOTING

## TROUBLESHOOTING – COMBINATION AND FLUID PANELS

| Condition | Possible Causes | Recommended Actions |
|---|---|---|
| Supervisory contact from Victaulic Vortex™ Panel is closed. No indicator lamps are lit. | Victaulic Vortex™ Panel is not powered | Restore system power |
| | Power wiring polarity is incorrect | Verify and correct power wiring |
| | Fuse on PCB is open | Replace fuse with appropriately-rated fuse |
| Supervisory contact from Victaulic Vortex™ Panel is closed. Yellow fault indicator lamp is on. | Pressure transducer wiring is faulty | Verify and repair pressure transducer wiring |
| | Maintenance switch is in maintenance position | Place maintenance switch in ready position |
| | For zoned systems, pressure may be trapped between the Fluid and Zone Panels | Check if pressure transducer is reporting pressure - relieve pressure by opening Zone Panel nitrogen |
| | Internal wiring to the ARV, or the ARV itself, is damaged | Check internal panel wiring for unplugged components |
| Supervisory contact from Victaulic Vortex™ Panel is on. Yellow fault indicator lamp is on. LED 3 is off. | A component is unplugged or internal Victaulic Vortex™ Panel wiring is damaged | Check internal Victaulic Vortex™ Panel wiring for unplugged components |
| LED 4 is off | Needle valve is not seated | Cycle maintenance switch to maintenance position and then back to ready position to seat needle valve |
| Intermittent supervisory indication from Victaulic Vortex™ Panel | Interference on pressure transducer wiring | Verify Victaulic Vortex™ Panel is grounded properly |
| | | Verify pressure transducer wiring is proper type and is grounded properly |
| | | Verify pressure transducer on DC power wiring is not located in conduit with power signals |
| ARV does not open when test button is pressed | Victaulic Vortex™ Panel is in supervisory state | Cycle maintenance switch and troubleshoot supervisory contact/fault indicator lamp |
| | Maintenance switch is in maintenance position | Return maintenance switch to ready position |
| ARV does not operate when 24V is applied to release input (Dry Contact Panels only) | Victaulic Vortex™ Panel is in supervisory state | Cycle maintenance switch and troubleshoot supervisory contact/fault indicator lamp |
| | Victaulic Vortex™ Panel is not a Dry Contact Panel | Verify system design and bill of materials against installed equipment |
| ARV does not operate when pressure is applied to the inlet of the Victaulic Vortex™ Panel (Active Release Panels only) | Victaulic Vortex™ Panel is in supervisory state | Cycle maintenance switch and troubleshoot supervisory contact/fault indicator lamp |
| | Victaulic Vortex™ Panel is not an Active Release Panel | Configure system with appropriate ARV release signal from agent-releasing FACP |
| Alarm contact is closed. Red fault indicator lamp is on. | Nitrogen pressure greater than 150 psi/10.3 Bar is applied to the inlet of the Victaulic Vortex™ Panel | Close the nitrogen supply - relieve pressure by using nitrogen bleed valve in Victaulic Vortex™ Panel |
| Communication fault on touch-screen interface | Touch-screen interface to ARV cable disconnected | Check touch-screen interface to ARV cable connection |
| Touch-screen interface pressure indicates "fault" | Faulty pressure transducer wiring | Check pressure transducer wiring |
| | Inadequate power supply voltage | Verify input voltage to Victaulic Vortex™ Panel is within specified range |
| Touch-screen interface pressure indicates "open" | Maintenance switch is in maintenance position | Return maintenance switch to ready position |
| | Faulty pressure transducer wiring | Check pressure transducer wiring |
| Agent-releasing FACP indicates open circuit on needle valve release signal (Dry Contact Panels only) | Agent-releasing FACP requires lower impedance to clear supervisory | Add a properly-sized resistor to J9 on PCB |
| Agent-releasing FACP indicates open circuit on nitrogen solenoid release signal | Needle valve is not seated | Cycle maintenance switch to maintenance position and then back to ready position to seat needle valve |
| | Maintenance switch is in maintenance position | Return maintenance switch to ready position |
| Primary discharge solenoid does not activate when nitrogen release signal is applied | Needle valve is not seated | Cycle maintenance switch to maintenance position and then back to ready position to seat needle valve |
| | Maintenance switch is in maintenance position | Return maintenance switch to ready position |

**⚠ CAUTION**

- **DO NOT make or break any connections with power applied to the Victaulic Vortex™ Panel.**

**Failure to follow this instruction could cause damage to the ARV, resulting in improper system operation.**

**If you have any questions concerning the safe installation and operation of this product, contact Victaulic (scan QR code on front cover for contact information for your region).**

# Victaulic Vortex™ Hybrid Fire Extinguishing System

## TROUBLESHOOTING – ZONE PANELS

| Condition | Possible Causes | Recommended Actions |
|---|---|---|
| Supervisory contact from Victaulic Vortex™ Panel is closed. No indicator lamps are lit. | Victaulic Vortex™ Panel is not powered | Restore system power |
| | Power wiring polarity is incorrect | Verify and correct power wiring |
| | Fuse on PCB is open | Replace fuse with appropriately-rated fuse |
| Supervisory contact from Victaulic Vortex™ Panel is closed. Yellow fault indicator lamp is on. | Maintenance switch is in maintenance position | Place maintenance switch in ready position |
| | A component is unplugged or internal Victaulic Vortex™ Panel wiring is damaged | Check internal Victaulic Vortex™ Panel wiring for unplugged components |
| Alarm contact is closed. Red fault indicator lamp is on. | Nitrogen ball valve is open | Verify release signal is not applied to Victaulic Vortex™ Panel - cycle maintenance switch to maintenance position and then back to ready position to close nitrogen valve |
| Supervisory contact from Victaulic Vortex™ Panel is on. Yellow fault indicator lamp is on. LED 3 is off. | A component is unplugged or internal Victaulic Vortex™ Panel wiring is damaged | Check internal Victaulic Vortex™ Panel wiring for unplugged components |
| LED 4 is off | This is normal for Zone Panels | No action required |
| ARV does not open when test button is pressed | This is normal for Zone Panels (test button is used for testing ARV on Combination and Fluid Panels) | Use ARV input signal for opening nitrogen valve |
| ARV does not operate when 24V is applied to release input (Dry Contact Panels only) | Victaulic Vortex™ Panel is in supervisory state | Cycle maintenance switch and troubleshoot supervisory contact/fault indicator lamp |
| Agent-releasing FACP indicates open circuit on needle valve release signal (Dry Contact Panels only) | Agent-releasing FACP requires lower impedance to clear supervisory | Add a properly-sized resistor to J9 on PCB |

## TROUBLESHOOTING – GENERAL EQUIPMENT

| Condition | Possible Causes | Recommended Actions |
|---|---|---|
| Supervisory from nitrogen isolation valve | Nitrogen isolation valve is not open | Open nitrogen isolation valve |
| | Supervisory switch is not positioned correctly | Inspect and reposition supervisory switch, as required |
| Low-pressure supervisory from primary or secondary gauge assembly | Nitrogen cylinder pressure is not sufficient to reset low-pressure switch | Verify nitrogen cylinder pressure is higher than setpoint of pressure switch (generally greater than 2400 psi/165.5 Bar) |
| Supervisory from water tank level switch | Water level low | Verify water level with sight glass |
| | Water tank level switch is not positioned correctly | Inspect and reposition water tank level switch, as required |

**⚠ CAUTION**

- **DO NOT make or break any connections with power applied to the Victaulic Vortex™ Panel.**

**Failure to follow this instruction could cause damage to the ARV, resulting in improper system operation.**

**If you have any questions concerning the safe installation and operation of this product, contact Victaulic (scan QR code on front cover for contact information for your region).**