POWER & ENERGY SOCIETY
INDUSTRY APPLICATIONS SOCIETY
LIFE MEMBERS AFFINITY GROUP
NEW YORK SECTION

INNOVATIONS IN FIRE PROTECTION DESIGN
FACTORS TO CONSIDER FOR TODAY’S PRACTICES

Rick Seidel – Fike Corporation
Regional Sales Manager
Agenda

• Inert Gas Fire Suppression
  – “Clean Extinguishing Agent”
  – Evolved Enhancements
  – Advantages

• Watermist Fire Suppression
Definition of a Clean Extinguishing Agent

• As Defined by NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems
  – Electrically nonconductive, volatile, or gaseous fire extinguishant that does not leave a residue upon evaporation.
Mission Critical Protection

• Asset Protection
• Minimizes Downtime
• Safe for People and Assets
• Non-Conducting
• No Residue
• Space Efficient
• 3-Dimensional Fire Fighting

Back to business.........
Why Not Water?

Sprinkler flow time of 30 minutes
Each sprinkler discharging 18 to 35 gpm of water

That’s 540 to 1,050 gallons of water on your valuable assets!

Discharge of two sprinkler heads is common – that’s 1,080 to 2,100 gallons of water!!
Fire Extinguishment vs. Fire Control

The diagram illustrates the heat release rate over time for both fire extinguishment and fire control.

- **Sprinkler activation** occurs at a time marked as ~3 min, indicating a delay in the response time.
- **Clean Agent system activation** is indicated at 30s, showing a quicker response time.
- **Fire Extinguishment (Clean Agents)** is depicted as a rapid decrease in heat release rate, potentially suggesting an effective extinguishment method.
- **Fire Control (Sprinklers)** shows a slower response, with a heat release rate that remains relatively high until ~3 min, indicating less immediate control.

The graph highlights the importance of timing and method in fire protection strategies.
Clean Agent Systems Primary Advantages

• Ability to extinguish shielded, obstructed, 3-D fires
• Provide rapid extinguishment
• Significantly reduces collateral Smoke and water damage caused by delayed extinguishment and Sprinklers
  – Odorless, Colorless, No residue left behind
Clean Agent Fire Protection
Halon 1301
Halon 1301

Agent Characteristics

- Chemical name – Bromotrifluoromethane
- Vapor Pressure – 235 psi
- Molecular Weight – 148.9
- Boiling Point – -72 F
- Design Concentration, occupied spaces 5% - 7%
- Global Warming Potential – 6,290
- Ozone Depleting Potential – 16
- Safe for Occupied Spaces? YES!
Halon 1301.....

• Production Ceased in countries that signed the Montreal Protocol in 1994
  – Ozone Depletion
• No longer sold for new systems
• Only sold as recycled / reclaimed agent that is used for recharging systems
• Thousands of systems remain in service, with many users actively seeking replacement due to:
  – Corporate Environmental Initiatives
  – Long-term Supply Availability
  – Cost of Replenishment
NFPA 2001; Present Day

• Commercially available agents
  – HFC-227ea (FM-200, FE-227)
  – HFC-125 (FE-25, ECARO-25)
  – HFC-236fa (FE-36)
  – IG-55 (Argonite, ProInert)
  – IG-541 (Inergen)
  – FK-5-1-12 (Novec 1230, Sapphire)
Two Categories of “Clean Agents”

Man-Made Agents

✔ Zero-Ozone Depleting
✔ LOW- Global Warming Potential (GWP)

• Waterless Flash Gases
  - FM-200® 1994
  - ECARO-25® 2003

• Fluids – Fluoroketones
  - Novec™ 1230 2005

Naturally Occurring Gases

✔ Zero-Ozone Depleting
✔ Zero-Global Warming Potential (GWP)

• Inert Gases
  - 1st Generation: Inergen® 1994
  - 2nd Generation: Prolnert2 2009
  - Agronite®
100% Green Fire Protection

Inert Agents

Argonite®

Inergen®

PROINERT®
Launched in 1994 by Ansul.

Is a mixture of three natural occurring gases: Nitrogen, Argon & Carbon Dioxide.

Environment-friendly, people-safe agent with ZERO ozone depletion potential, ZERO global warming potential, and ZERO atmospheric lifetime.
Inert Gases

Extinguish a fire by reducing the residual oxygen concentration to a level that will no longer support combustion, but will still sustain human existence.
Agent Characteristics

- Chemical name – Mixture of Inert Gases & Carbon Dioxide
  52% N2, 40% Ar and 8% CO2
- ASHRAE Designation – IG-541
- Molecular Weight – 34
- Boiling Point – -320.8F
- Design Concentration, occupied spaces – 38.5% - 52%
- Maximum Human Exposure Time – up to 43% is 5 minutes
- Maximum Human Exposure Time – 43 to 52% is 3 minutes
- Ozone Depletion Potential - 0
ProInert2 was launched in to the US market in 2008 by Fike.

Inert systems for Fike make up 90% of their clean agent fire systems sold in Europe.

ProInert2 does not use CO2 in its mixture.

IG-55 is the same mixture as you will find in Argonite.
What Is ProInert?

• Inert Gas Fire Extinguishing System
  – Extinguishes Fires by **Oxygen Reduction**
  – Gas stored as a compressed gas/vapor

• Extinguishing Gas
  – IG-55 = 50% Ar / 50% N2
  – IG-541 = 50% AR / 40% N2 / 10% CO2
Agent Characteristics

- Chemical name - N²/Ar (50% - 50% blend of Nitrogen & Argon)
- ASHRAE Designation – IG-55
- Molecular Weight – 33.95
- Boiling Point – -310.2F
- Design Concentration, occupied spaces – 39% - 52%
- Maximum Human Expose Time – up to 43% is 5 minutes
- Maximum Human Expose Time – 43 to 52% is 3 minutes
- Ozone Depletion Potential - 0
ProInert² - Storage Footprint

Traditional Inert Systems:

Up to 40% less

Reduced Storage
Safe for People
ProInert is completely safe for use in occupied spaces.
What does 12.7% Oxygen Mean to You?

Pikes Peak, Colorado

- Most visited mountain peak in North America
- Elevation = 14,110 feet above sea level
- Minimum allowable design concentration for egress = 10%

> 25% Safety Factor
Inert Agents

• **Benefits:**
  
  – Equipment and installation costs close to other clean agents
  
  – Similar maintenance costs to other clean agents
  
  – Full height walls not an issue
  
  – Remote agent storage capability up to 200’ away
  
  – Upgrade Any Existing Halon or Clean Agent System Utilizing All Original Piping
  
  – Low refill costs
Agent Comparisons

Man Made Agents

- **ECARO25**
  - 156lb protects 5000 cubic feet
  - (7) Of IG-541
  - (4) Of PI2

- **HFC-227ea**
  - 156lb protects 4550 cubic feet
  - (6) of IG-541
  - (3) of PI2

- **FK-5-1-12**
  - 156lb protects 3650 cubic feet
  - (6) of IG-541
  - (3) of PI2
Complete System Cost Comparison

- 150K = Vortex/Marioff
- 100K = Fike DQ
- 150K = Water Mist
- 68K = Inergen
- 47K = Ketone
- 45K = ProNert2
- 43K = FM-200
- 39K = ECARO-25

1500 sq ft. Enclosure
# Agent Comparisons

<table>
<thead>
<tr>
<th>Agent</th>
<th>ASHRAE</th>
<th>Molecular Weight</th>
<th>Global Warming Potential</th>
<th>Boiling Point</th>
<th>Concentration %</th>
<th>Ozone Depletion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halon 1301</td>
<td>n/a</td>
<td>148.9</td>
<td>6290</td>
<td>-72 F</td>
<td>5 – 7%</td>
<td>16</td>
</tr>
<tr>
<td>FM-200</td>
<td>HFC-227ea</td>
<td>170.3</td>
<td>3350</td>
<td>2.5 F</td>
<td>6.25 – 10.5%</td>
<td>0</td>
</tr>
<tr>
<td>ECARO -25</td>
<td>HFC-125</td>
<td>120.2</td>
<td>3170</td>
<td>-54.7</td>
<td>8 – 11.5%</td>
<td>0</td>
</tr>
<tr>
<td>Novec</td>
<td>FK-5-1-12</td>
<td>316.04</td>
<td>&lt;1</td>
<td>120.6 F</td>
<td>4.5 – 6%</td>
<td>0</td>
</tr>
<tr>
<td>Inergen</td>
<td>IG-541</td>
<td>34</td>
<td>0</td>
<td>-320.8 F</td>
<td>38.5 – 52%</td>
<td>0</td>
</tr>
<tr>
<td>Argonite</td>
<td>IG-55</td>
<td>33.95</td>
<td>0</td>
<td>-310.2 F</td>
<td>39 – 52%</td>
<td>0</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>CO2</td>
<td>44</td>
<td>1</td>
<td>-109.3F</td>
<td>34% +</td>
<td>0</td>
</tr>
<tr>
<td>“Air”</td>
<td></td>
<td>29</td>
<td>0</td>
<td>-319F</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>
What About Pressure Displacement During An Inert Gas System Discharge?
Pressure Venting

- Inert Agents displace the oxygen in the room.
- Pressure venting is required to avoid over-pressurizing the room.
- If you forget to do it, the system has a built-in method of correcting the problem.
Fike’s ProInert system is the only system that uses a **constant flow rate valve** that discharges the agent at a constant low pressure (645 psi / 42 bar) over the required 60 seconds discharge time.

*Other systems have an aggressive initial discharge, and then decrease flow over time. This can lead to room and equipment damage, and does not extinguish a fire any faster than Fike’s steady flow system.*
<table>
<thead>
<tr>
<th>Inert Gas Systems</th>
<th>IG-541 Inergen™</th>
<th>IG-55 Argonite™</th>
<th>IG-55 Prolnert™</th>
<th>IG-55 Prolnert²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage PSI</td>
<td>150 Bar</td>
<td>200 Bar</td>
<td>200 Bar</td>
<td>300 Bar</td>
</tr>
<tr>
<td></td>
<td>200 Bar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge PSI</td>
<td>2175 PSI</td>
<td>2900 PSI</td>
<td>645 PSI</td>
<td>645 PSI</td>
</tr>
<tr>
<td></td>
<td>2900 PSI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Reducer</td>
<td>Orifice Plate</td>
<td>Orifice Plate</td>
<td>Fike Patented Modulating Valve</td>
<td>Fike Patented Modulating Valve</td>
</tr>
<tr>
<td>Minimum Nozzle PSI</td>
<td>150 Bar 325 PSI</td>
<td>200 Bar 430 PSI</td>
<td>116 PSI</td>
<td>116 PSI</td>
</tr>
<tr>
<td></td>
<td>200 Bar 375 PSI</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An important advantage of Prolnert is the lower pressure at discharge, which allows for a controlled flow of gas into the room to extinguish a fire. It can also result in lower cost (lower pressure) piping, fewer nozzles, and smaller venting requirements compared to other inert gas systems.
Natural Agents Discharge Room Pressure

1st Generation Natural Agents Room Pressure

ProINERT² Room Pressure

900-950 Pa = 19-20 PSF

<400 Pa = 8.35 PSF

Wall Strength Specs:
250 Pa (5 PSF) 2x4 walls 16” OC
500 Pa (10 PSF) 2x6 walls 16” OC
What are the Advantages of the Fike valve?

• All piping used in the system from the cylinder to the nozzle is the same as used in chemical systems, Schedule 40 piping and 300 pound fittings
• Competition’s inert gas systems require the use of Schedule 160 piping before their required pressure reducing orifice plate and Schedule 80 piping above 2 ½” throughout system.
• Competition fittings are 2,000 or 3,000 forged steel before their required pressure reducing orifice plate

• Significant savings on installations because of:
  – Lighter scale piping requirement
  – Greater flexibility with piping networks configuration and length
Design Factors

Maximum Elevation Differences in Pipe Runs = UNLIMITED
(Old Limit = 20.4 ft.)

- a. If nozzles are only located above the cylinder outlet, the maximum elevation difference between the cylinder outlet and the farthest horizontal pipe run or discharge nozzle is unlimited.
- b. If nozzles are only located below the cylinder outlet, the maximum elevation difference between the cylinder outlet and the farthest horizontal pipe run or discharge nozzle is unlimited.
- c. If nozzles are located above and below the cylinder outlet, the maximum elevation difference between the cylinder outlet and the farthest horizontal pipe run or discharge nozzle is unlimited.

System with a single level of Nozzles

System with multiple levels of Nozzles

System with ceiling and sub-floor Nozzles

No Limit

No Limit

No Limit
Design Factors
Now you can do this . . .
Why Not Water......Mist?
Water Mist Overview: What is Water Mist?

- Extinguishes fire using a very fine water spray with droplets <1,000µm.
- The fine droplets; cools the flame, displaces $O^2$ with water vapor and reduces radiant heat.
- Designated for use in Class A: Combustible materials (wood, paper, fabric, refuse), Class B: flammable or combustible liquids as the fuel source., and some Class C: electrical hazards; such as transformers (in enclosures).
- Class A requires larger droplets to help penetrate fuel source (fuel wetting).
- Class B requires finer droplets to avoid agitating fuel surface.
- First systems approved, aimed for smallest droplet size, high pressure.
- Newer, low pressure systems have obtained FM approvals with larger droplet sizes at much lower pressures.
Water Mist Overview: Droplet Size

• A larger droplet is more effective at penetrating down into the fire plume (Fuel Wetting) using its momentum (= mass x velocity)
• Small droplets do very well in small spaces, smaller the space the better the droplets can be directed to the fire.
• The larger the space gets the small droplet now gets difficult to control, it loses velocity as soon as it leaves the nozzle, it then does not know where to go.
• Smaller droplets means smaller waterways within the nozzle, now the water quality and impurities become extremely important.
Water Mist Overview: Concepts

* 3 Main Concepts/Functions:
1. Inerting
2. Cooling
3. Fuel wetting

All three are very important.
  * Inerting = Oxygen Displacement
  * Cooling = Heat Extraction
  * Fuel wetting = Blocking of Radiant Heat, preventing the fire from propagating.

• Droplet size impacts the relative presence of each effect

* Different Fires require different amounts of each element!
Water Mist Overview: Droplet Size

Smaller Droplet: More efficient vaporization, cooling and inerting.

10 µm 100 µm 300 µm 400 µm

SWEET!

Larger Droplet: More efficient fuel wetting. Storage applications.

1,000 µm

300 µm gives the droplet the best of both efficient vaporization and fuel wetting.

Water Mist Nozzle

Sprinkler Heads
Water Mist Overview: Benefits

• As the water mist turns to steam, it expands immensely (1700 times) forcing oxygen away from the flame.
• Takes the energy out of the fire.
• Water mist incorporates a smoke scrubbing element.
• Provides extinguishment, not control.
• Provides 3D fire protection.
• Only need about 6-8 psi bar inlet pump pressure (wet pipe system), this is an estimate as the amount is determined by the Net Positive Suction Head Required (NPSHR) for the pumps plus our manual’s safety margin of 2 psi. (Deluge system needs 29psi to keep the valve shut).
• Uses up to 80% less water than sprinklers (deluge app), and 50% less water than sprinklers (Light Hazard app).
Water Mist Overview: System Types

**High Pressure**
- A water mist system where the distribution system piping is exposed to pressures of 500psi or greater and up to 2000psi.
- Uses ultra-high pressure pipe, fittings, & valves.

**Low Pressure**
- A water mist system where the distribution piping is exposed to pressures 175psi or less.
- Uses standard pipe, such as Sch 40 SS, plus Class 150 300psi fittings.

**Fixed Supply**
- Driven through system by $N_2$ pressure
- Must be refilled after discharge
- System cannot fight against any possible reignition of fire.

**Continuous Supply**
- Uses building water supply
- Driven by pump
- Unlimited discharge time
Water Mist Overview: System Design

- No universal design method is recognized for water mist protection systems.
- Fike’s design is different from others.
- Design & install in accordance with each manufacturer’s Design, Installation, Operation, and Maintenance Manual (DIOM), requirements of FM Global (where applicable), NFPA Standards (750), and the requirements of the AHJ.
DuraQuench™ Benefits: Simplicity vs:
Versatile, Affordable Water Mist Fire Suppression

- **LOWER OPERATING PRESSURE**
  175 psi versus 2000 psi

- **MORE PIPE & FITTING OPTIONS**
  Easily sourced pipe, fittings, and tools
  Stainless steel, copper, CPVC

- **SIMPLE LAYOUT & DESIGN**
  Use any hydraulic flow-calc software

- **STANDARD FIKE LEAD TIMES**
  Made from readily available components

- **FM APPROVED, NFPA-750 COMPLIANT**

- **WATER**
  Only need 6-8 psi inlet pump pressure
  50-80% less water than sprinkler
Pump Controller

- USB Waterproof Adapter
- Audible Alarm
- Color Display
- Isolating Switch (Isolating Means)
- Circuit Breaker (Disconnecting Means)
- Start (Pushbutton)
- Stop (Pushbutton)
- Emergency Manual Operator Latch
- Emergency Manual Operator
- Pressure Sense Line Connection
DuraQuench™ Benefits: Largest Machinery Space & Turbine Enclosure Approved Volume

<table>
<thead>
<tr>
<th>Company</th>
<th>Maximum Approved Room Volume</th>
<th>Max Ceiling Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fike - DuraQuench™</td>
<td><strong>162,801 ft³</strong></td>
<td>39.4 ft</td>
</tr>
<tr>
<td>Marioff – HI-FOG GPU</td>
<td>53,000 ft³</td>
<td>32.8 ft</td>
</tr>
<tr>
<td>HI-FOG MT4 Water Mist System</td>
<td>48,600 ft³</td>
<td>36.1 ft</td>
</tr>
<tr>
<td>Tyco - AquaMist®</td>
<td>45,203 ft³</td>
<td>26 ft. 3 in</td>
</tr>
<tr>
<td>FOGTEC Water Mist System</td>
<td>9,535 ft³</td>
<td>Not available</td>
</tr>
<tr>
<td>HI-FOG MT4 Water Mist System</td>
<td>48,600 ft³</td>
<td>36.1 ft</td>
</tr>
<tr>
<td>Securiplex - FIRE-SCOPE® 5000</td>
<td>42,380 ft³</td>
<td>36 ft</td>
</tr>
<tr>
<td>TomCO2 Fogex® System</td>
<td>17,657 ft³</td>
<td>Not available</td>
</tr>
</tbody>
</table>

Not FM Approved for insulated turbines.
DuraQuench™

Deluge Systems in Industrial Applications

Wet Pipe Systems

Commercial Applications
DuraQuench™ Deluge: System Info

- Utilizes Open Nozzles. Total Flood.
- **Piping network is empty** (open to atmosphere) from the system deluge valve to the nozzles during normal system operation.
- Water supply is held back by the deluge valve.
- Deluge valve is opened automatically through the activation of the solenoid installed on the valve trim in response to the activation of the fire detection system installed in the protected area.
- Simultaneously, the detection system activates the fire pump sending pressurized water through the piping network to the open nozzles.
- **ONLY Stainless steel** Sch 10 and/or Sch 40 pipe can be used along with Class 150 (300psi) threaded fittings.
DuraQuench™ Deluge: Zoned System
**DuraQuench™ Deluge: C-EL Control Valve**

- Used as a full flooding deluge valve or as a zone valve.
- 29 psi needed to keep closed.

**Specifications**

| Weight          | 2” = 46 lbs.(20.8 kg)  
<table>
<thead>
<tr>
<th></th>
<th>3” = 74 lbs. (33.6 kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Pressure</td>
<td>232 psi maximum</td>
</tr>
<tr>
<td></td>
<td>29 psi minimum</td>
</tr>
<tr>
<td>Factory Tested</td>
<td>348 psi maximum</td>
</tr>
<tr>
<td>Pressure</td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>Stainless Steel, ANSI 316L</td>
</tr>
<tr>
<td>Gasket Materials</td>
<td>EPDM</td>
</tr>
<tr>
<td>Pressure Gauge</td>
<td>Valve Inlet and Primary Valve Outlet</td>
</tr>
<tr>
<td>Locations</td>
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<tr>
<td>Activation Options</td>
<td></td>
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<tr>
<td></td>
<td>Manual Release Lever</td>
</tr>
<tr>
<td></td>
<td>Electric Impulse Solenoid (24 VDC, 10W, NC)</td>
</tr>
<tr>
<td>Listing / Approvals</td>
<td>Factory Mutual</td>
</tr>
</tbody>
</table>
DuraQuench™ Deluge: Open Nozzle

- Open head nozzle
- **4.1 GPM per nozzle** at minimum pressure.
- Tested by FM for hazard volumes up to 28,252ft³ and 162,801ft³
  - Nozzle spacing and ceiling height varies according to enclosure volume approval.
- K Factor = 0.387 g/min/√psi (5.6 L/min/bar)

### Specifications

<table>
<thead>
<tr>
<th>FM Approved Volume (max.)</th>
<th>28,252 ft³</th>
<th>162,801 ft³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling Height (max.)</td>
<td>26.2 ft</td>
<td>39.4 ft</td>
</tr>
<tr>
<td>Nozzle Spacing (max.)</td>
<td>117.3 ft²</td>
<td>96.8 ft²</td>
</tr>
<tr>
<td></td>
<td>10.8 ft x 10.8 ft</td>
<td>9.8 ft x 9.8 ft</td>
</tr>
<tr>
<td>Distance to wall (max.)</td>
<td>5.4 ft</td>
<td>4.9 ft</td>
</tr>
<tr>
<td>Water Density</td>
<td>0.055</td>
<td>0.067</td>
</tr>
</tbody>
</table>

- K Factor = 0.387 gal/min/√psi
- Drop size: $D_{V_{90}} < 300$ μm
- Material: Brass (NiSn Coated)/Stainless Steel 316L
DuraQuench™ Industrial Applications: General Machinery Space Protection

- Diesel generators / Turbines
- CNC areas
- Gear boxes
- Drive shafts
- Bearings
- Lube skids
- Transformer rooms
DuraQuench™ Industrial Applications: Automotive - Test Cell Protection (Example Layout)
DuraQuench™ Wet Pipe: System Info

- Utilizes Closed Head automatic nozzles.
- Operates just like a traditional sprinkler system.
- Wet Pipe network is filled with water to the nozzles during normal system operation.
- Thermal element designed to open the nozzle when the temperature surrounding the nozzle reaches 135°F.
- Must be installed in areas where the temperature is reliably maintained above 40°F so that pipes do not freeze.
- Optional pressure maintenance (jockey) pump.
DuraQuench™ Wet Pipe: Applications – Light Hazard (HC-1)

Hazard

- Non-Storage Occupancies, Hazard Category 1
- Lightly loaded non-storage, non-manufacturing areas
- Examples: Apartments, churches, concealed spaces, hospitals, hotels, kitchens, libraries, museums, nursing homes, offices, restaurants, schools, un-used heated attics

Design Considerations

- Closed head nozzles with glass bulb rated for 135°F (Fike).
- Wet Alarm system, water is present in pipe at all times.
- Designed to provide water (FM) for 60 minutes to the nine most hydraulically remote nozzles or all nozzles in 1500 ft² space, whichever is greater.

FM Approvals

- Unlimited area
- Approved pipe: Stainless, Copper, & CPVC.
DuraQuench™ Wet Pipe: Closed Nozzles

- Closed head nozzle works just like a traditional sprinkler head.
- **12.50 GPM per nozzle** at minimum pressure, 50% less water than a traditional sprinkler head (1/2” 5.6k sprinkler at 25-30gpm).
- Chrome or white cover plate, plus custom color options.
- K-Factor 1.16 g/min/√psi

### Specifications

<table>
<thead>
<tr>
<th>Minimum water pressure</th>
<th>116 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum water pressure</td>
<td>232 psi</td>
</tr>
<tr>
<td>K-Factor</td>
<td>1.16 g/min/√psi</td>
</tr>
<tr>
<td>Drop size</td>
<td>DV_{90} &lt; 300 μm</td>
</tr>
<tr>
<td>Material</td>
<td>Brass (NiSn Coated)</td>
</tr>
<tr>
<td>Nominal Release Temp</td>
<td>135°F</td>
</tr>
</tbody>
</table>

### Nozzle Spacing Specifications

<table>
<thead>
<tr>
<th>Ceiling Height (max.)</th>
<th>16.4 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nozzle Spacing (max.)</td>
<td>14.8 ft x 14.8 ft</td>
</tr>
<tr>
<td>Distance to wall (max.)</td>
<td>7.4 ft</td>
</tr>
</tbody>
</table>
DuraQuench™: “Accepted” or “Performance Based Design” Applications

- FM has testing protocols for applications that Fike hasn’t pursued...yet. So these, by definition, are outside of our current approvals.
- However, we can get the design “Accepted” by the Local AHJ based on the design and fire testing that has been completed.
- Fike can provide you with fire testing documents and design information on most applications.
DuraQuench™ Accepted Design: Application - Pre-Action Protection

- Protection of Data Centers with pre-action valves & closed nozzles.
- We already have a Pre-Action valve so an “Accepted” system can be designed.
- Data Center FM Approvals coming in Q4 2018:
  - Above Floor Protection
  - Below Floor Protection – Area of Coverage Design
  - Below Floor Protection – Local Application Design
DuraQuench™ Accepted Design: Application - Industrial Fryer Protection

- Can provide an Industrial Oil Cooker Nozzle that is FM Approved, use that with DuraQuench™’s FM Approved system components for easy acceptance by AHJ.
- DuraQuench™ installed protecting 7 industrial oil cookers at a peanut facility in North Carolina. AHJ accepted system after conference call and live system demonstration at the peanut facility.
In Closing.....

- Most Environmentally Friendly Clean Agent
- Now can use 40 - 50% less cylinders
- Controlled Discharge to minimize violence

DuraQuench™

- Low Pressure & Easy to Flow
- Unlimited & CLEAN Water Supply
- Easily sourced and lower cost hardware and installation
In Closing.....

Fike Fire Protection Solutions

Systems
- Fire alarm
- Fire detection and control
  - Intelligent alarm
  - Video image
  - Early warning detection
- Fire suppression

Suppression
- Clean agent
- CO₂
- Water based
Thank You!
Questions?