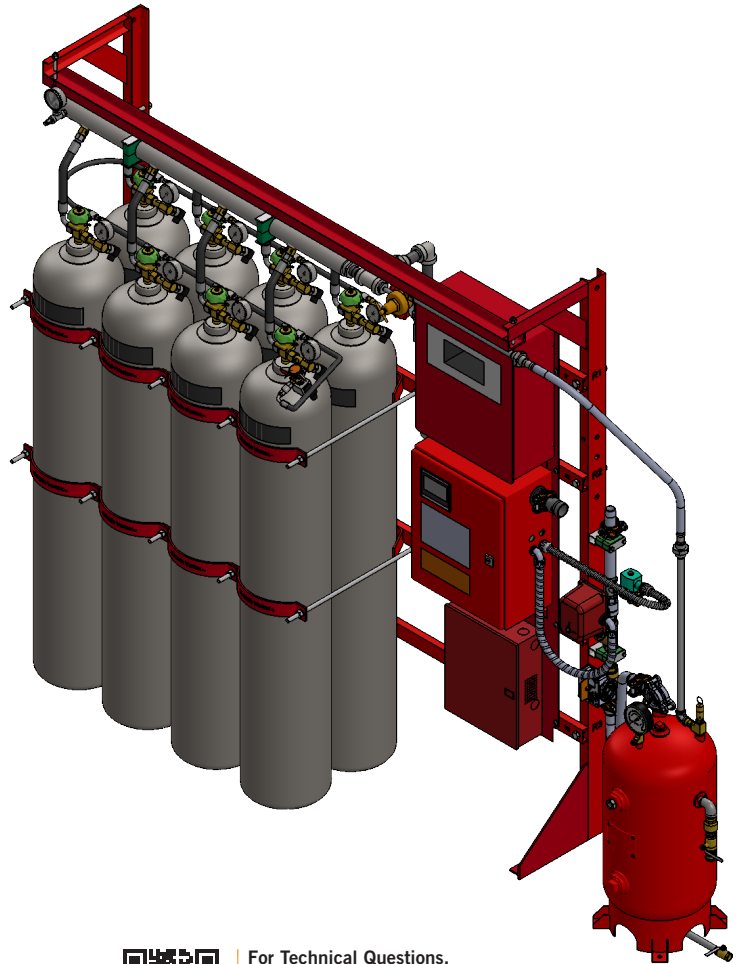


# Victaulic Vortex™ Pre-Engineered Hybrid Fire Extinguishing System

For Small, Single-Enclosure Room Volumes Including FM Approved Data Processing Rooms/Halls and Performance Based Designs Outside the FM Approvals



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## ⚠ 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.



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# 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™ PRE-ENGINEERED SYSTEM" REFERENCES USED THROUGHOUT THIS MANUAL

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

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

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



### "FACP" REFERENCES USED THROUGHOUT THIS MANUAL

FACP, used throughout this manual, is an abbreviated reference to Fire Alarm Control Panel and is intended to encompass connections to the Victaulic Vortex™ Pre-Engineered System, as well as general references to fire alarm requirements for Victaulic Vortex™ Pre-Engineered System operation.

#### **NOTICE**

- If Victaulic Vortex™ Pre-Engineered System components are used outside the scope of this manual, reference the I-VORTEX.IOM and other applicable VDM-VORTEX design manual documentation for consideration of an engineered system.

**SAFETY REQUIREMENTS**

<b>⚠ WARNING</b>	
	<ul style="list-style-type: none"> <li>• Victaulic Vortex™ Pre-Engineered Systems shall be installed only by certified system installers that have successfully completed all appropriate Victaulic training. System Designs, Installations, and Service shall be conducted per all applicable laws, codes, and industry standards.</li> <li>• System installers shall use sound engineering judgment to design the Victaulic Vortex™ Pre-Engineered System in accordance with this I-VORTEX/PE.DIOM manual. A complete evaluation of the hazards, authority having jurisdiction (AHJ) requirements, applicable laws, codes, and industry standards shall be conducted.</li> <li>• Always verify that the piping system has been completely depressurized and drained immediately prior to installation, removal, adjustment, or maintenance of any Victaulic products.</li> <li>• Contractors shall be certified, per local code requirements, and shall successfully complete all Victaulic training before attempting to install the Victaulic Vortex™ Pre-Engineered System. Always reference this I-VORTEX/PE.DIOM manual and consult the local authority having jurisdiction (AHJ) for complete installation requirements. This manual contains important safety and operational information.</li> </ul>
	<ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> <li>• Use only Victaulic replacement parts when servicing the Victaulic Vortex™ Pre-Engineered System.</li> <li>• Changes to hazard classifications or hazard zones may affect system performance. All changes shall be reported to the AHJ for approval.</li> <li>• Fire Alarm and releasing component design, selection, installation, operation, and maintenance is the sole responsibility of the certified Victaulic Vortex™ installer.</li> </ul> <p>Failure to follow these instructions could result in death or serious personal injury and property damage.</p>

**GENERAL SAFETY REQUIREMENTS**

1. **Read and understand all instructions before proceeding with installation and maintenance of this Victaulic Vortex™ Pre-Engineered 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. VICTAULIC VORTEX™ PRE-ENGINEERED SYSTEM COMPONENTS 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.** Department of Transportation (DOT) or local guidelines shall be followed when transporting 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.

<b>NOTICE</b>
<ul style="list-style-type: none"> <li>• Adequate ventilation shall be provided in the nitrogen storage area in case of a nitrogen leak.</li> <li>• Low nitrogen pressure at the cylinders may indicate low oxygen in the nitrogen storage area.</li> </ul>

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 if the Victaulic Vortex™ Pre-Engineered 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™ Pre-Engineered System, certified and trained individuals shall read and fully understand the contents of this manual, follow all the instructions in this manual, and install the system in accordance with current National Fire Protection Association (NFPA) standards, Factory Mutual (FM) requirements, and local codes and standards. Failure to follow the instructions and comply with codes voids any Victaulic warranty.
- 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™ Pre-Engineered System components.
- THIS SYSTEM IS NOT TESTED OR APPROVED FOR EXPLOSIVE ENVIRONMENT APPLICATIONS.

The Victaulic Vortex™ Pre-Engineered System is designed as a total-flooding fire protection system. The Victaulic Vortex™ Pre-Engineered 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 and piping design 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

- Selection of system configuration, based on the hazard classification of the application, is the sole responsibility of the Victaulic Vortex™ Certified individual.
- 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™ Pre-Engineered 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.

**VICTAULIC VORTEX™ PRE-ENGINEERED SYSTEM COMPONENTS ARE NOT RATED FOR OUTDOOR USE.**

## 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.
  - 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™ Pre-Engineered System can cause rapid cooling, resulting in depressurization of the protected space.
  - In the event of system discharge, activation of the Victaulic Vortex™ Pre-Engineered System will release nitrogen into the protected space.
- 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.

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

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

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

## SUPPLIES

The following section identifies supplies and other equipment that are recommended for installing the Victaulic Vortex™ Pre-Engineered 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.

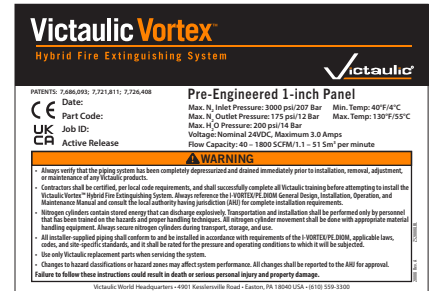
### General Equipment for System Support:

- Personal Oxygen Meter
- Personal Protective Equipment
- Discharge or Testing Warning Signs
- Leak Detection Method
- Refill Adapter Assembly

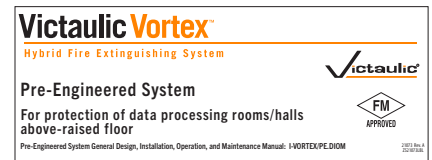
## SAFETY SIGNAGE/PLACARDS

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

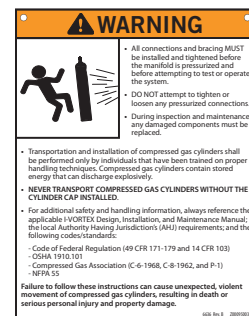
**Victaulic Vortex™ Panel Nameplate** – Each Victaulic Vortex™ Pre-Engineered System will contain a nameplate that is affixed to the Victaulic Vortex™ Panel.



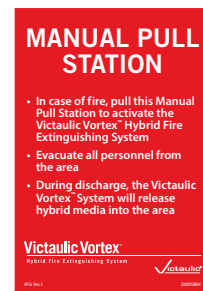
**Victaulic Vortex™ Design Nameplate** – A design nameplate is required for the specific design method. The nameplate shall be affixed to the front of the Victaulic Vortex™ Panel.



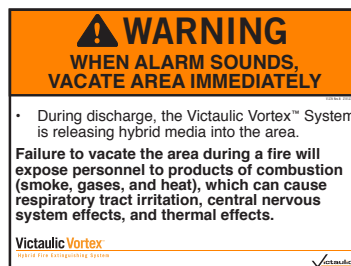
**Nitrogen Cylinder Rack Warning Placard** – Each Victaulic Vortex™ Pre-Engineered System will ship with a nitrogen cylinder rack warning placard that shall be attached to the cylinder rack.



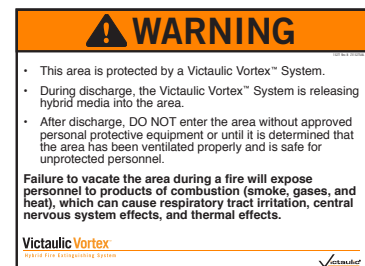
**Manual Pull Station Placard** – Victaulic has a manual pull station placard available for order. The system designer/installer should consider the amount of manual pull station placards that are required. **NOTE:** A placard that is deemed necessary by the system designer/installer, building owner,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



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

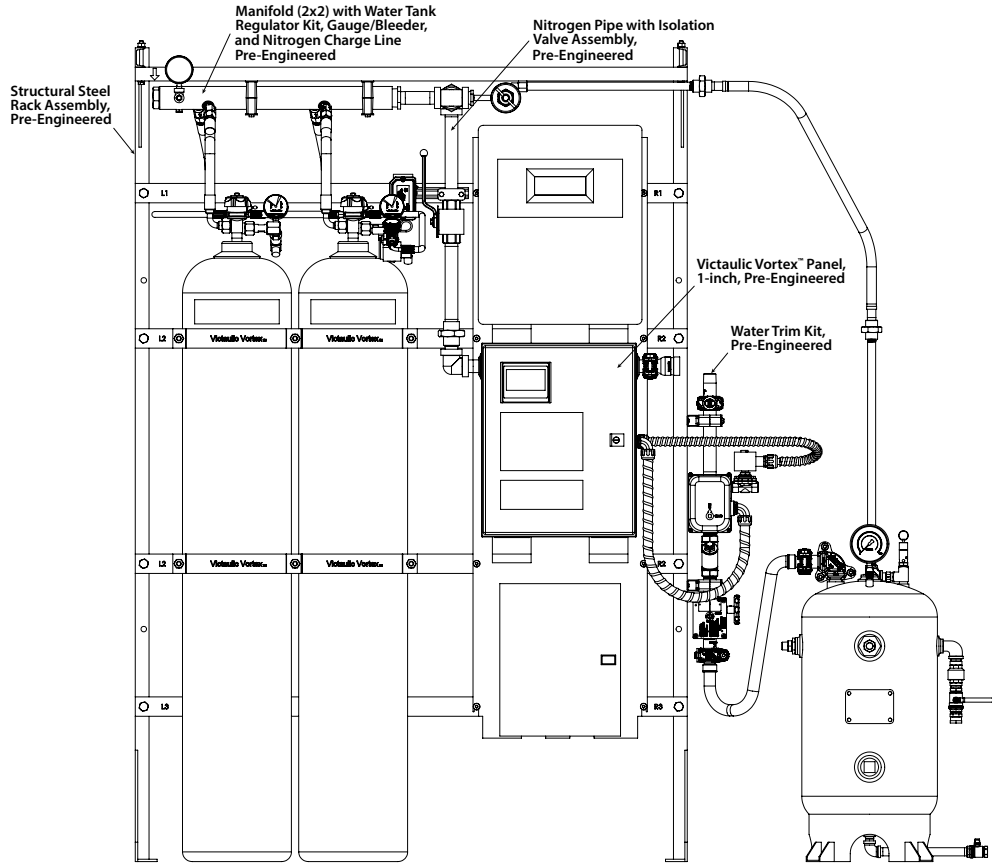


Placard for Within the Protected Space

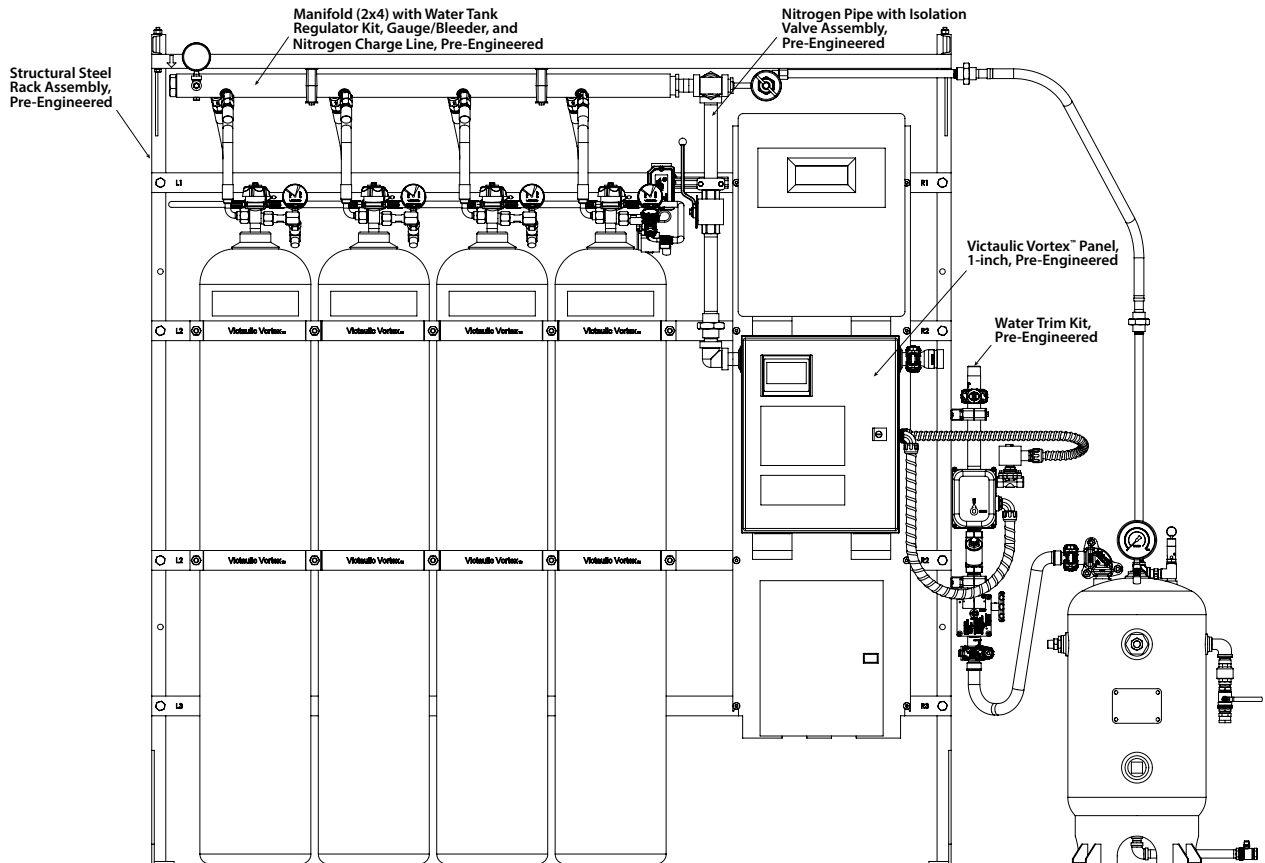


Placard for Outside the Protected Space

**Victaulic Vortex™ Pre-Engineered System Components (1 to 4-Cylinder Configuration Shown Below)**



**Victaulic Vortex™ Pre-Engineered System Components (5 to 8-Cylinder Configuration Shown Below)**



## BASIC SYSTEM OPERATION

The Victaulic Vortex™ Pre-Engineered System is intended to be installed to protect a single enclosure.

The Victaulic Vortex™ Pre-Engineered System requires Victaulic Vortex™ hybrid emitters and panels, nitrogen storage, and a water source (refer to the drawings on the previous page). The minimum required discharge time is dependent upon system design.

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.

The Victaulic Vortex™ Panel contains 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 – 60 psi/ 1.7 – 4.1 Bar, which is programmed depending on hybrid emitter selection, piping size, and system layout.

High-pressure nitrogen cylinders utilize one primary solenoid release assembly and several secondary release assemblies that are used to charge the nitrogen supply manifold.

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 may be required in single-enclosure systems. Refer to Section IV for when Victaulic requires pressure relief valves to be installed. Local codes and standards may have additional requirements for pressure relief valves.

The only water supply option for the Victaulic Vortex™ Pre-Engineered System is a stand-alone tank provided by Victaulic. Refer to Section IV 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 Section VIII for guidance on fire alarm system requirements.

Reference Section II for system requirements prior to ordering or installation of the Victaulic Vortex™ Pre-Engineered System.

## PRE-ENGINEERED SYSTEM OVERVIEW

The Victaulic Vortex™ Pre-Engineered System consists of components configured into a single package:

- Intended for use in single-enclosure applications
- Racking available up to 8 cylinders
- Pre-assembled piping sub-assemblies to help ease installation
- Piping rules that govern the piping system that can be extended from the outlet of the unit
- When rules are followed, hybrid emitter operating pressure and water delivery time requirements are met
- Specific design methods and intended applications

A specific Victaulic Vortex™ Pre-Engineered System configurator is intended to be used with all system sizing and selection process.

**NOTE:** Any system that does not meet all of the above statements would be considered a Victaulic Vortex™ Engineered System and shall require a certified designer for system implementation.

# SECTION II

# SYSTEM REQUIREMENTS

## PREREQUISITES FOR VICTAULIC VORTEX™ PRE-ENGINEERED SYSTEM

The Victaulic Vortex™ Pre-Engineered System is intended to be used in applications where the following requirements shall be satisfied prior to selection and installation of the system:

1. It is the sole responsibility of the Victaulic Vortex™ Certified individual to verify proper identification of the hazards present in the protected area has been performed for the application. Identification of hazards is critical to ensure performance of the Victaulic Vortex™ Pre-Engineered System. A fire protection engineer, or another qualified individual accepted by the AHJ, shall identify all hazards.
2. Selection of the proper system design type shall be identified. The system design types applicable for the Victaulic Vortex™ Pre-Engineered System are as follows (reference Appendix A and B for additional information):
  - a. Data Centers in accordance with the FM Approved Data Processing Rooms/Halls applications
  - b. Performance-Based Class A/C Fire applications in accordance with NFPA 770 discharge requirements
  - c. Performance-Based Class B Fire applications in accordance with NFPA 770 discharge requirements
3. Confirm enclosure requirements (detailed below) are satisfied by the protected space.
4. It is the responsibility of the Victaulic Vortex™ Certified individual to ensure the proper installation of a Fire Alarm system that is designed and intended for use in a special hazard/agent releasing configuration. This includes detection, control panel(s,) power supply requirements, notification, auxiliary controls, wiring, raceways, electrical enclosures, devices, and any other requirements pertaining to the proper design, installation, and maintenance of the Fire Alarm System.

### WARNING

- The Victaulic Vortex™ Pre-Engineered System is intended to simplify the design and installation of Victaulic Vortex™ technology. The Certified Victaulic Vortex™ individual is solely responsible for verification that all applicable hazard analysis, fire alarm requirements, auxiliary functions, enclosure requirements, and special hazard requirements are considered and implemented. Failure to properly select system design type can result in abnormal performance of the Victaulic Vortex™ Pre-Engineered System. The wrong system design can also cause personal injury, property damage, and death.

## VICTAULIC VORTEX™ PRE-ENGINEERED SYSTEM CONFIGURATOR AND PIPING RULES

The Victaulic Vortex™ Pre-Engineered System Configurator Tool shall be used and will produce a complete bill of materials (BOM) and installation parameters for the system, including hybrid emitter selection, piping rules, and set pressures. The piping rules, pressure transducer location, and set pressures for the Victaulic Vortex™ Pre-Engineered System are pre-calculated by Victaulic to ensure hybrid emitter operating pressure and water delivery time. This tool can be accessed through the Victaulic Vortex™ Portal and shall be utilized for ordering the system. The piping rules identified by the configurator and as specified in this manual shall be followed.

## PERFORMANCE-BASED DESIGN APPLICATIONS

Performance-based designs are outside the FM Approvals and are intended to have a hazard analysis performed by a qualified individual. Application examples can be obtained from Victaulic or a Certified Victaulic Vortex™ Designer, in addition to details on specific material types that Victaulic Vortex™ Systems have successfully extinguished. Determination of a Class A/C or Class B system may require partial- or full-scale fire testing, data from equivalent fire extinguishment, or application examples. Contact Victaulic Application Engineering or a Certified Victaulic Vortex™ Designer for support on application suitability. See Appendix B of this document for more information.

## FM APPROVED DATA PROCESSING ROOMS/HALLS APPLICATIONS

The Victaulic Vortex™ Pre-Engineered System is intended for use in FM Approved Data Processing Rooms/Halls applications. Verify that the applicable FM Loss Prevention Data Sheets are referenced and the protected space meets FM requirements for the construction and configuration. See Appendix A of this document for more information.

## ENCLOSURE REQUIREMENTS

Victaulic Vortex™ Pre-Engineered Systems that are designed as total flooding systems are intended to operate in single enclosures built using typical construction practices. Large openings, such as doors and windows, shall be closed. Forced ventilation systems shall be shut down or closed automatically where their continued operation would adversely affect system performance. Completely self-contained, recirculating ventilation systems are not required to shut down. The volume of the ventilation system and associated ductwork shall be considered as part of the total hazard volume.

### NOTICE

- The Victaulic Vortex™ Pre-Engineered System is approximately limited to 10,000 ft<sup>3</sup> at sea level due to the unit being limited to eight cylinders.

## ALLOWABLE OPENINGS IN ENCLOSURE PER HYBRID EMITTER

Per FM Data Processing Rooms/Halls Approval Requirements:

Hybrid Emitter Size	System Operating Pressure psi/Bar	Maximum Opening Per Hybrid Emitter ft <sup>2</sup> /m <sup>2</sup>	Minimum Opening Per Hybrid Emitter ft <sup>2</sup> /m <sup>2</sup>
¾ inch	50	0.83	0.11
	3.5	0.077	0.010
½ inch	50	2.00	0.27
	3.5	0.186	0.025

Per Performance Based Designs Outside the FM Approvals Specifications:

Hybrid Emitter Size	System Operating Pressure psi/Bar	Maximum Opening Per Hybrid Emitter ft <sup>2</sup> /m <sup>2</sup>	Minimum Opening Per Hybrid Emitter ft <sup>2</sup> /m <sup>2</sup>
¾ inch	50	1.1	0.11
	3.5	0.102	0.01
¾ inch	25	0.71	0.06
	1.7	0.066	0.006
½ inch	50	2.15	0.18
	3.5	0.200	0.017
½ inch	25	1.25	0.11
	1.7	0.116	0.01
¾ inch	50	2.75	0.27
	3.5	0.255	0.025
¾ inch	25	2.15	0.18
	1.7	0.200	0.017

## OXYGEN LEVELS AND DISCHARGE TIMES

The Victaulic Vortex™ Technology has a final design oxygen target of 12.5 to 14%. With smaller room volumes, it is possible to see estimated final oxygen levels below 12.5%. Reference NFPA 770 for occupancy times in oxygen-diluted environments, as well as exceptions including other discharge times for Class B hazards. For Performance-Based Designs, the discharge time is a minimum of 2.1 minutes with a maximum of 3 minutes. For FM Approved Data Processing Rooms/Halls applications, the discharge time is a minimum of 3.5 minutes. Discharge times outside these parameters are not within the scope of the Victaulic Vortex™ Pre-Engineered System.

## NITROGEN SUPPLY REQUIREMENTS

The Victaulic Vortex™ Pre-Engineered System is provided with pre-specified nitrogen cylinders. 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™ Pre-Engineered 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™ Pre-Engineered System is designed for operation at a nominal starting supply pressure of 2400 psi/ 165.5 Bar when using 49-liter cylinders and 3000 psi/ 206.8 Bar when using 80-liter cylinders. 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 system documentation for the required quantity of nitrogen and fill pressure.

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.

### Nitrogen Gas Supply

### WARNING

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

Failure to follow this instruction could result in death or 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 XII, 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.

Water quantity is determined by the Pre-Engineered Configurator.

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

### Standalone Water Supplies

Victaulic will 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 Section V for available water tank capacities.

## FACP REQUIREMENTS

Refer to Section VIII for detailed Fire Alarm Control Panel (FACP) requirements. A listed or approved FACP is required for operation and monitoring of the Victaulic Vortex™ Pre-Engineered System. This includes the FACP, detection, notification, and auxiliary components to be supplied by the installer of the Victaulic Vortex™ Pre-Engineered System. Victaulic does not supply any FACP components.

The Certified Victaulic Vortex™ user is solely responsible for verifying that the proper design, installation, and maintenance of the fire alarm system is completed by a qualified individual and is suitable for the application, that it conforms to all applicable codes and standard, and is accepted by the AHJ.

## ELECTRICAL REQUIREMENTS

- For detailed instructions on component electrical installation requirements, refer to Section VII.
- For detailed instructions on component installation requirements to the system FACP, refer to Section VII.
- For detailed information on system electrical specifications, refer to Section VIII.

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# SECTION III SYSTEM CONFIGURATOR

## WARNING

- System design shall include suitable safeguards to ensure prompt evacuation and to prevent entry into hazardous atmospheres, including a means for prompt rescue of trapped personnel.
- Safety items shall include personnel training, warning signs, discharge alarms, self-contained breathing apparatus, evacuation plans, and fire drills.

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

## USING THE PRE-ENGINEERED SYSTEM CONFIGURATOR

The Victaulic Vortex™ Certified individual shall enter inputs and follow steps as called out in the Victaulic Vortex™ Pre-Engineered Configurator. The configurator will calculate and display nitrogen cylinder volume, number of nitrogen cylinders, hybrid emitter size and operating pressure, number of hybrid emitters, estimated discharge time, and final estimated oxygen level percentage. It is the Victaulic Vortex™ Certified individual's responsibility to verify that oxygen level percentage, estimated discharge time, and all components meet design specifications and piping rules defined throughout this manual.

Enclosure volume is calculated by inputting the enclosure's length, width, and height into the configurator in the system volume section. Elevation of the enclosure location above or below sea level shall be determined and input into the configurator prior to order. If the elevation falls in between two available values select the next closest option. The temperature is the ambient temperature of the protected space during normal operation and is also required to be known and input into the configurator prior to order.



## Pre-Engineered System List Price =

[Status : WARN] - Subfloors are not included (single zone and single enclosure applications only)

[Status : OK] -

**User Selection and Inputs**

First Name: John, Last Name: Smith  
 Company Name: Vortex Certified Company  
 Project Name: Example 1  
 Project Location: Somewheresville  
 Phone #: 888-867-5309  
 Email: J.Smith@VortexCertifiedindividual.com  
 Imperial  Metric

Project Elevation: 0FT/0KM  
 Cylinder Refill Adapter: CGA-580  
 Water Tank Certifications: ASME/FM

Power Supply: 120 VAC  
 Add-ons:  Include panels and system signage  
 Total number of doors: 1

Edit Values  
 Estimated Release Points (FACP)  
 Estimated Monitor Points (FACP)

Multiplier: .5, Price: [ ]  
 CALCULATE  
 EXPORT EXCEL BILL OF MATERIAL  
 SUBMIT PROJECT

SystemID	System Name	Volume = Length x Width x Height (ft)	Temperature (°F)	Design Method	Cylinder QTY	Emitter QTY	Emitter Size Operating Pressure	Emitter Style Selection	Flow Cartridge Selection	Est. Discharge Time (min.)	Est. O2 Level (%)
0	Server Room	L: 25 W: 25 H: 8 Volume: 5000.00 ft³	77	FIM Data Centers	4-00L	1	5/8" Cavity Foil 50 PSI	Escutched aimless	0.53 GPM	5.4	13.4

1. Input user information and project name/location.
2. Input project elevation relative to sea level information, adapter requirements, and water tank certification requirements.
3. Input power supply and add on information.
4. Input enclosure name, dimensions, ambient temperature, and selected design method.
5. Select desired hybrid emitter style.
6. Input pricing multiplier your company has with Victaulic. This is determined with your Victaulic Sales Representative.
7. Press calculate and make note of any warnings or errors, fix as required.
8. Export project to BOM for submission to Victaulic Customer care for ordering.

Pipe Runs	Pipe Parameters	Value
Nitrogen Piping	Pipe Size	1.5" Sch 10
	Maximum Pipe Length from Panel to Emitter	150'
	Minimum Pipe Length from Panel to Emitter	20'
	Maximum Direction Changes	10
Water Piping	Pipe Size	1" Sch 10 or 40 (Type K)
	Pipe Size	1" Sch 40
Hybrid Emitter Drops	Pipe Size	1" Sch 40
	Maximum Pipe Length	2'

**Design Recommendation**

The following image is not to scale and should only be used as a guide for how to arrange the Hybrid Emitter(s).

**Note:** The configurator will also display the piping rules and produce an example system layout. This information will also be in the exported BOM.

Zone Name	Volume	Temperature	Design Method	Emitter Qty	Cylinder Qty	Emitter Size/Style	Flow Cartridge Selection	Est. Discharge Time (min)	Est. Oxygen Level (%)
Server Room	5000	77	FM Data Centers	1	4 80L	5/8" Cavity Foil @ 50 PSI	0.53 GPM	5.4	13.4

Ready Scroll Lock Accessibility: Good to go

**Note:** The BOM produced by the configurator contains an overview of the inputs as well as other important information such as warnings associated with the inputs and outputs and a list of fire alarm monitor and releasing points.

# SECTION IV

## PIPING LAYOUT AND PIPING RULES

### WARNING

- System design shall include suitable safeguards to ensure prompt evacuation and to prevent entry into hazardous atmospheres, including a means for prompt rescue of trapped personnel.
- Safety items shall include personnel training, warning signs, discharge alarms, self-contained breathing apparatus, evacuation plans, and fire drills.

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

### PIPING LAYOUT INTRODUCTION

The Victaulic Vortex™ Pre-Engineered System piping rules, when followed, ensure that hybrid emitters will operate within specification.

#### Pipe Support and Connections

Hangers shall be approved for the pipe being installed. Refer to NFPA 13 for low-pressure piping and ASME B31.1 for high-pressure piping, and consult with the local AHJ to determine requirements for seismic bracing.

### WARNING

- Pipe joining methods shall comply with the manufacturer's installation requirements.
- Pipe size, schedule, and material shall be appropriate for the environment for which it is specified.
- Pipe size, schedule, and material shall meet all applicable local and national codes.

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

## PIPING LAYOUT DEFINITIONS

**Feed Main** - Primary supply line up to the separated feed or branch line

**Cross Feed Main** - Connection of pipe typically perpendicular to the connections to multiple branch-lines

**Branch Line** - Piping from the feed line (main/separated) to the hybrid emitter

### Flushing and Cleaning of Piping



Each pipe and tube section shall be cleaned internally after preparation and before assembly, in accordance with standard piping practices. The piping network shall be free of particulate, threading chips, and oil residue before any hybrid emitters are installed.



The piping distribution system shall be inspected to determine that it is in compliance with design and installation documentation (refer to applicable drawings).



A flow test using nitrogen gas or compressed air shall be performed on the piping network to verify that flow is continuous and that piping and hybrid emitters are unobstructed.

## NOTICE

- Victaulic Vortex™ Pre-Engineered System components shall be protected from damage. Depending on the hazard, system components (except for hybrid emitters, strainers, water flow control cartridges, and required piping), should be located outside the hazard zone.
- Care shall be taken in determining the location of the nitrogen supply, since an accidental release of nitrogen may result in a low-oxygen condition in the area.
- The protected enclosure shall have the structural strength and integrity necessary to contain the nitrogen discharge. If the developed pressures present a threat to the structural strength of the enclosure, venting shall be provided to prevent excessive pressures. Any powered venting shall be considered in the design. Designers/installers shall consult with Victaulic regarding powered venting or to account for any necessary enclosure venting. It is critical to verify that over-pressurization falls within acceptable limits.

## MATERIAL SPECIFICATIONS

### Nitrogen Piping

Low-pressure nitrogen hybrid emitter piping (downstream of the ARV) may be comprised of minimum Schedule 10 carbon steel pipe or Schedule 5 stainless steel pipe for 2 ½-inch/63.5-mm and smaller diameter piping. Alternative piping materials, including non-metallic (ABS), may be used, provided that the pipe is rated for this service, is protected from external damage, equivalent in size and friction loss to that of the IPS pipe size dictated by the piping rules, and is allowed by the AHJ and all applicable codes.

Refer to the hybrid emitter specifications for the rated operating pressures. Piping layout and sizes shall be designed to keep all hybrid emitters within their recommended operating pressures.

### Water Piping

Water supply piping used in the Victaulic Vortex™ Pre-Engineered System system shall have a minimum working pressure rating of 175 psi/12.1 Bar and shall meet or exceed standards specified in NFPA 770.

Water supply piping may be copper tubing or stainless steel pipe. Copper tubing wall thickness may be Type K, L, or M. The water pipe connection from the water flow control cartridge to the hybrid emitter is a 36" long, 1/4" braided stainless steel flex line provided with the unit and is sized appropriately for flow and delivery time.

### Nitrogen Piping Fittings

High-pressure nitrogen fittings are supplied by Victaulic as threaded Class 3000 fittings. Fittings for low pressure nitrogen pipe network and hybrid emitter drops can be grooved, threaded, or welded. For alternate pipe materials, pipe joining solutions that meet the pressure requirements of the system and are installed in accordance with the manufactures instructions shall be acceptable. Alternate materials shall be equivalent in size and friction loss to that of the IPS or copper pipe size as dictated by the piping rules.

### Water Piping Fittings

Stainless steel fittings for water pipe network and hybrid emitter drops can be grooved, threaded, press, or welded. Copper fittings for water pipe network and hybrid emitter drops can be bent, soldered, brazed, press, or welded. For alternate pipe materials, pipe joining solutions that meet the pressure requirements of the system and are installed in accordance with the manufactures instructions shall be acceptable. Alternate materials shall be equivalent in size and friction loss to that of the IPS or copper pipe size as dictated by the piping rules.

**PIPING LAYOUT RULES**

**Single Hybrid Emitter**

Pipe Runs	Pipe Parameters	Total Nitrogen Flow Rate	
		40 – 500 SCFM/68 – 850 m <sup>3</sup> /hr	
Nitrogen Piping	Pipe Size	1 ½-inch Sch. 10	
	Maximum Pipe Length from Victaulic Vortex™ Panel to Hybrid Emitter	150 feet/45.7 meters	
	Minimum Pipe Length from Victaulic Vortex™ Panel to Hybrid Emitter	20 feet/6.1 meters <sup>(2)</sup>	
	Maximum Direction Changes	10	
Water Piping	Pipe Size for Elevation Changes of Less Than +/- 25 feet/7.6 meters	1-inch Sch. 10 or 40 (Type K)	
	Pipe Size for Elevation Changes of Greater Than +/- 25 feet/7.6 meters	¾-inch Sch. 40 (Type K)	
Hybrid Emitter Drop	Pipe Size	1-inch Sch. 40	
	Maximum Pipe Length from Nitrogen Piping Connection to Hybrid Emitter	2 feet/0.6 meters	
	Distance from Flow Cartridge to Hybrid Emitter	The provided SS flex line is 36-inches in length	
	Pipe Connection from 1-inch Nitrogen Drop to ¾-inch FPT Hybrid Emitter Connection	¾-inch nipple shall not exceed 4-inches in length	

**Multiple Hybrid Emitters**

Pipe Runs	Pipe Parameters	Total Nitrogen Flow Rate		
		40 – 500 SCFM 68 – 850 m <sup>3</sup> /hr	501 – 1000 SCFM 851 – 1699 m <sup>3</sup> /hr	1001 – 1800 SCFM 1700 – 3058 m <sup>3</sup> /hr
Nitrogen Feed Main	Pipe Size	1 ½-inch Sch. 10	2-inch Sch. 10	2 ½-inch Sch. 10
	Maximum Pipe Length from Victaulic Vortex™ Panel to Cross Main	150 feet/45.7 meters		
	Minimum Pipe Length from Victaulic Vortex™ Panel to First Hybrid Emitter	20 feet/6.1 meters <sup>(2)</sup>		
	Maximum Direction Changes	10		
Water Feed Main	Pipe Size for Elevation Changes of Less Than +/- 25 feet/7.6 meters	1-inch Sch. 10 or 40 (Type K)		
	Pipe Size for Elevation Changes of Greater Than +/- 25 feet/7.6 meters	¾-inch Sch. 40 (Type K)		
Nitrogen Cross Main (Maximum of Four Branchlines)	Pipe Size	1 ½-inch Sch. 10	2-inch Sch. 10	2 ½-inch Sch. 10
	Maximum Direction Changes	4		
	Maximum Distance Between Branchlines	16 feet/4.9 meters or Based on Maximum Hybrid Emitter Spacing		
	Minimum Distance Between Branchlines	Based on Minimum Hybrid Emitter Spacing		
Water Cross Main and Branchline	Pipe Size	¾-inch Sch. 40 (Type K)		
Nitrogen Branchlines (Maximum of Three Hybrid Emitter Drops)	Pipe Size	1 ½-inch Sch. 10	2-inch Sch. 10	2 ½-inch Sch. 10
	Maximum Direction Changes	2		
	Maximum Length to First Hybrid Emitter Drop	24 feet/7.3 meters		
Hybrid Emitter Drops	Pipe Size	1-inch Sch. 40		
	Maximum Pipe Length from Branchline Connections to Hybrid Emitter	2 feet/0.6 meters		
	Distance from Flow Cartridge to Hybrid Emitter	The provided SS flex line is 36-inch/914mm in length		
	Pipe Connection from 1-inch Nitrogen Drop to ¾-inch FPT Hybrid Emitter Connection	¾-inch nipple shall not exceed 4-inches/101mm in length		

**NOTICE**

- (1) The Victaulic Vortex™ Pre-Engineered System incorporates a pressure transducer feedback loop in the nitrogen piping that monitors and provides data to the ARV. For Systems with a nitrogen flow of less than 150 SCFM/255 m<sup>3</sup>/hr, a downstream pressure relief valve shall be installed. See optional system components in Section IV.
- (2) Installations with less than 60 feet/18.3 meters of pipe may result in the formation of ice on the hybrid emitter foil during discharges without fire events, which may result in a non-uniform discharge pattern. This does not affect the system's ability to extinguish fire.

### **Elevation Change in Pipe Network**

A maximum elevation change of +/- 50 feet/15.2 meters is allowed from the unit to the highest hybrid emitter/flow cartridge. For elevation change below the Victaulic Vortex™ Panel, refer to supervised auxiliary drain valve in "Optional Test Connection, Pressure Switch, and Supervised Auxiliary Drain Valve(s) for Hybrid Emitter Piping" later in this section.

### **Pressure Transducer Location Requirements**

For single hybrid emitter systems, the pressure transducer shall be installed a minimum of 5 feet/1.5 meters and a maximum of 15 feet/4.5 meters from the hybrid emitter.

For multiple hybrid emitter systems, the pressure transducer shall be installed in a location that meets the requirements below:

- Pressure transducer is installed in the cross main
- Pressure transducer is installed in between the first tee and one of the first branch lines
- When there is an odd number of branch lines, pressure transducer is installed in the cross main with the greatest number of branch lines
- Pressure transducer is installed within 30 feet/9.1 meters of the closest hybrid emitter

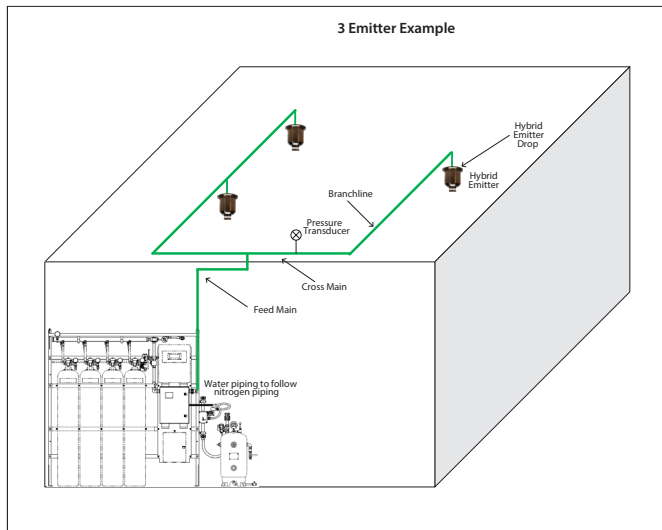
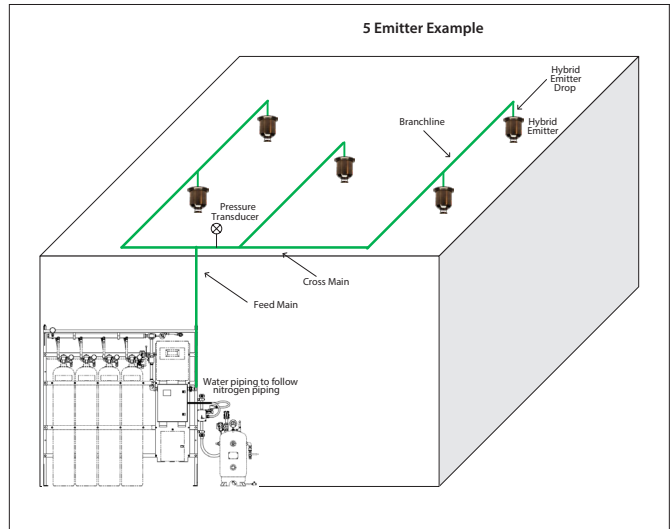
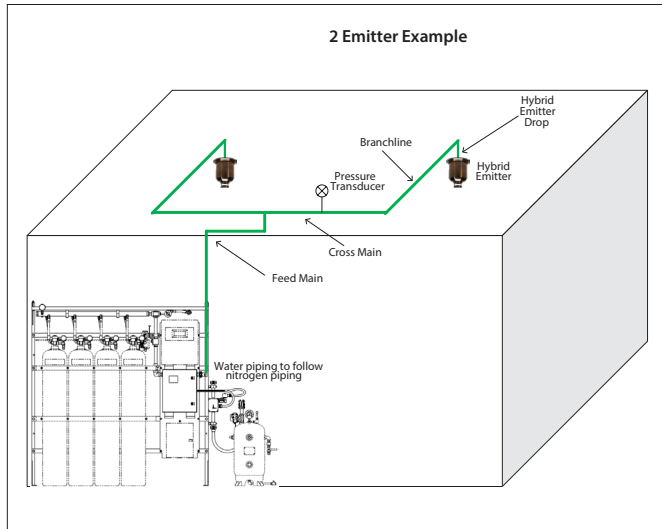
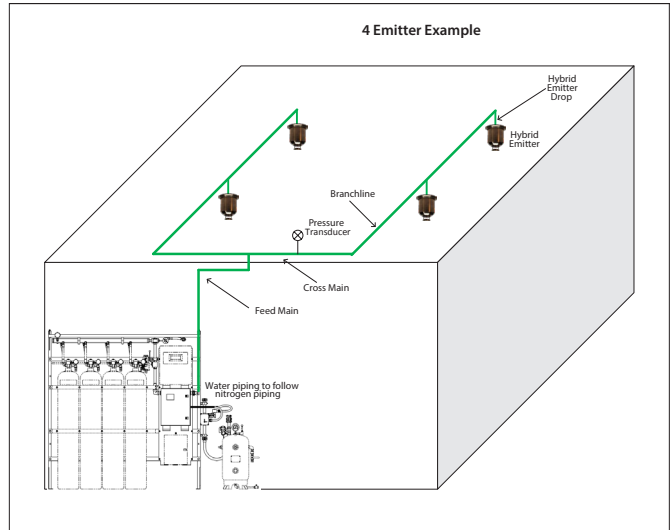
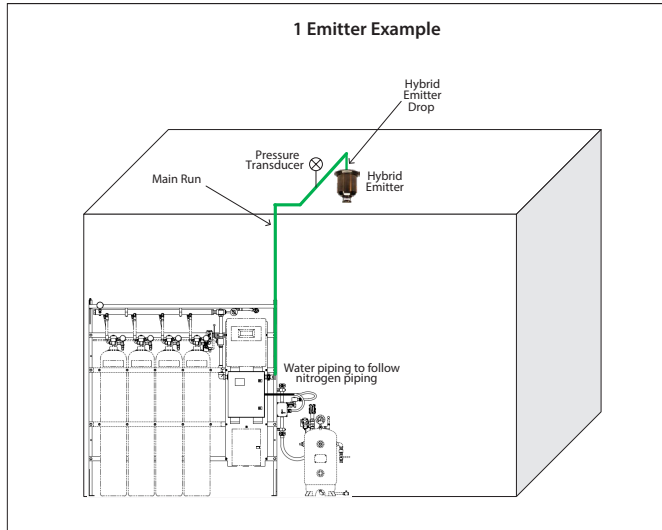
### **Victaulic Vortex™ Panel Settings**

- The pressure transducer setting is factory set for the Victaulic Vortex™ Pre-Engineered System
- For hybrid emitters operating at 25 psig/1.7 Bar nominally, the pressure transducer setting will be 32 psi/2.2 Bar
- For hybrid emitters operating at 50 psig/3.4 Bar nominally, the pressure transducer setting will be 55 psi/3.8 Bar
- Water turn on pressure shall be set to 5 psi/0.345 Bar

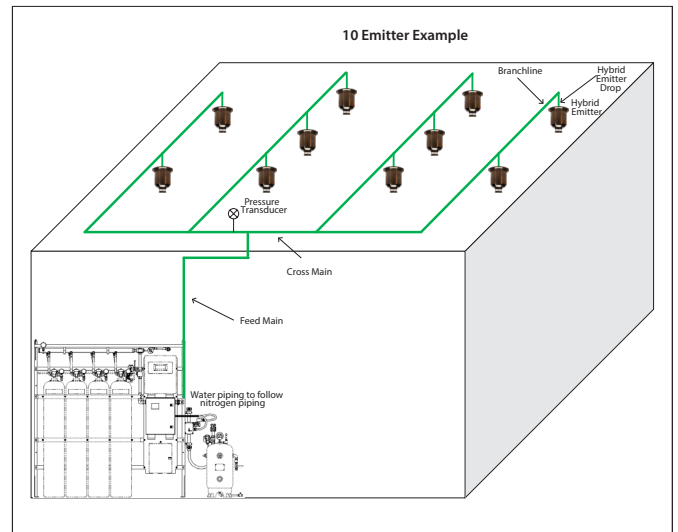
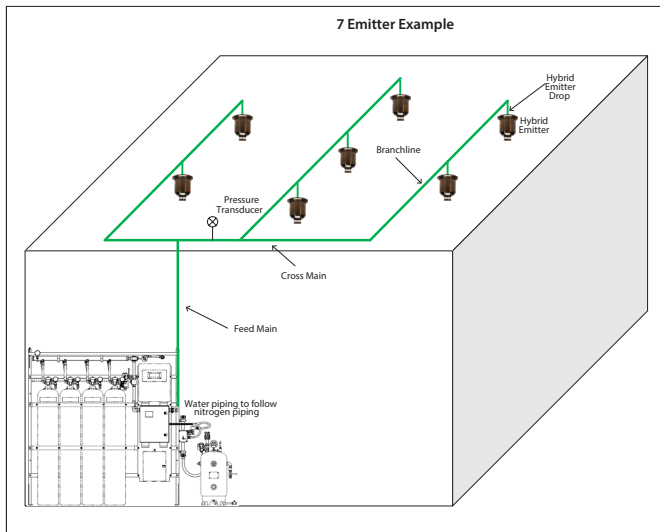
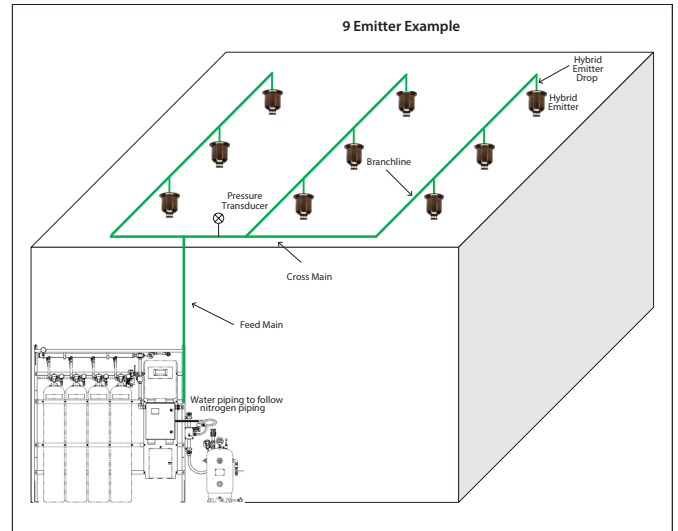
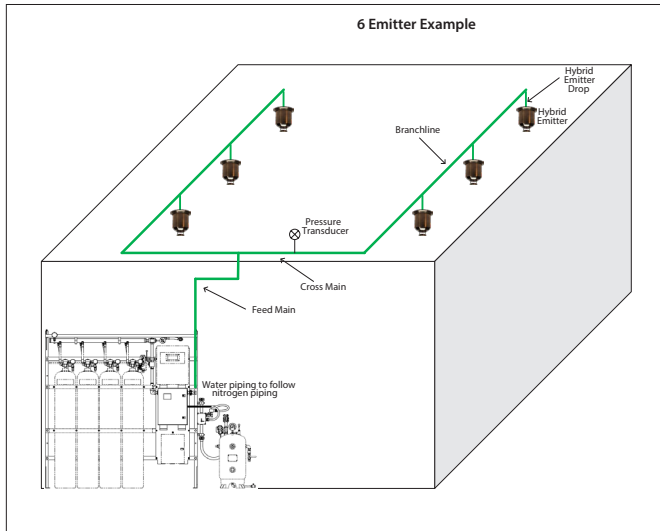
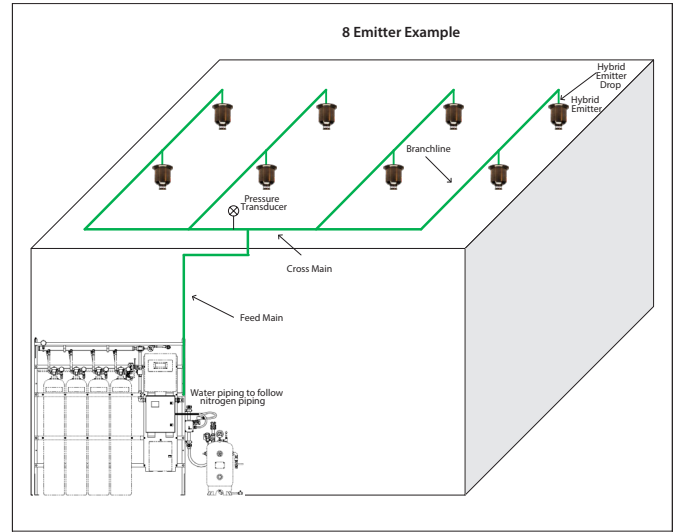
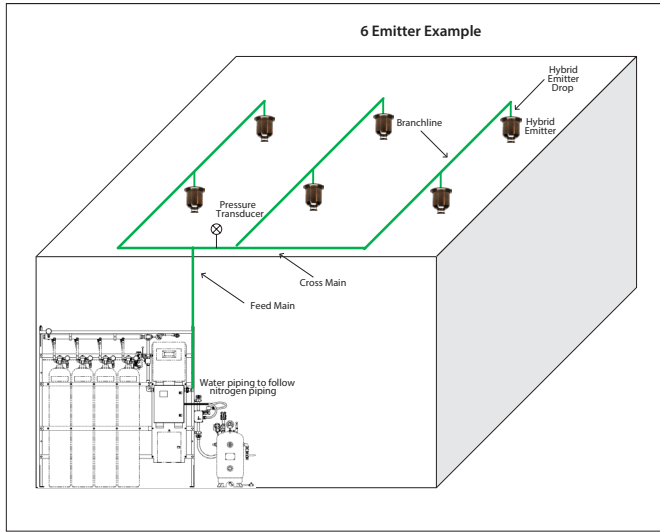
### **Water Tank Pressure Setting**

The water tank pressure shall be set to 100 psig/6.9 Bar +20%, -0%.

**PIPE LAYOUT EXAMPLES**

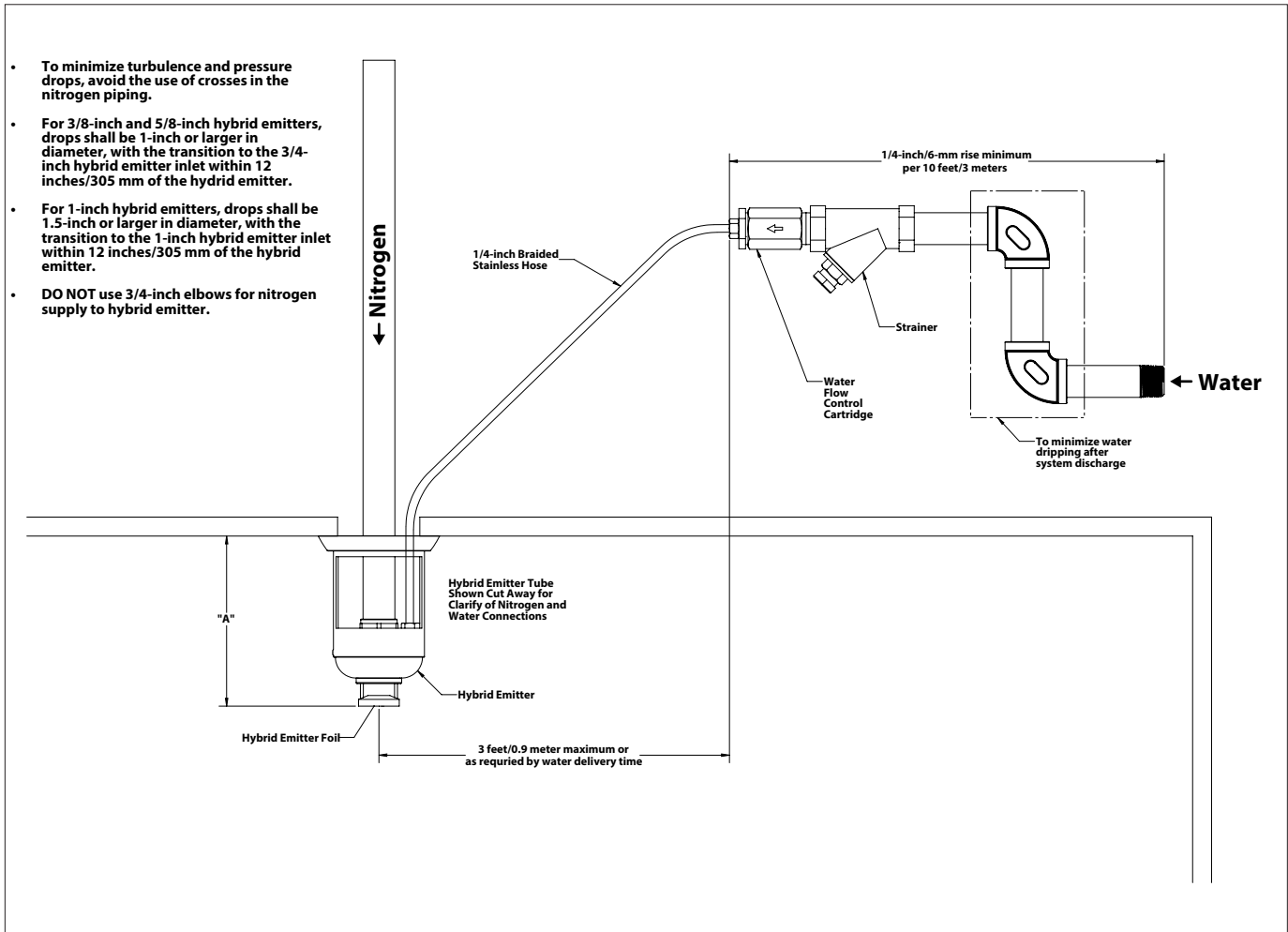


PIPE LAYOUT EXAMPLES - CONTINUED



## HYBRID EMITTER PLACEMENT

### Hybrid Emitter – Pendent Installation Detail



### Spacing Requirements for Pendent Emitters – FM Approved Data Processing Rooms/Halls

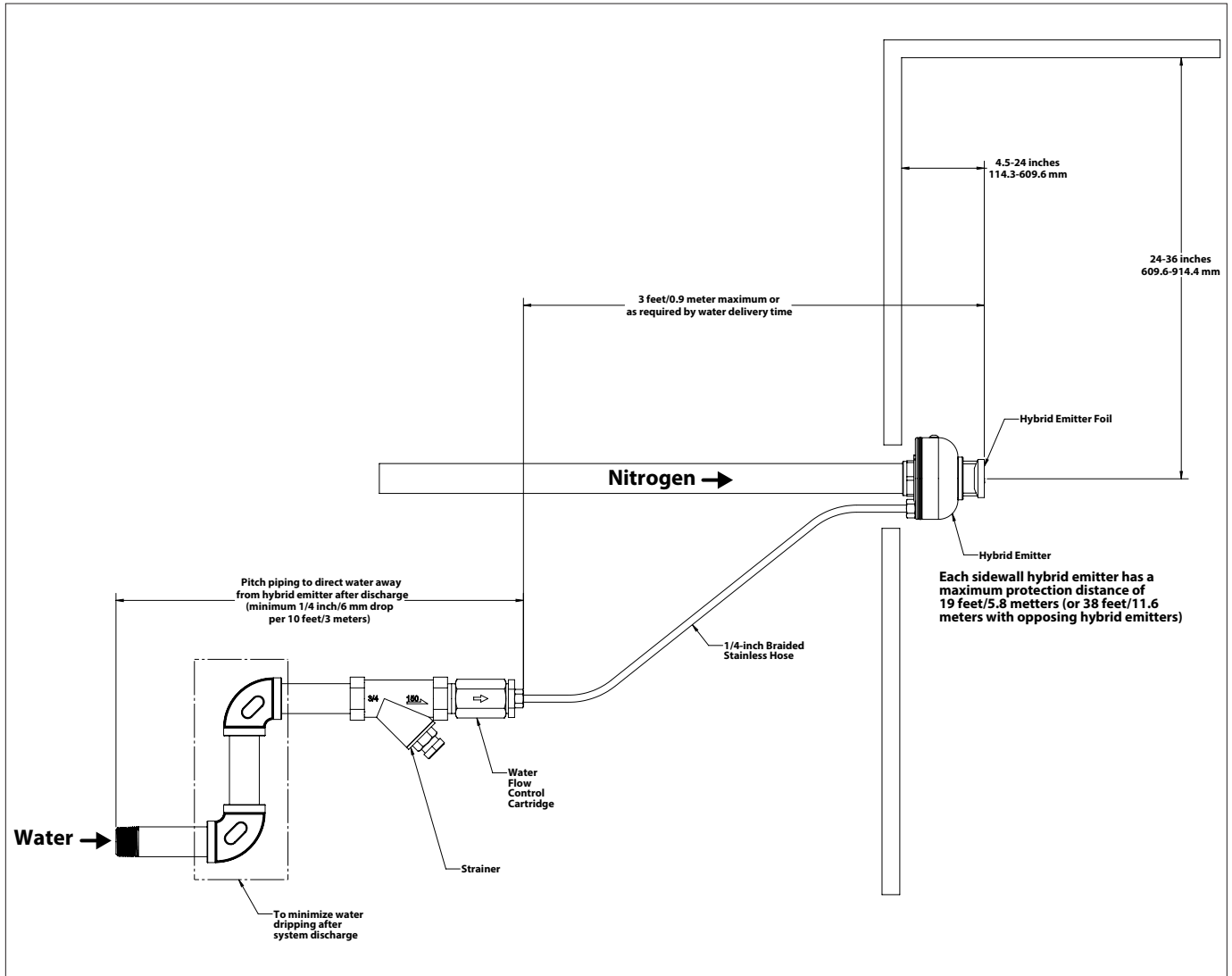
Hybrid Emitter	Maximum Distance Between Hybrid Emitters	Minimum Distance Between Hybrid Emitters	Maximum Distance to Wall	Minimum Distance to Wall	Foil Distance to Ceiling (A)
3/8 inch	10 feet 3 meters	6 feet 1.8 meters	10 feet 3 meters	2 feet 0.6 meters	4.5 - 24 inches 114 - 609 millimeters
5/8 inch	16 feet 5 meters	8 feet 2.5 meters	16 feet 5 meters	3 feet 0.9 meters	4.5 - 24 inches 114 - 609 millimeters

### Spacing Requirements for Pendent Emitters – Performance Based Designs Outside the FM Approvals

Hybrid Emitter	Distance Between Hybrid Emitters	Minimum Distance to Wall	Foil Distance to Ceiling (A)
3/8 inch	Evenly distributed throughout space following "Piping Layout Rules"	2 feet 0.6 meters	4.5 - 24 inches 114 - 609 millimeters
1/2 inch		2.5 feet 0.8 meters	4.5 - 24 inches 114 - 609 millimeters
5/8 inch		3 feet 0.9 meters	4.5 - 24 inches 114 - 609 millimeters

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

Hybrid Emitter – Sidewall Installation Detail



Spacing Requirements for Sidewall Emitters – FM Approved Data Processing Rooms/Halls

Hybrid Emitter	Maximum Distance Between Hybrid Emitters	Minimum Distance Between Hybrid Emitters	Maximum Distance to Adjacent Wall	Minimum Distance to Adjacent Wall
5/8 inch	20 feet 6 meters	8 feet 2.5 meters	20 feet 6 meters	3 feet 0.9 meters

Spacing Requirements for Sidewall Emitters – Performance Based Designs Outside the FM Approvals

Hybrid Emitter	Distance Between Hybrid Emitters	Minimum Distance To Adjacent Wall
3/8 inch	Evenly distributed throughout space following "Piping Layout Rules"	2 feet 0.6 meters
1/2 inch		2.5 feet 0.8 meters
5/8 inch		3 feet 0.9 meters

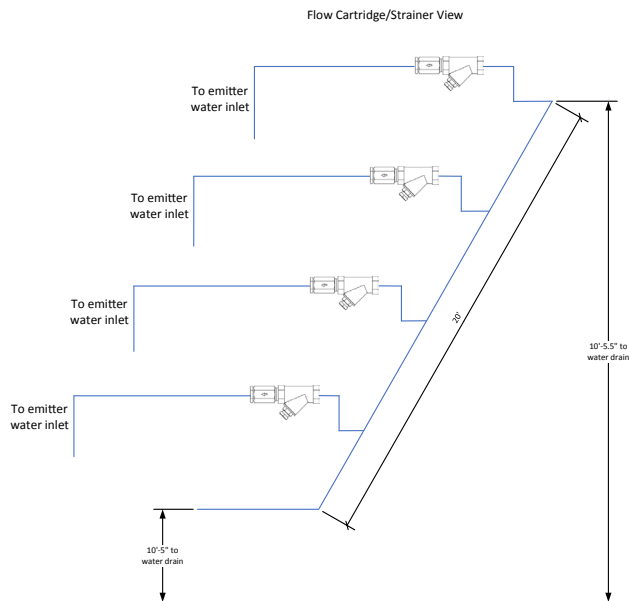
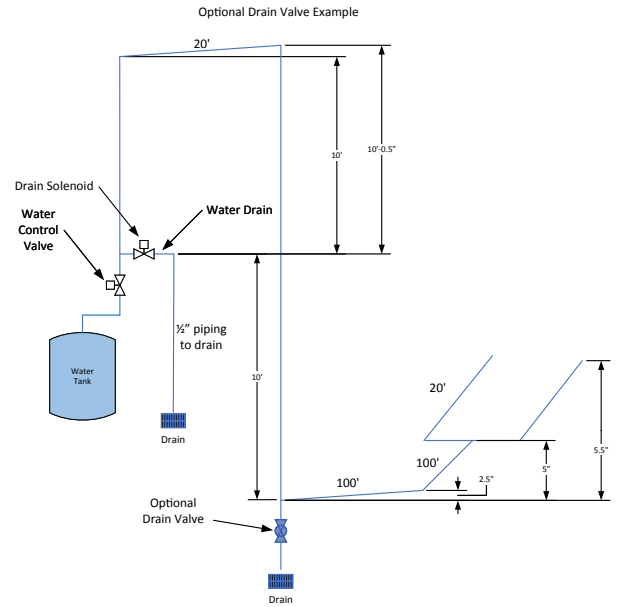
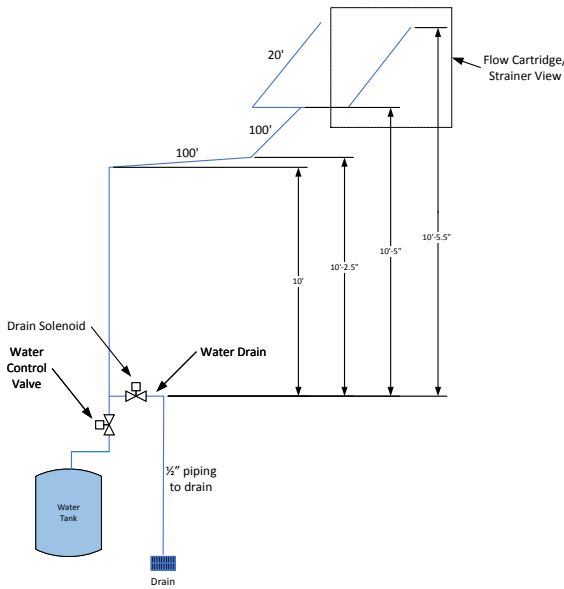
NOTE: Installing hybrid emitters less than the minimum distance values may cause excessive wetting.

**Lockout/Tagout**

Victaulic offers, and requires, a supervised nitrogen isolation valve at the nitrogen source and a supervised water isolation valve at the water source. Evaluate your site's lockout/tagout requirements. Additional lockout valves may be installed at the inlet to water tank pressure regulators, or at other locations in the system consistent with applicable safety requirements. DO NOT install nitrogen lockout valves on the outlet of the Victaulic Vortex™ Panel. Closed isolation valves shall not result in over-pressurization of any component in the event of a discharge.

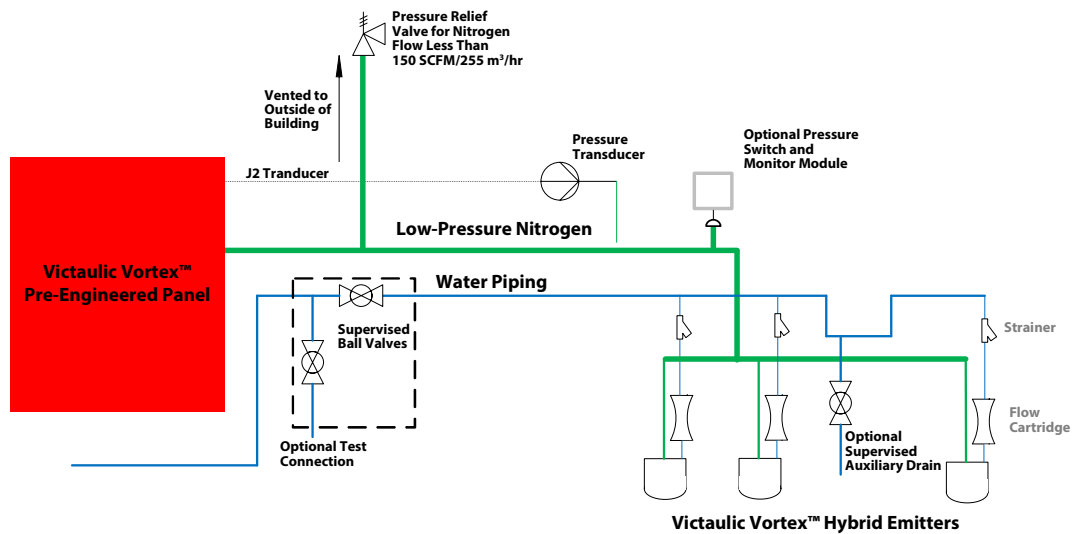
**Piping Drainage**

Pipe shall be pitched back to the Victaulic Vortex™ Panel, away from the hybrid emitter a minimum 1/4 inch/6 mm per 10 feet/3 meters. If there is potential for trapped water, or for sections of pipe that may pitch toward the hybrid emitter, consider placing drain valves in the hybrid emitter water piping.



## OPTIONAL TEST CONNECTION, PRESSURE SWITCH, AND SUPERVISED AUXILIARY DRAIN VALVE(S) FOR HYBRID EMITTER PIPING

Some Victaulic Vortex™ Pre-Engineered System installations may benefit from additional integrator-supplied components. The diagram below shows an optional test connection, pressure switch, and supervised auxiliary drain valves that shall be considered. Refer to Section V for details on optional system components.



### Test Connection

FM Data Sheet 4-6 recognizes that a test connection may be provided to verify water or nitrogen flow. When discharging water into the space is not practical for acceptance testing and inspection, a test connection shall be installed:

- Ball valves shall be supervised
- Supervised test connection ball valves shall be installed between the Victaulic Vortex™ Panels and hybrid emitters
- An alternative configuration is to provide a supervised test connection at the furthest hybrid emitter and then plug the water connection at each hybrid emitter during testing

In most applications, a test connection only on the water line will provide the greatest benefit with the least amount of additional components.

Typically, test connections are not required on the nitrogen line. If a test connection is placed in the nitrogen piping, a thorough review of system operation, along with the test process, shall be conducted to ensure that:

- Nitrogen flow remains within the capabilities of the Victaulic Vortex™ Panel
- The pressure transducer is not isolated from panel output
- The discharged nitrogen is directed away from personnel and movable objects
- All components remain within rated pressures

DO NOT allow operation of the system with the nitrogen piping blocked or closed. Nitrogen shall be able to discharge from the panel outlet to atmosphere to avoid over-pressurization. Install an appropriately-sized relief valve between the panel outlet and test connection.

If a test connection is placed in the water piping, a thorough review of the test process shall be conducted to ensure that:

- Water is directed into a drain capable of handling the expected volume and flow

### Supervised Auxiliary Drain (Part Code S004N69106)

When the water piping configuration may prevent proper drainage after a discharge, or for critical applications, a supervised auxiliary drain valve shall be installed:

- Supervised auxiliary drains shall be FM Approved
- Supervised auxiliary drain may be manually or automatically actuated
- Supervised auxiliary drains shall drain to an area capable of handling the maximum anticipated discharge
- To minimize probability of water dripping from hybrid emitters after discharge, the FACP shall activate a supervised automated drain valve after discharge is complete
- System acceptance testing shall include testing timing and sequencing of any automated valves

### Nitrogen Discharge Verification Pressure Switch (Part Code S000760044)

When it is necessary to indicate that the low-pressure nitrogen piping is pressurized, a pressure switch may be added to the low-pressure piping. The pressure switch shall be FM Approved.

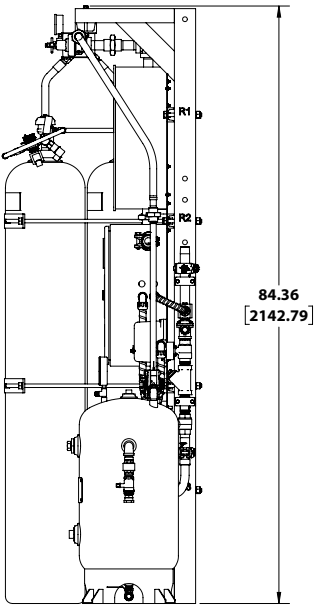
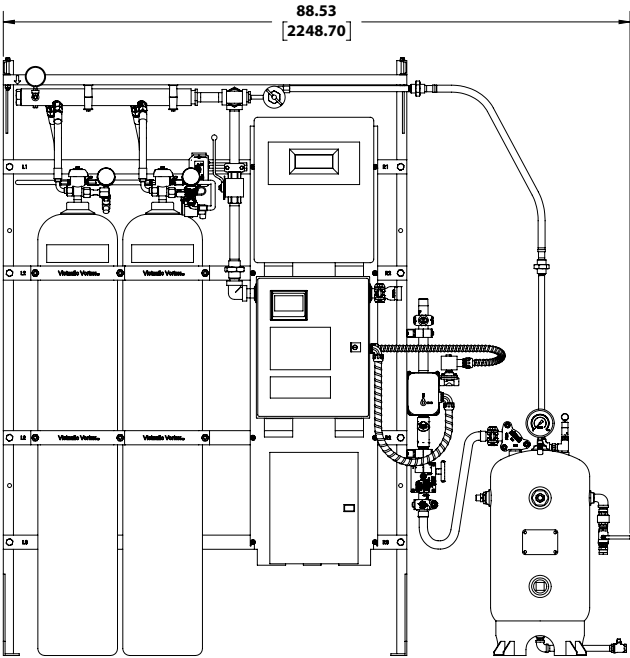
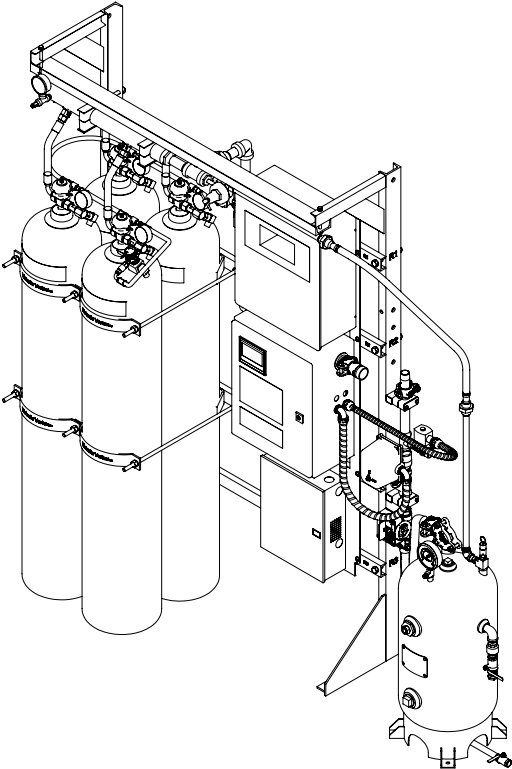
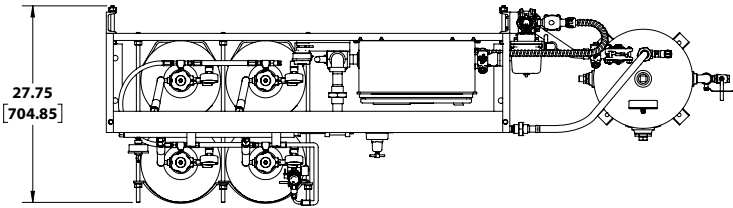
When additional monitoring of system discharge and alarm state is required, an auxiliary pressure switch may be installed in the hybrid emitter low-pressure nitrogen piping. Nitrogen flows when the low-pressure nitrogen piping is pressurized. The nitrogen pressure switch shall be set to match the water turn-on pressure of the Victaulic Vortex™ Panel, which will provide the best indication of when hybrid media is being discharged. Acceptance testing of the pressure switch requires a discharge test with nitrogen, removal of the pressure switch from the system for bench testing, or application of static pressure to the low-pressure hybrid emitter piping.

### Pressure Relief Valve (Part Code S010951RLV)

A pressure relief valve is required in single-enclosure systems where the combined flow capability of the hybrid emitters is less than 150 SCFM/ 255 m<sup>3</sup>/hr to ensure that pressure does not build up greater than the pipe rating. 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).

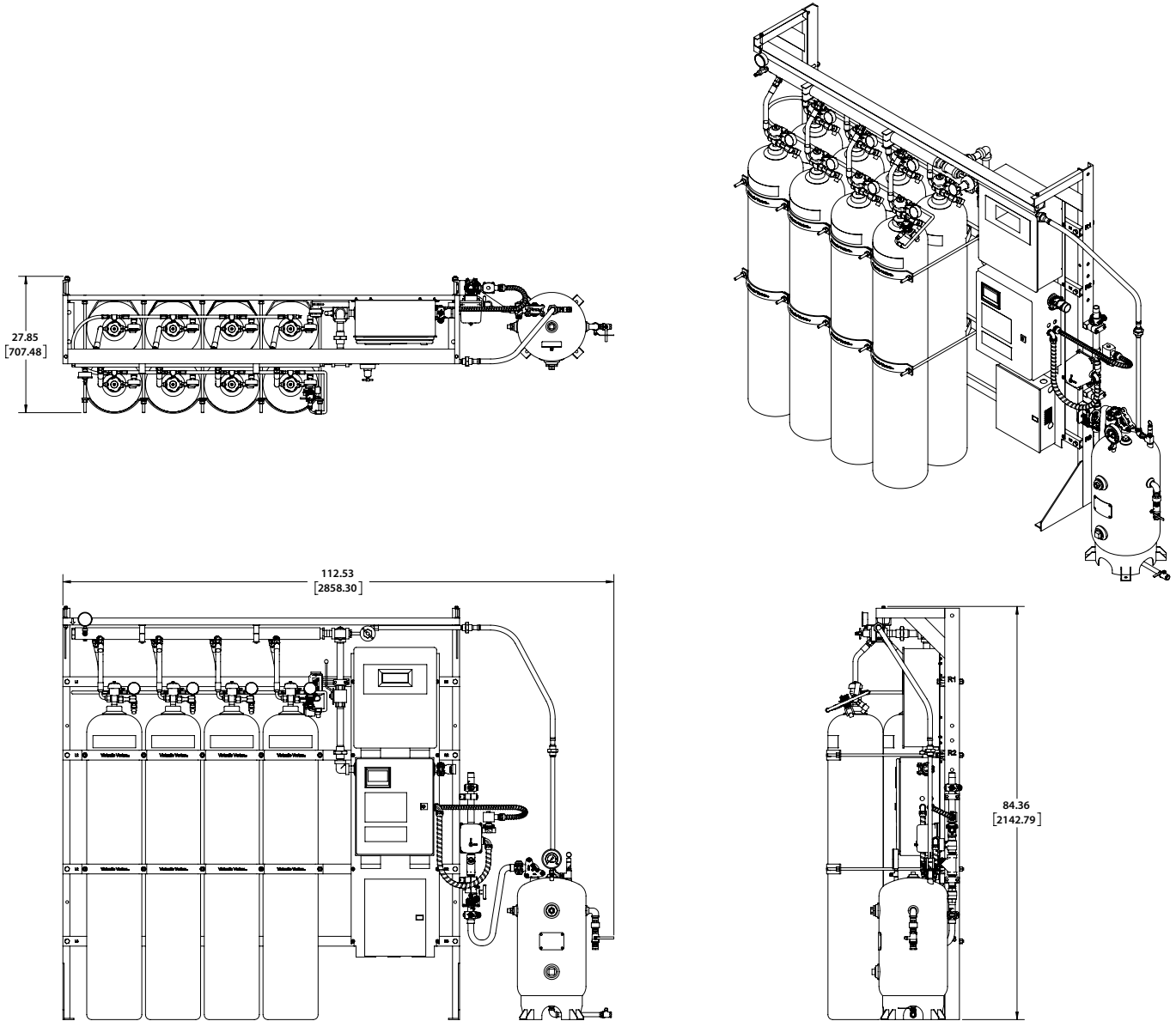
# SECTION V COMPONENTS

## 1 TO 4 CYLINDERS, PRE-ENGINEERED ASSEMBLY LAYOUT



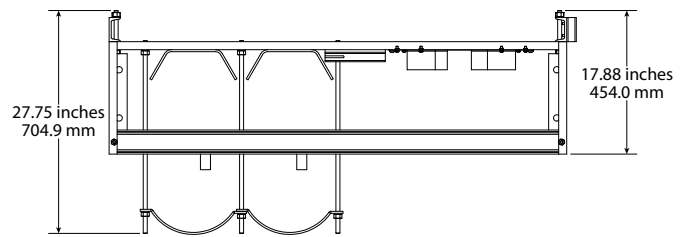
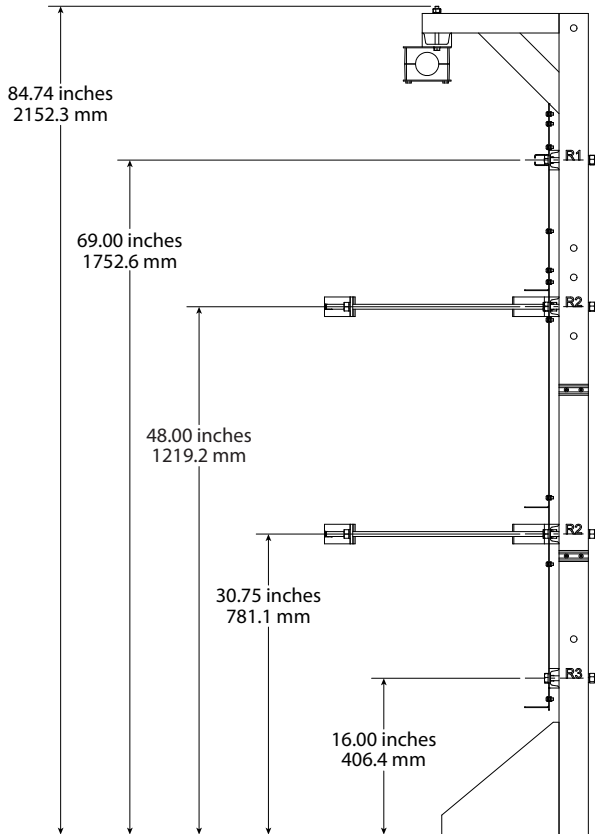
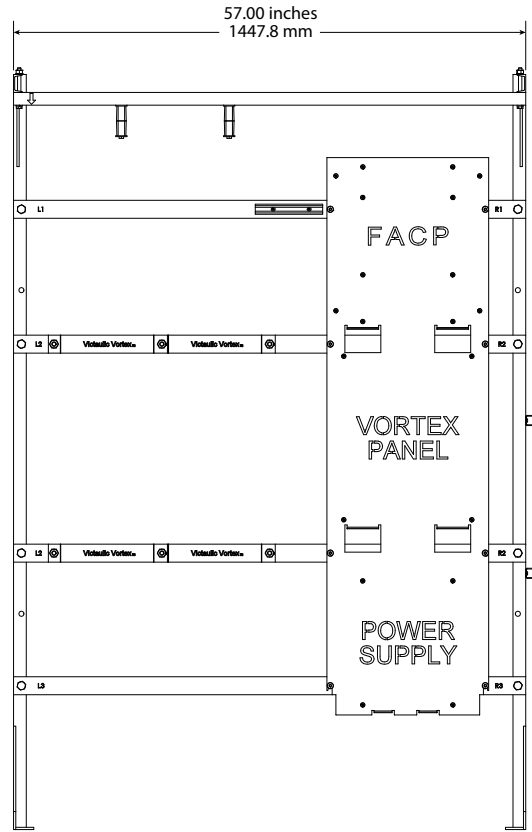
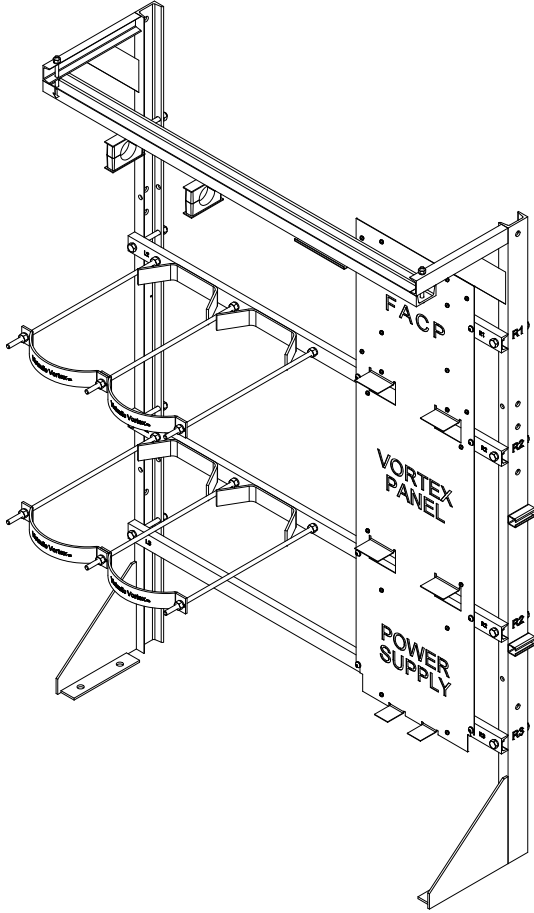
**NOTE:** Recommended clearance for 4 cylinder unit is 96" of wall space, 96" of height clearance, and 78" from wall. This allows for adequate space for the installation of the unit, piping, FACP components, wiring, and future service requirements for the system.

## 5 TO 8 CYLINDERS, PRE-ENGINEERED ASSEMBLY LAYOUT

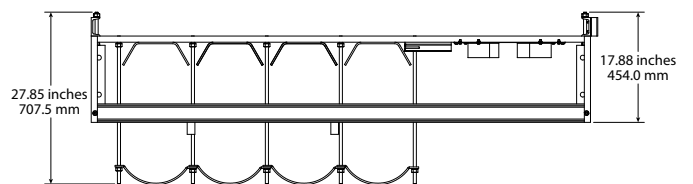
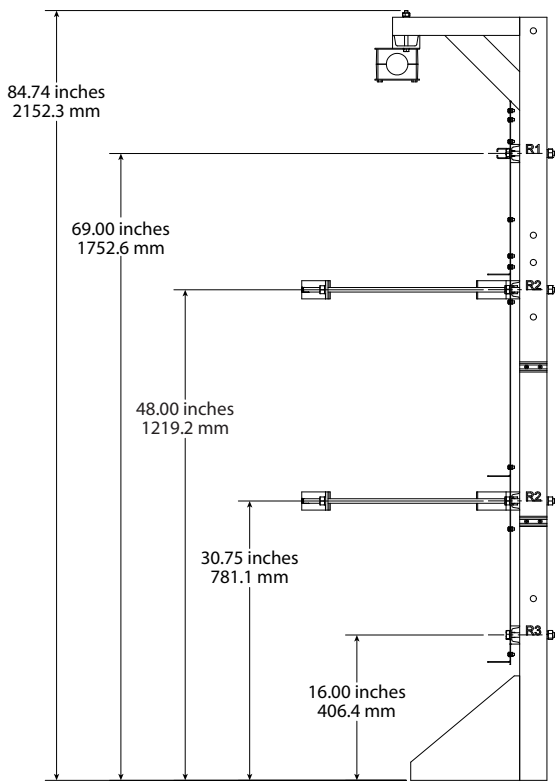
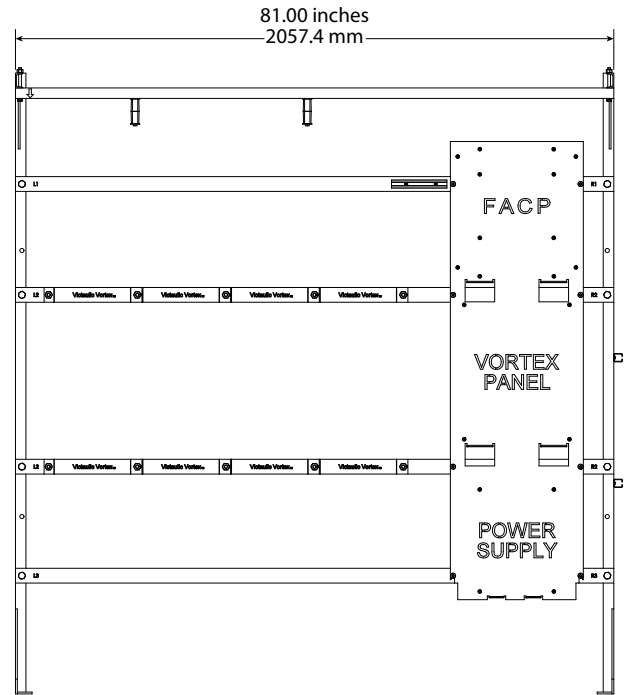
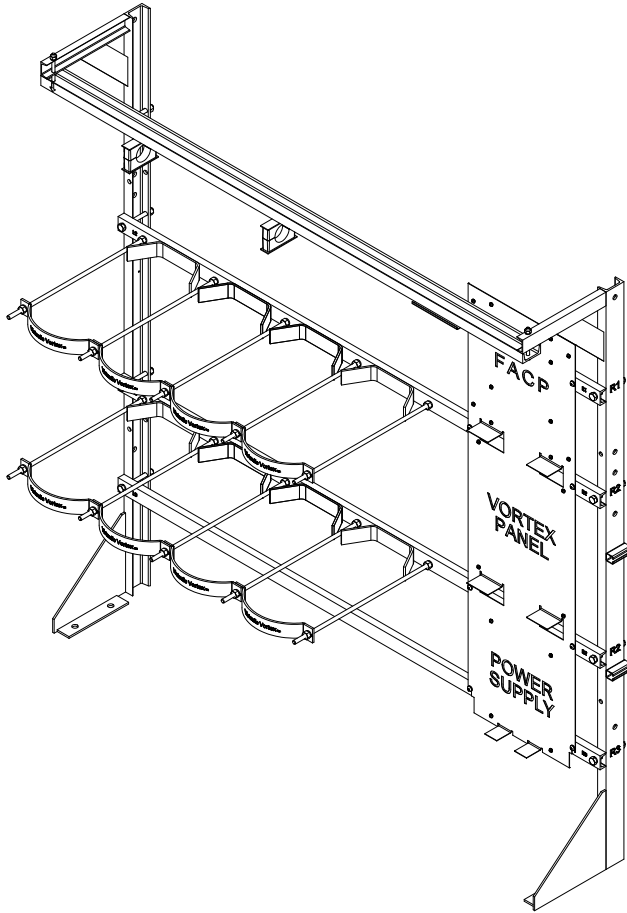


**NOTE:** Recommended clearance for 8 cylinder unit is 128" of wall space, 96" of height clearance, and 78" in from wall. This allows for adequate space for the installation of the unit, piping, FACP components, wiring, and future service requirements for the system.

**STRUCTURAL STEEL RACK ASSEMBLY, 1 TO 4 CYLINDERS, PRE-ENGINEERED**



**STRUCTURAL STEEL RACK ASSEMBLY, 5 TO 8 CYLINDERS, PRE-ENGINEERED**

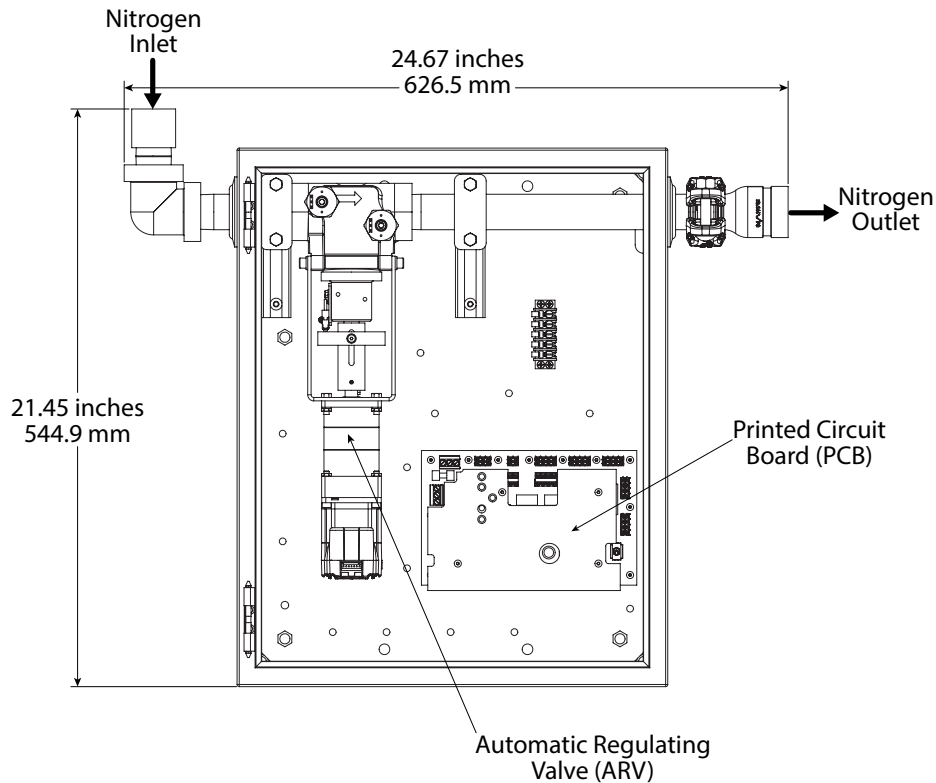


## VICTAULIC VORTEX™ PANEL WITH EXTERNAL WATER CONTROL VALVE AND DRAIN VALVE

The Victaulic Vortex™ Panel is IP 52/NEMA 12 rated and houses the Automatic Regulating Valve (ARV) and Printed Circuit Board (PCB). The Victaulic Vortex™ Panel is available with a 1-inch/33.7-mm ARV. The external water control valve and drain valve come with ½-inch conduit and wire leads that are wired to a terminal block inside the panel.

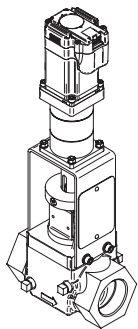
The Victaulic Vortex™ Panel is available as Active Release. Active Release Panels begin opening the ARV when nitrogen pressure is detected at the inlet to the panel. An Active Release Panel requires, at minimum, one 24VDC release signal from the agent-releasing FACP to operate the primary solenoid release assembly. When manual discharge is required, Active Release Panels begin discharging when nitrogen pressure is detected at the inlet.

Power is required for the panel to operate, even when nitrogen is manually released. A battery backed-up power supply is required and supplied with the Victaulic Vortex™ Pre-Engineered Unit.



Victaulic Vortex™ Panel, Active Release, 1-inch/33.7-mm Assembly Shown Above

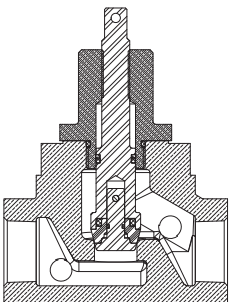
## VICTAULIC VORTEX™ PANEL COMPONENTS

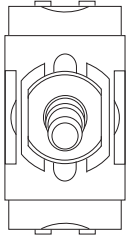


### ARV

The ARV is located in the Victaulic Vortex™ Panel 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<sup>2</sup>/290 mm<sup>2</sup>.





**Maintenance Switch**

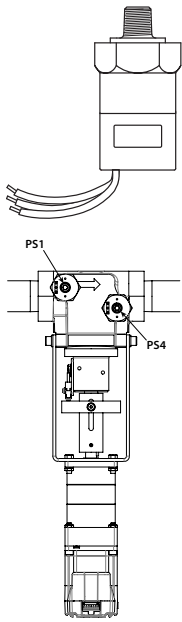
The maintenance switch and yellow supervisory indicator light are provided on each Victaulic Vortex™ Panel. The maintenance switch is designed to prevent the ARV from operating during testing situations. Additionally, the maintenance switch will reset or close the ARV when its end-of-stroke is reached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

When the maintenance switch is in the maintenance position, and if the FACP release circuit is wired into R input contact and out of S output contact on the PCB to the solenoid, this switch will disconnect the solenoid release circuit internal of the PCB via relay.



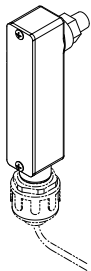
**Inlet and Outlet Pressure Switches**

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 1/8-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-enclosure system. Refer to Section IV for detailed information on pressure transducer location.

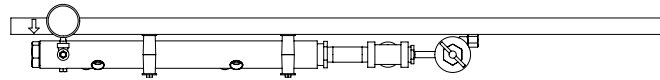
Explosion-proof pressure transducers are available. Contact Victaulic for specific dimensions and wiring requirements (scan QR code on front cover for contact information for your region).

## MANIFOLD ASSEMBLIES

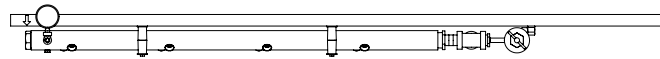
### Manifold with Water Tank Regulator Kit and Gauge/Bleeder

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.

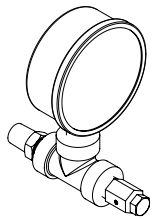
Class 3000 ¾-inch Male NPT plugs are provided to plug unused inlet connections.



4-Port Manifold

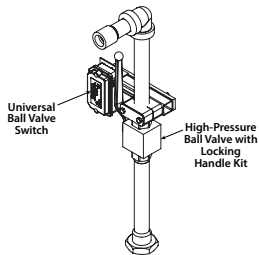


8-Port Manifold



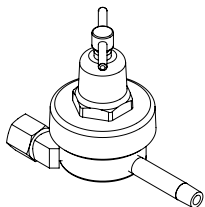
### Nitrogen Bleed Valve and Pressure Gauge Assembly

The nitrogen bleed valve and pressure gauge is shipped separately as an assembly. The assembly shall be threaded into the 1/4" NPT port provided on the high pressure manifold.



### Manifold Isolation Valve

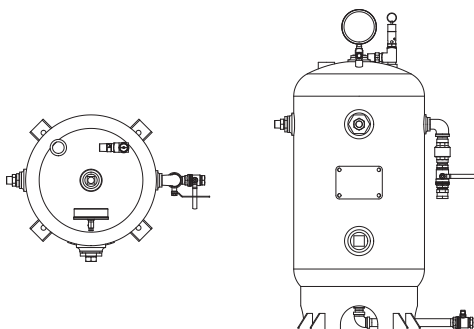
The manifold isolation valve and universal ball valve switch are included in the Victaulic Vortex™ Pre-Engineered System.



### Water Tank Regulator Kit

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.

## WATER TANK



Nominal Size gallons/liters	Part Codes for Red Tank with Trim
10 38	S100950140
30 114	S300950141
60 227	S600950140

A Victaulic-supplied carbon steel, epoxy-lined (ASME BPVC Sec VIII, Div 1) water tank is required. 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. Float switch electrical specification rating is 0.3 Amp DC @ 0-30 Volts [20 VA].

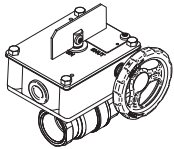
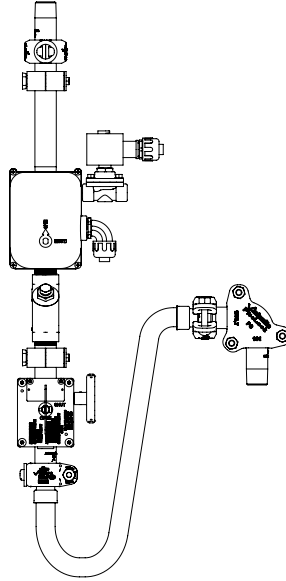
The water outlet is taken from a siphon tube. The water outlet for the 10-gallon/38-liter tank is located at the top of the tank. For all other tank sizes, the water outlet is located on the lower-left-hand side. A connection is provided at the bottom outlet of the water tank for drain accommodations.

Refer to the "Water Tank Filling Procedure" in Section XI for complete filling instructions. Refer to Victaulic publication 70 .05 for dimensions and performance.

**WARNING**

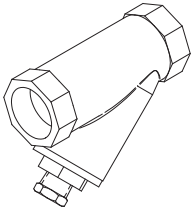
- Adequate water supply shall be available and shall be supervised by the agent-releasing FACP.  
Failure to follow this instruction could result in serious personal injury and/or property damage.

**WATER TANK TRIM KIT, PRE-ENGINEERED**



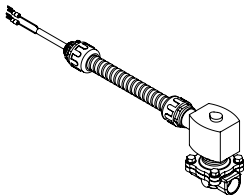
**System Water Control Valve**

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.



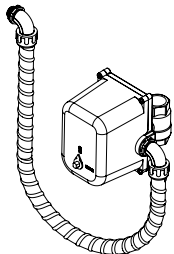
**System Water Strainer**

The system water strainer is a 1-inch FPT, 100-mesh “Y” strainer that ships with the Victaulic Vortex™ Pre-Engineered System.



**Water Trim Kit Drain Valve**

The drain valve provides drainage of water lines after system discharge. The valve is a ½-inch normally-open 24VDC/11.6W solenoid. The drain valve will be activated (closed) by a 24VDC signal from the Victaulic Vortex™ Panel PCB to drain water piping from the hybrid emitters after discharge.



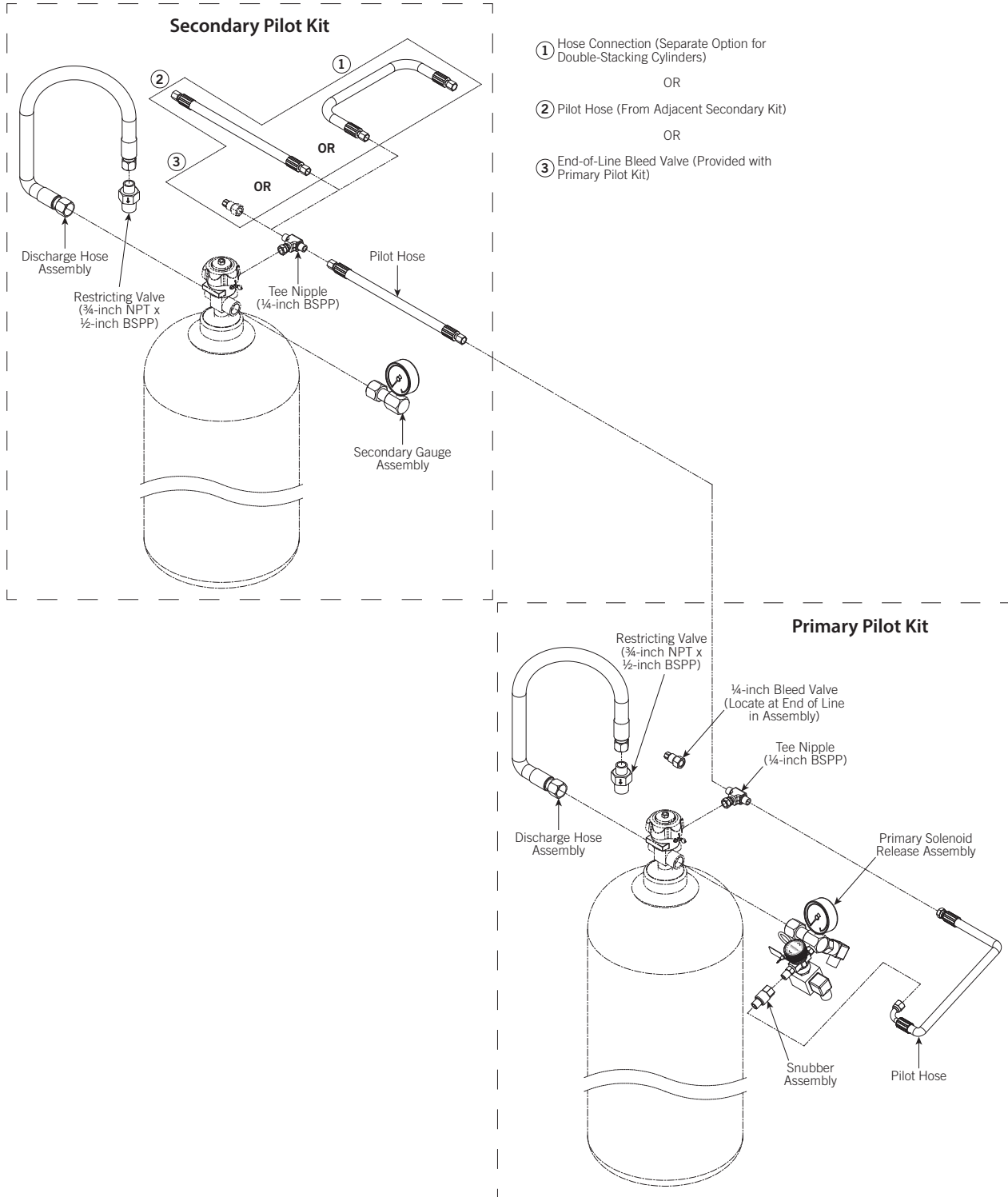
**Water Ball Valve**

The water ball valve is a 1-inch, 24VDC operated valve. The valve is activated (opened and closed) by a 24VDC signal from the Victaulic Vortex™ Panel PCB. During discharge, the water ball valve will open, allowing water to flow from the water tank to the hybrid emitter(s). After discharge, the water ball valve will close and water lines will drain through the water trim kit drain valve.

## 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 the 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 Victaulic Vortex™ 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™ Pre-Engineered System is designed to begin discharge upon pressure being detected at the input to the panel. 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.



## CYLINDERS

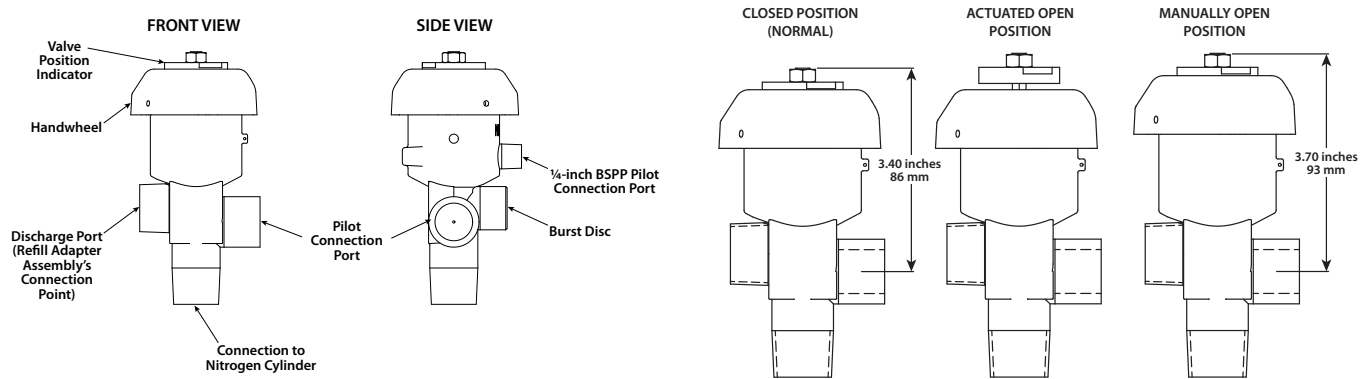
### Cylinder Valve Assembly

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.

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.

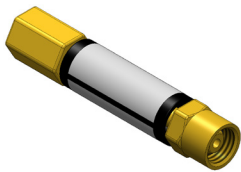
**NOTE:** The discharge port is located higher than the pilot connection port.

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.

## REFILL ADAPTER ASSEMBLY



**Part Code S002950000 for Single-Cylinder Refill Adapter,**

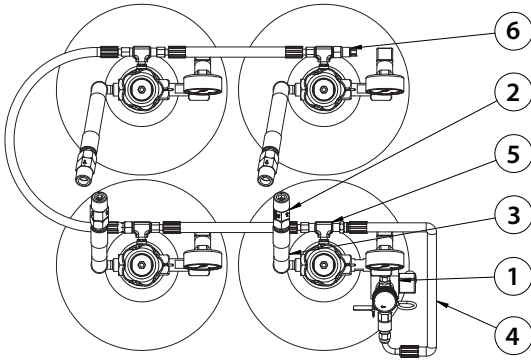
**CGA-580 Inlet**

**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 XII for complete instructions on how to use the refill adapter assembly.

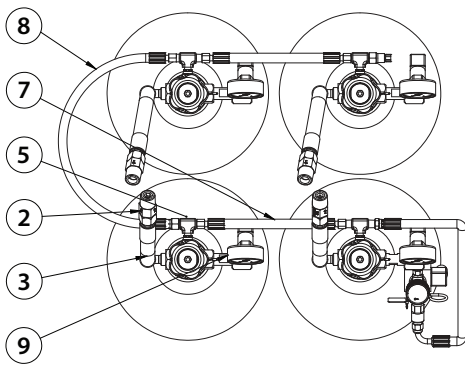
## PRIMARY PILOT KIT FOR 80-LITER CYLINDERS



**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		

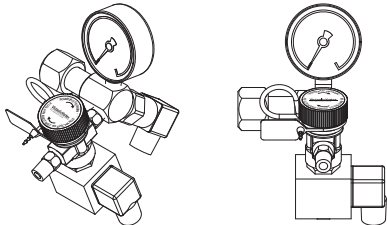
## SECONDARY PILOT KIT FOR 80-LITER CYLINDERS



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

Item	Part Code	Description
2	S000950BA1	Discharge Hose Restricting Valve
3	P000955A29	Discharge Hose, DOT 80L, Right Angle, 13.5" Overall Length
5	S000950BA2	¼" BSPP/Rp Pilot Line Tee Nipple
7	S000950P32	¼" Pilot Hose for Adjacent Cylinders, 11.8" Overall Length
8	S000950P70	¼" Pilot Hose for Cylinder Rows, 27.5" Overall Length
9	P000951135	Secondary Gauge Assembly with Pressure Switch
Part Code for Entire Secondary Pilot Kit - S000950PSP		

### Primary Solenoid Release Assembly

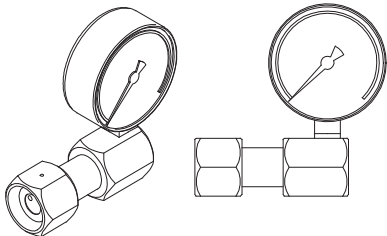


The primary solenoid release assembly includes a pressure gauge, a solenoid with manual release, and a pressure switch. A coil position monitoring switch is available. Every primary solenoid release assembly provides a means to electrically (24VDC) and manually release the system.

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.

### Secondary Gauge Assembly with Pressure Switch



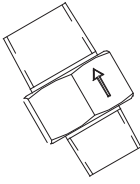
The secondary gauge assembly attaches to the pilot connection port and includes a pressure gauge and pressure switch. The gauge displays the pressure within the cylinder. The pressure switch provides a supervisory output for each cylinder. To adjust the pressure setting of the switch, apply a known pressure 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). To adjust pressure switch setpoint, refer to the "Primary Solenoid Release Assembly" section above.

## NOTICE

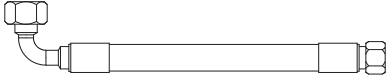
- Verify that the threaded nut of the primary solenoid release assembly and the threaded nut of the secondary gauge assembly are tightened completely to the pilot connection port of the cylinder valve during installation.

**Discharge Hose Restricting Valve**



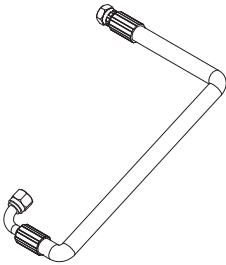
The supplied discharge hose restricting valves are installed between the discharge hoses and manifold and are specially designed to provide controlled nitrogen flow. The discharge hose restricting valves allow for full nitrogen flow from the cylinder to the manifold and restricted flow from the manifold 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**



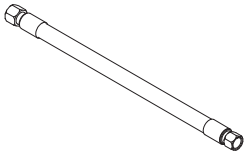
The discharge hose has ¾-inch BSPP/Rp x ½-inch BSPP/Rp connections and is used to transmit nitrogen gas from the cylinder valves to the manifold.

**Primary Pilot Hose**



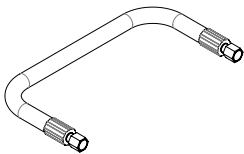
The primary pilot hose is a ¼-inch ID reinforced rubber hose with a 90° elbow and ¼-inch BSPP/Rp connections; this hose is used to connect the outlet of the releasing solenoid to the tee connection used on the cylinder valve.

**Pilot Hose for Adjacent Cylinders**



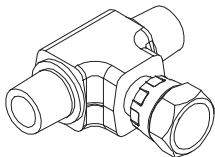
The pilot hose for adjacent cylinders is a ¼-inch ID reinforced rubber hose that is used to connect the tee connections on the cylinder valves. The standard pilot hose is 11.8 inches/300 mm in length and is provided to accommodate connection of cylinders.

**Pilot Hose for Stacked Rows**



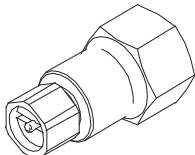
The pilot hose for stacked rows is a ¼-inch ID reinforced rubber hose that is used to connect the tee connections on the cylinder valves. The pilot hose is 27.5 inches/700 mm in length and is provided to interconnect cylinder rows.

**Pilot Line Tee Nipple**



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**



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.

## HYBRID EMITTERS



Standard \ Hybrid Emitter



Escutcheon Hybrid Emitter



PVDF Hybrid Emitter

### NOTICE

- Fluid supply pressure is dependent upon system piping configurations.
- 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.

3/8", 1/2", and 5/8" hybrid emitters are available for use in the Victaulic Vortex™ Pre-Engineered System. These hybrid emitters are available in Standard Stainless, Escutcheon, and PVDF styles. Reference Victaulic publication 70.12 for approvals, complete material specifications and dimensional information.

**\*It is the customer's responsibility to verify hybrid emitter material compatibility (refer to Section IV 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 Victaulic publication 70.12 for additional information.

## HYBRID EMITTER ACCESSORIES

The water flow control cartridge, installed at each hybrid emitter, regulates water flow if the required inlet pressure at the water flow control cartridge is maintained. Refer to Section IV.

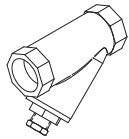
A strainer and water flow control cartridge shall be installed for each hybrid emitter. The strainer and water flow control cartridge shall be installed in an accessible location for servicing, and it shall be installed in close proximity to the hybrid emitter (maximum of 3 feet/0.9 meters, or as required by water delivery time). The strainer protects the water flow control cartridge and hybrid emitter from potential debris.

### ⚠ WARNING

- Hybrid emitter selection and installation shall be based upon the hazard being protected.

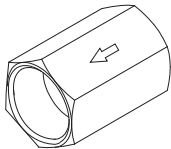
Failure to follow this instruction will cause improper system operation, resulting in death or serious personal injury and property damage.

#### Hybrid Emitter Water Strainer



The hybrid emitter water strainer is a 100-mesh "Y" strainer. Piping size is 3/4-inch FNPT.

#### Water Flow Control Cartridge



The water flow control cartridge controls the amount of water flow to each hybrid emitter and contains a 3/4-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 page 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, 3/4-inch NPT	FM Approved
K000953X13	Water Flow Kit Containing 0.13 GPM Water Flow Control Cartridge, Stainless, 3/4-inch NPT	FM Approved
K000953026	Water Flow Kit Containing 0.26 GPM Water Flow Control Cartridge, Brass, 3/4-inch NPT	FM Approved
K000953X26	Water Flow Kit Containing 0.26 GPM Water Flow Control Cartridge, Stainless, 3/4-inch NPT	FM Approved
K000953053	Water Flow Kit Containing 0.53 GPM Water Flow Control Cartridge, Brass, 3/4-inch NPT	FM Approved
K000953X53	Water Flow Kit Containing 0.53 GPM Water Flow Control Cartridge, Stainless, 3/4-inch NPT	FM Approved
K000953079	Water Flow Kit Containing 0.79 GPM Water Flow Control Cartridge, Brass, 3/4-inch NPT	-
K000953X79	Water Flow Kit Containing 0.79 GPM Water Flow Control Cartridge, Stainless, 3/4-inch NPT	-
K000953106	Water Flow Kit Containing 1.06 GPM Water Flow Control Cartridge, Brass, 3/4-inch NPT	FM Approved
K000953X06	Water Flow Kit Containing 1.06 GPM Water Flow Control Cartridge, Stainless, 3/4-inch NPT	FM Approved

## SPARE PARTS LIST

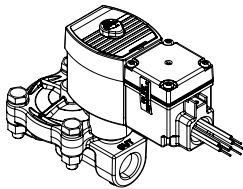
Description	Part Code
Emitter Cap, ¼ - ½-inch, Standard-Style Emitter	P002953260
Emitter Cap, ⅝-inch Standard-Style Emitter	P006953560
Emitter Cap, Escutcheon-Style Emitter	P006953522
O-Ring Kit, Primary/Secondary	K000950KIT
Discharge Hose, 49L/50L, Rt. Angle, 22.25-inch OAL	P000955B29
Discharge Hose, 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

Description	Part Code
Primary Solenoid Release Assembly	S000950B22
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
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

Victaulic recommends Certified individuals have spare items with them that have a high potential for wear, damage, or loss, during installation. This includes hose O-ring kit (K000950KIT,) PCB fuse (P000951RFP,) and crush washer for bleeder valve (P000950018.) Any one of these items missing or being unusable can prevent final installation or proper operation of the Victaulic Vortex™ Pre-Engineered System.

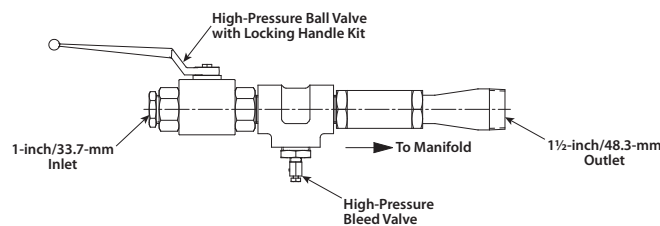
## OPTIONAL SYSTEM COMPONENTS

### Supervised Auxiliary Drain Valve – Part Code S004N69106



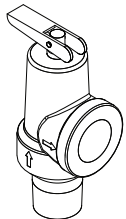
The supervised auxiliary drain valve provides additional drainage of water lines after system discharge. The valve is a ½-inch normally closed 24VDC/9W solenoid with a fire protection surveillance switch. In installations where it is not possible to slope water piping from the hybrid emitters back to the Victaulic Vortex™ Panel, 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.

### Manifold Fill Assembly – 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.

### Pressure Relief Valve – Part Code S010951RLV for Pressure Relief Valve, 0.85-inch/22-mm Orifice, 1 ½-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 a relief valve, which is available with a 1 ½-inch MNPT inlet (0.85-inch/22-mm orifice).

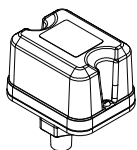
At minimum, relief valves shall be used in single-enclosure systems when the total flow capacity of the emitters is less than 150 SCFM/255 m<sup>3</sup>/hr. The pressure relief valve is installed in the low-pressure nitrogen piping and shall be vented to outside the building (or to a space sufficiently 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.

### Water Tank Pressure Switch – 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).


### Nitrogen Discharge Verification Pressure Switch – Part Code S000760044



The field-adjustable, low-pressure nitrogen pressure switch can be installed in the nitrogen piping downstream of the Victaulic Vortex™ 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).

**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	
Primary Pilot Kit	
Secondary Pilot Kit	
Manifold	
Manifold Isolation Valve Kit	
Cylinder Rack	
Victaulic Vortex™ Panel with External Water Control Valve and Drain Valve	
Pressure Transducer	
Hybrid Emitters	Reference Victaulic Vortex™ submittal 70.12
Water Flow Kit	Reference Victaulic Vortex™ submittal 70.16
Pressure Relief Valve	
Low-Pressure Nitrogen Pressure Switch	
System Water Control Valve	
Water Tank Regulator Kit	
Water Tank Pressure Switch	
Water Tanks	

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# SECTION VI INSTALLATION

## NOTICE

- Maintain 4 feet/1.2 meters of work clearance in front of the Victaulic Vortex™ Pre-Engineered System.
- Open all boxes and verify that all components are provided before proceeding with installation.

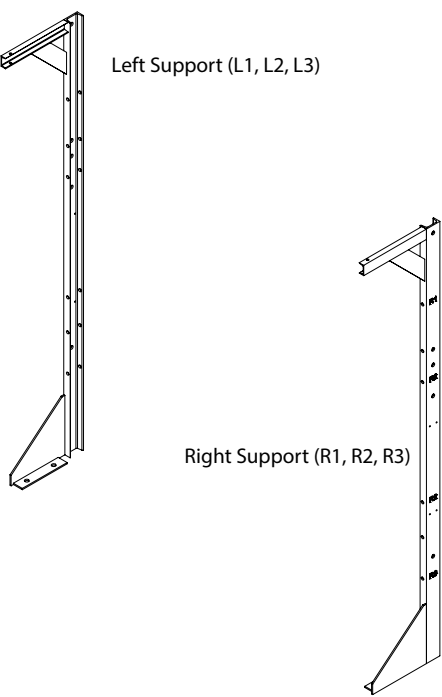
## TOOLS/MATERIALS RECOMMENDED FOR INSTALLATION

- Various Wrench Sizes
  - ¾ inch
  - 7/16 inch
  - 27 mm
  - 32 mm
  - 36 mm
  - 12-inch Adjustable
  - 18-inch Adjustable
- PH1 and PH2 Philips-Head Screwdriver
- 3 ½-mm Blade Width Flat-Head Screwdriver
- Thread Sealant Tape
- High-Pressure Thread Sealant or Dope (Victaulic recommends Loctite® 567 high pressure thread sealant)
- 2 ½-mm Hex Ball End L-Key (Provided with Supervisory Switch)
- 5/32-inch Hex Ball End Screw Holding Bit and Hex Bit Holder Screwdriver (Provided with Victaulic Vortex™ Panel)
- 7/32-inch Hex Ball End T-Handle (Provided with Racking Hardware)
- Pipe Stand
- Vise (Chain Vise or Similar)
- 1 ¼-inch Deep Socket
- ¾-inch Deep Socket

## STRUCTURAL STEEL RACK INSTALLATION

Start with left (L1, L2, L3) and right (R1, R2, R3) support that are labeled accordingly.

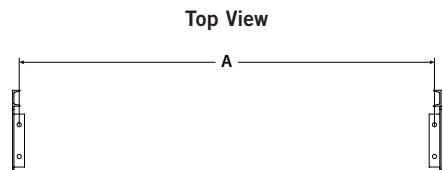
1. Anchor the side supports to the floor by using ¾-inch anchors (not provided). Follow the table below for the dimensions between each floor support based on the configuration selected. Seismic bracing shall be considered in accordance with applicable NFPA Standards, Factory Mutual (FM) requirements, AHJ approval, and National, State, and local codes. **NOTE:** If there is enough space in the work area, step 2 can be completed first.



Left Support (L1, L2, L3)

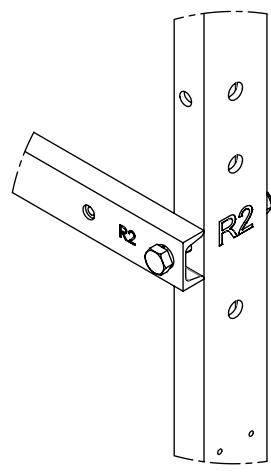
Right Support (R1, R2, R3)

Top View



Rack Configuration	A inches/mm
1-4 Cylinders	54.50 1384
5-8 Cylinders	78.50 1994

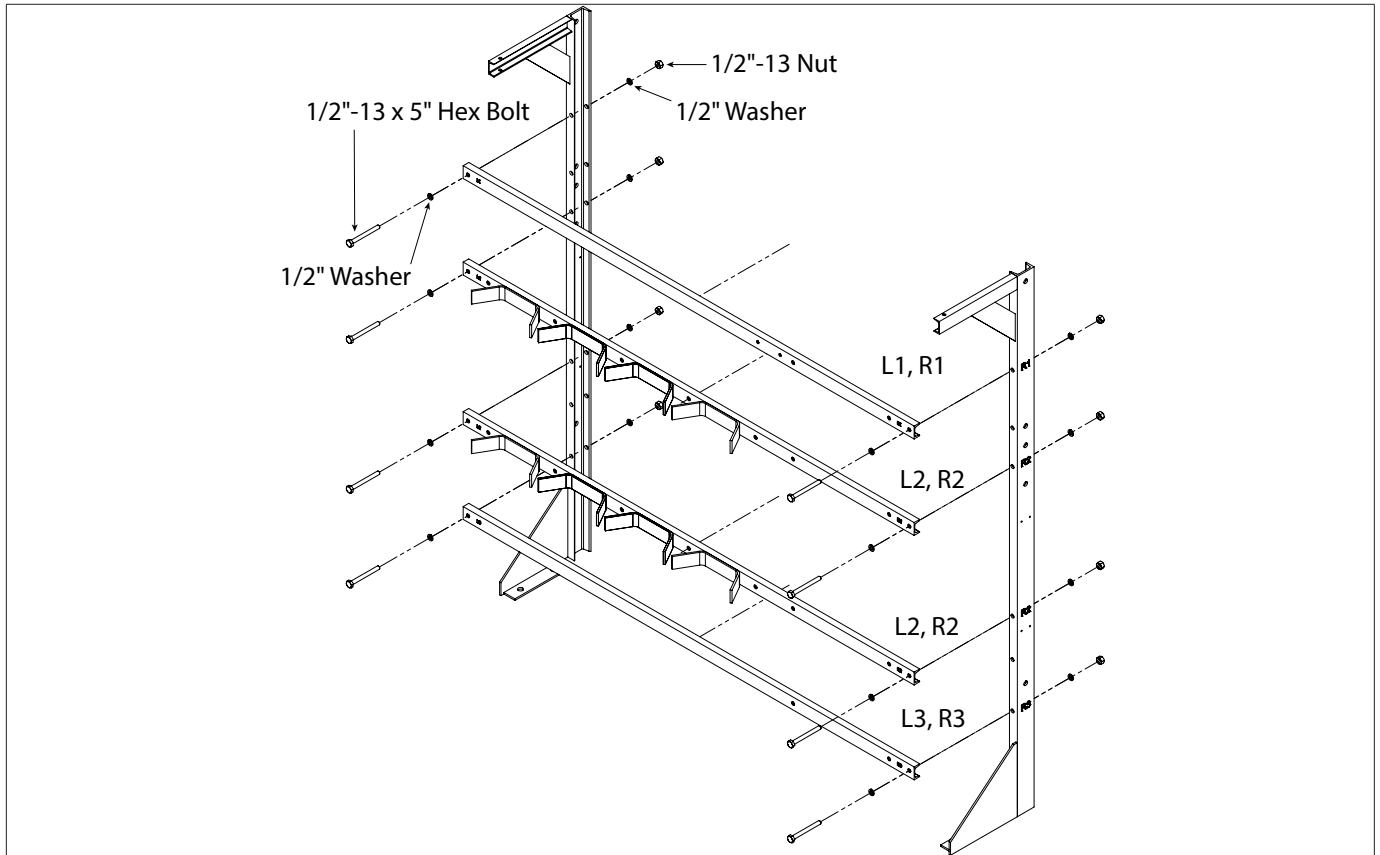
**NOTE:** Offset left and right support from wall to leave enough room for nuts and bolts for panel support rails and tank support rails.



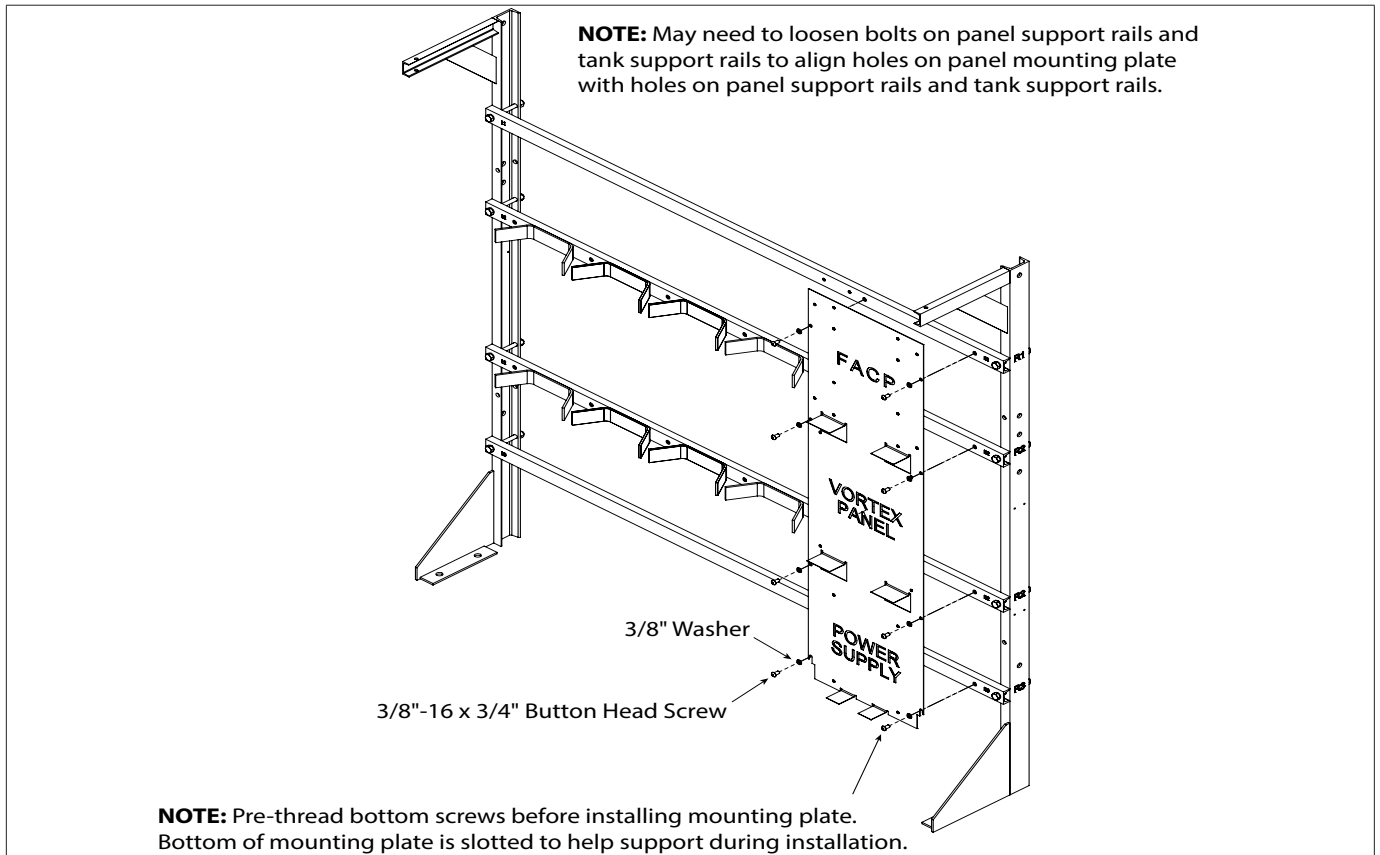
**DETAIL A**

**NOTE:** Support rails and side supports contain corresponding alignment marks ("R2" to "R2").

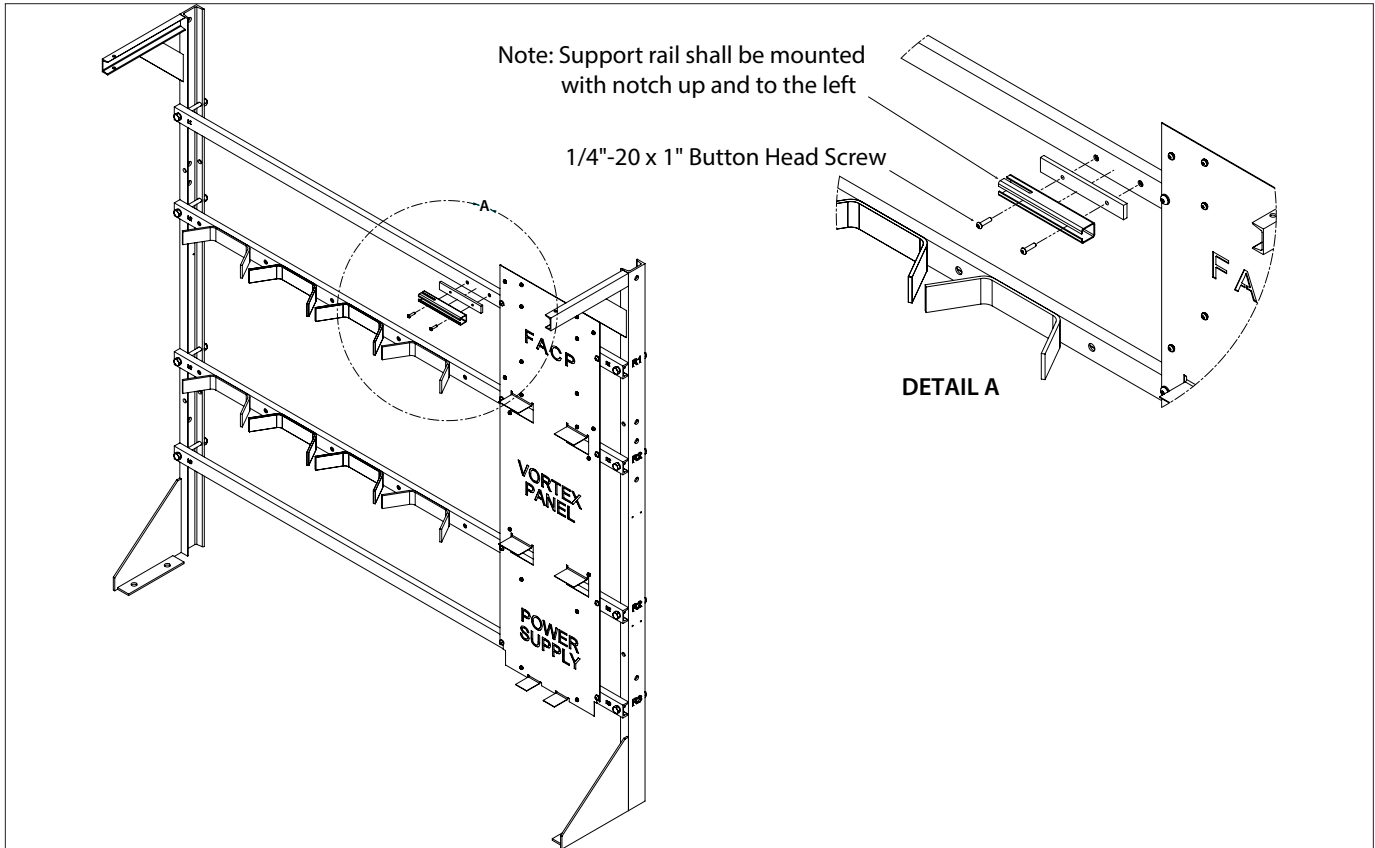
- Using a 3/4-inch deep socket, install panel support rails and tank support rails onto side supports with the 1/2-inch hardware provided.  
**NOTE:** Do not use an impact gun to tighten racking hardware.



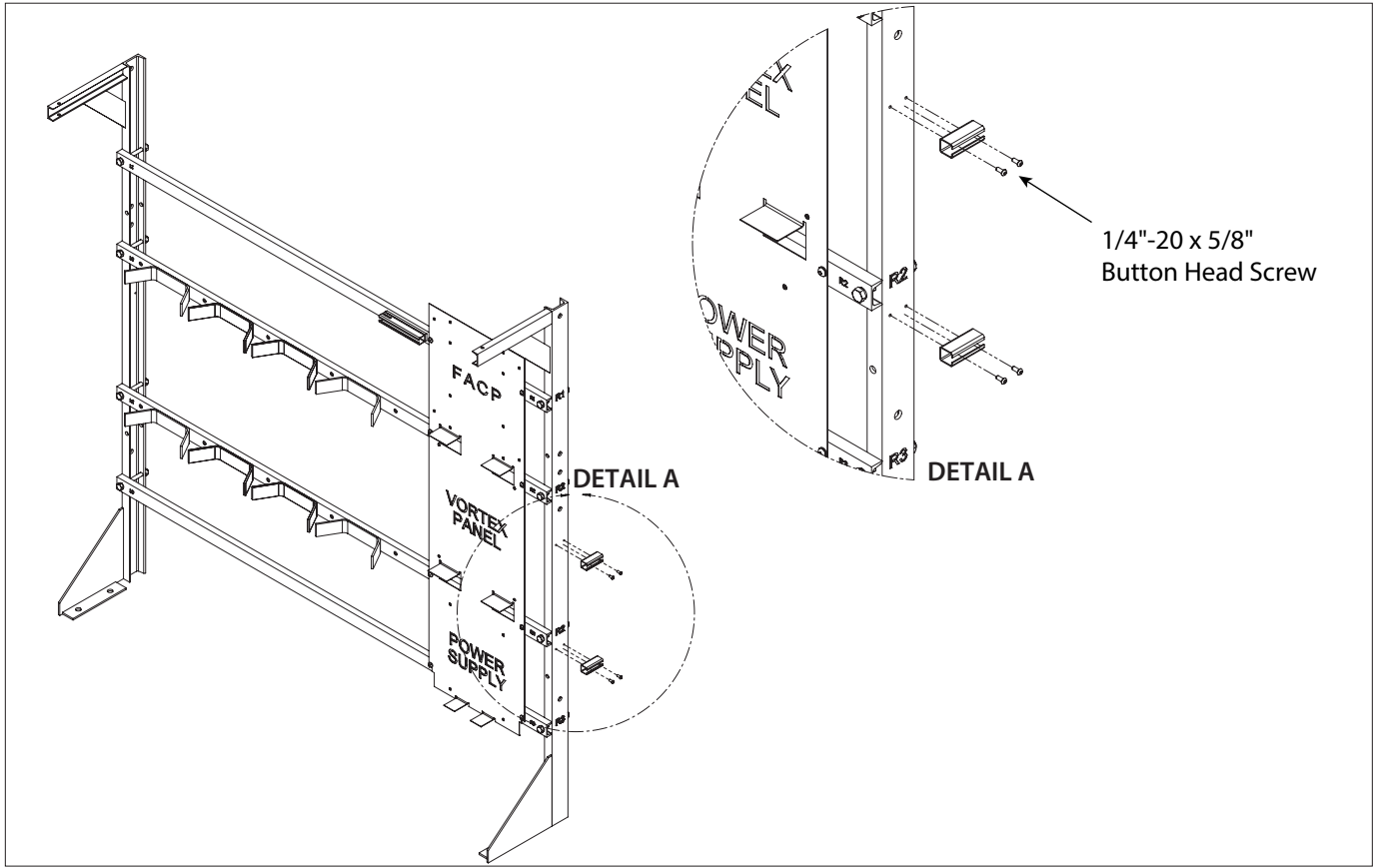
- Using the provided 7/32-inch T-handle hex key, install the panel mounting plate to the panel support with the 3/8-inch hardware provided.



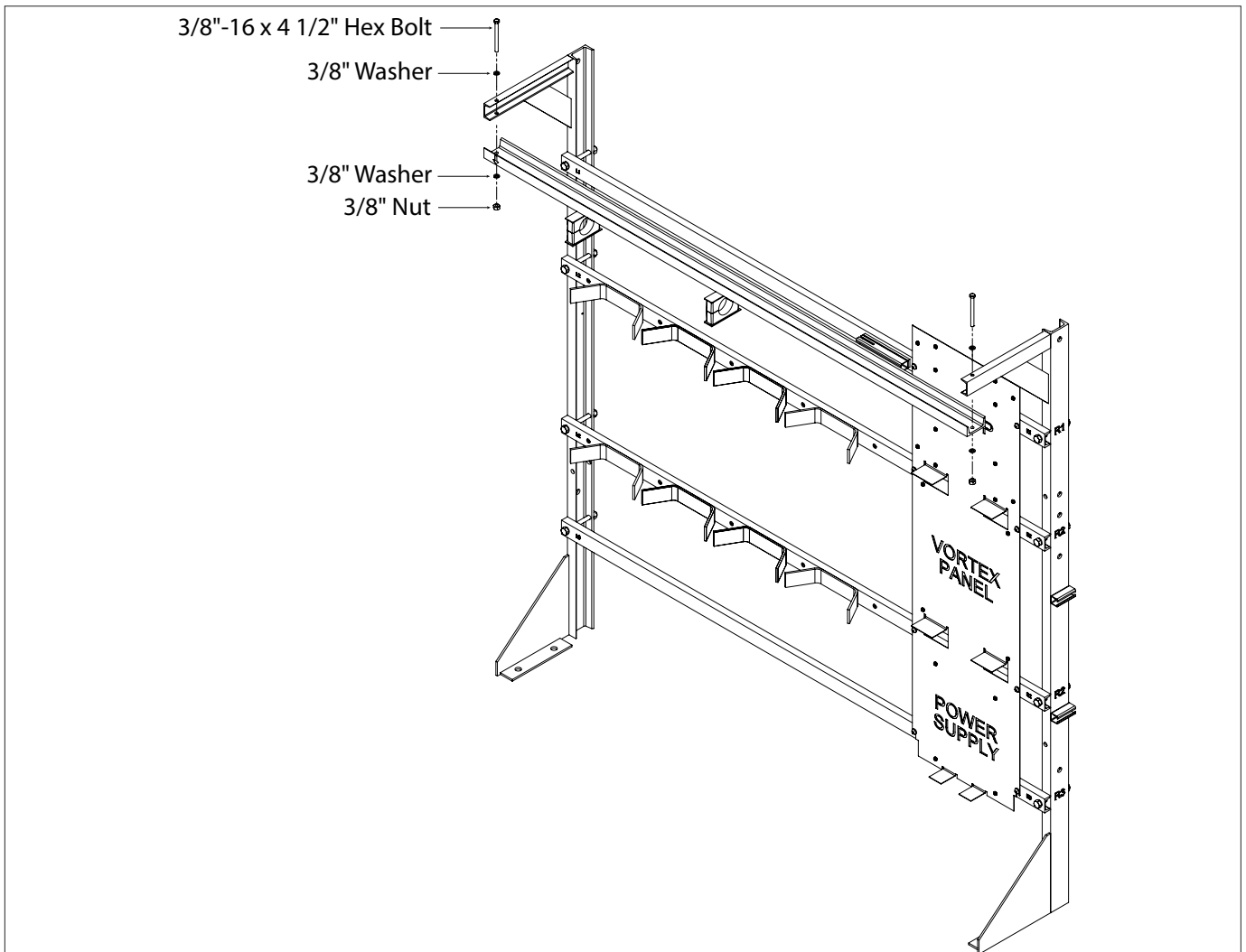
4. Using the provided 5/32-inch hex ball end screw holding bit and hex bit holder screwdriver, mount the spacer plate and isolation valve support rail to the top panel support rail with the 1/4-20 hardware provided.



5. Using the provided 5/32-inch hex ball end screw holding bit and hex bit holder screwdriver, mount the water trim support rails to the right support with the 1/4-20 hardware provided.



6. Using an  $\frac{1}{16}$ -inch socket, install the manifold support with clamps onto the side supports with the  $\frac{3}{8}$ -inch hardware provided.  
**NOTE:** Do not use an impact gun to tighten racking hardware.

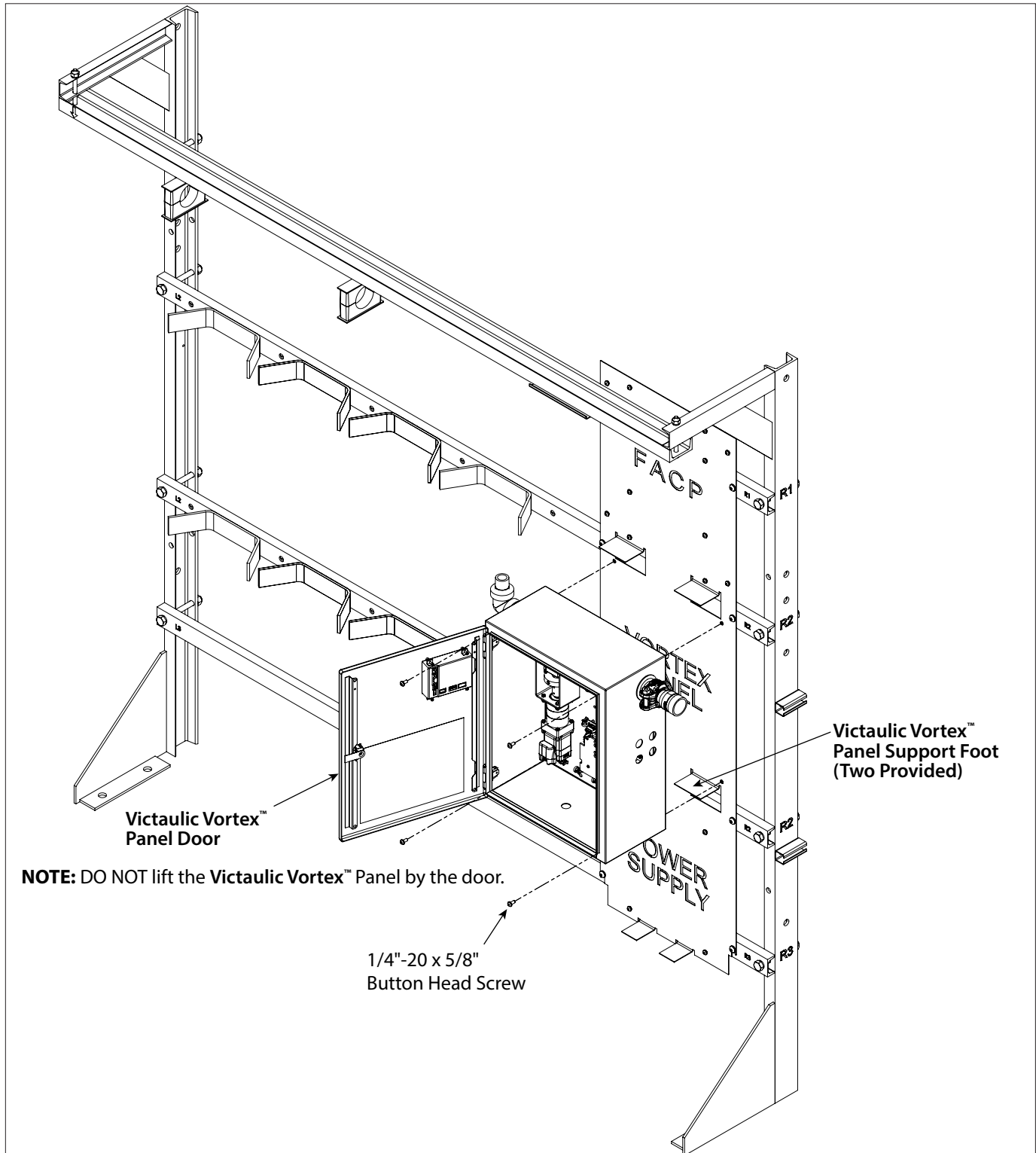


## VICTAULIC VORTEX™ PANEL INSTALLATION

1. Using the provided 5/32-inch hex ball end screw holding bit and hex bit holder screwdriver, mount the Victaulic Vortex™ Panel to the mounting plate on the rack with the ¼-inch hardware provided.

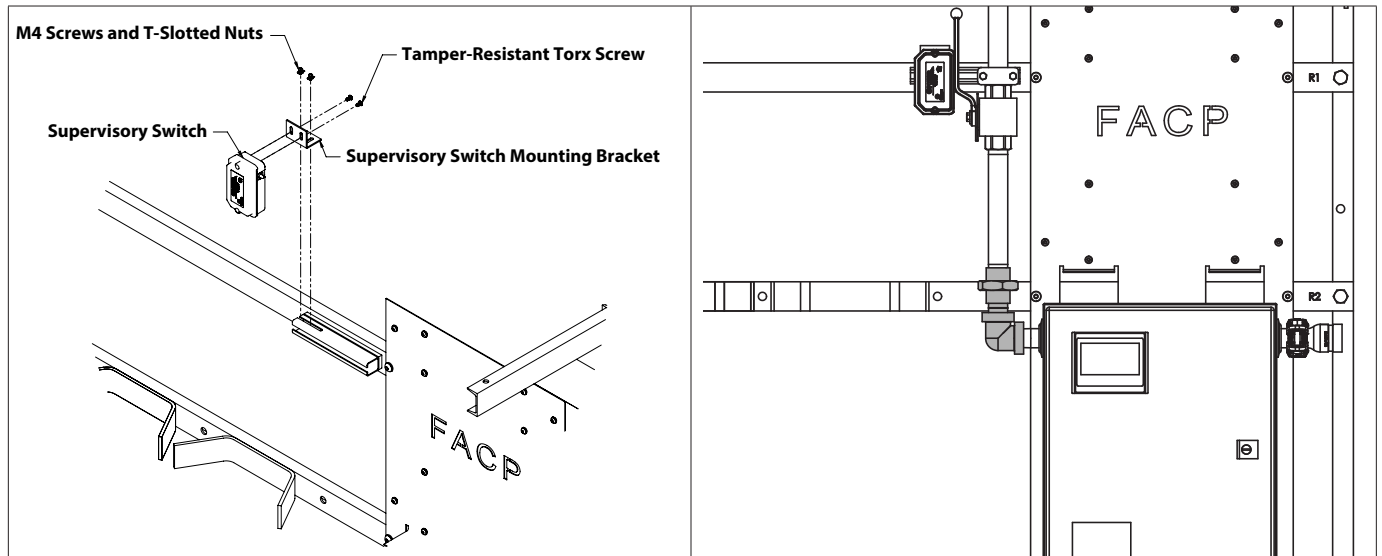
### NOTICE

- The door of the Victaulic Vortex™ Panel must be open during mounting.
- DO NOT lift the Victaulic Vortex™ Panel by the door.
- Rest the Victaulic Vortex™ Panel on the support feet of the mounting plate while tightening the screws.



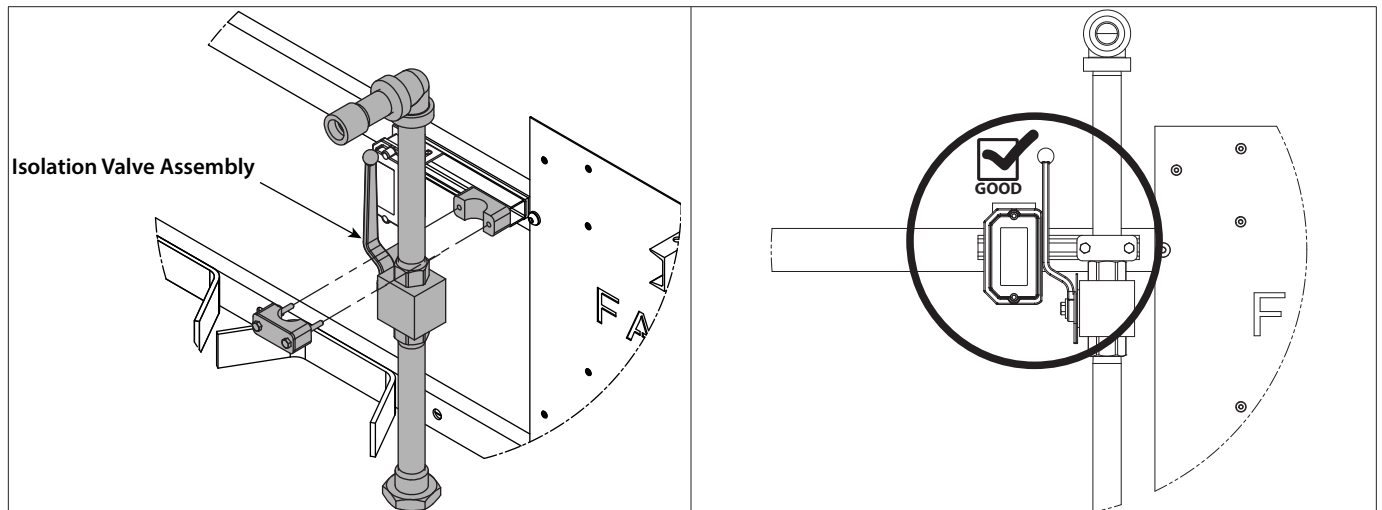
## ISOLATION VALVE AND SUPERVISORY SWITCH INSTALLATION

1. Mount the supervisory switch on the support rail using the L bracket, tamper-resistant torx screw, M4 screws, and T-slot nuts.
2. Align union on valve assembly to union on Victaulic Vortex™ Panel assembly and tighten union.



NOTE: Manifold support with clamps not shown for clarity of other components.

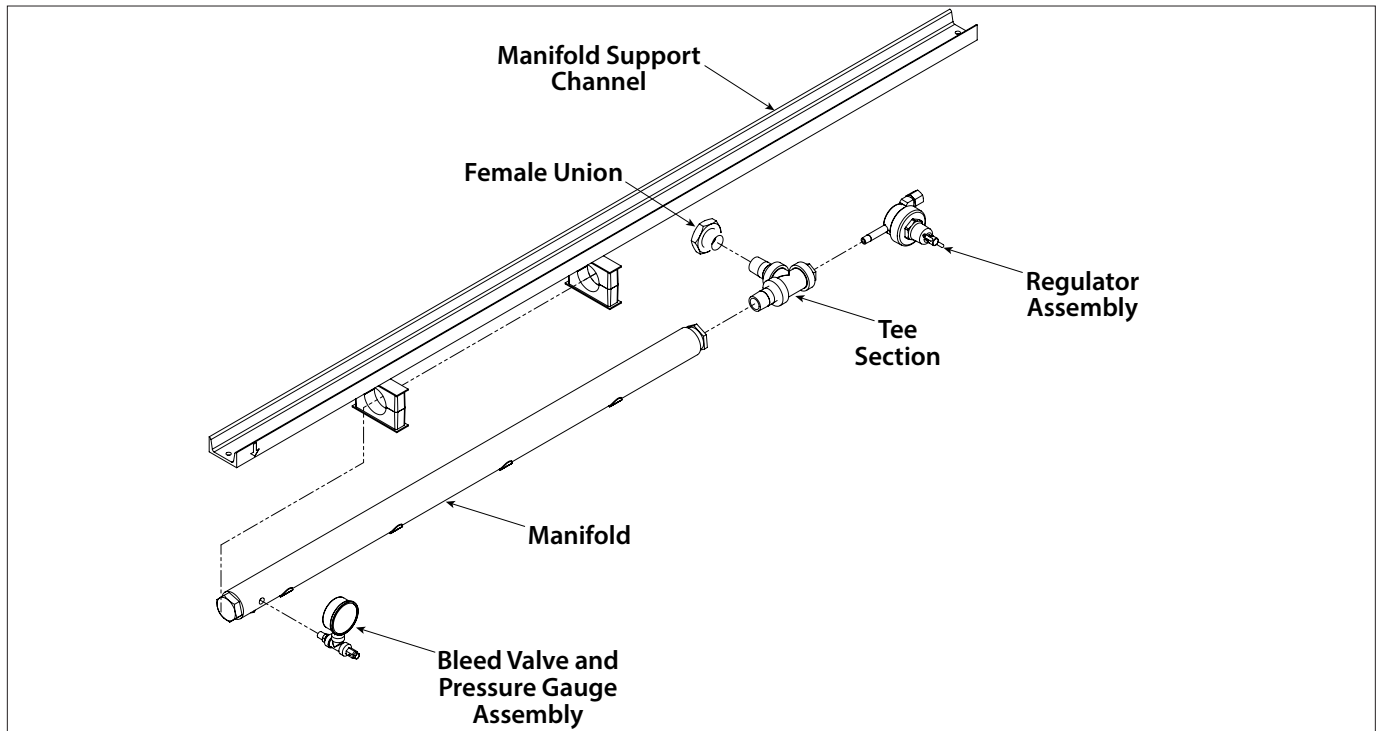
3. Seat the isolation valve assembly in the pipe clamp and mount to the support rail.
4. Adjust the supervisory switch so that it is depressed against the isolation valve handle when the handle is in the open position.



## MANIFOLD INSTALLATION

### NOTICE

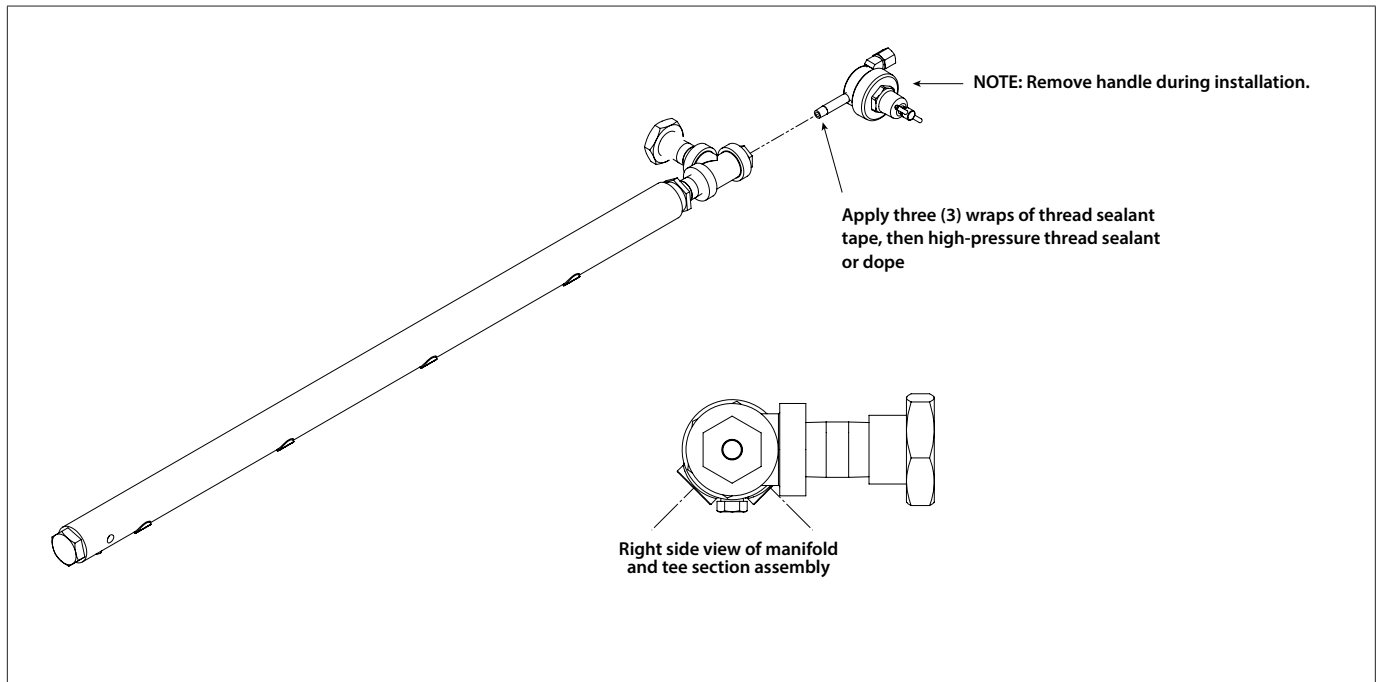
- FOR HIGH-PRESSURE THREADED CONNECTIONS, TIGHTEN UNTIL NO MORE THAN 3 TO 4 THREADS ARE SHOWING.
- ALL HIGH PRESSURE FITTINGS SHALL HAVE THREE (3) WRAPS OF THREAD SEALANT TAPE AND LOCTITE® 567 HIGH PRESSURE THREAD SEALANT APPLIED.



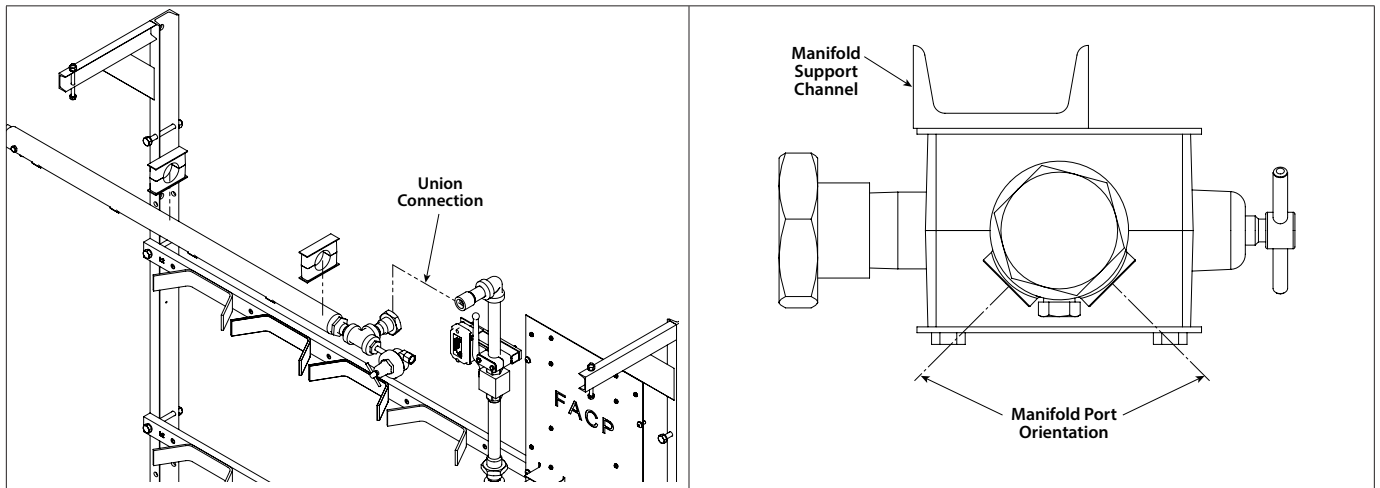
### NOTICE

- The following steps shall be completed before the manifold assembly is installed in the pipe clamps on the rack unit.
- Victaulic recommends placing the manifold in a vise for ease of assembly.

1. Manifold and regulator assembly shall be threaded together in the orientation shown below.  
**NOTE:** Remove regulator handle during installation. Place handle in a secure location. Re-install when setting pressure to water tank.

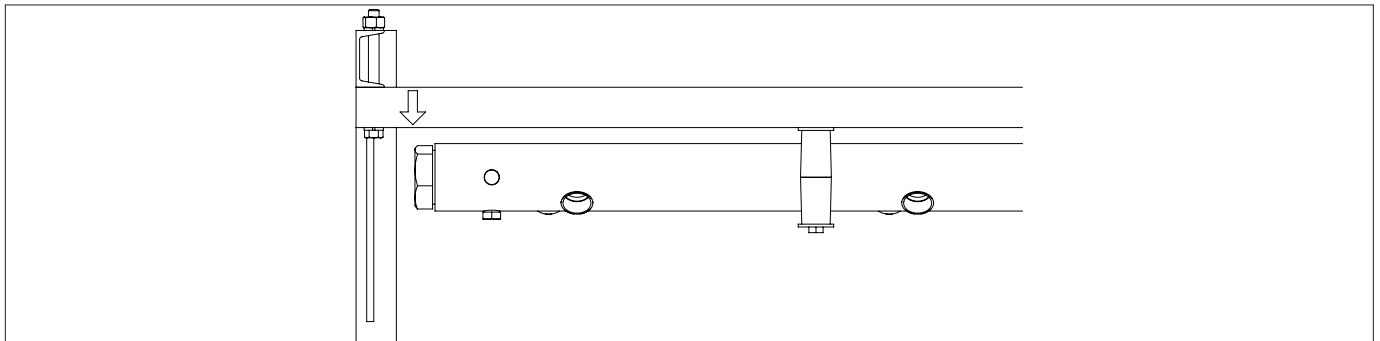


- When mounting manifold assembly in pipe clamps, align female union on manifold assembly with male union on isolation valve assembly. Tighten pipe clamps. Verify manifold ports match orientation shown below.

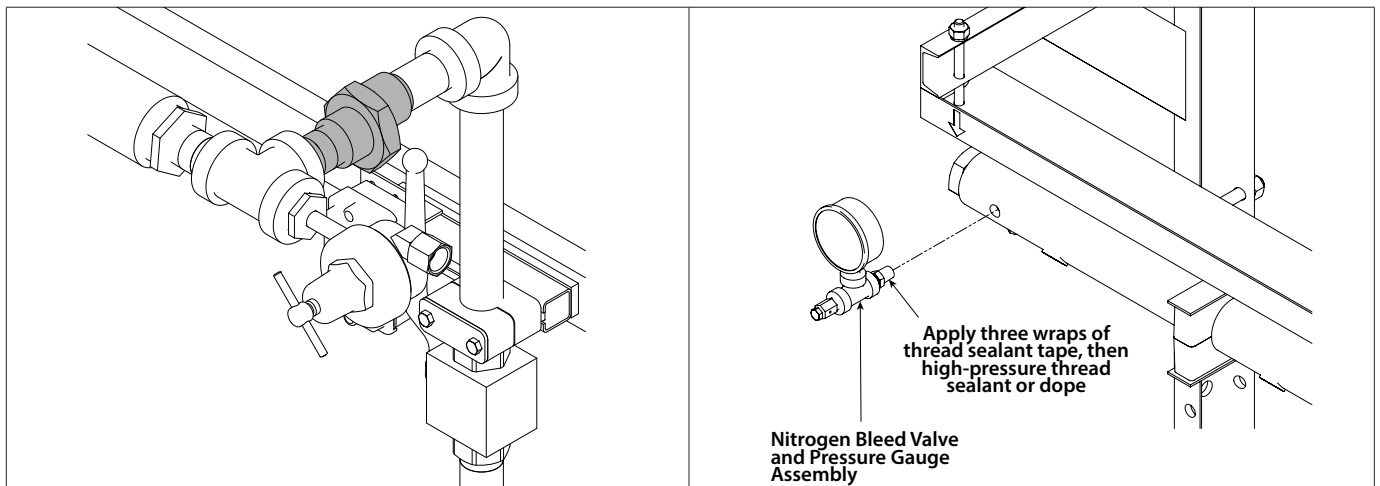


NOTE: Manifold support channel and horizontal rack support (L1/R1) not shown for clarity of other components.

There is an indicator marking on the left side of the manifold support channel that can also be used help locate the manifold assembly in the pipe clamps.



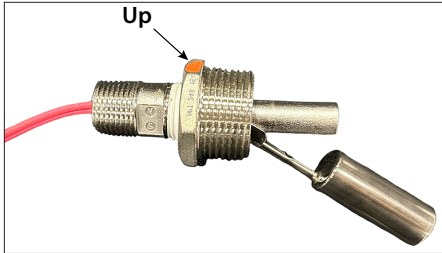
- With manifold assembly secured in pipe clamps, tighten union between manifold assembly and isolation valve assembly.
- Install nitrogen bleed valve and pressure gauge assembly to manifold assembly.



## WATER TANK INSTALLATION

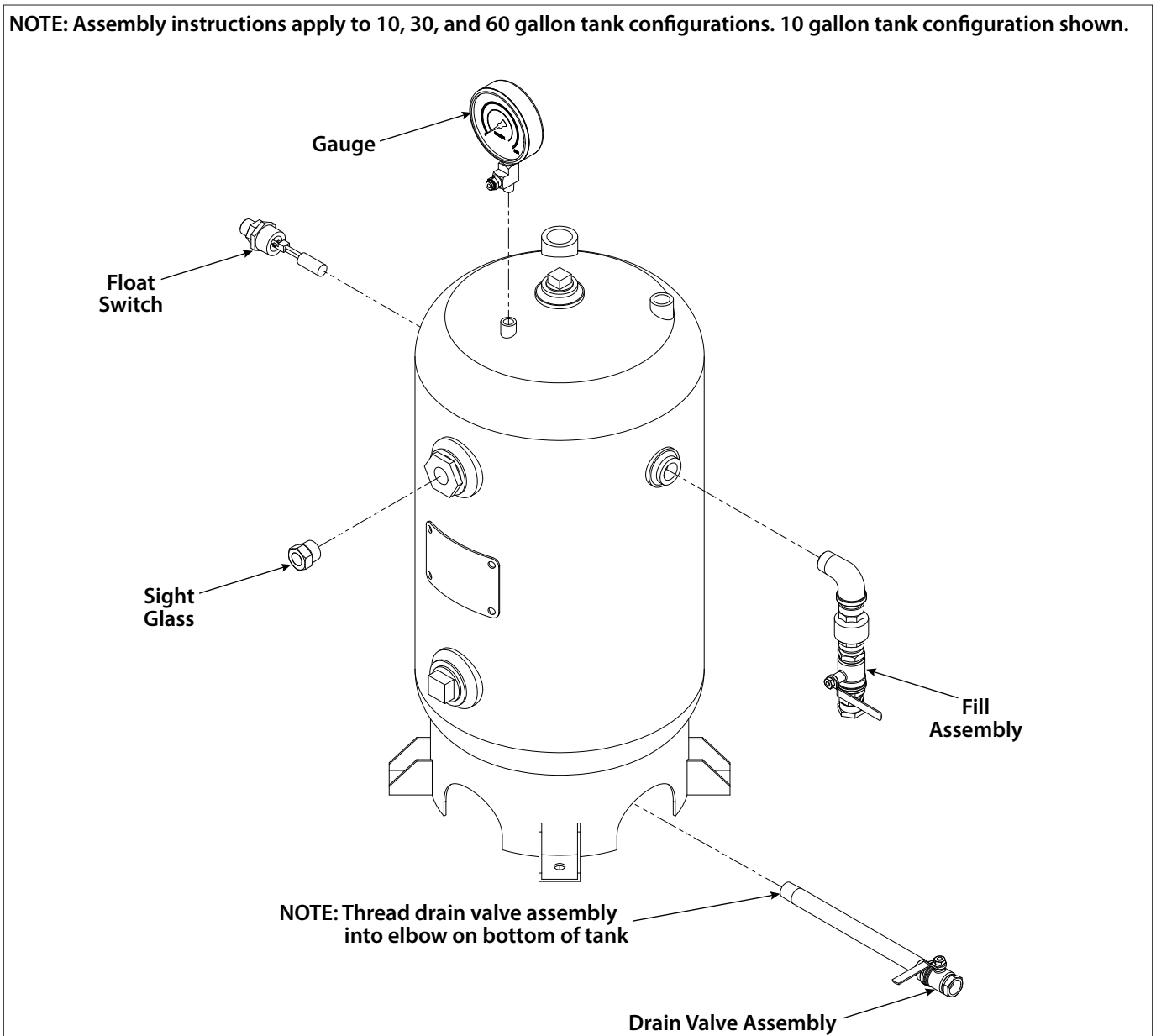
### NOTICE

- When installing the float switch, mark the UP orientation on the hex collar of the switch. Once tightened, the switch shall be installed in the UP orientation. **ORIENTATION IS CRITICAL.**

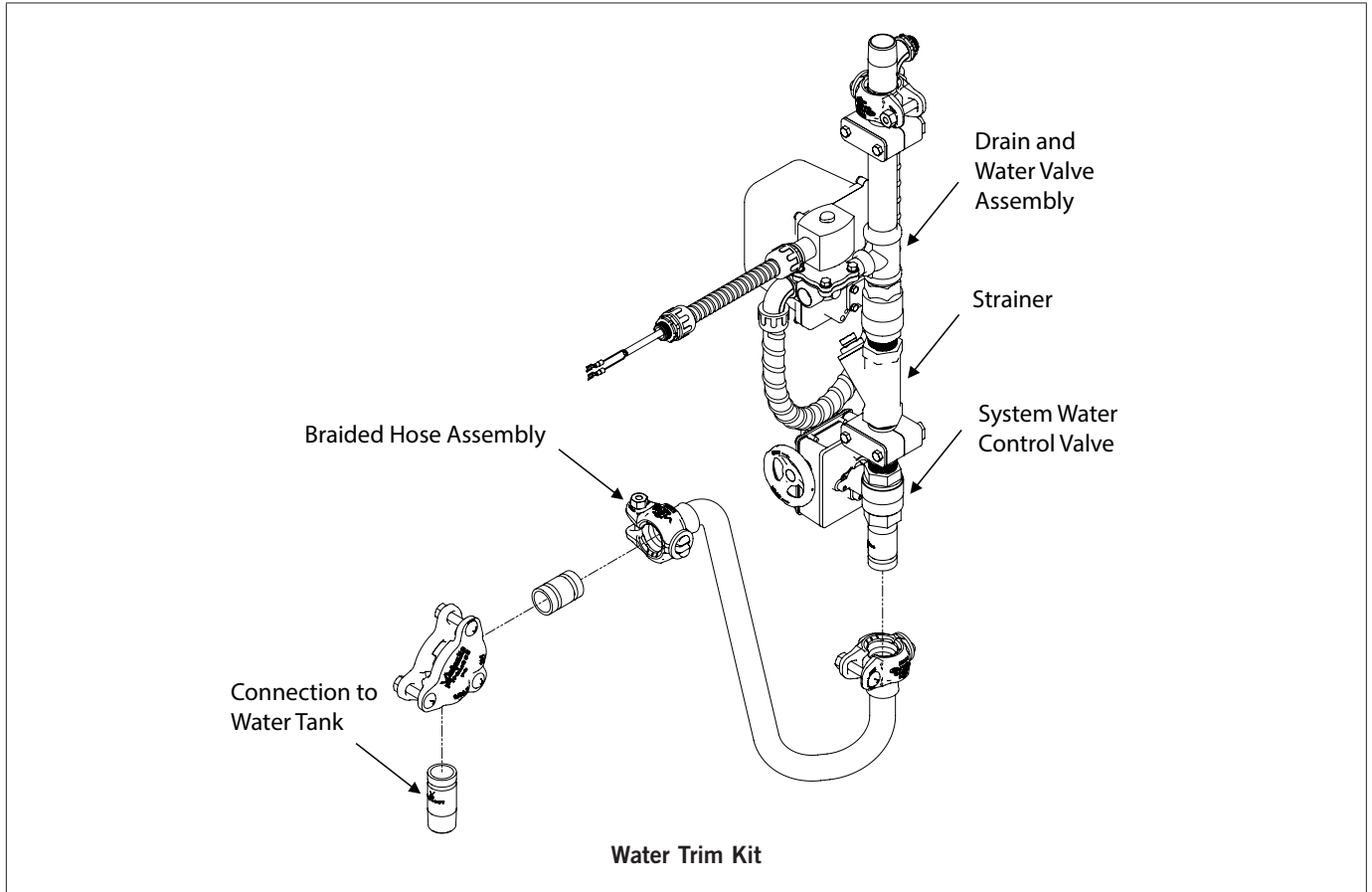


1. Apply thread sealant tape to all threaded connections.

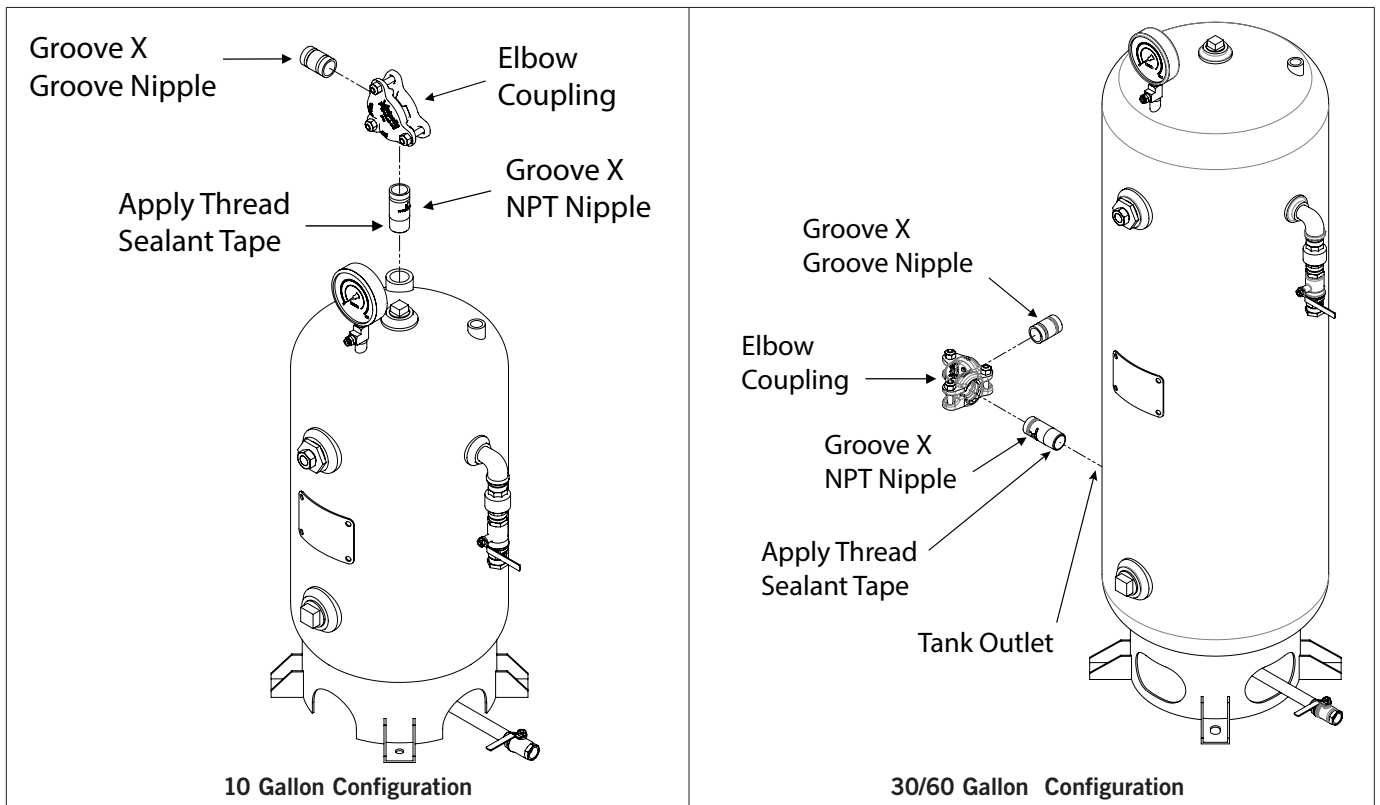
**NOTE: Assembly instructions apply to 10, 30, and 60 gallon tank configurations. 10 gallon tank configuration shown.**



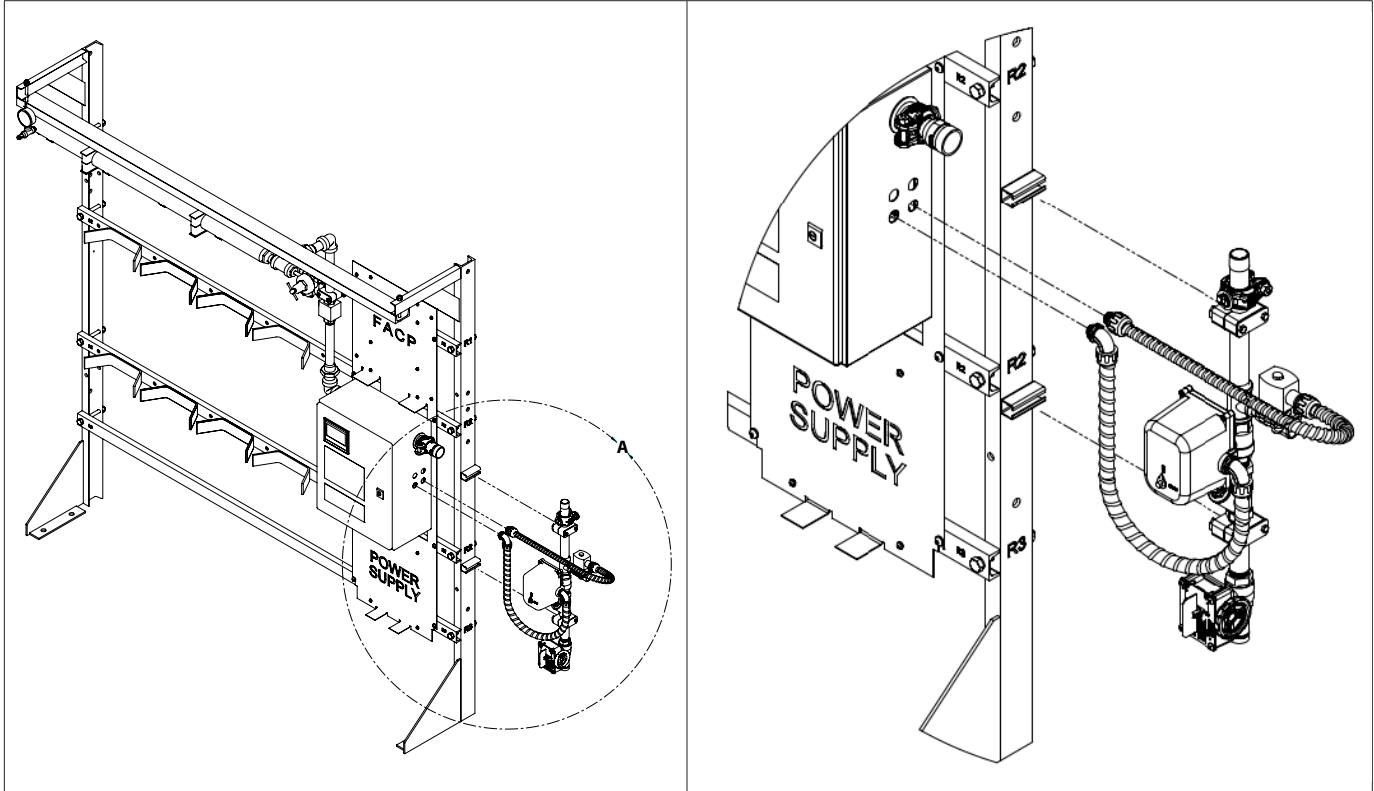
**WATER TRIM INSTALLATION**



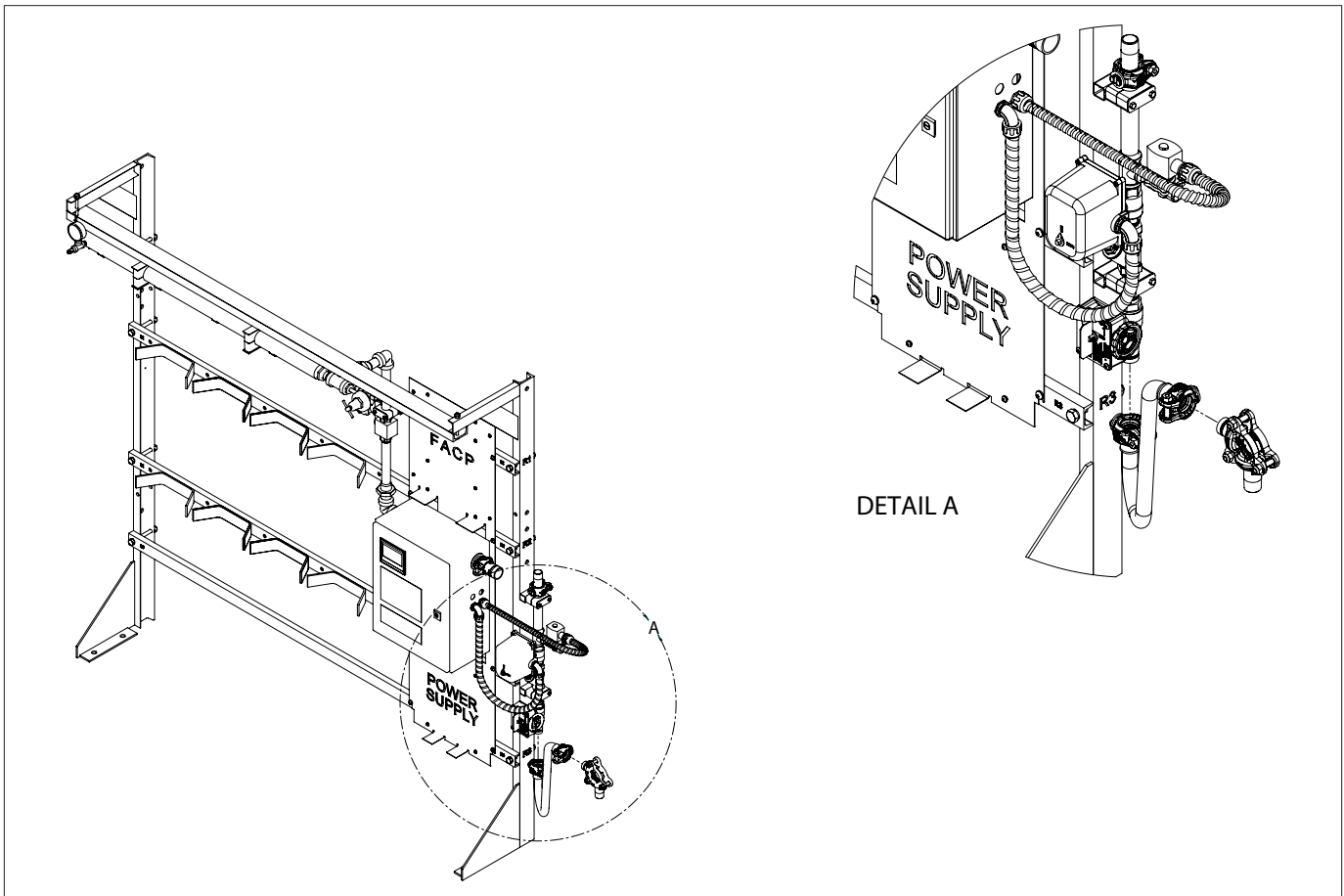
1. Apply Teflon tape to threaded end of groove x NPT nipple and install to water tank. Fit together groove x groove nipple and elbow and install to groove x NPT nipple using 11/16" deep socket on coupling bolts. **NOTE:** Leave coupling loose enough that it can rotate. This will make it easier to install the braided hose assembly later.

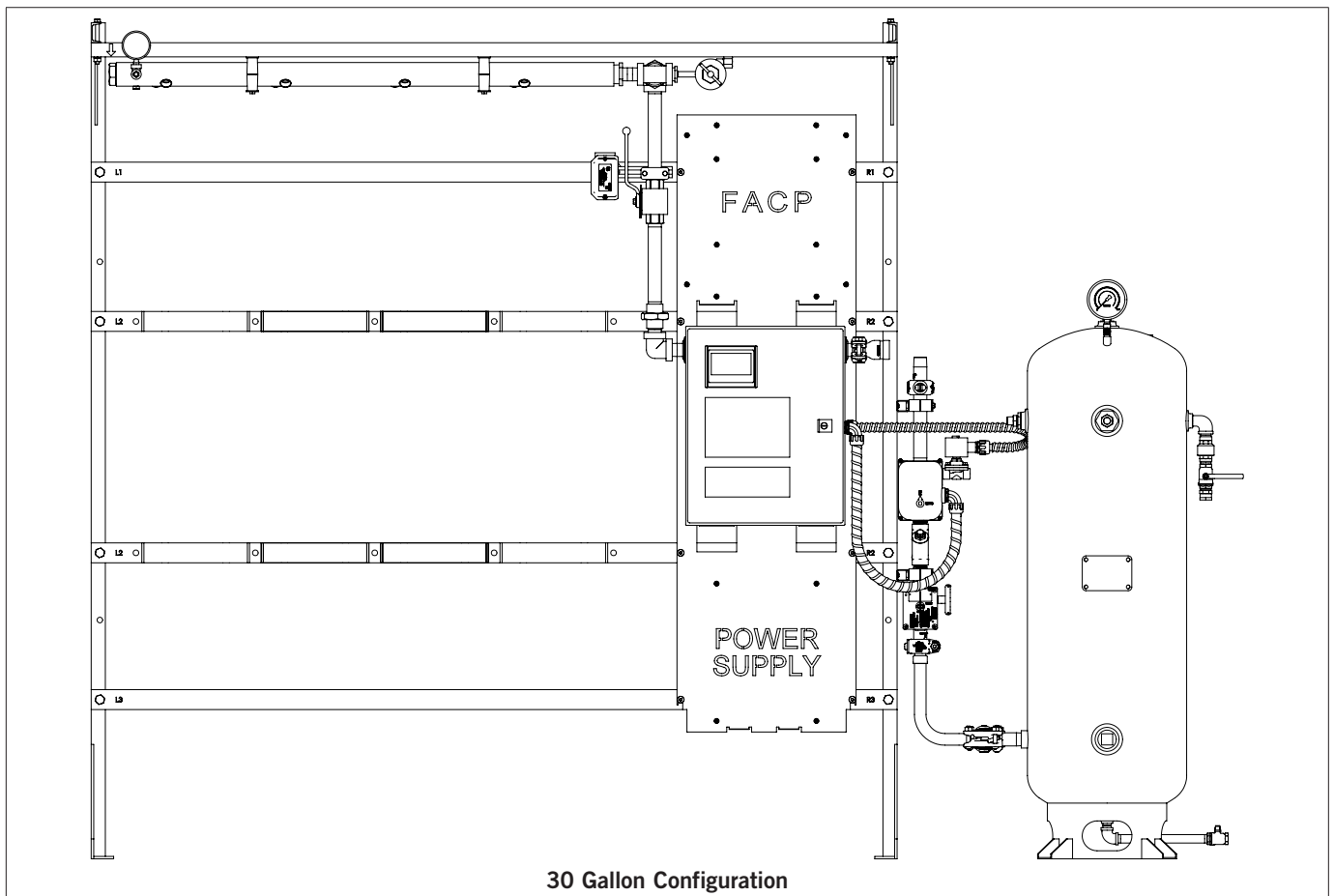
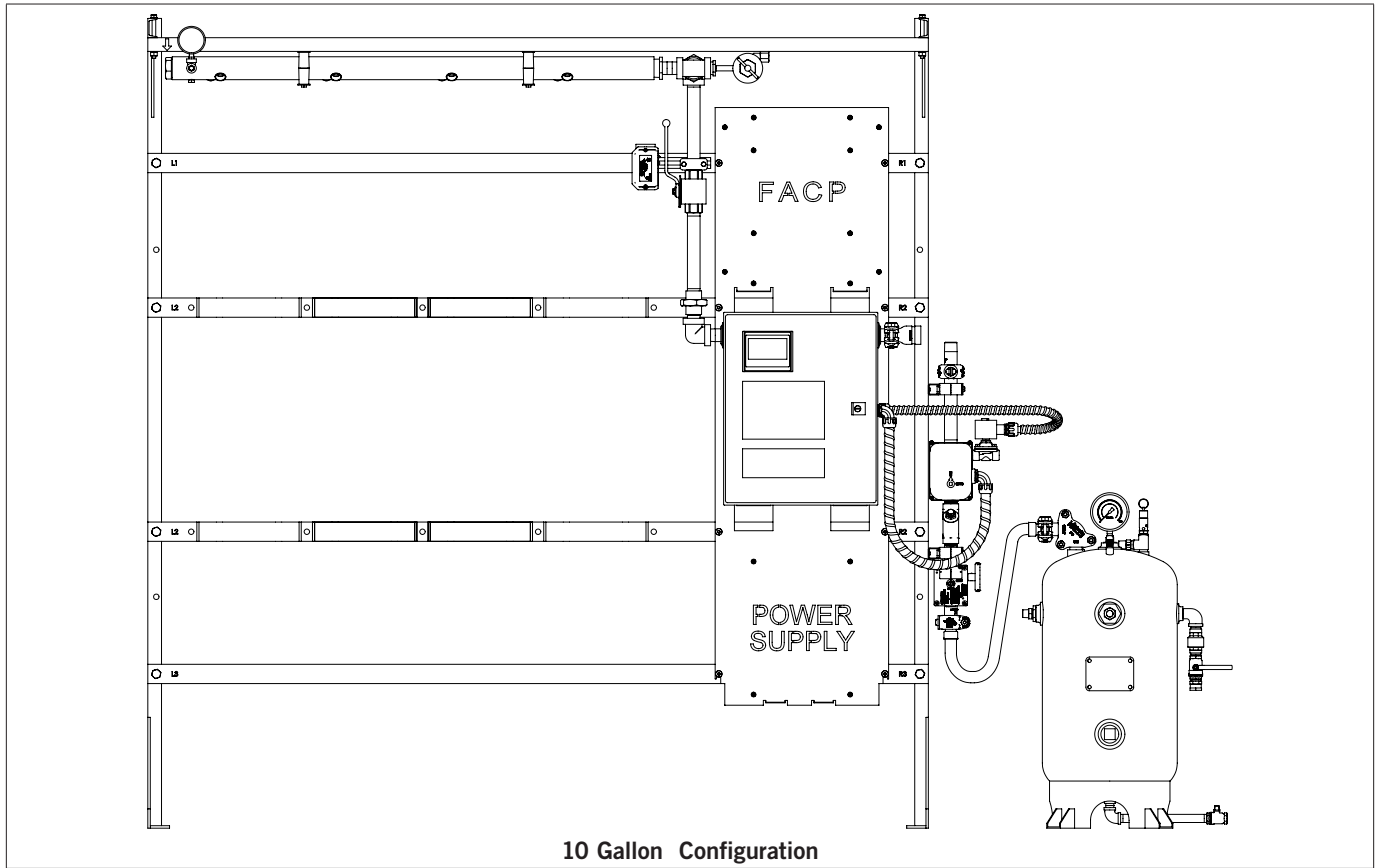


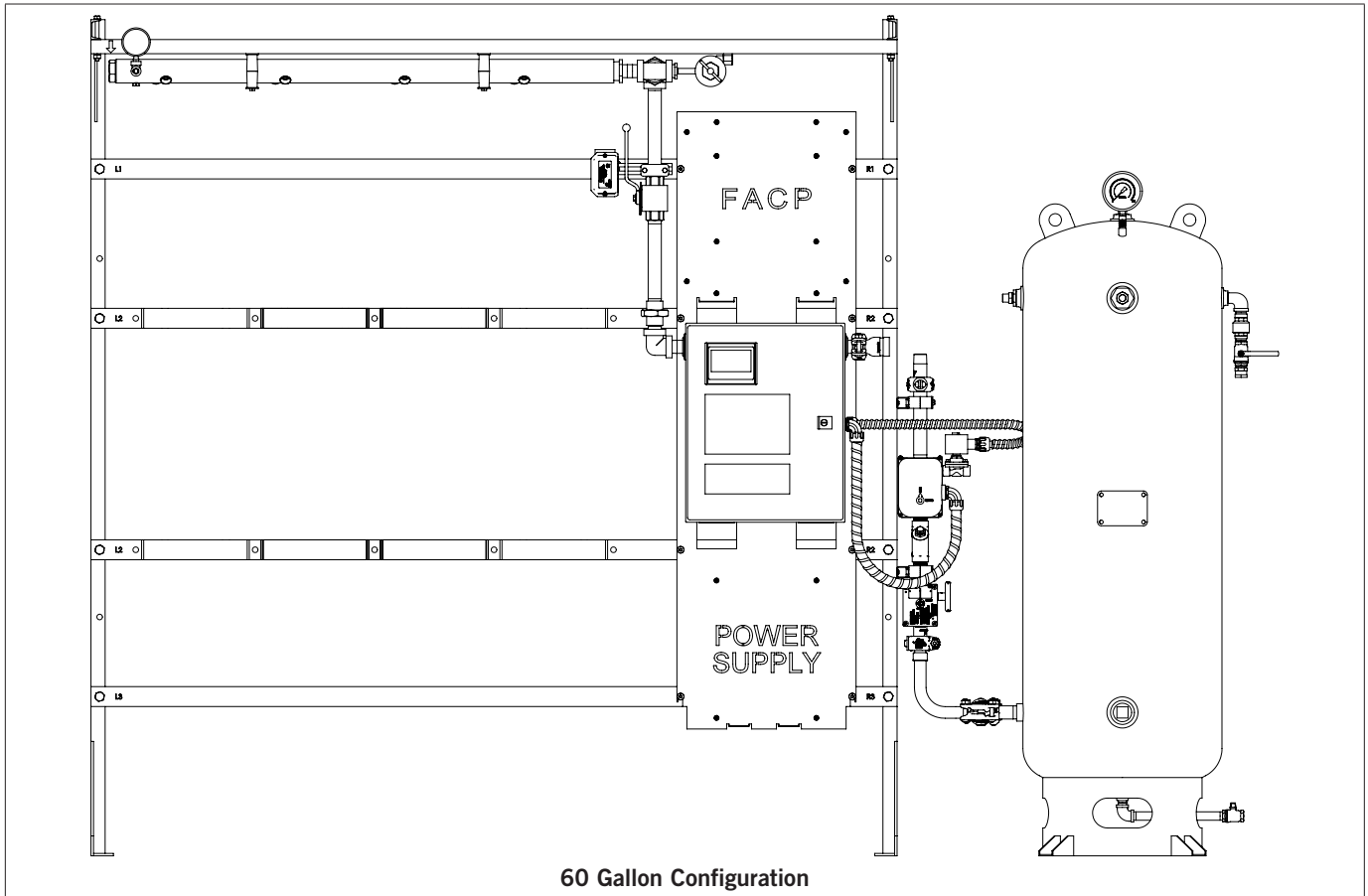
2. Mount drain valve and water valve assembly to the support rails on rack unit using 7/16" wrench for pipe clamps.



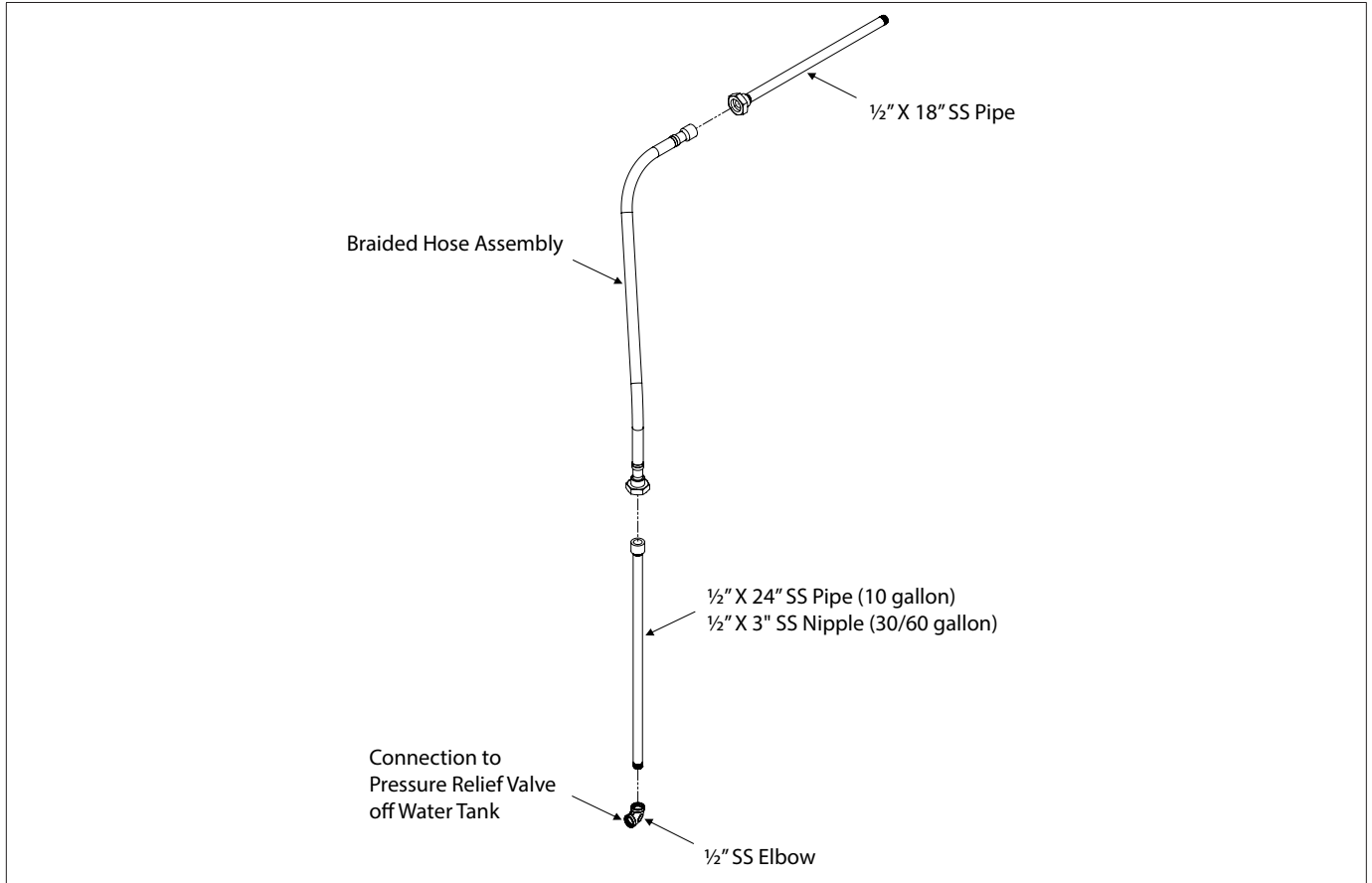
3. Install braided hose assembly to connect water valve and drain valve assembly to water tank using 11/16" deep socket for the coupling bolts.





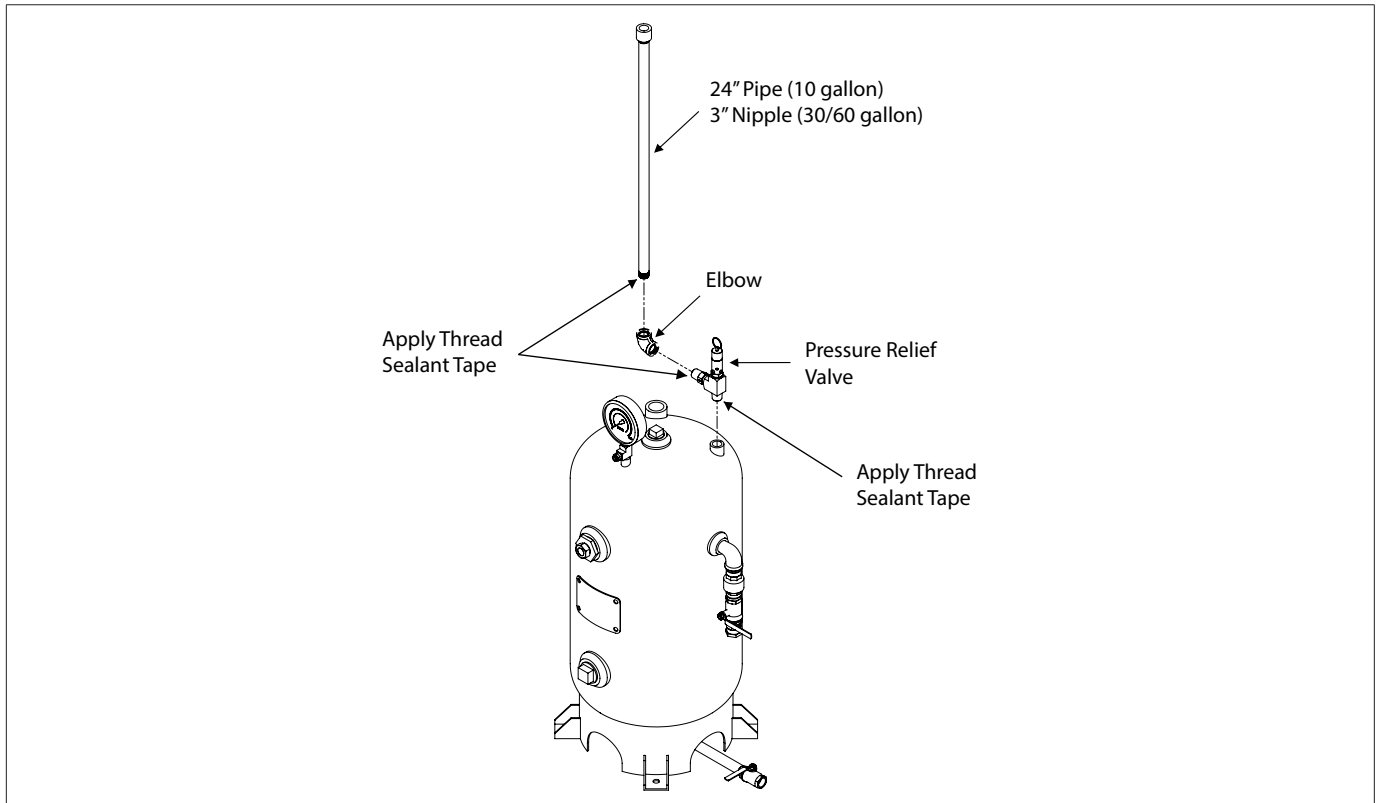


## NITROGEN CHARGE LINE INSTALLATION

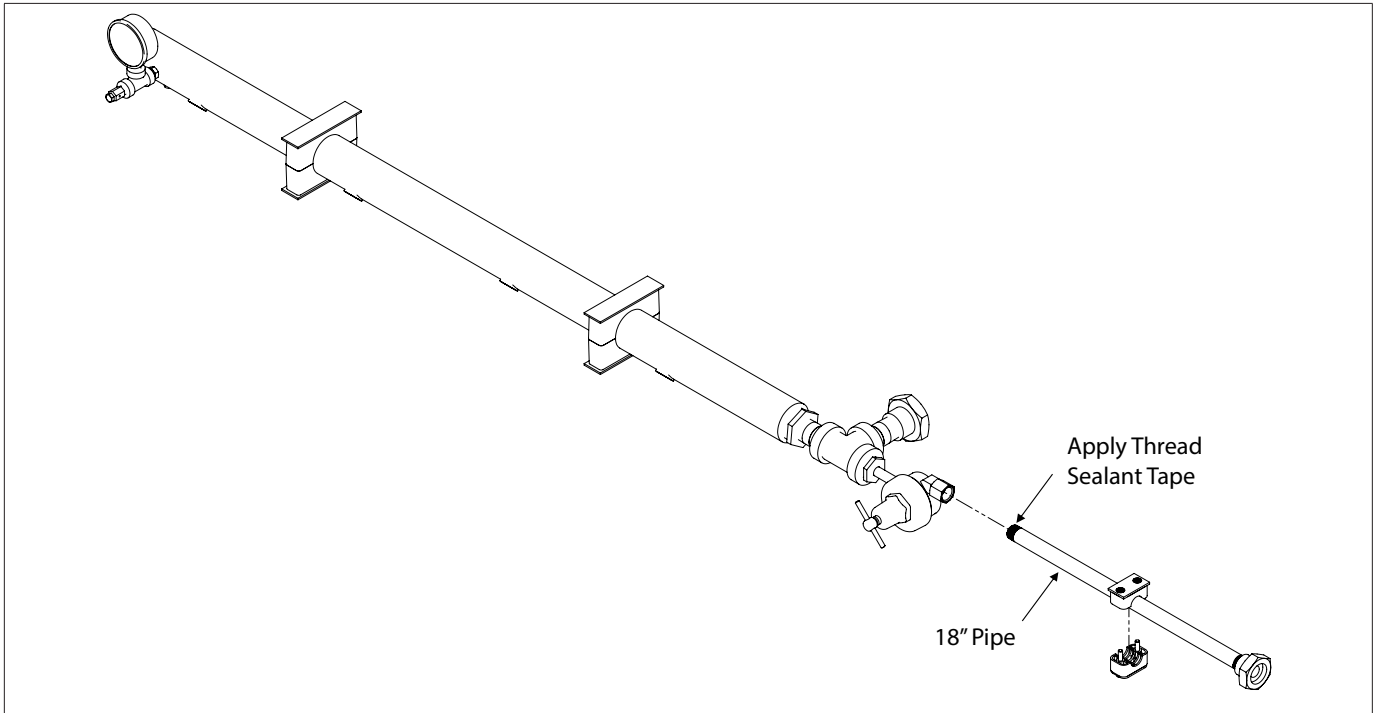


**Nitrogen Charge Line**

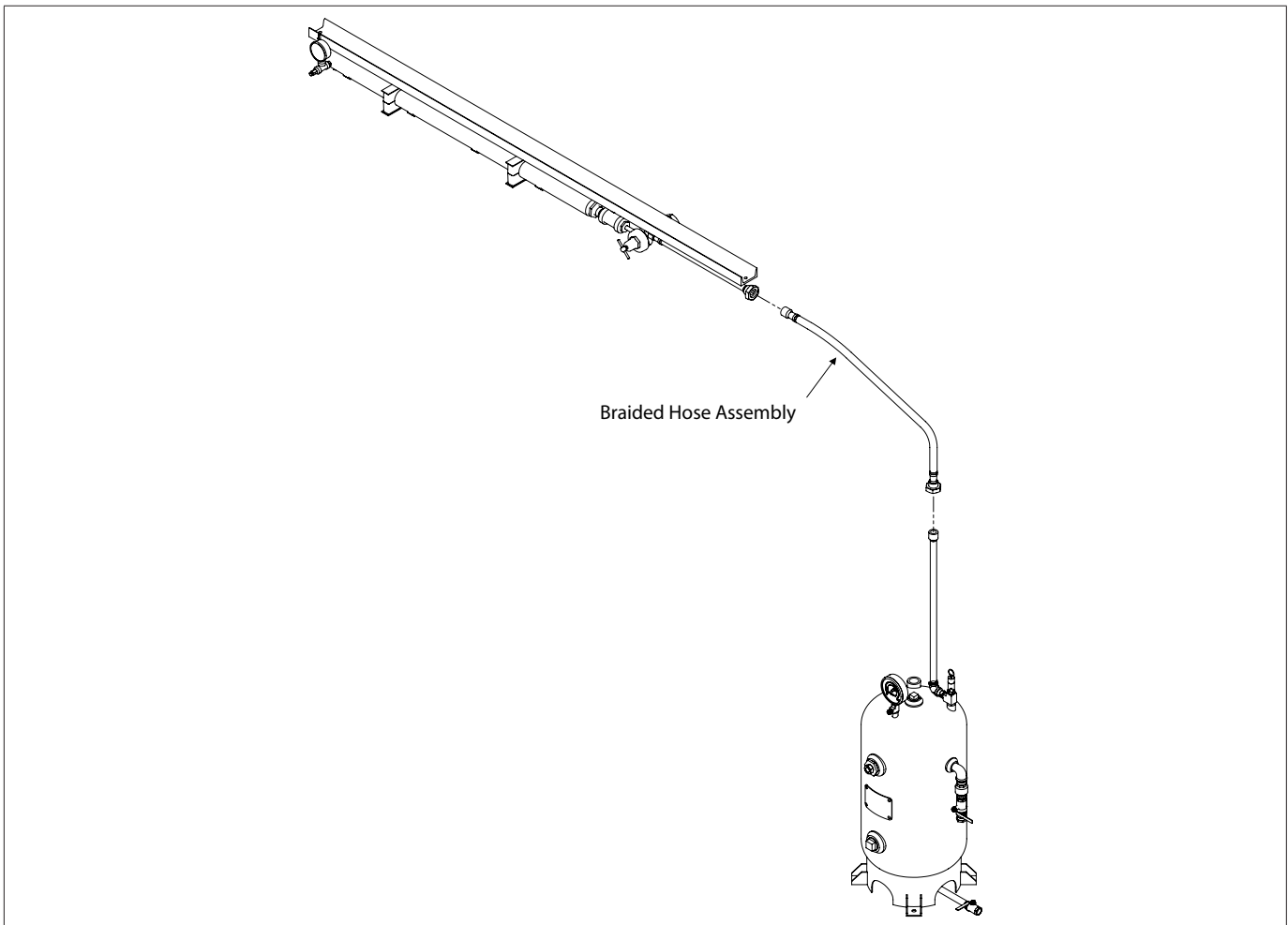
1. Apply Teflon tape to all threaded connections and install to water tank. **NOTE:** Install elbow onto relief valve first.



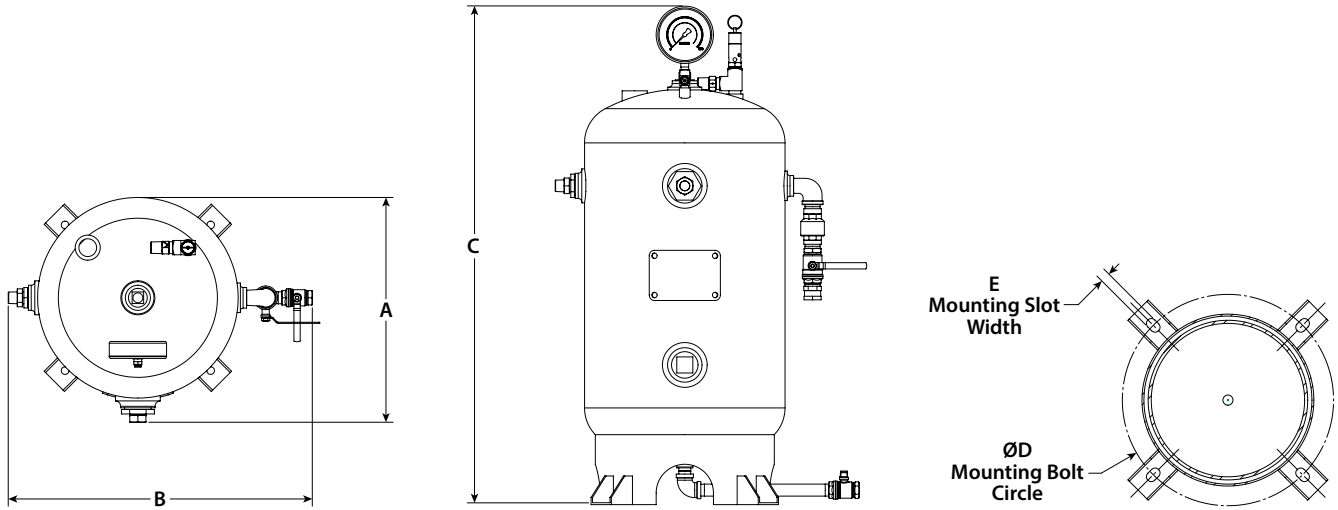
2. Apply thread sealant tape to the end of the 18-inch/457-mm pipe without the union and install to regulator. Verify that the pipe is seated in pipe clamp and fasten clamp together.



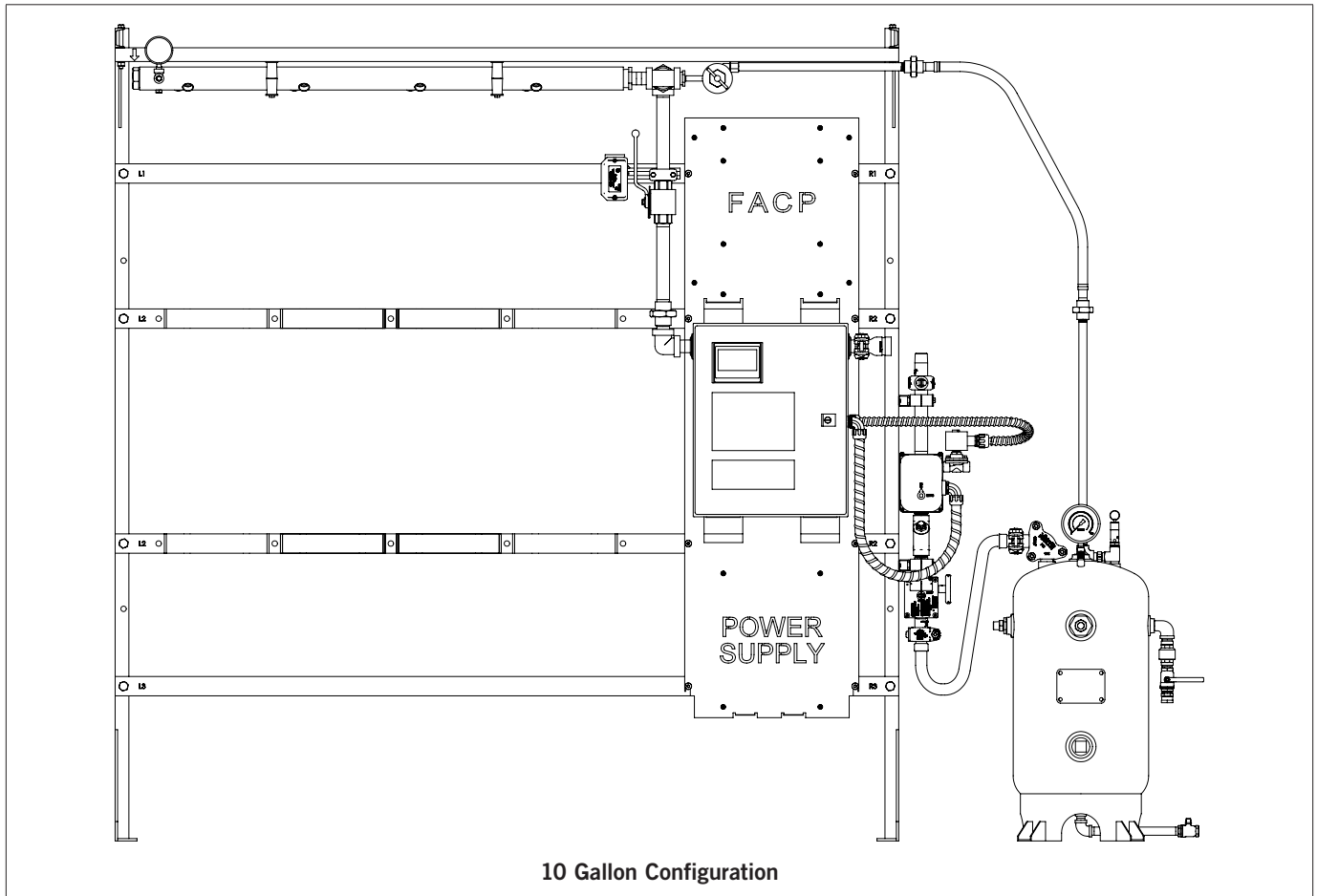
3. Align unions and install braided hose assembly to connect manifold assembly to the water tank.

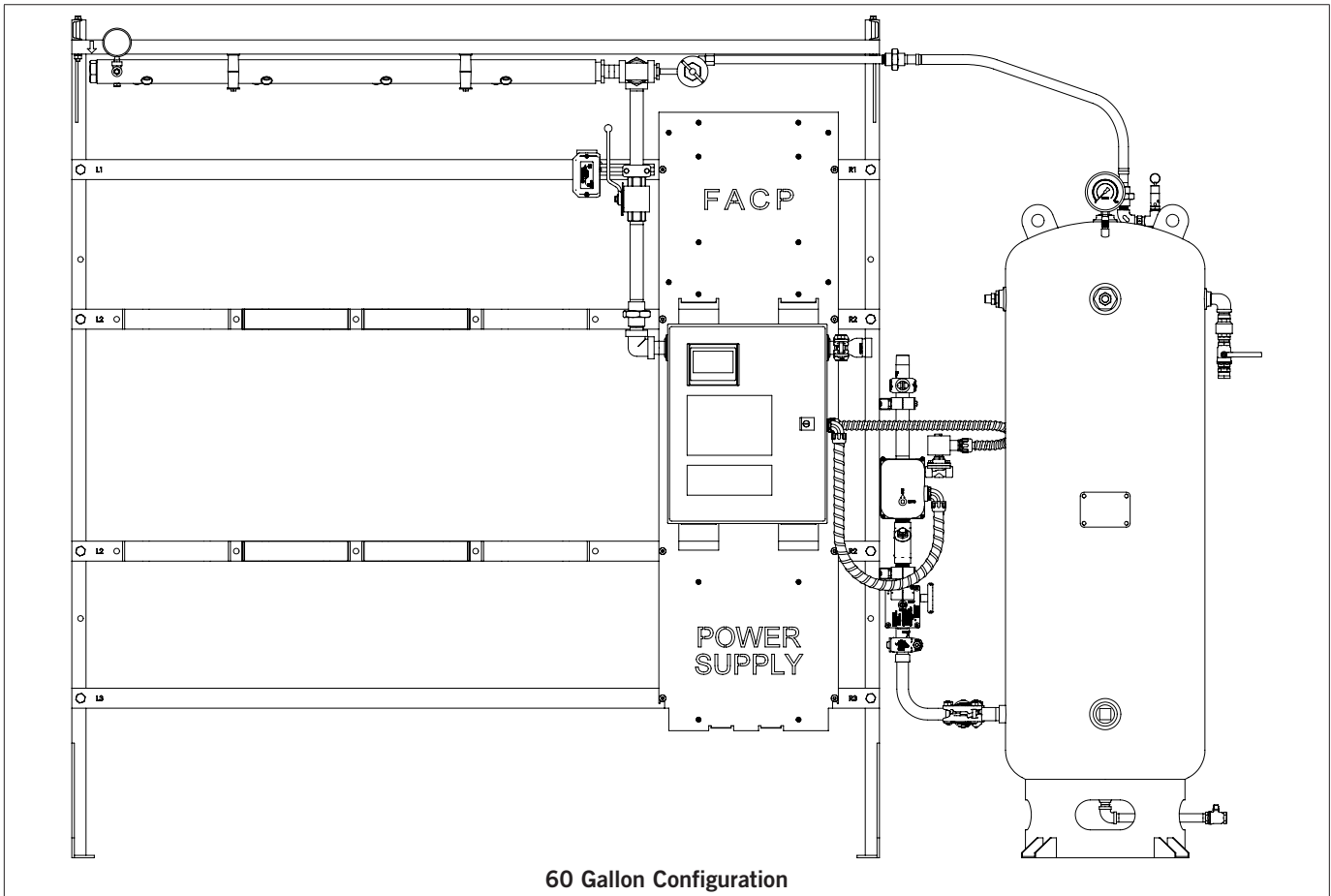
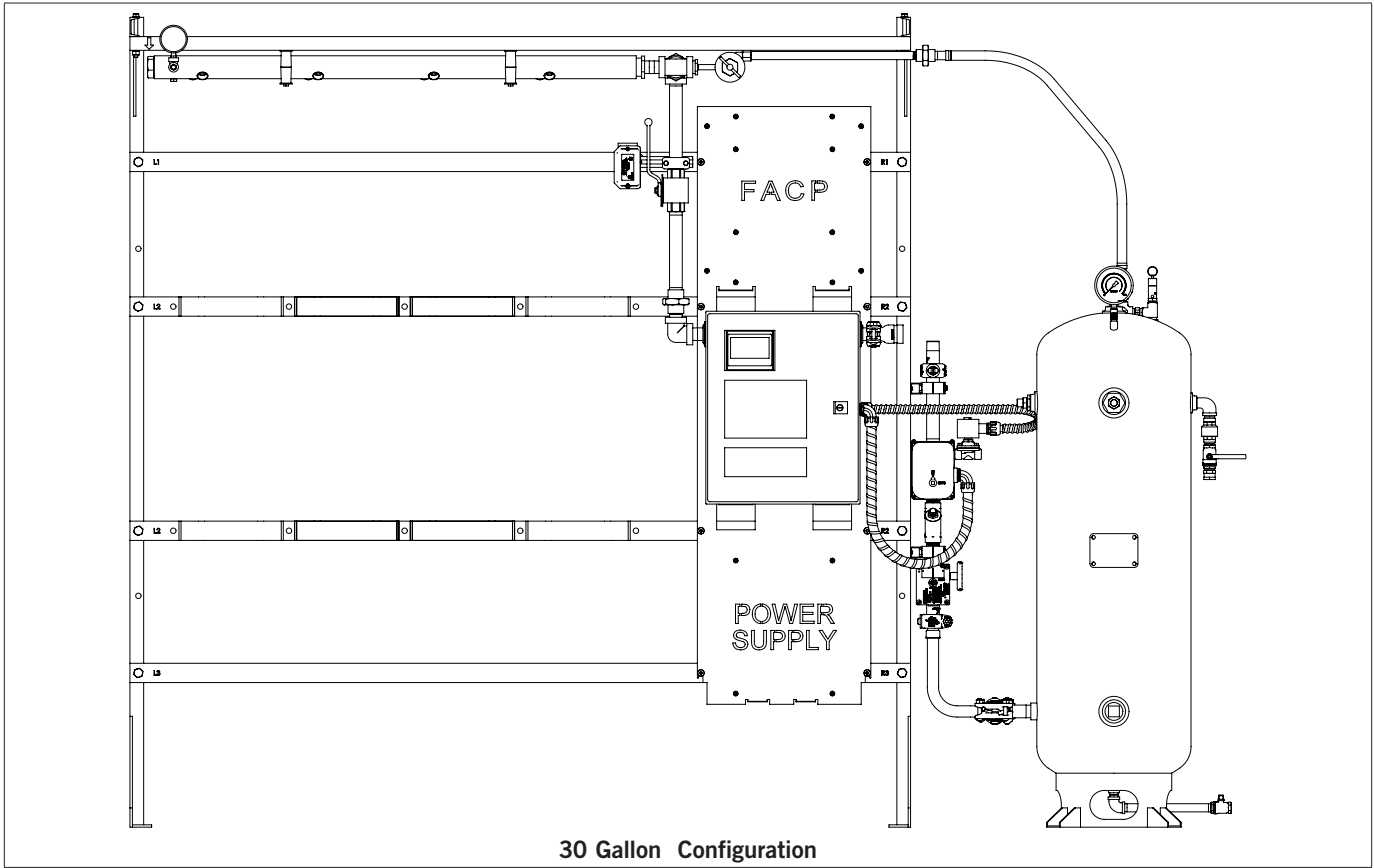


- With piping complete, secure water tank to floor with appropriate fasteners, in accordance with applicable NFPA Standards, Factory Mutual (FM) requirements, AHJ approval, and National, State, and local codes.



Nominal Size gallons/liters	Part Codes for Red Tank with Trim	Dimensions – inches/mm				
		A	B	C	D	E
10	S100950140	15.7	21.2	35.5	14.38	0.531
38		399	539	902	365.3	13.49
30	S300950141	17.7	22.2	57.9	14.75	0.688
114		449	565	1471	374.7	17.46
60	S600950140	21.7	24.8	68.8	18.75	0.688
227		551	630	1749	476.3	17.46





## ELECTRICAL INSTALLATION

It is recommended to do the electrical installation at this time; however, the electrical installation can be completed now or at any point in the installation process moving forward. Performing the electrical installation at this point will allow the installer to access the wall behind the racking to install electrical raceways, if necessary. Refer to Section VII for electrical installation instructions.

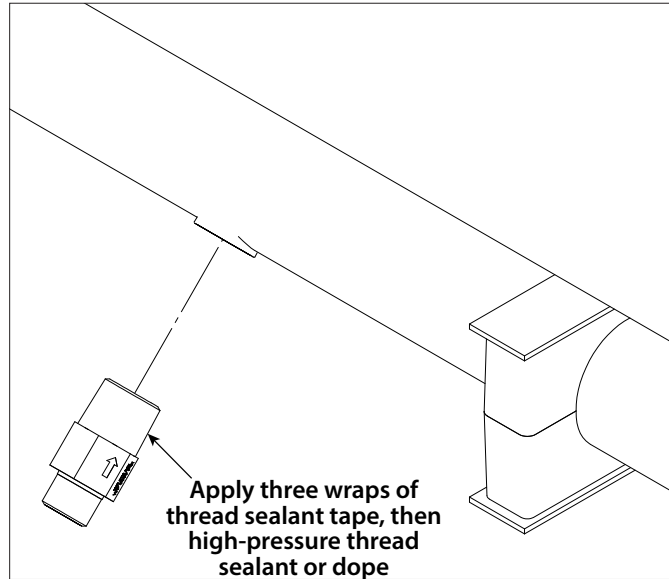
## CYLINDER INSTALLATION

### ⚠ WARNING

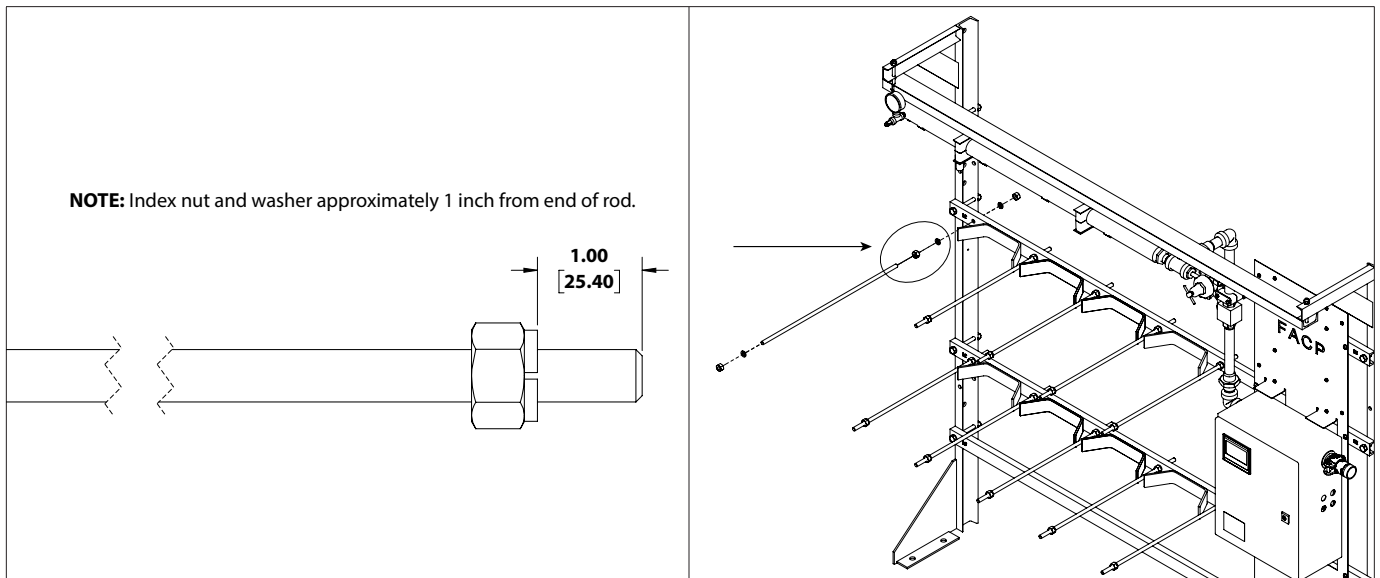
- Only Victaulic Vortex™ Certified individuals shall complete the following steps.

Failure to follow this instruction will cause improper system operation, resulting in death or serious personal injury and property damage.

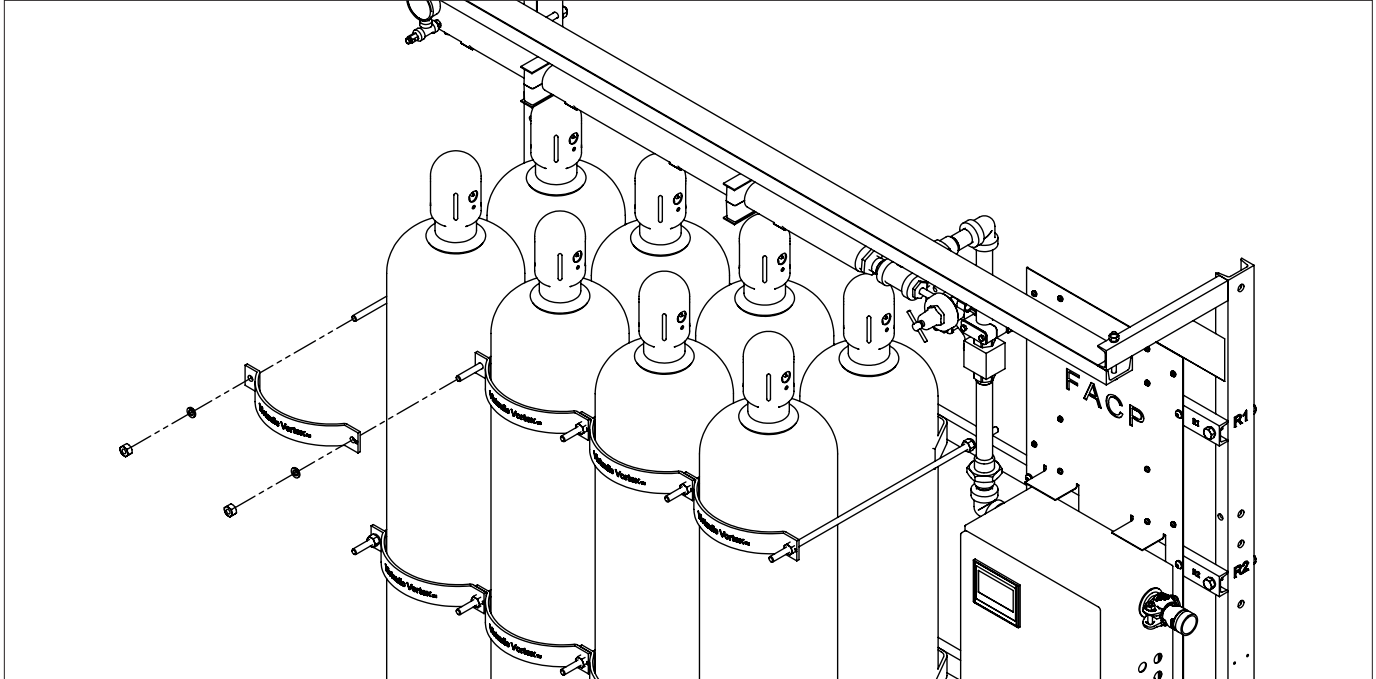
1. Using a 27-mm wrench, thread discharge hose restricting valves into manifold. Typically, a properly tightened restricting valve will have 3-4 threads visible. If any ports do not require a restricting valve, a plug shall be installed in its place.



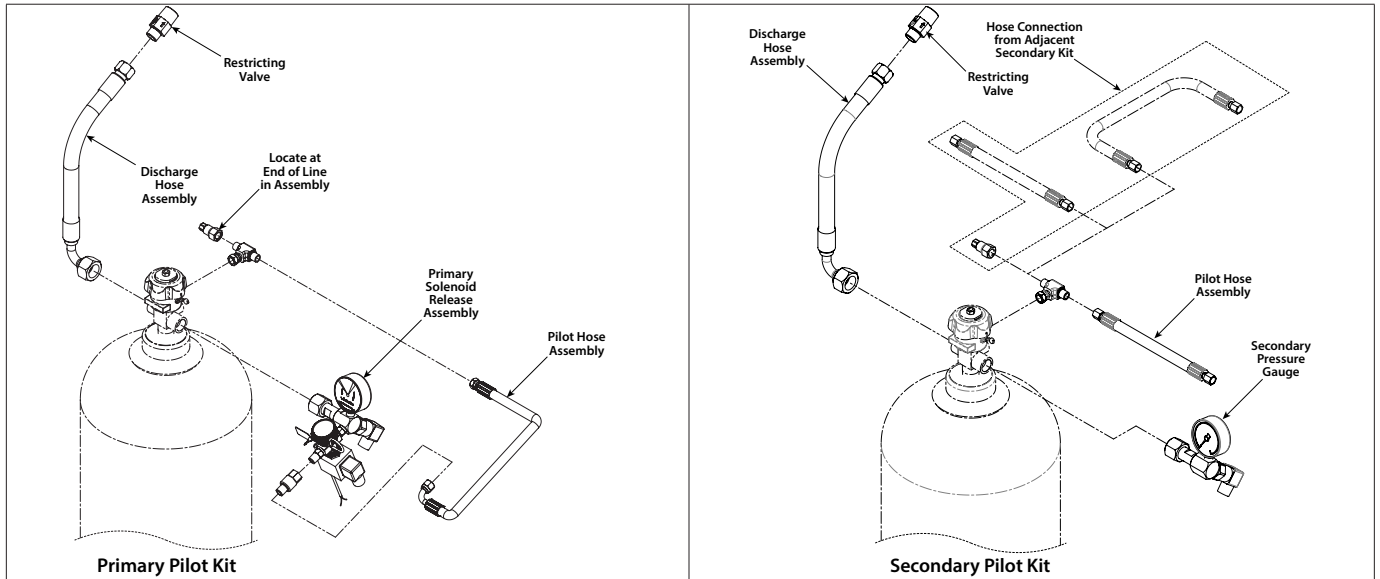
2. Install ½-13 threaded rod to rack unit with supplied nuts and washers.



3. Install cylinders in rack. Cylinders shall be 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. See configurations later in this section based on cylinder count.
- NOTE:** Configurations apply to both 49-liter and 80-liter cylinders regardless of the cycle count. Once a column is filled, install lower and upper cylinder restraints. **DO NOT REMOVE PROTECTIVE CYLINDER CAPS UNTIL CYLINDERS HAVE BEEN SECURED COMPLETELY WITH THE CYLINDER RESTRAINTS.**



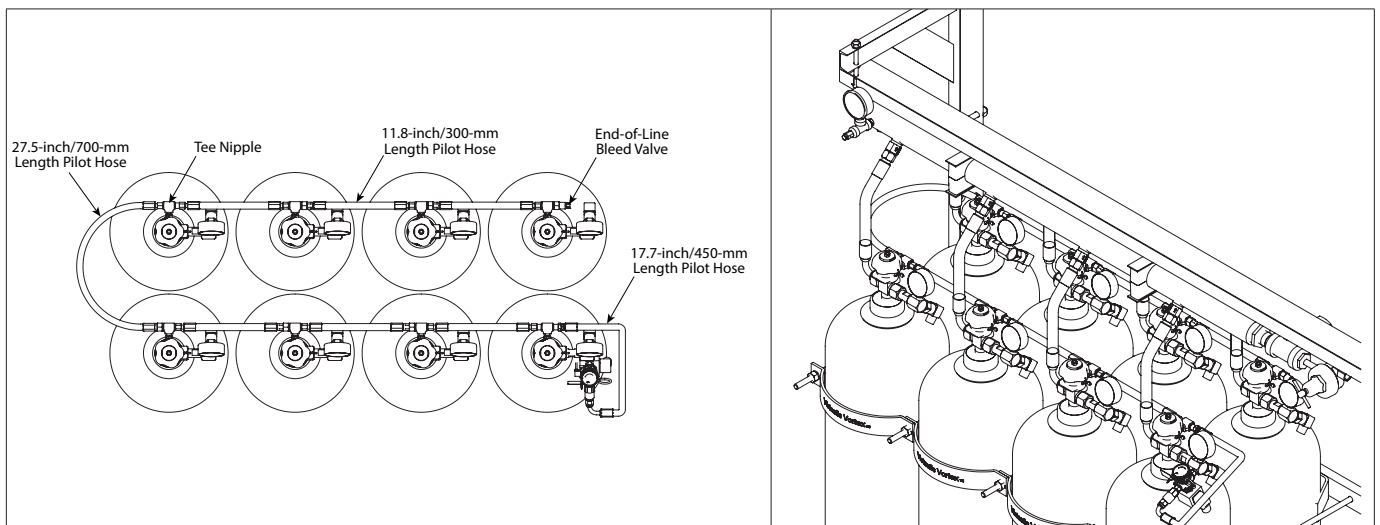
## INSTALLATION OF PRIMARY AND SECONDARY PILOT KITS



### NOTICE

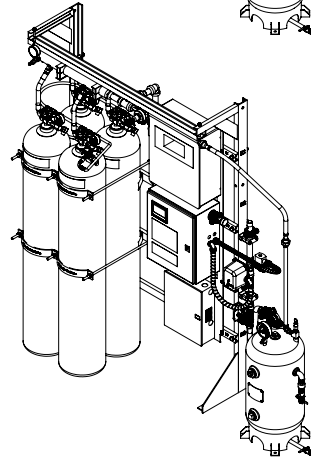
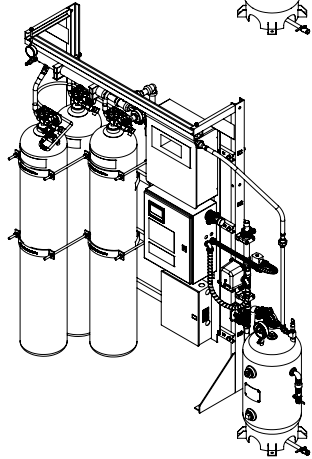
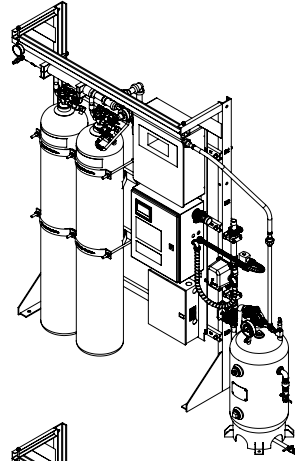
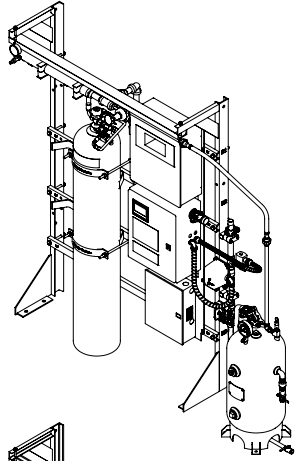
- Discharge hoses and pilot line hoses do not require thread sealant since they contain o-ring seals.
- Verify that the sealing surfaces of discharge hoses are clean. Avoid rotating the hose when it is tightened against the sealing surfaces.

1. When installing discharge hoses, start threads on each end of hose before tightening either end. Typically, properly tightened hoses have 1-2 threads visible. Use a 27-mm wrench when tightening discharge hoses to restricting valves and a 32-mm wrench when tightening discharge hoses to cylinder valves.
2. Install pilot line using an adjustable wrench (orientation will vary based on the number of cylinders). Install tee nipple pilot connection port on rear of cylinder valves. To ease installation, leave this connection loose until all pilot hoses are connected. An 11.8-inch/300-mm length pilot hose is provided with secondary pilot kits to connect adjacent cylinders. For systems with more than two cylinders, a 27.5-inch/700-mm length pilot hose is provided to connect cylinders between two rows. Install end-of-line bleed valve to tee nipple on last cylinder in pilot line. A 17.7-inch/450-mm length pilot hose is provided with primary pilot kits to connect primary solenoid release assembly to tee on back of cylinder valve.
3. Using a 36-mm wrench, install secondary gauge assemblies onto cylinder valves. Use wrench flats to hold back the gauge assembly and prevent rotation during tightening. Both primary and secondary assemblies engage a Schrader\* valve during tightening. When the Schrader\* valve is engaged, more torque will be required 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. **NOTE:** DO NOT hold assembly by gauge or pressure switch during tightening.
4. Install primary solenoid release assembly last. The primary solenoid release assembly should be installed on the front right-most cylinder in the group of cylinders. To tighten the primary assembly to the cylinder valves, follow the same steps for the secondary gauge assemblies. **NOTE:** DO NOT hold assembly by gauge or pressure switch during tightening.

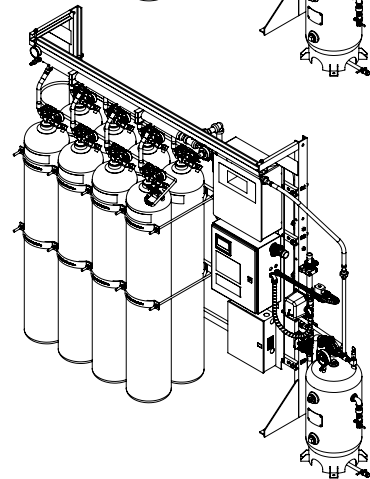
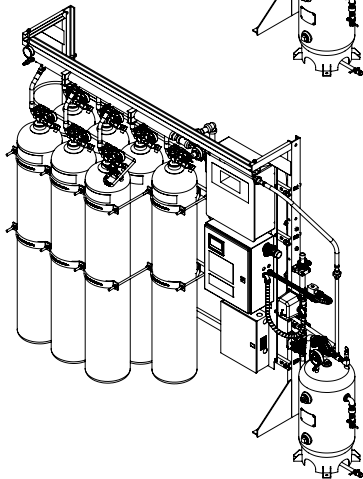
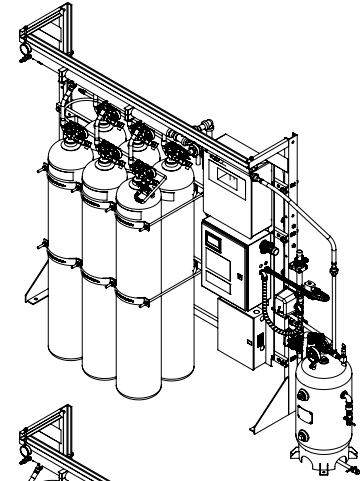
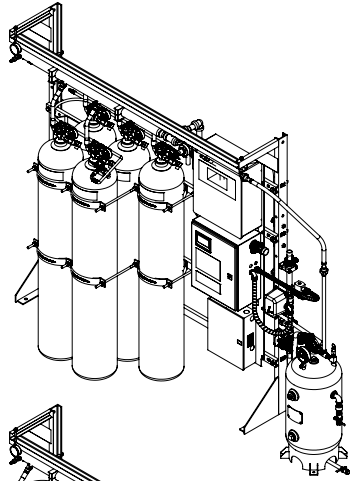


\* Schrader is a registered trademark of Schrader International, a Tomkins Company

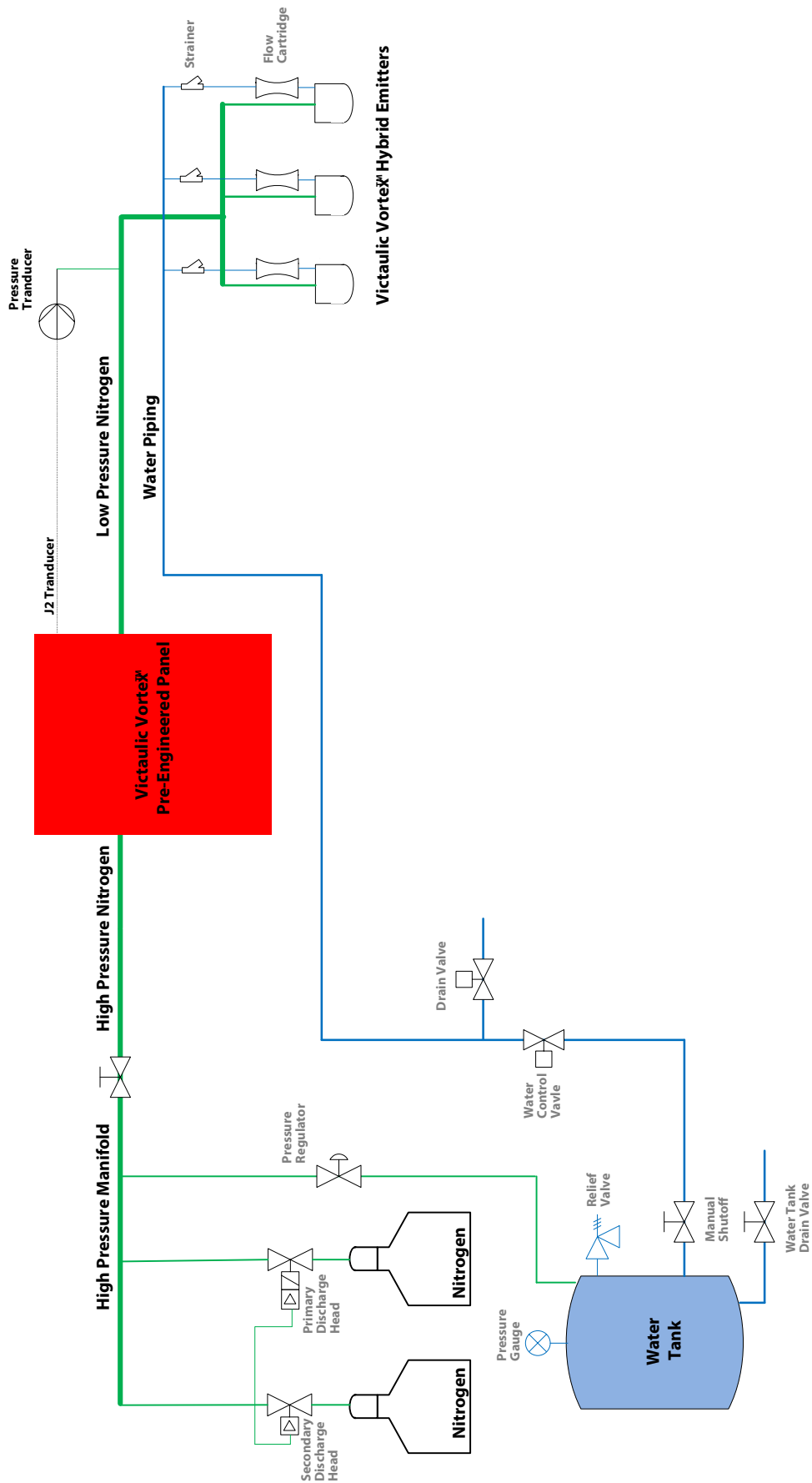
**COMPLETED 1 TO 4 PRE-ENGINEERED UNIT**



**COMPLETED 5 TO 8 PRE-ENGINEERED UNIT**



**SINGLE-ENCLOSURE SYSTEM PLUMBING**



# SECTION VII

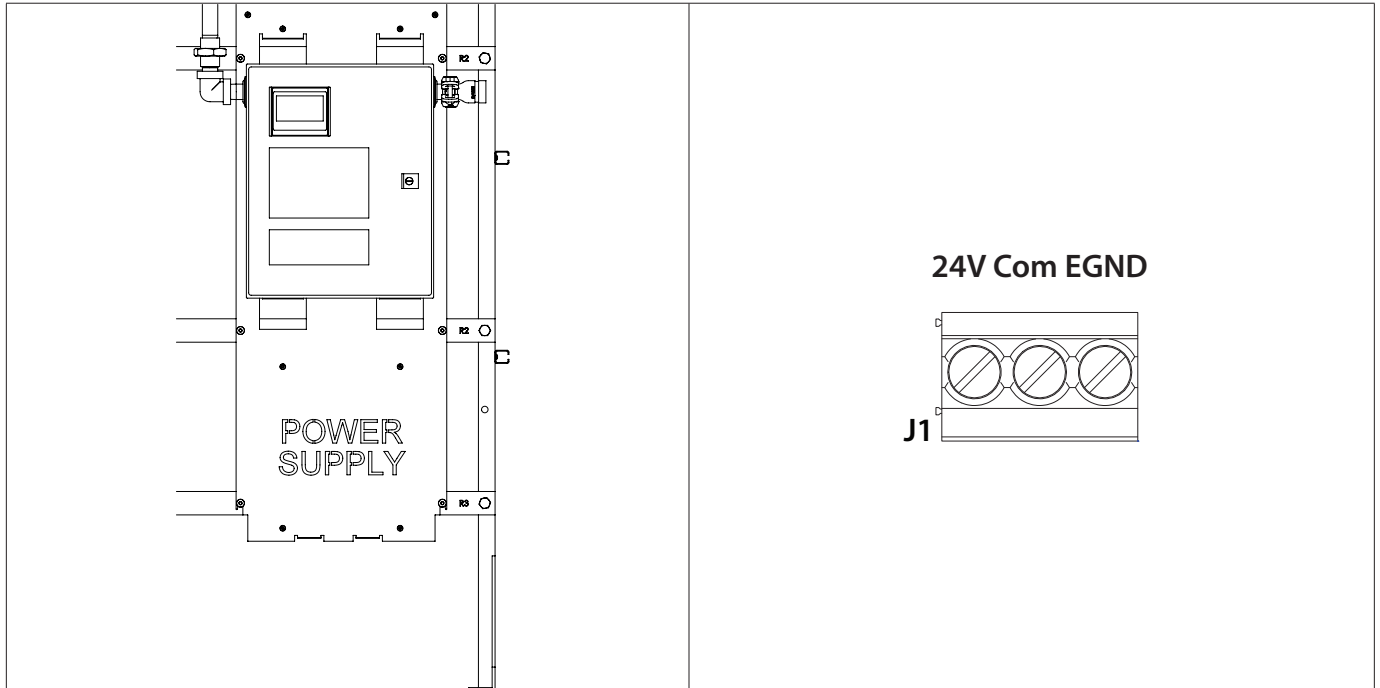
## COMPONENT WIRING

### NOTICE

- Component wiring shall follow all applicable national and local codes and standards specific to the application area and the location within which the components are installed. It is the responsibility of the installer to consult the Authority Having Jurisdiction (AHJ) for final electrical requirements.
- Conductors and raceways shall be sized and installed by qualified electrical and/or fire alarm installers.
- Reference Section VIII of this manual for electrical specifications.
- Examples of applicable wiring raceways include, but are not limited to: EMT conduit, flexible non-metallic conduit, flexible metallic conduit, or other applicable raceway methods in accordance with specific requirements of the application location.
- All applicable grounding and bonding requirements in accordance with all applicable electrical NFPA Standards, Factory Mutual (FM) requirements, AHJ approval, and National, State, and local codes shall be considered and implemented.
- Electrical connections to Victaulic Vortex™ components are intended to be watertight/gasketed to provide protection against direct water spray, debris, and dust.
- Mounting of electrical raceways is acceptable to the structural steel and panel backplate on the Victaulic Vortex™ Pre-Engineered System, where applicable. Wiring and raceway installation to Victaulic Vortex™ Pre-Engineered System racking and back plate shall not interfere with component operation or service. Mounting hardware for such purpose is not provided by Victaulic. Bolting or taping into the panel backplate is acceptable, where required, for mounting of electrical raceways.
- Hardware utilized to mount electrical raceways, enclosures, or boxes to the Victaulic Vortex™ Pre-Engineered System's back plate shall not exceed two, 3/8-inch holes per square inch and one, 1/2-inch hole per square inch on the racking.
- "Tapping" or utilization of a knockout tool to provide additional electrical connections to either the Victaulic Vortex™ Panel or the power supply is permitted as long as the knockout does not impede operation of panel components, follows applicable national and local electrical codes and standards, and are filled with a blank when knockouts are not utilized.
- The panel backplate on the Victaulic Vortex™ Pre-Engineered System contains an area labeled "FACP", which is intended for use in mounting either a Fire Alarm Control Panel, a module/card enclosure, or modules to provide a central location for all fire alarm components required for the Victaulic Vortex™ Pre-Engineered System.

### MOUNTING THE POWER SUPPLY

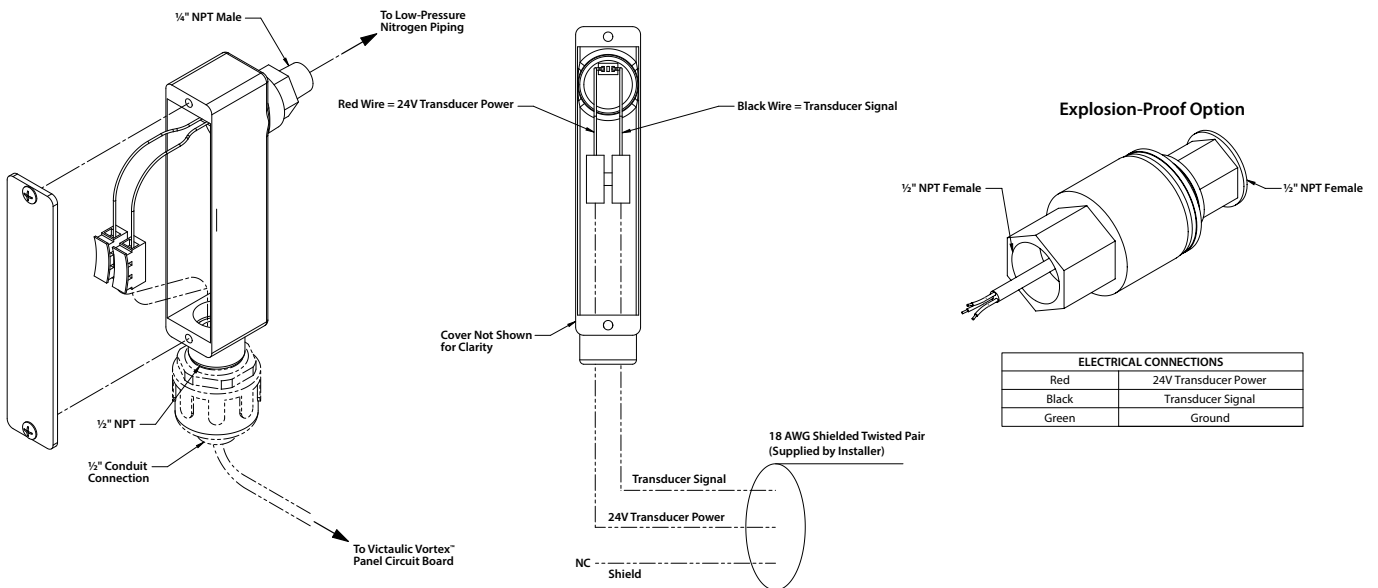
1. Locate the power supply on the panel backplate. The power supply location is etched with "Power Supply" and is directly below the Victaulic Vortex™ Panel.
2. Mount the provided power supply to the specified location with the provided ¼-inch hardware. There are four bolt hole locations to mount the power supply to the panel backplate.
3. Once power supply is mounted, utilize applicable wiring raceway to wire 24VDC power to the Victaulic Vortex™ Panel. The conductors from the output of the power supply shall be wired to the J1 "24V Com EGND" 24VDC connection on the Victaulic Vortex™ Panel's PCB.



### 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.



## NOTICE

- The pressure transducer shall be located in accordance with the piping rules section of this manual.
- Refer to Section IV 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

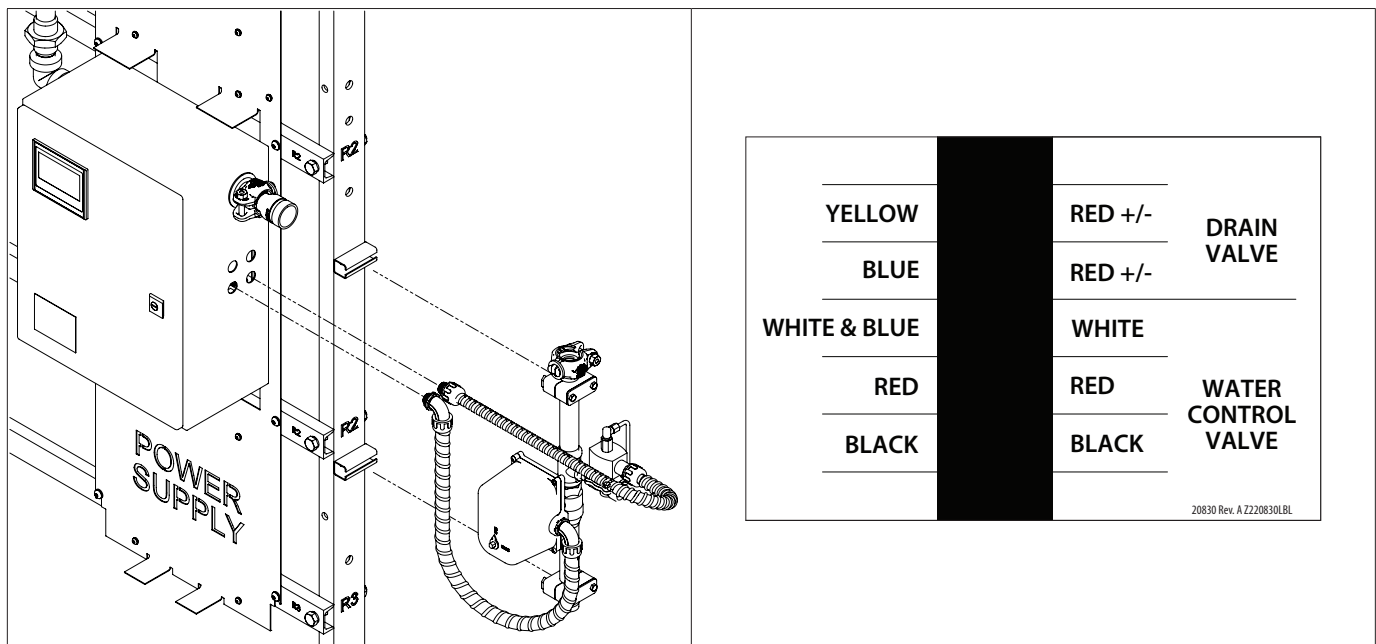
## ⚠ CAUTION

- 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 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.

### WIRING THE EXTERNAL WATER VALVE AND DRAIN VALVE

1. If not already completed, the non-metallic, pre-wired connections provided shall be made to the right side of the Victaulic Vortex™ Panel utilizing the provided lock washer on each connection. The lock washer shall be on the inside of the panel with the gasket on the fitting flush against the outside of the Victaulic Vortex™ Panel.
2. Wire the connections in accordance with the labels on the terminal block located directly above the PCB internal of the Victaulic Vortex™ Panel. Follow the color code for correct connector to terminal location. **NOTE:** Drain solenoid wiring is non-polarity sensitive, meaning either lead can be landed on either drain solenoid terminal.



\* Belden is a registered trademark of Belden Inc.

## VICTAULIC VORTEX™ COMPONENT WIRING TO FACP

### Victaulic Vortex™ Panel Monitor Points

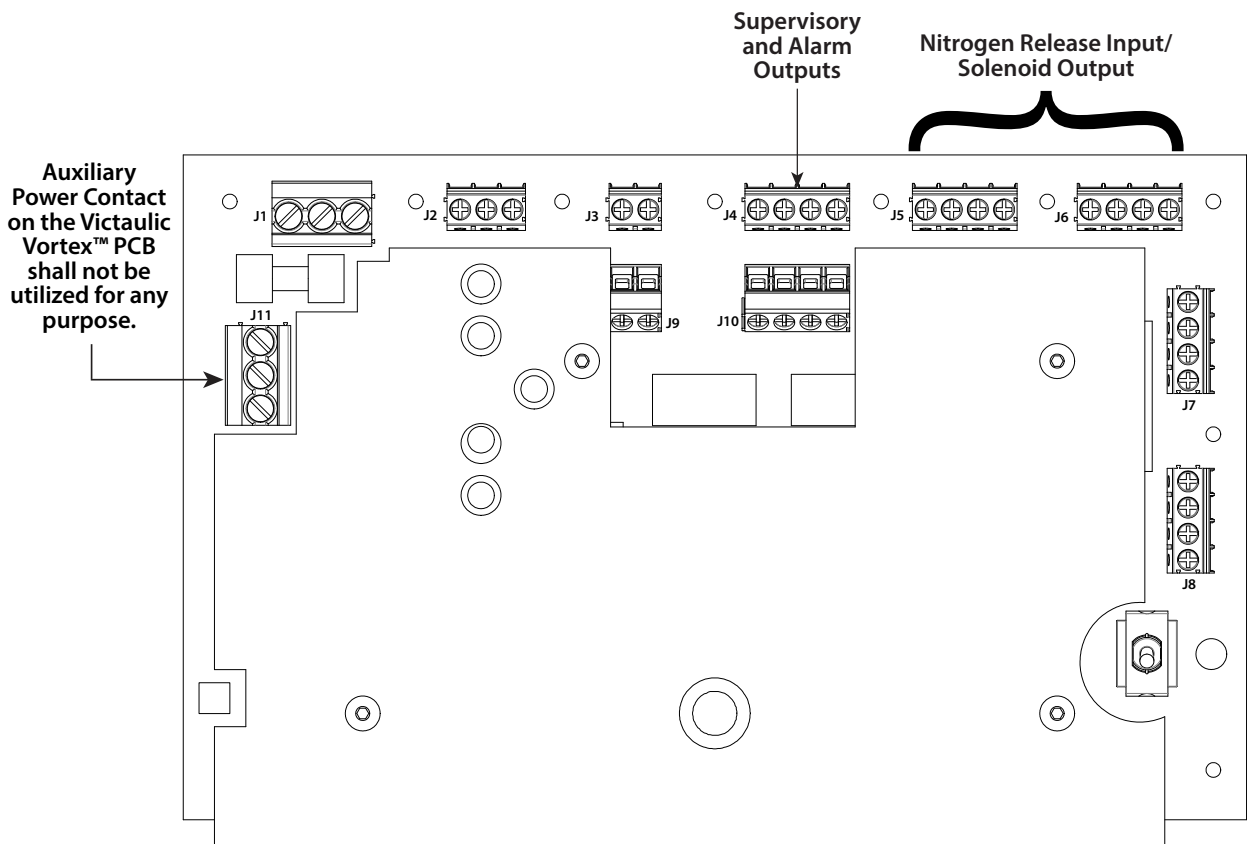
On the PCB that are two monitor points labeled “Alarm” and “Supervisory”. These points shall be monitored by the FACP for a panel alarm condition and panel fault condition.

### Victaulic Vortex™ Panel Releasing point

On the PCB are contacts labeled release input (R1) and solenoid output (S1). These contacts shall be utilized for the releasing circuit connection to the Primary release assembly. Wire the conductors from the releasing module or releasing circuit through R1 and out of S1 to the solenoid.

POWER INPUT	TRANSDUCER INPUT	RELEASE INPUT ARV	SUPERVISORY SIGNALS	NITROGEN RELEASE INPUT/OUTPUT				
24VDC Non-Resettable Supply		24VDC, 300Ω Not Used on Active Release Panels	Maintenance/ System Fault	Discharge Active	Primary 1 Release Input	Primary 2 Release Input	Discharge 1 Solenoid Output	Discharge 2 Solenoid Output
24V+ 24V- GND	SHIELD TRANSDUCER SIGNAL TRANSDUCER POWER	RELEASE+ RELEASE-	COM N.O.	COM N.O.	RELEASE 1+ RELEASE 1- RELEASE 1+ RELEASE 1-		SOLENOID+ SOLENOID- SOLENOID+ SOLENOID-	

### Printed Circuit Board (PCB) FACP Connections



### WARNING

- The Victaulic Vortex™ Panel shall be electrically tested for full functionality prior to any and all pressure testing of the Victaulic Vortex™ Pre-Engineered unit.

Failure to follow this instruction could cause system failure, resulting in death or serious personal injury and property damage.

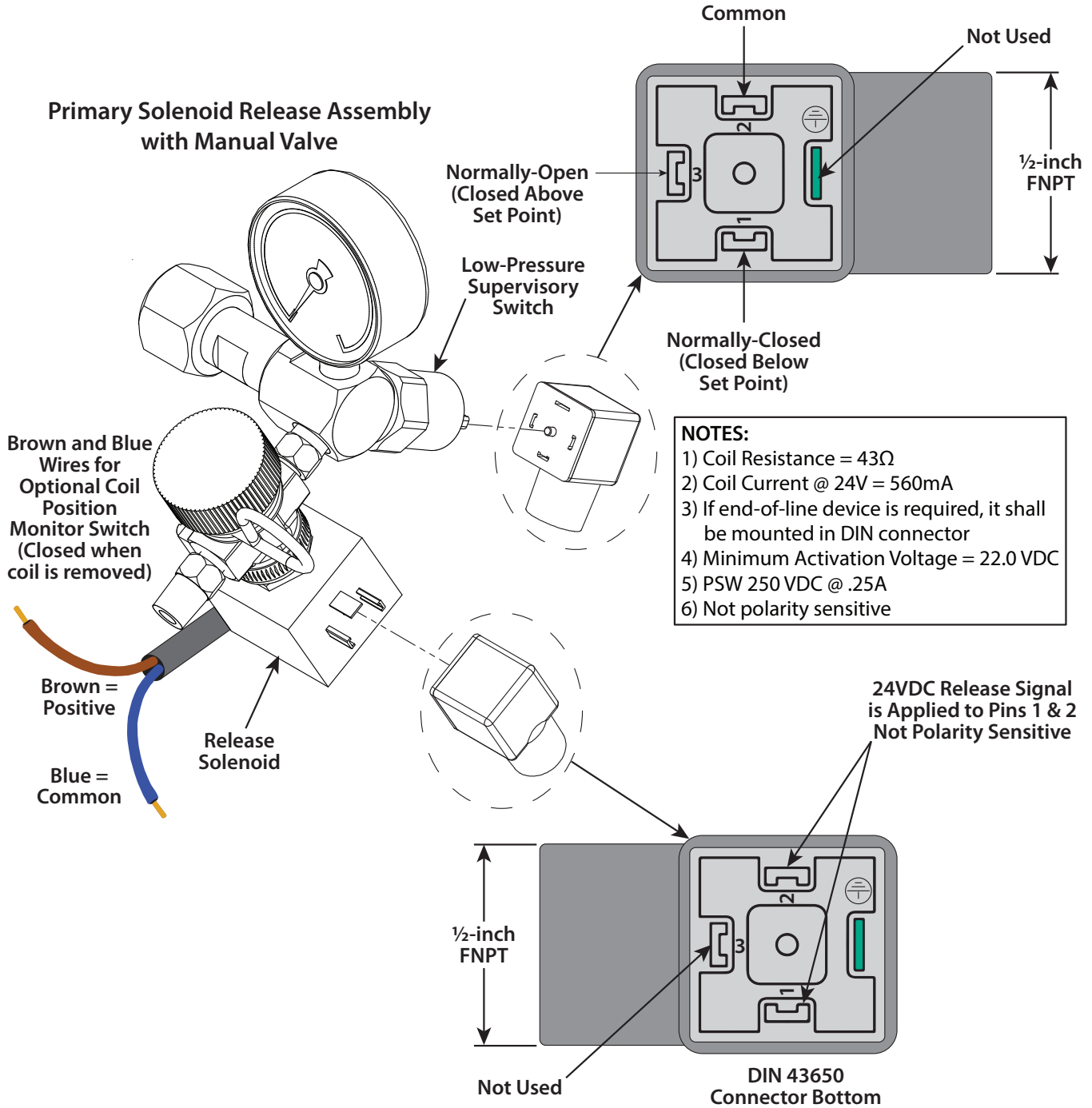
### TEST FOR:

- ARV Cycle Operation
- All Green LEDs are Illuminated with No Fault in a Normal Condition
- Water Valve Operation
- Drain Valve Operation
- Correct Water Turn On and Pressure Transducer Settings
- ARV is Fully Seated Prior to Pressure Testing

**Primary Solenoid Release Assembly Electrical Connections (With Manual Valve)**

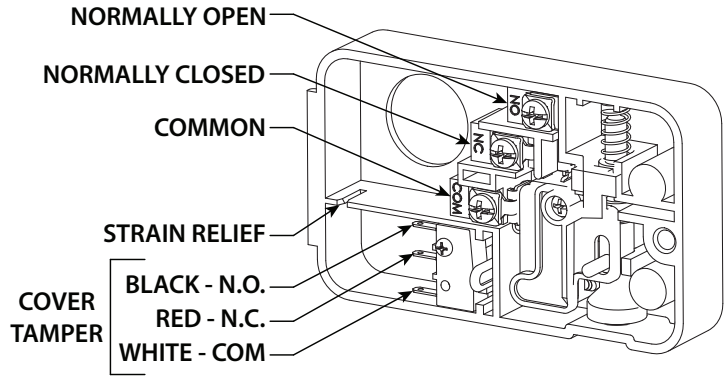
Victaulic Vortex™ Pre-Engineered System discharge begins with a 24VDC release signal from a releasing module or release circuit to the solenoid (non-polarity sensitive). Either circuit is typically programmed as solenoid release with unsupervised shorts. Connection to the solenoid is made through a female 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.

The Primary Solenoid Release Assembly contains two supervisory points: one for coil position monitoring of the solenoid coil and one for low nitrogen pressure.



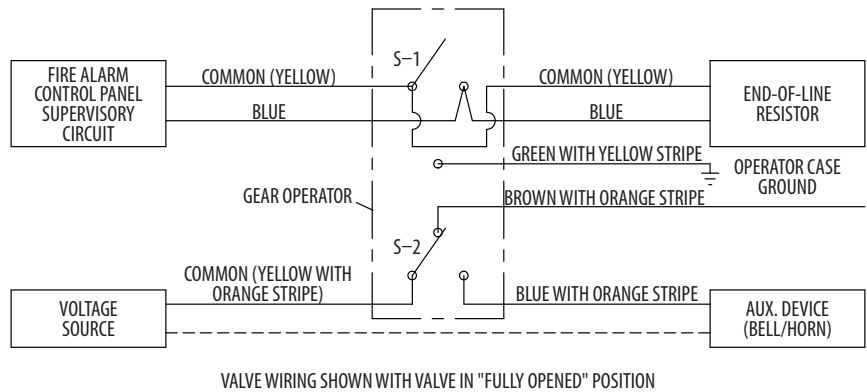


**Nitrogen Isolation Valve Electrical Connections (Wire to Agent-Releasing FACP Supervisory Input)**



**Water Line Isolation Valve (Victaulic Series 728 Ball Valve)**

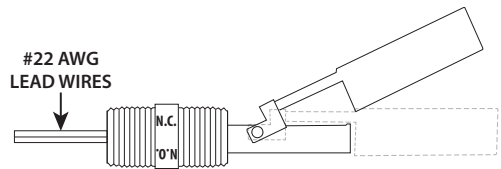
The monitor point on the isolation valve is the two solid blue conductors. The Victaulic Series 728 Ball Valve's actuator contains a female ½-inch threaded connection for conduit connections.



VALVE WIRING SHOWN WITH VALVE IN "FULLY OPENED" POSITION

**Water Tank Float Switch Installation and Wiring (Wire to Agent-Releasing FACP Supervisory Input)**

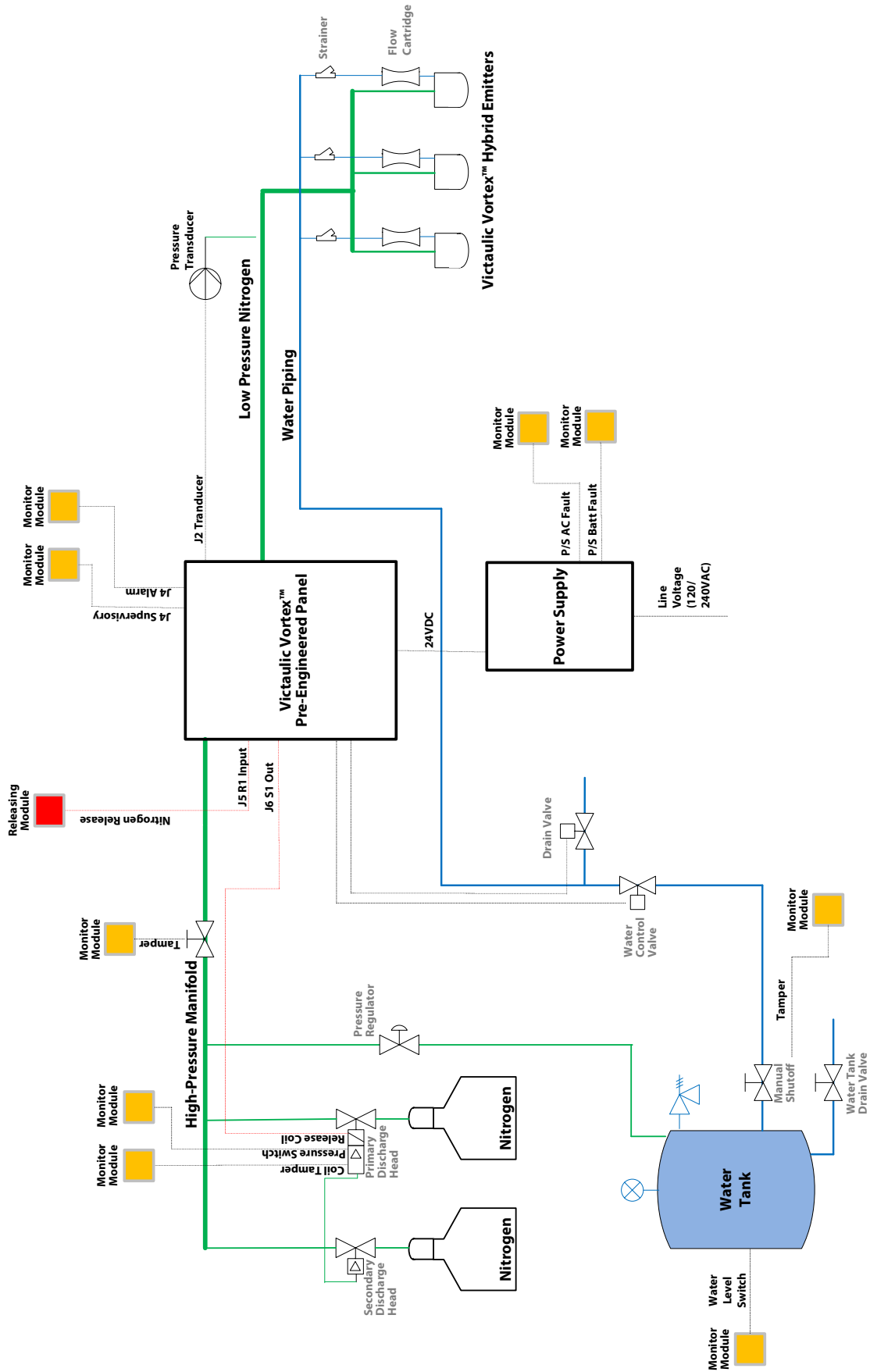
The water tank float switch is installed, as shown, with contacts open when tank is filled above the level of the switch. This float switch is not polarity sensitive.



**Power Supply Supervisory Points**

There are two monitor points on the power supply: one for monitoring AC line voltage and one for battery fault.

System Connection Diagram



# SECTION VIII

## ELECTRICAL AND FACP SPECIFICATIONS

### NOTICE

- Component wiring shall follow all applicable national and local codes and standards specific to the application area and the location within which the components are installed. It is the responsibility of the installer to consult the Authority Having Jurisdiction (AHJ) for final electrical requirements.
- Conductors and raceways shall be sized and installed by qualified electrical and/or fire alarm installers.
- Reference Section VIII of this manual for electrical specifications.
- Examples of applicable wiring raceways include, but are not limited to: EMT conduit, flexible non-metallic conduit, flexible metallic conduit, or other applicable raceway methods in accordance with specific requirements of the application location.
- All applicable grounding and bonding requirements in accordance with all applicable electrical NFPA Standards, Factory Mutual (FM) requirements, AHJ approval, and National, State, and local codes shall be considered and implemented.
- Electrical connections to Victaulic Vortex™ components are intended to be watertight/gasketed to provide protection against direct water spray, debris, and dust.
- Mounting of electrical raceways is acceptable to the structural steel and panel backplate on the Victaulic Vortex™ Pre-Engineered System, where applicable. Wiring and raceway installation to Victaulic Vortex™ Pre-Engineered System racking and back plate shall not interfere with component operation or service. Mounting hardware for such purpose is not provided by Victaulic. Bolting or taping into the panel backplate is acceptable, where required, for mounting of electrical raceways.
- Hardware utilized to mount electrical raceways, enclosures, or boxes to the Victaulic Vortex™ Pre-Engineered System's back plate shall not exceed two, 3/8-inch holes per square inch and one, 1/2-inch hole per square inch on the racking.
- "Tapping" or utilization of a knockout tool to provide additional electrical connections to either the Victaulic Vortex™ Panel or the power supply is permitted as long as the knockout does not impede operation of panel components, follows applicable national and local electrical codes and standards, and are filled with a blank when knockouts are not utilized.
- The panel backplate on the Victaulic Vortex™ Pre-Engineered System contains an area labeled "FACP", which is intended for use in mounting either a Fire Alarm Control Panel, a module/card enclosure, or modules to provide a central location for all fire alarm components required for the Victaulic Vortex™ Pre-Engineered System.

### ELECTRICAL WIRING INTRODUCTION

#### WARNING

- For proper installation and operation of the Victaulic Vortex™ Pre-Engineered 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 Victaulic Vortex™ 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™ Pre-Engineered System.

#### Victaulic Vortex™ 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

- 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 Victaulic Vortex™ Certified individual 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

- Operating voltage input
- Supervised by system fault contact
- 24VDC + Earth Ground Polarity Sensitive

#### Pressure Transducer - J2

- Polarity sensitive
- Shield connection terminated at panel only
- Operation and wiring supervised by system fault contact

#### 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**

- Refer to primary solenoid release assembly electrical specifications
- Passes through interlock switch to nitrogen solenoid output
- Release signal (R+, R1) is input from agent-releasing FACP
- Solenoid output (S+, S-) is output to primary solenoid release assembly

**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
Pre-Engineered Panel	3A	210 mA

Calculate battery backup time based on number of panels and system configuration..

**EXAMPLE**

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

**⚠ WARNING**

- **The dedicated power supplied with the Pre-Engineered unit shall not be utilized for any function outside of powering the Victaulic Vortex™ Panel. This includes powering modules for the FACP intended for releasing and monitoring the Victaulic Vortex™ Pre-Engineered System.**

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

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. It may be acceptable to have one dedicated circuit breaker for both the Victaulic Vortex™ Pre-Engineered System's power supply and the FACP.

**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 shall be monitored in accordance with applicable fire codes.

- 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 mm 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)

## FIRE ALARM SYSTEM REQUIREMENTS

### 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.
- All agent-releasing FACP, agent-releasing module, alarm devices, and detection shall be FM Approved when designing an FM Approved system.

#### Listed or Approved Agent-Releasing FACP or Agent-Releasing Module

The Victaulic Vortex™ Pre-Engineered System is designed to be activated by a Listed or Approved agent-releasing FACP or agent-releasing module. The Victaulic Vortex™ Certified individual shall use controls, detectors, notification appliances, 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.

#### Releasing Circuits and Devices

The Victaulic Vortex™ Pre-Engineered System requires at least one listed releasing circuit. This is typically achieved by wiring directly to a Listed/Approved solenoid agent release output circuit, programmed for unsupervised shorts, from the main FACP board or from a Listed/Approved releasing module.

The Victaulic Vortex™ Pre-Engineered System shall not be released from any relay module or control module that is not specifically Listed or intended for solenoid agent release.

While an NFPA 72 disconnect key switch may be required for the solenoid circuit, Victaulic recommends wiring the solenoid releasing circuit through the PCB in the Victaulic Vortex™ Panel to isolate the circuit to the solenoid when the panel is in maintenance mode or there is a fault.

#### Detection

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

All detection shall be selected to provide adequate response time to a fire event based on the expected hazards present in the application space.

#### Notification Appliances and Alarm Signaling

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. An egress time evaluation may be required to determine applicable discharge delay in accordance with the requirements for discharge delay in NFPA 770.

If there is an FACP in the building, the FACP installed to release the Victaulic Vortex™ Pre-Engineered System shall be supervised for alarm, supervisory, and trouble by the building's FACP.

#### Monitoring and Supervision

The following table contains points that shall be monitored by the FACP. There is one alarm monitor point in the Victaulic Vortex™ Panel. The rest are intended to be supervised points.

Supervisory Point	Location	Purpose
Victaulic Vortex™ Panel Supervisory	Victaulic Vortex™ Panel	Indicates System Fault
Victaulic Vortex™ Panel Alarm Output		Indicates Nitrogen Pressure at Input to Panel
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	Installer's Piping Between Nitrogen Supply and Victaulic Vortex™ Panel	Indicates Nitrogen Isolation Valve is Open
Manual Water Control Valve	Installer's Piping Between Water Supply and Victaulic Vortex™ Panel	Indicates Water Control Valve is Open

#### Auxiliary Functions and Controls

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
- Damper activation
- Any other building or equipment function that may or will directly contribute to a hazardous environment in the application space or affect fire propagation or Victaulic Vortex™ Pre-Engineered System performance.

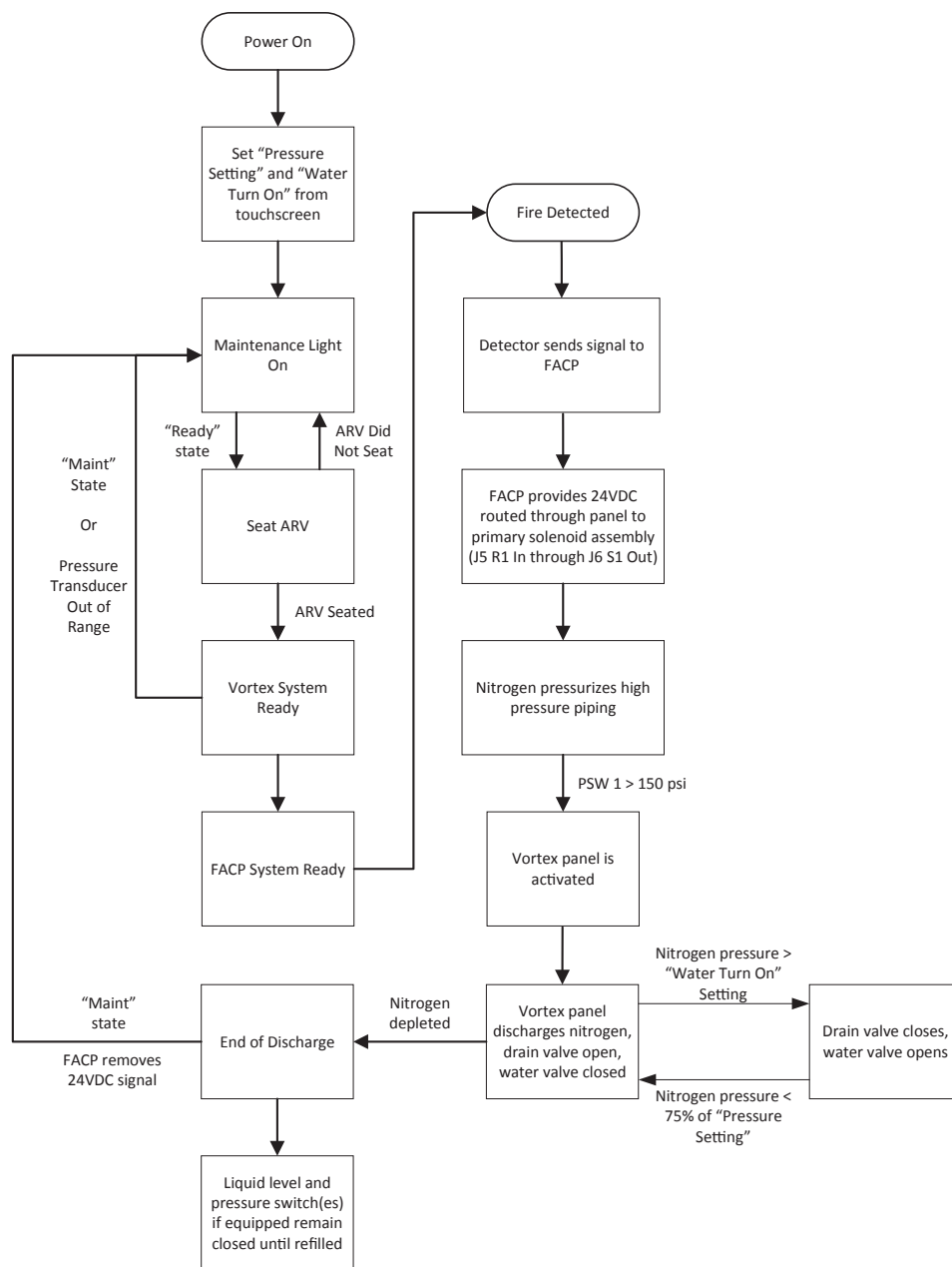
#### Auxiliary Components

Auxiliary isolation valves, pressure switches or auxiliary drain valves added to the pipe network outside of standard system components shall be monitored (supervised) to prevent accidental shut-off and proper function.

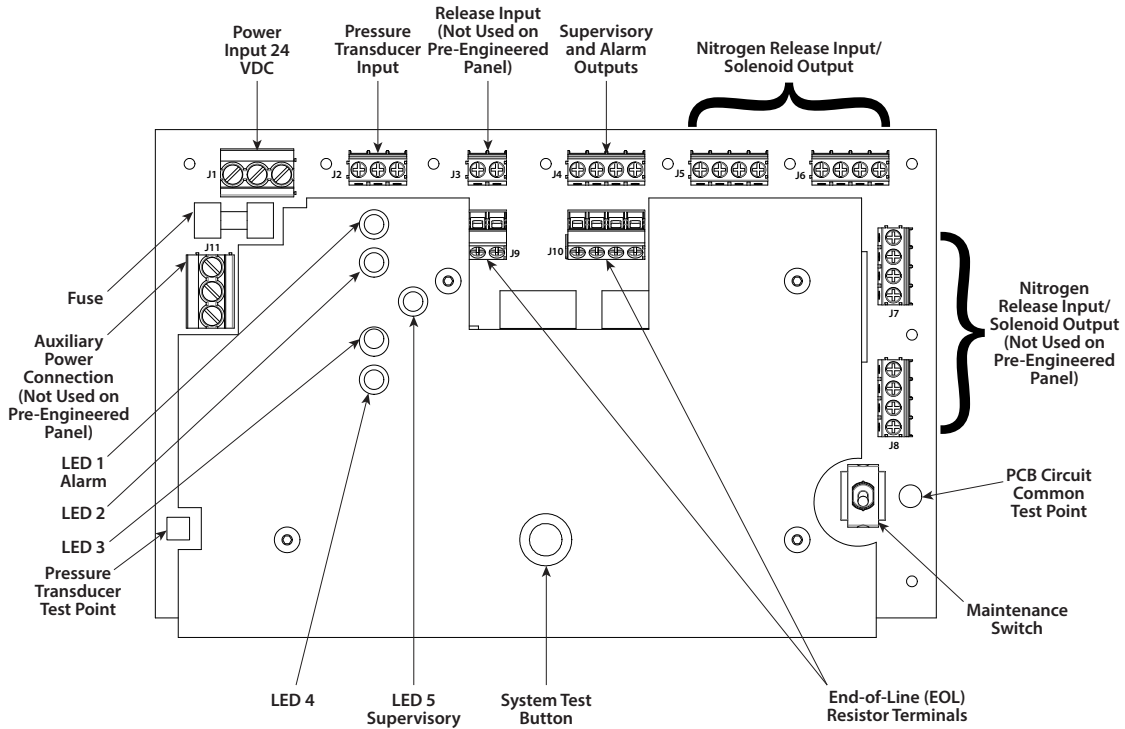
**Order of Operation for Single-Enclosure, Active Release Victaulic Vortex™ Pre-Engineered System**

1. A detector in the zone protected by the Victaulic Vortex™ Pre-Engineered System sends a signal to the agent-releasing FACP.
2. The agent-releasing FACP provides a 24VDC release signal routed through the Victaulic Vortex™ Panel to one or more primary solenoid release assemblies.
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 Victaulic Vortex™ 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 Victaulic Vortex™ 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 Victaulic Vortex™ Panel reaches the “Water Turn On” setting.
9. The water valve closes when the pressure transducer downstream of the Victaulic Vortex™ 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 – Pre-Engineered Panel**



**PRINTED CIRCUIT BOARD (PCB)**

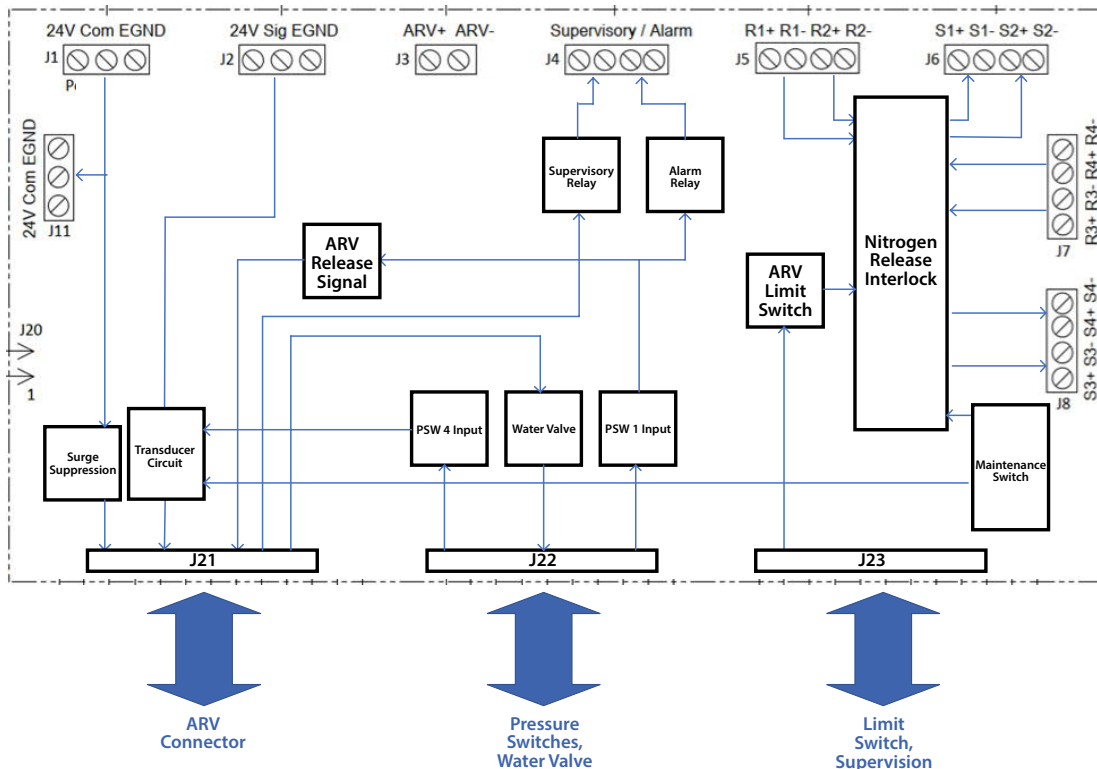


The printed circuit board (PCB) is located within the Victaulic Vortex™ Panel and provides user wiring connection points, LED diagnostics, and the logic to operate components in the Victaulic Vortex™ Panel. This PCB is designed for use with Victaulic-recommended 24-volt DC power supplies. A plastic cover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

Not all connectors are used in every installation. Refer to Section VII 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. DO NOT use the auxiliary power connection on the Victaulic Vortex™ Pre-Engineered System.

In the normal system ready state, the Victaulic Vortex™ Panel should display three green LEDs (LED 2, LED 3, and LED 4). 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 Operation of Active Release Pre-Engineered Panel with External Ball Valve and Drain**

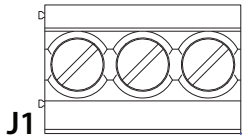


**ELECTRICAL CONNECTIONS**

**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

**24V Com EGND**

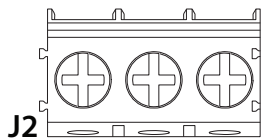


**J1**

**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 Victaulic Vortex™ Panel. The power input is polarity sensitive; therefore, the Victaulic Vortex™ Panel will not power up if the polarity is reversed.

**24V Sig EGND**

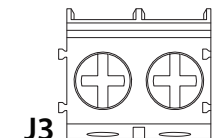


**J2**

**Pressure Transducer Input**

The pressure transducer input is used in the Victaulic Vortex™ Panel. The Victaulic Vortex™ Pre-Engineered 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).

**ARV+ ARV-**

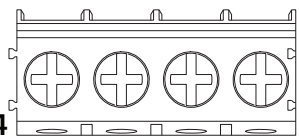


**J3**

**Panel Release Input**

The J3 terminal is not used in the Victaulic Vortex™ Pre-Engineered Panel.

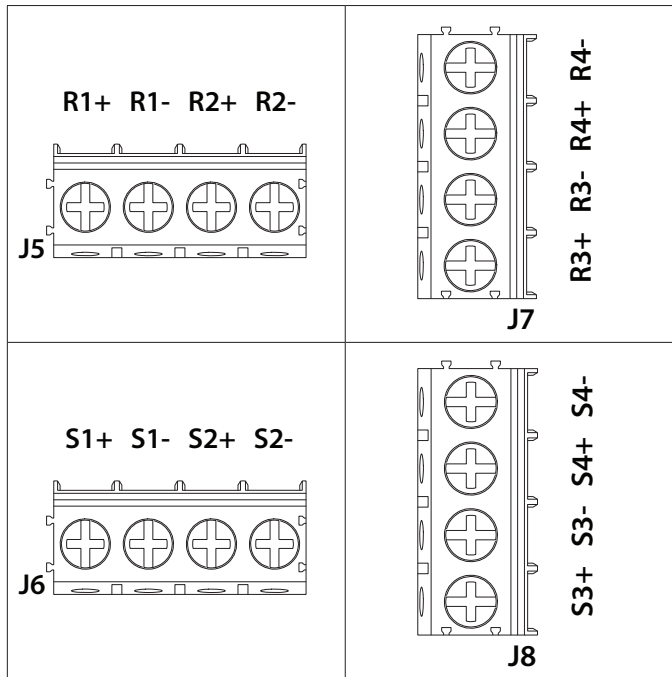
**Supervisory/Alarm**



**J4**

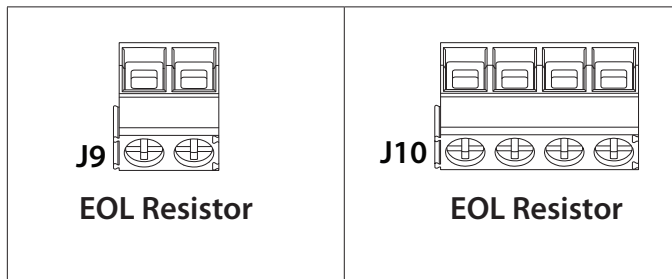
**Supervisory/Alarm Signals**

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™ Pre-Engineered System is connected to agent-releasing FACP 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.



**Nitrogen Release Input/Solenoid Output**

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. For the Victaulic Vortex™ Panel, only one pair is required with one release circuit. 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 shall be configured to supervise the release signal.

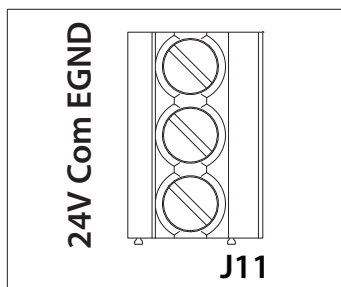


**EOL Resistors**

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**

The auxiliary contact shall not be used in the Victaulic Vortex™ Pre-Engineered Panel for any auxiliary power purpose.

## FACP PROGRAMMING GUIDANCE

The following information is subject to all applicable local codes, standards, and AHJ acceptance. The specific requirements for fire alarm sequence can and will vary based on the type of application, type of expected fire, and applicable codes and standards. This information is intended to serve as an example and does not represent a recommendation for all system fire alarm design requirements.

Basic sequence of operations in the program of the agent releasing FACP should follow the general outline:

1. Initial detection:

- Initial notification appliances are sounded to initiate evacuation of the hazard space
- There is typically at least two "zones" or "stages" of detection required to activate in order to release a special hazard system

2. Pre-Discharge:

- Activated after second stage of detection is initiated and discharge delay countdown is started
- Discharge time delay is based on the determined egress time
- Egress time is determined from an egress time study

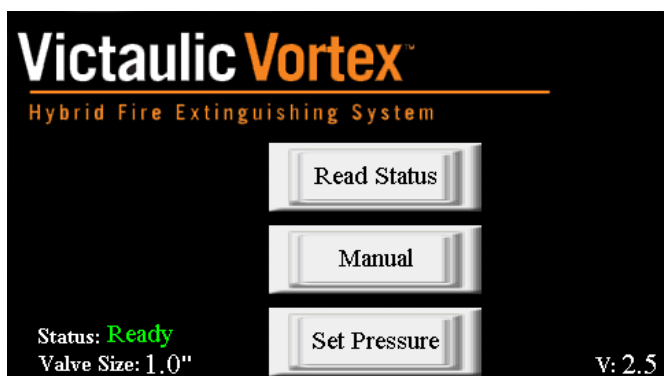
3. Discharge:

- Following discharge delay, signal is sent to the releasing module wired to the Vortex solenoid through the PCB
- Manifold pressurizes
- Alarm contact in the Victaulic Vortex™ Pre-Engineered
- Discharge initiates

	Event					
	Pre-Alarm	Pre-Discharge	30-Sec. Delay	Discharging	Post Discharge	FACP Silenced
Detection Zone/Stage 1	X	X	X	X	X	X
Detection Zone/Stage 2		X	X	X	X	X
Releasing Solenoid Output				X	X	X
Notification: Strobes	X	X	X	X	X	X
Notification: Horns @ 60 BPM	X					
Notification: Horns @ 120 BPM		X	X			
Notification: Horns @ Steady				X	X	
<b>Victaulic Vortex™ Panel Alarm Monitor</b>						
Victaulic Vortex™ Panel Alarm Monitor				X		
<b>Victaulic Vortex™ Panel Fault Monitor</b>						
Victaulic Vortex™ Panel Fault Monitor				X	X	X
<b>Water Tank Float Switch</b>						
Water Tank Float Switch					X	X
<b>Nitrogen Low-Pressure Switch</b>						
Nitrogen Low-Pressure Switch					X	X
NOTE: An "X" indicates an activated device or circuit. Specific orders, zones, sequencing, and notifications are examples only and are not representative of specific requirements for all applications.						

# SECTION IX

## 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.

A wire harness and touch-screen interface for performing maintenance functions can be ordered separately.

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.

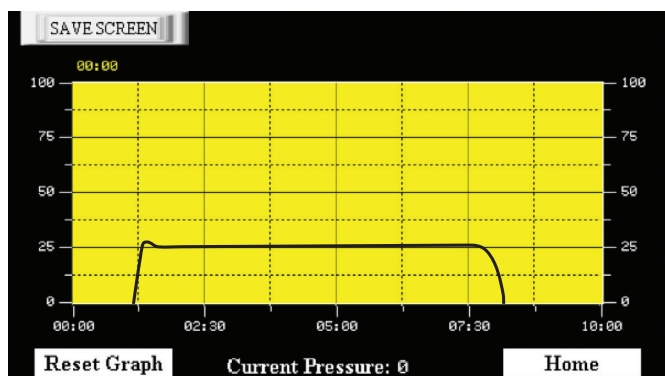
The touch-screen interface is normally in the sleep mode (screen will be blank). Touch the display to refresh/view the home screen. **NOTE:** The display will automatically go to sleep after approximately 90 seconds of screen inactivity.

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. 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.

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.



# SECTION X

## SYSTEM ACCEPTANCE

### DANGER

- Before performing maintenance on any Victaulic Vortex™ Pre-Engineered 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 the Victaulic Vortex™ Panel is fully seated and that the panel is in maintenance state.

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™ Pre-Engineered System.
- Any impairments to the system shall be corrected in a timely manner.

### WARNING

- The Victaulic Vortex™ Panel shall be electrically tested for full functionality prior to any and all pressure testing of the Victaulic Vortex™ Pre-Engineered System.
- 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 this instruction could cause system failure, resulting in death or serious personal injury and property damage.

#### TEST FOR:

- ARV Cycle Operation
- All Green LEDs are Illuminated with No Fault in a Normal Condition
- Water Valve Operation
- Drain Valve Operation
- Correct Water Turn On and Pressure Transducer Settings
- ARV is Fully Seated Prior to Pressure Testing

Victaulic recommends that system acceptance review and testing be conducted prior to placing a Victaulic Vortex™ Pre-Engineered 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™ Pre-Engineered 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 Section IV) 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 Victaulic Vortex™ 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 V
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 V
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. The ARV will attempt to seat the needle valve, and the yellow supervisory indicator light will go out.
2. Confirm operation of the Victaulic Vortex™ Panel's external water and drain valves. 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 the Victaulic Vortex™ Panel. The touch-screen interface may be used to manually actuate the supervisory contact.
4. The water tank regulator, if used, should be adjusted to the required pressure during system acceptance testing.
5. 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.
6. 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™ Pre-Engineered 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. Verify that the low-pressure piping is not obstructed.
2. Verify that the ARV in the Victaulic Vortex™ Panel is seated and closed.
3. Place maintenance switch in the Victaulic Vortex™ Panel in the maintenance position. Confirm that the yellow supervisory indicator light is on.
4. 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.
5. 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.
6. 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.
7. The water tank regulator, if used, may be adjusted as needed to supply the required pressure to the water tank.
8. Release the nitrogen pressure from the manifold after testing by using the bleed valve on the manifold (or other appropriate method).
9. 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 Victaulic Vortex™ Panel is seated and closed.
3. Place maintenance switch in the Victaulic Vortex™ 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™ Pre-Engineered 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 IV, 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, and water valve and drain valve 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, 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<sup>3</sup>/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.

#### 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 maintenance switch in the Victaulic Vortex™ Panel in the maintenance position. Confirm that the yellow supervisory indicator light is on.
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

**⚠ 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.

6. 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
7. 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
8. 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. Turn water supply isolation valve back to open position
  - f. 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 maintenance switch in the Victaulic Vortex™ Panel in the maintenance position. Confirm that the yellow supervisory indicator light is on.
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. 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.

7. 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
8. Return the maintenance switch to the ready position. Verify that the yellow supervisory indicator light remains off.
9. 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. Pressure at the input of the Victaulic Vortex™ Panel will cause a discharge active supervisory output from the Panel

**Abbreviated Nitrogen Discharge (Continued)**

10. 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

**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. Close the nitrogen supply isolation valve between the manifold and the Victaulic Vortex™ Panel.
3. 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
4. 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.
5. Place maintenance switch in the Victaulic Vortex™ Panel in the ready position. Verify that the yellow supervisory indicator light remains off.
6. 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. Pressure at the input of the Victaulic Vortex™ Panel will cause a discharge active supervisory output from the Panel
  - c. Water discharge will occur within 30 seconds from the start of the discharge
  - d. Nitrogen pressure at the hybrid emitters will reach 85% of the operating pressure within 30 seconds
7. 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

# SECTION XI

## OPERATION AND MAINTENANCE

### MANUAL DISCHARGE PROCEDURE

Power is required to the Victaulic Vortex™ Panels to discharge the system. The Victaulic Vortex™ Panel 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.

1. Verify that the maintenance switch is in the ready position.
2. Release nitrogen at the primary solenoid release assembly by rotating the handwheel on the primary solenoid release assembly in the indicated open direction.
3. Pressure at the input of an Active Release Panel will cause the ARV needle valve to begin opening, 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 below.
2. Drain the water piping completely to prevent formation of rust or corrosion that could be released during subsequent discharges.
3. Clean the strainer at the outlet of the water tank 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 re-seat 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™ Pre-Engineered 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 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 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 as well as the flex hose off water tank outlet. Clean (flush) water tank and flex hose to remove debris. Refill water tank.
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. Inspect and clean water trim strainer. If visual examination shows any damage or deterioration, strainer shall be replaced immediately.
7. Check the water tank and nitrogen cylinders for signs of damage.
8. Verify operation of primary discharge solenoid coil.
9. Inspect and cycle auxiliary valves, including auxiliary drain valves, and test connections.

### 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 re-qualification of cylinders used as a fire extinguisher (part 180). For additional guidance on marking, testing, recharge, re-qualification, and shipment, refer to the Fire Suppression Systems Association’s (FSSA) 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.

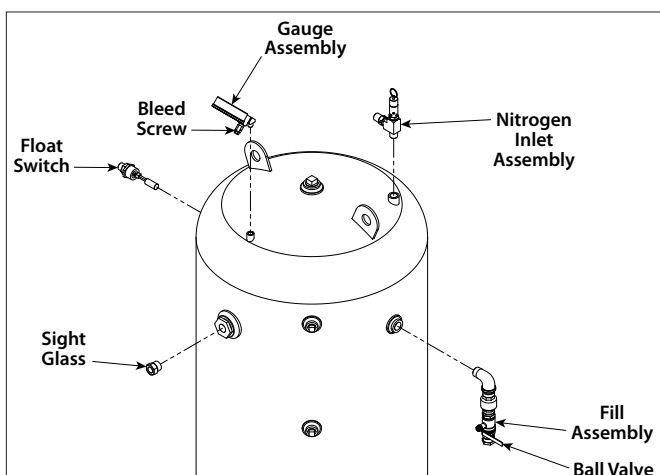
### Records

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. Add water to tank until full.
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 X.

# SECTION XII

## INDIVIDUAL CYLINDER REFILL PROCEDURE

### ⚠ WARNING



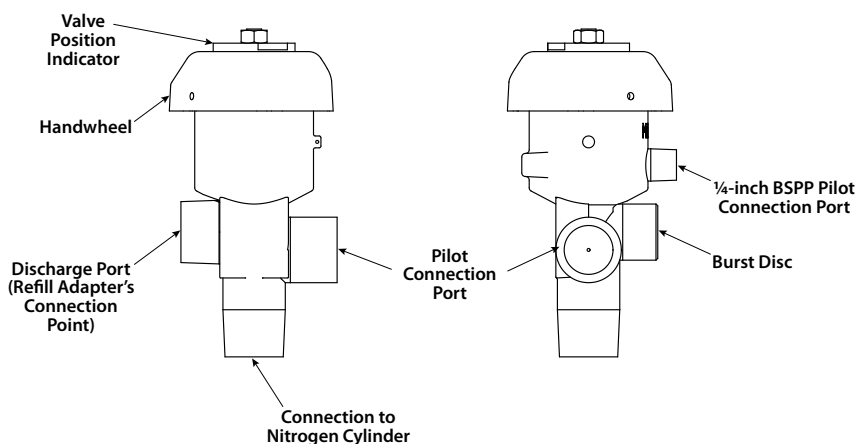
Failure to follow instructions and warnings may cause system failure, resulting in serious personal injury, death, and property damage.

- Read and understand all instructions before attempting to install, remove, adjust, or maintain any Victaulic products.
- Wear safety glasses, hardhat, and foot protection.
- These 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.
- Before performing maintenance on any Victaulic Vortex™ system components, verify that 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. **DO NOT** attempt to tighten or loosen any pressurized connections.
- During inspection and maintenance, any damaged components shall be replaced.
- All connections and bracing **SHALL** be installed and tightened before the manifold is pressurized **AND** before attempting to test or operate the system.
- Always download the current revision of these instructions by scanning the QR code found on the label applied to the refill adapter.

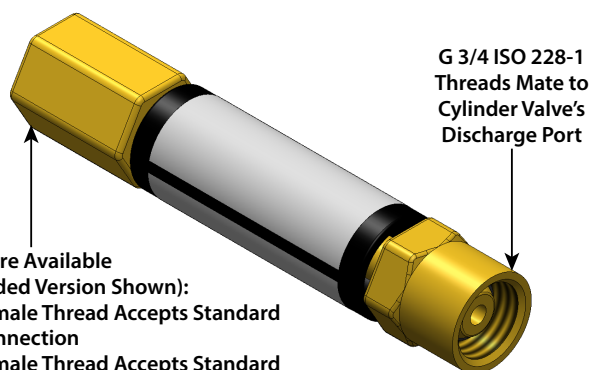
Several options are available for refilling cylinders after a discharge. The choice of refill method is dependent upon locally available facilities and equipment. Refilling cylinders shall always be done in accordance with all applicable codes and standards (reference warnings on following page).

- 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.

### Cylinder Valve Assembly

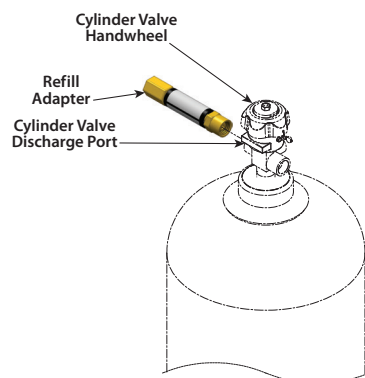


### Refill Adapter (Female Threaded Version Shown)



- Two Versions are Available (Female Threaded Version Shown):
- 1) CGA 580 Female Thread Accepts Standard CGA 580 Connection
  - 2) CGA 677 Female Thread Accepts Standard CGA 677 Connection

### Refill Adapter Connection Point



\* The 1/4-inch BSP Tee Nipple is shown removed from the cylinder valve for clarity.



## 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 serious personal injury, death, 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 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.

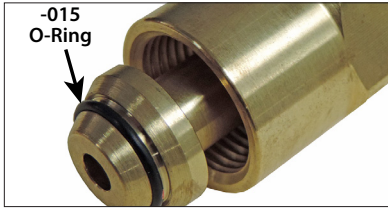
1. Verify that there is no trapped nitrogen acting on the cylinder valve's valve position indicator. Relieve pressure from the pilot line by depressing the pin on the pilot line bleed valve with the appropriate tool. **DO NOT ATTEMPT TO DEPRESS THE SCHRADER\* VALVE LOCATED ON THE CYLINDER VALVE.**
2. 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 gauge 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

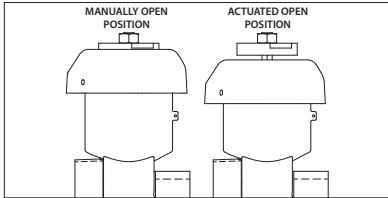
- Nitrogen cylinders contain stored energy that can discharge explosively. All nitrogen cylinder operations such as transportation, service, filling, and installation shall be performed only by personnel trained on the hazards and proper handling techniques.
  - All nitrogen cylinder movement shall be done with appropriate material handling equipment. Always secure nitrogen cylinders while in storage or during use.
  - NEVER TRANSPORT NITROGEN CYLINDERS WITHOUT THE CYLINDER CAP INSTALLED.
  - All operations within this instruction sheet and the applicable Vortex Installation, Operation, and Maintenance Manual shall be in accordance with the following:
    - Code of Federal Regulations (CFR)
    - Occupational Safety and Health Administration (OSHA)
    - Compressed Gas Association (CGA)
    - National Fire Protection Association (NFPA)
    - Authority Having Jurisdiction (AHJ)
    - All other applicable laws, codes, and industry standards
  - No information within this instruction sheet, nor within the applicable Vortex Installation, Operation, and Maintenance Manual, is intended to contradict the standards referenced above. If a conflict arises, a qualified engineer shall be consulted for resolution.
- Failure to follow these instructions may cause unexpected, violent movement of nitrogen cylinders, resulting in serious personal injury, death, and property damage.

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

## 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 32-mm wrench, install the BSPP threaded end of the refill adapter to the cylinder valve's discharge port, as shown in the drawing on page 86.
2. Attach the nitrogen source to the CGA 580 or CGA 677 connection of the refill adapter.
3. Remove the safety wire tie from the cylinder valve assembly.

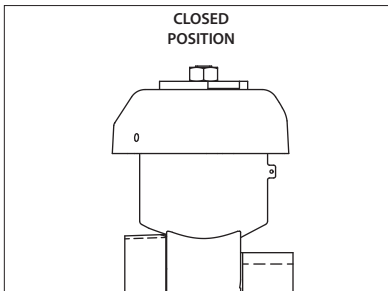


4. Fully open the cylinder valve manually by turning the handwheel counterclockwise. This will raise the valve position indicator to the top of the handwheel, as shown in the graphic to the left.

### ⚠ 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 serious personal injury, death, 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. Always reference the system documentation for required quantity of nitrogen and fill pressure.
6. When the cylinder is refilled, stop the flow of source nitrogen.



- 7a. Fully close the cylinder valve manually by turning the handwheel clockwise. The valve position indicator is spring-loaded and will travel downward with the handwheel, as shown in the graphic to the left.
- 7b. 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 or CGA 677 connection of the refill adapter.
9. Using a 32-mm wrench, remove the refill adapter from the discharge port of the cylinder valve.



**Cylinder Valve shown 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



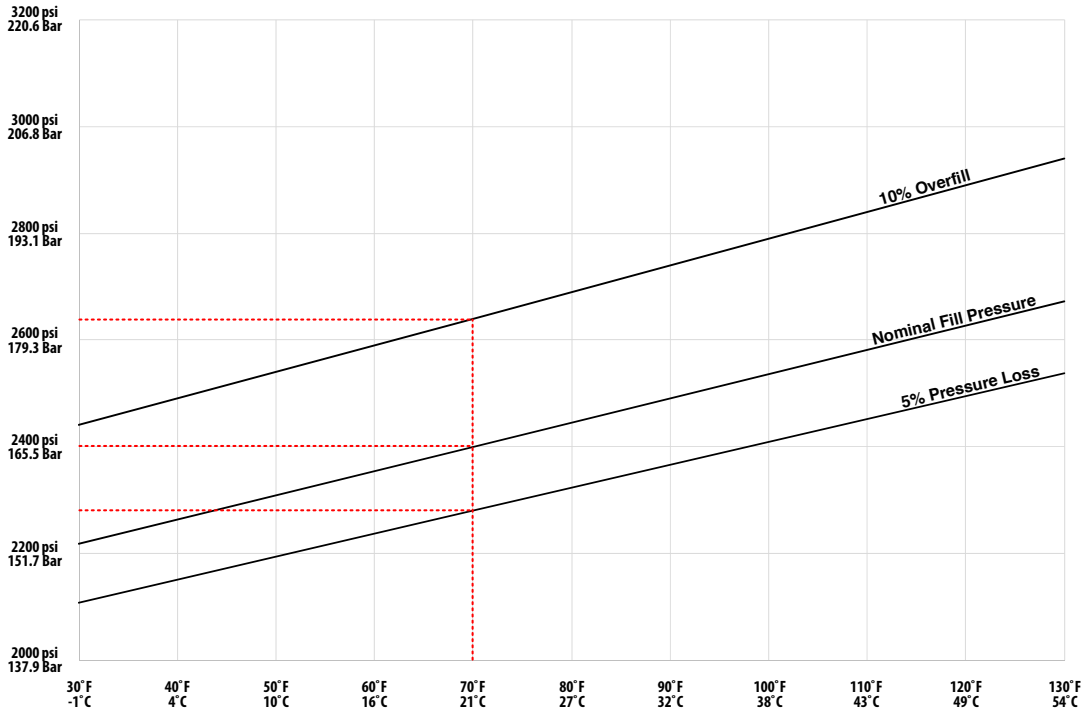
- All connections and bracing **SHALL** be installed and tightened before the manifold is pressurized **AND** before attempting to test or operate the system.
  - **DO NOT** attempt to tighten or loosen any pressurized connections.
  - During inspection and maintenance, any damaged components shall be replaced.
- Failure to follow these instructions can cause unexpected, violent movement of nitrogen cylinders, resulting in serious personal injury, death, and property damage.

1. Reinstall the cylinder(s) into the rack and return the system to service by following all instructions listed in this manual.

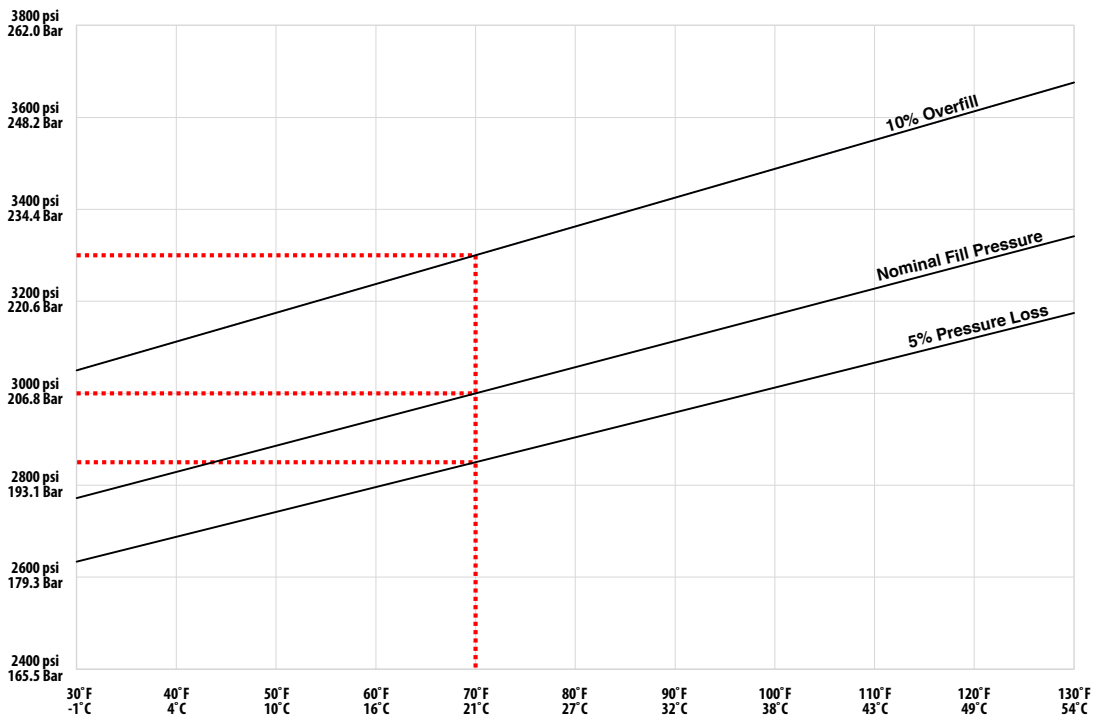
**Cylinder Capacity**

The nitrogen requirement is determined by the hazard zone size, pipe size, number of hybrid emitters, discharge time, and pipe lengths to individual hazard zones. Nitrogen is stored in the cylinders as a gas. Cylinders are available in 49-liter and 80-liter capacities, filled at 2400 psi and 3000 psi respectively. Refer to Victaulic publication 70 .04 for complete nitrogen cylinder material specifications and dimensions.

**Temperature Effects on Nitrogen Pressure  
49-liter Cylinder with 2400-psi/165.5-Bar Nominal Fill**



**Temperature Effects on Nitrogen Pressure  
80-liter Cylinder with 3000-psi/206.8-Bar Nominal Fill**



# SECTION XIII

# TROUBLESHOOTING

**TROUBLESHOOTING – VICTAULIC VORTEX™ PANEL**

Condition	Possible Causes	Recommended Actions
Supervisory contact from Victaulic Vortex™ Panel is closed. No indicator lamps are lit.	Victaulic Vortex™ Panel is not powered Power wiring polarity is incorrect Fuse on PCB is open	Restore system power Verify and correct power wiring 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 Maintenance switch is in maintenance position Internal wiring to the ARV, or the ARV itself, is damaged	Verify and repair pressure transducer wiring Place maintenance switch in ready position 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. LED 4 is off	A component is unplugged or internal Victaulic Vortex™ Panel wiring is damaged Needle valve is not seated	Check internal Victaulic Vortex™ Panel wiring for unplugged components 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 Maintenance switch is in maintenance position	Cycle maintenance switch and troubleshoot supervisory contact/fault indicator lamp 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 Victaulic Vortex™ Panel is not a Dry Contact Panel	Cycle maintenance switch and troubleshoot supervisory contact/fault indicator lamp 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 Victaulic Vortex™ Panel is not an Active Release Panel	Cycle maintenance switch and troubleshoot supervisory contact/fault indicator lamp 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 Inadequate power supply voltage	Check pressure transducer wiring Verify input voltage to Victaulic Vortex™ Panel is within specified range
Touch-screen interface pressure indicates "open"	Maintenance switch is in maintenance position Faulty pressure transducer wiring	Return maintenance switch to ready position Check pressure transducer wiring
Agent-releasing FACP indicates open circuit on nitrogen solenoid release signal	Needle valve is not seated Maintenance switch is in maintenance position	Cycle maintenance switch to maintenance position and then back to ready position to seat needle valve Return maintenance switch to ready position
Primary discharge solenoid does not activate when nitrogen release signal is applied	Needle valve is not seated Maintenance switch is in maintenance position	Cycle maintenance switch to maintenance position and then back to ready position to seat needle valve Return maintenance switch to ready position

**TROUBLESHOOTING – GENERAL EQUIPMENT**

Condition	Possible Causes	Recommended Actions
Supervisory from nitrogen isolation valve	Nitrogen isolation valve is not open Supervisory switch is not positioned correctly	Open nitrogen isolation valve 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 Water tank level switch is not positioned correctly	Verify water level with sight glass Inspect and reposition water tank level switch, as required

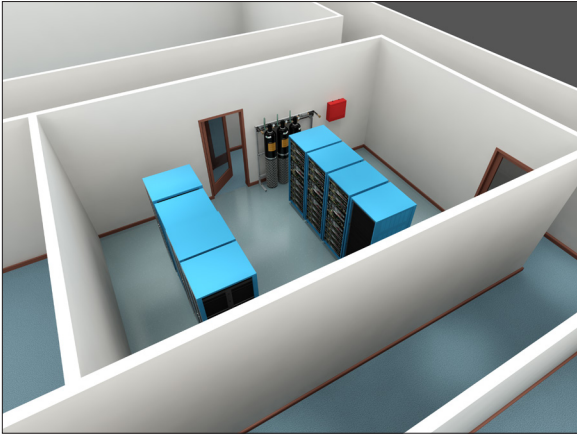
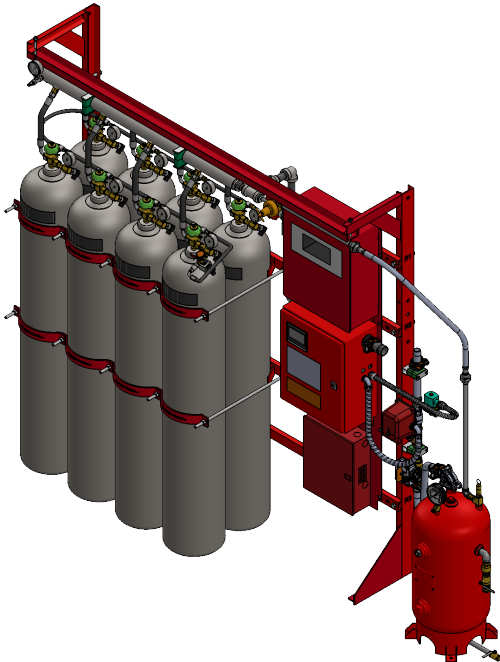
**⚠ CAUTION**

- 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).

# APPENDIX A PROTECTION OF DATA PROCESSING ROOMS/HALLS OVERVIEW

## Protection of FM Approved Data Processing Rooms/Halls Above-Raised Floor



## ⚠ WARNING

The Victaulic Vortex™ system SHALL NOT be used in areas that contain the following materials, unless approved by the AHJ:

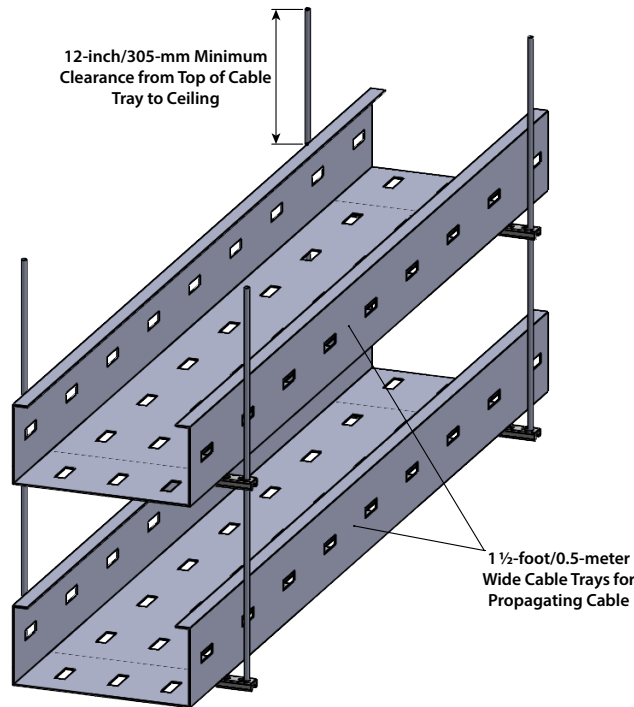
- Chemicals or mixtures of chemicals, such as cellulose nitrate and gun powder, that are capable of rapid oxidation in the absence of air
- Reactive metals, such as lithium, sodium, potassium, magnesium, titanium, zirconium, uranium, and plutonium
- Metal hydrides
- Chemicals, such as certain organic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

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

Acceptable applications can be determined by referencing the FM Listing and FM Loss Prevention Data Sheets.

**Total Flooding Class A Data Processing Rooms/Halls Applications** - For the protection of data processing rooms/halls above floor in enclosures and similar spaces where Class A fuels are present. Examples include enclosures with data processing equipment (data centers, information technology equipment, telecommunication facilities, cable spreading rooms) and other similar equipment using Class A fuels. Typically, 5/8-inch hybrid emitters are used for Total Flooding Class A Applications. Smaller or larger hybrid emitters are available for applications where a lower or higher discharge rate is required to meet the recommend discharge times.

The FM Approval for Data Processing Rooms/Halls includes and was tested with multiple stacked cable trays with propagating cable materials and a 12-inch/305-mm minimum clearance from the top of the cable tray to the ceiling, as shown below.



Hybrid Emitter	Orientation	Foil Type	Required Operating Pressure	Nitrogen Flow Rate @ Required Operating Pressure	Required Water Flow Control Cartridge	Required Discharge Time	Flooding Factor Data Processing Rooms/Halls
3/8 inch	Pendent	Cavity	50 psi/3.4 Bar (40 – 60 psi/2.8 – 4.1 Bar Acceptable)	130 SCFM 3.68 Sm <sup>3</sup> /min	0.13 GPM 0.50 LPM	3.5 Minutes Minimum	0.375
5/8 inch	Pendent	Cavity		369 SCFM	0.53 GPM		
5/8 inch	Sidewall	Cavity		10.45 Sm <sup>3</sup> /min	2.00 LPM		

Refer to Victaulic publication 70.12 for hybrid emitter dimensions and performance

### 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 -20%/+20% pressure difference for 50 PSI nominal pressure emitters.

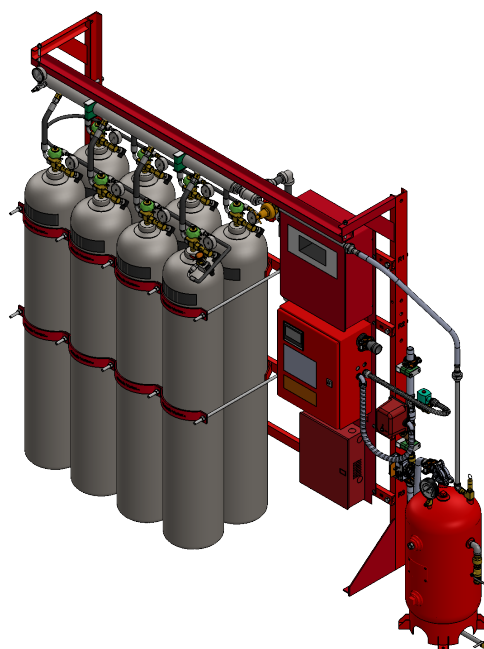
- Hybrid emitters shall be distributed throughout the protected space to provide even distribution of hybrid media, in accordance with the hybrid emitter minimum and maximum spacing rules in accordance with Factory Mutual (FM) requirements.
- Hybrid emitters may be angled to optimize distribution and 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 24 inches/610 mm is recommended depending on the hybrid emitter type. 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.

# APPENDIX B

## PERFORMANCE-BASED DESIGNS

### OVERVIEW

## Protection of Special Hazards: Class A/C and B Fire Hazard Applications, and Other High-Value Assets Using Performance Based Design Outside the FM Approvals



The Victaulic Vortex™ Pre-Engineered System can be used for total flooding applications. System design starts with determining the type of application, which is based on the hazard. For total flooding applications, the quantity of nitrogen is determined by the hybrid flooding factor for the application and the atmospheric conditions. The quantity of emitters is determined by the quantity of nitrogen required and the total flow required to meet the discharge time requirements. The quantity of water is based on the required water flow control cartridge for the emitter and application type.

The Victaulic Vortex™ Pre-Engineered System has two primary system configurations:

**1.** Class A applications include expected fires that occur when common combustible materials like wood, paper, fabric, trash, plastics, and cabling catch fire. The Class A Victaulic Vortex™ Pre-Engineered System configuration utilizes hybrid emitters that primarily inert the hazard space with less water flow for extinguishing fires with heat release rates consistent with Class A combustibles. This system configuration typically results in minimal wetting of the application space.

- Class A system configurations are limited to applications containing Class A materials where combustibility is low, quantities of combustibles are low-to-moderate, and fires with low-to-moderate heat release rates are expected.

**2.** Class B applications include expected fires that occur when flammable liquids, especially fuels, gasoline, paint, kerosene, and lubrication oils are ignited in various quantities. The Class B Victaulic Vortex™ Pre-Engineered System configuration utilizes hybrid emitters that primarily cool the hazard space by utilizing a higher rates of water flow while also inerting the hazard space.

- Flooding Factors with Class B Fuels Per NFPA 770 (3-Minute Discharge Time) – the testing conducted by utilizing procedures in NFPA 770 Appendix B.5, “Tests with Class B Fuels.” These values are provided for use in total- flooding Victaulic Vortex™ systems designed to meet the requirements of NFPA 770, Chapter 8.

**Total Flooding Applications with Energized Electrical Equipment** – Electrical conductivity of hybrid media and incidental collection of water on any surfaces shall be addressed when considering applications where the primary fire is a Class C. Conditions for shutdown of energized equipment is at the discretion of the AHJ and applicable codes and standards. Refer to the hybrid factors and design recommendations based on the hazard evaluation and fuels present. System selection for total flooding application with Class C hazards is typically configured with Class A system design guidance.

**Additional Guidance for Specific Hazards** – Additional guidance for protecting specific hazards may be available in Victaulic Application Notes. Refer to the Victaulic Vortex™ Portal for the most recent updates, Additional guidance for using hybrid systems for protecting specific hazards may be available from Victaulic or third parties, such as FM Global, that have an interest in protecting specific hazards.

System designs shall meet the minimum nitrogen requirements per the design criteria for the hazard. Typical designs will result in oxygen levels between 12.5% -14%. Expected oxygen level shall be calculated considering the discrete number of cylinders used and nitrogen delivered to the space. The stated equations do not include reduction due to a fire. Guidance for potential exposure times shall be acceptable to the AHJ and follow applicable codes, standards, industry best practices, and sound engineering judgment.

## NOTICE

- For applications that fall outside the scope of this manual, such as local applications, FM Approved Wet Benches, FM Approved Combustion Turbines, FM Approved machinery spaces, or system designs utilizing piping configurations that differ from the piping rules in this manual, reference the applicable VDM-VORTEX, Victaulic Vortex™ Engineered System Design Manual, and the Victaulic Vortex™ Portal for technical guidance.

Intended Hazard Selection	Hybrid Emitter	Foil Type	Recommended Operating Pressure	Flow Rate at Recommended Operating Pressure	Recommended Water Flow Control Cartridge	Recommended Discharge Time
Class A	3/8 inch	Cavity	50 psi/3.5 Bar (40.0 – 60.0 psi/2.8 – 4.1 Bar Acceptable)	130 SCFM 3.7 Sm <sup>3</sup> /minute	0.13 GPM 0.5 LPM	2.1 Minute Discharge Minimum Per Victaulic Requirements, 3 Minute Maximum Per NFPA 770.
	3/8 inch	Cavity	25 psi/1.7 Bar (22.5 – 30.0 psi/1.6 – 2.1 Bar Acceptable)	82 SCFM 2.3 Sm <sup>3</sup> /minute	0.13 GPM 0.5 LPM	
	5/8 inch	Cavity	50 psi/3.5 Bar (40.0 – 60.0 psi/2.8 – 4.1 Bar Acceptable)	369 SCFM 10.4 Sm <sup>3</sup> /minute	0.53 GPM 2.0 LPM	
	5/8 inch	Cavity	25 psi/1.7 Bar (22.5 – 30.0 psi/1.6 – 2.1 Bar Acceptable)	230 SCFM 6.5 Sm <sup>3</sup> /minute	0.26 GPM 1.0 LPM	
Class B	3/8 inch	Dome	50 psi/3.5 Bar (40.0 – 60.0 psi/2.8 – 4.1 Bar Acceptable)	130 SCFM 3.7 Sm <sup>3</sup> /minute	0.79 GPM 3.0 LPM	2.1 Minute Discharge Minimum Per Victaulic Requirements, 3 Minute Maximum Per NFPA 770.
	3/8 inch	Dome	25 psi/1.7 Bar (22.5 – 30.0 psi/1.6 – 2.1 Bar Acceptable)	82 SCFM 2.3 Sm <sup>3</sup> /minute	0.53 GPM 2.0 LPM	
	1/2 inch	Dome	50 psi/3.5 Bar (40.0 – 60.0 psi/2.8 – 4.1 Bar Acceptable)	235 SCFM 6.7 Sm <sup>3</sup> /minute	1.59 GPM 6.0 LPM	
	1/2 inch	Dome	25 psi/1.7 Bar (22.5 – 30.0 psi/1.6 – 2.1 Bar Acceptable)	145 SCFM 4.1 Sm <sup>3</sup> /minute	1.06 GPM 4.0 LPM	

Refer to Victaulic publication 70.12 for hybrid emitter dimensions and performance

## 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 between each hybrid emitter is -10%/+20% when operating at 25 psi and -20%/+20% when operating at 50 psi.

- 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 typically in Class B applications where there is not as much of a concern of wetting mechanical equipment.
- 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 24 inches/610 mm is recommended depending on the hybrid emitter type. 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.



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# **Victaulic Vortex™ Pre-Engineered Hybrid Fire Extinguishing System**

**For Small, Single-Enclosure Room Volumes Including FM Approved Data Processing Rooms/Halls and Performance Based Designs Outside the FM Approvals**

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For complete contact information, visit [victaulic.com](http://victaulic.com)

**I-VORTEX/PE.DIOM 20362 REV A UPDATED 09/2024 Z000VTPES**

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