

VictaulicVortex™

total flooding fire suppression system



- minimal wetting of protected spaces
- no need to maintain room integrity
- minimal facility downtime for recharge
- green design - safe for the environment

 **victaulic**®

www.victaulicvortex.com



**Eco-Friendly, Revolutionary Technology.
Fire Suppression with Minimal Wetting.
Easy System Design and Strong ROI.
100% Green Design.**

The **Victaulic Vortex™ Fire Suppression System**

generates a hybrid liquid and gaseous agent delivery system to suppress fire. The system:

- Discharges the extinguishing agents in a homogenous suspension from a single outlet
- Emitters operate on less than 25psi of Nitrogen, and only 1-5psi of water
- Provides unrivaled protection and flexibility in a sensible, safe and effective method

Designed to combine simple components in easily scalable configurations, the Victaulic Vortex System is adaptable to applications from simple single zone coverage to broad networks of zones and varying hazards, such as machine spaces, flammable and combustible enclosures and IMO marine applications.

Performance

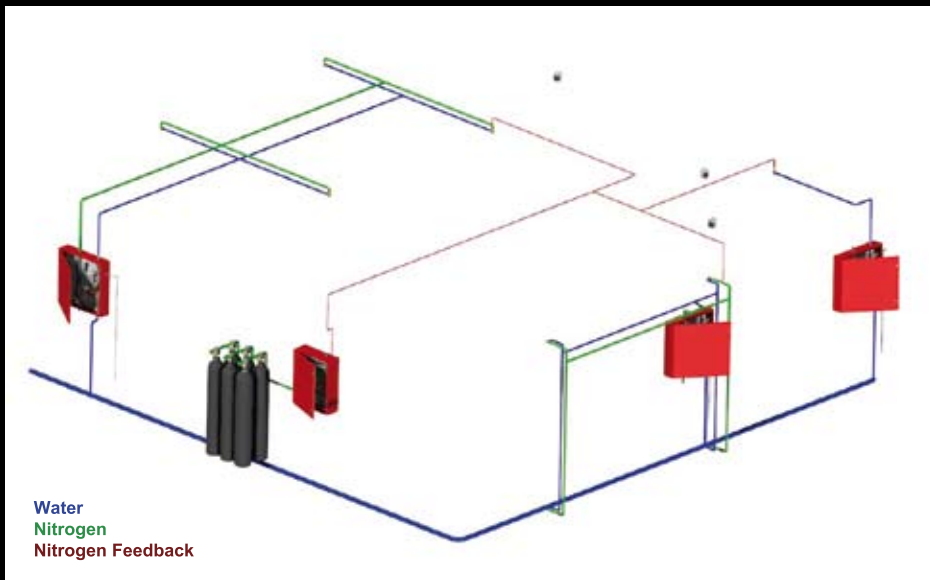
- Provides full suppression of fires with minimal wetting of protected space
- Designed for normal room enclosures: no special construction or hold time requirements
- Operates on less than 25psi of Nitrogen and 1-5psi of water at the emitter
- Delivers water droplets of less than 10 μ in size
- Delivers as little as 1 gallon of water per emitter per minute
- High velocity, low pressure creates a uniform mixing of the environment
- Extinguishes small fires in large rooms or large fuel-based fires

System Specification

- System sizing is extremely simplified based upon cubic-foot or cubic-meter of hazard: Each emitter can protect 2500 cubic feet/70 cubic meters
- Victaulic Vortex Emitters can be installed in pendent or sidewall configuration
- System can be self-contained with an internal water supply
- Victaulic Vortex System Emitters offer variable positioning
- Low system operating pressure permits direct cost savings in lightweight material piping

Safety/Environment

- Safe for your employees and the environment: only water and Nitrogen are dispersed by this system
- No toxic chemicals are used
- System suppresses fire completely, and is designed for a minimum 14% oxygen content in protected spaces



The Victaulic Vortex system consists of Zone Control Panels, patent-pending Emitters, Heat and/or Smoke Detection Equipment, Piping and Nitrogen and Water Supply (piped in or portable).



Room Integrity

- Maintaining room integrity is not a factor in performance
- The Victaulic Vortex Fire Suppression System will work effectively in a naturally ventilated space that is not air-tight.

Installation/Maintenance

- Friction losses and Nitrogen flows are compensated for automatically, affording practically unlimited transport distances
- Easily configured to support as a single zone system or in multiple zones to protect multiple hazards
- Replenishment of Nitrogen is simple and local sources are readily available; Nitrogen supply is fully supervised
- System can use potable water or a self-contained supply of deionized or distilled water
- System responds to activation devices used for hazard protection and can be connected to other facility panels.

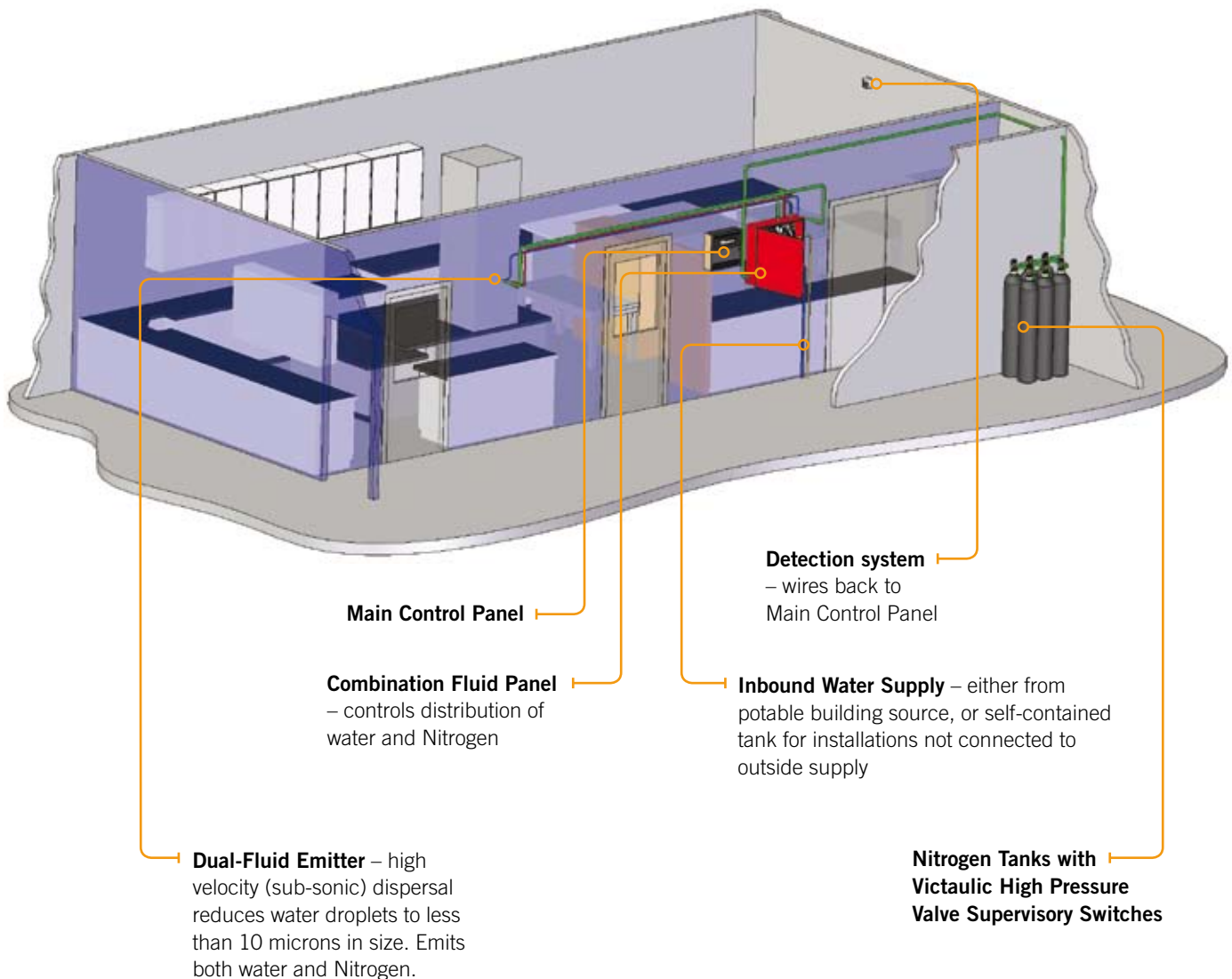
ROI/Financial

- Lower ongoing maintenance costs than existing technologies
- Can be integrated with existing and common detection systems
- System can be tested without water discharge to minimize disturbance of the protected environment
- Rapid reset of system after discharge to minimize facility downtime
- A cost-effective option when existing system needs to be replaced; installation impact is relatively low.

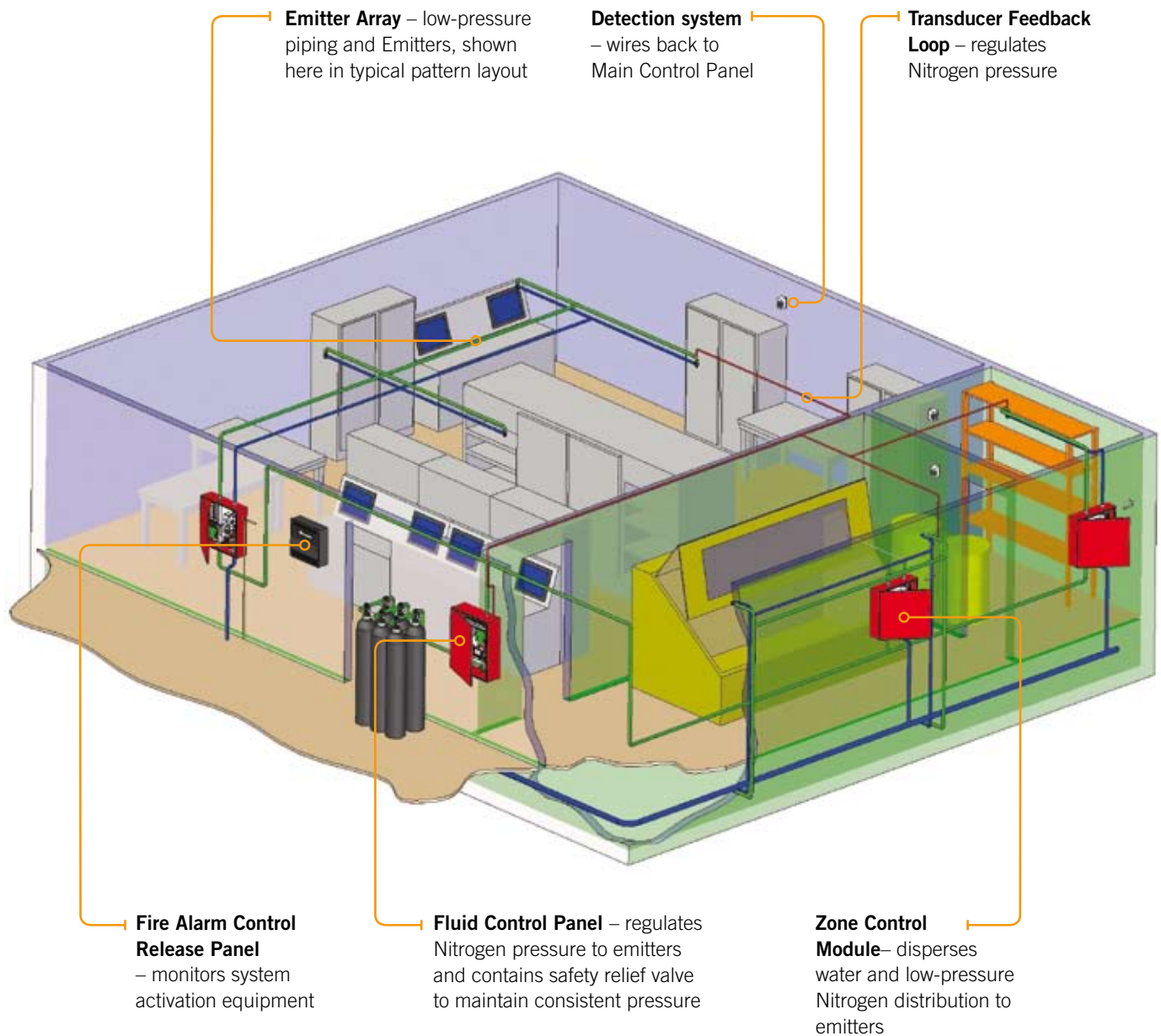
Typical System Application – Single-Zone Space

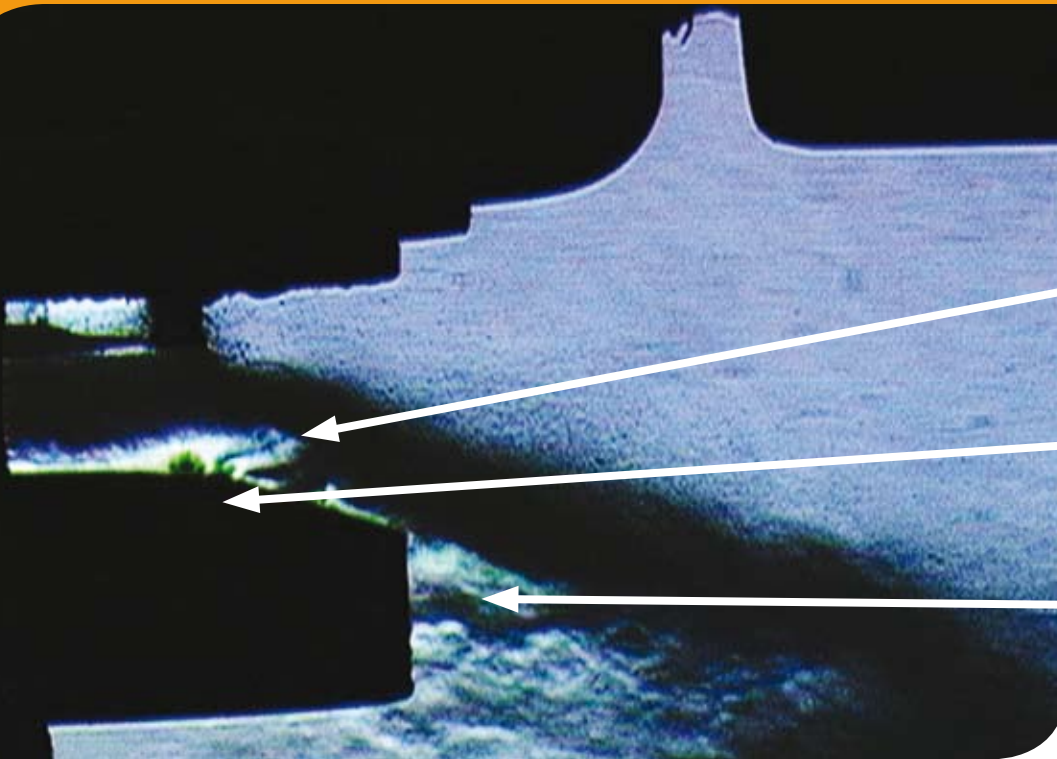
The Victaulic Vortex system is comprised of simple panel and piping components, including patent-pending valves and emitters. Scalability was a key design objective to provide easier specification and installation.

In this example of a single zone system, sidewall emitters are employed. Victaulic Vortex emitters can also be installed in a pendent configuration.



Typical System Application – Three-Zone Space





Shock waves where water flow hits Nitrogen

Emitter foil

Suspension of Water and Nitrogen exiting emitter

High-speed Schlieren Photography courtesy of Pennsylvania State University

Revolutionary Atomization Technology

The Challenge: Create very small droplets of water while maintaining high momentum capable of over-coming the aerodynamic forces that would normally decelerate the droplets.

The Victaulic Vortex Solution: Nitrogen enters the emitter at 25psi while water enters at 5psi external to the Nitrogen flow. The emitter is configured to accelerate the Nitrogen flow to a supersonic velocity. This forms a “shock disc” as a result of an instantaneous transition to sub-sonic velocity.

As the Nitrogen contacts the emitter foil, it is re-accelerated to localized supersonic velocities which then creates additional shock discs perpendicular to the flow field. Water is injected into this supersonic flow and rapidly atomized to <10micron size droplets.

This results in a very tight, high velocity distribution of the homogeneous suspension of water and Nitrogen into the hazard.

Performance Analysis: System Requirements

Agent	
Victaulic Vortex Fire Suppression System	A hybrid system utilizing inert gas and water. The sub-10 μ sized water droplets remove the heat in large fires and aid in the radiative and convective heat blocking. This homogenous suspension of Nitrogen and water are equally emitted with high velocity on a molar level. The Nitrogen extinguishes small fires in large rooms in fully ventilated environments.
Intermediate Pressure Water Mist	Larger size water droplet are used to soak the fuel source. Steam generated from the fire aids in the radiative and convective heat blocking. Large droplet size and momentum generally make this unsuitable for shielded fires.
High Pressure Water Mist	Water extracts heat from the fire. Steam generated from the fire aids in the radiative and convective heat blocking. Momentum is generally lost within a short distance of the nozzle. Most efficient for large fire extinguishment.
Sprinkler Systems	Same as Intermediate Pressure Water Mist. Larger droplet size allows the water to maintain momentum at lower pressures.
Inert Gases	Rely primarily on oxygen reduction. Limited thermal cooling and no reduction of radiative or convective heat transfer beyond vitiated smoke. Fuel is not cooled and reignition from hot objects is possible.
Halogenated Agents	Rely on flame temperature reduction due to the thermal characteristics of the agent. No reduction in radiative or convective heat transfer and the fuel is generally not cooled leading to possible reignition.





Performance Analysis: Water Characteristics	Flow, gpm per emitter, nozzle or sprinkler	Drop Size, µm	Operating Pressure, psig	Velocity
Agent				
Victaulic Vortex Fire Suppression System	<= 1	<10	25	High
Intermediate Pressure Water Mist	37	400 – 1000	350	High
High Pressure Water Mist	~8*	50 – 100	1500 – 2500	Low
Sprinkler Systems	>25	>1000	20 min	Moderate
Inert Gases	N/A	N/A	2500	N/A
Halogenated Agents	N/A	N/A	350	N/A

*Dependent upon system design

Performance Analysis: Environment Impact	Fuel Wetting	Oxygen Depletion	Temperature Reduction	Block Radiative Heat Transfer	Reduce Convective Heat Transfer	Total Flooding
Agent						
Victaulic Vortex Fire Suppression System	Minimal	Gradual	Fast	Yes	Yes	Yes (Very Minimal Wetting)
Intermediate Pressure Water Mist	High	Gradual	Moderate	Moderate	Moderate	Deluge (significant wetting)
High Pressure Water Mist	Minimal	Gradual	Fast	Yes	Yes	Yes (Minimal Wetting)
Sprinkler Systems	High	Gradual	Moderate	Moderate	Moderate	Deluge (significant wetting)
Inert Gases	No	Rapid	Minimal	No	No	Yes (no wetting)
Halogenated Agents	No	N/A	Moderate	No	No	Yes (no wetting)





Series 953 Victaulic Vortex Emitter. Can be installed as pendent or sidewall. Can protect 2500 ft³/ 70m³.



Agency Reports

The Victaulic Vortex Fire Suppression System has successfully completed all testing required by Factory Mutual for:

- machine spaces
- turbine enclosures
- Special Hazard machine spaces
- combustible/flammable liquids
- IMO marine applications

FM testing has proven the use of 2500 ft³/70m³ per emitter for any room size.

The Victaulic Vortex Fire Suppression system has been evaluated by Underwriter's Laboratory and found to extinguish Class A polymeric and wood crib materials and Class B flammable liquids fires effectively in accordance with UL 2127.

The Victaulic Vortex Fire Suppression System has demonstrated the capability of extinguishing all fire scenarios of NFPA 750 and NFPA 2001 without needing to meet the extended (30 minute) discharge, room integrity (10 minute hold time) and delivery time (1 minute) requirements of NFPA 750 and NFPA 2001.

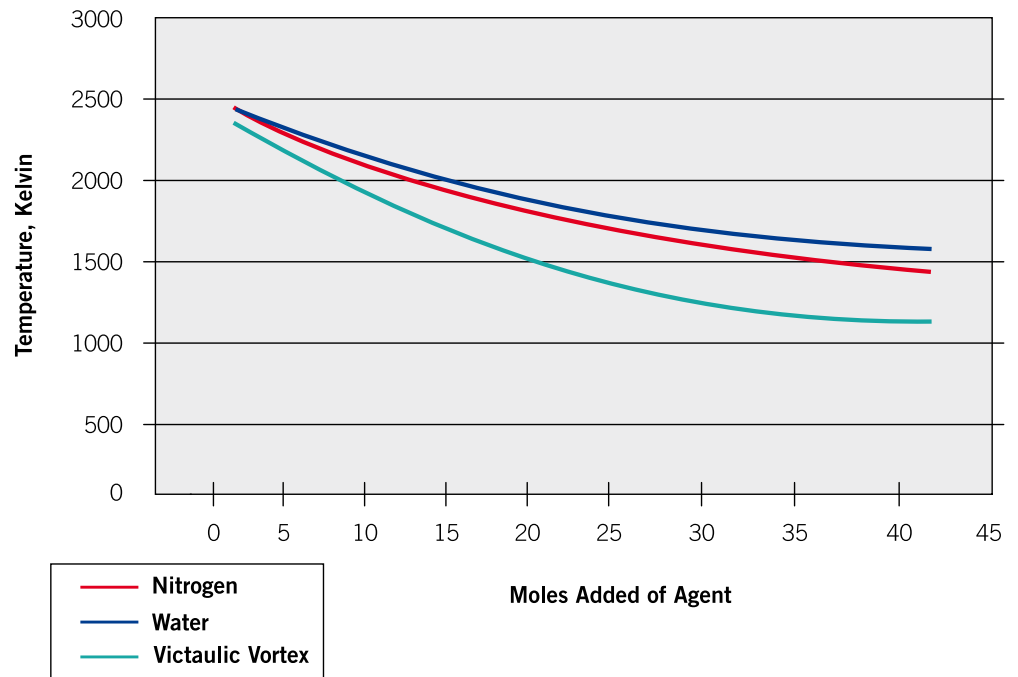
Excerpt from NFPA 13 Standard for the Installation of Sprinkler Systems

1.6.1 Nothing in this standard shall be intended to restrict new technologies of alternate arrangements, provided the level of safety prescribed by this standard is not lowered.

Adiabatic Flame Temperature

As affected by Nitrogen alone, water alone and the Victaulic Vortex System.

The Victaulic Vortex hybrid system surpasses the water and Nitrogen capabilities in reducing the adiabatic flame temperature.



For more than 80 years, Victaulic has set the standard in grooved pipe technology and fire protection systems.

- Victaulic owns over 150 patents and was the first company to receive Underwriters Laboratory approval for fire protection services in 1952.
- Victaulic has provided industry-leading valve and coupling technology since 1925
- Revolutionary dry, preaction, deluge devices offered since 1997 with a full and growing line of automatic sprinklers since 1998.

The Victaulic corporate philosophy is one of constant innovation and challenging of status quo technology.

The **Victaulic Vortex Fire Suppression System** is the result of over four years of research and development.



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