Fire Suppression Systems Association

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Sponsorships Available

Contact: Becca Stinner
FSSA Associate Director
becca@fssa.net

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- Company mentioned in webinar communication
- Single slide during of the webinar to include information on your company
- Company contact, logo, and tagline on webinar webpage

$750 per webinar

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- Company logo on e-blast to over 8,000 contacts
- Company website, email, and phone listed on e-blast
- Company contact listed on e-blast

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Introducing the New FSSA Training Program Platform

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- Real-time enrollment
- Automated Certificates
- Smooth and easy to navigate
- Take Notes

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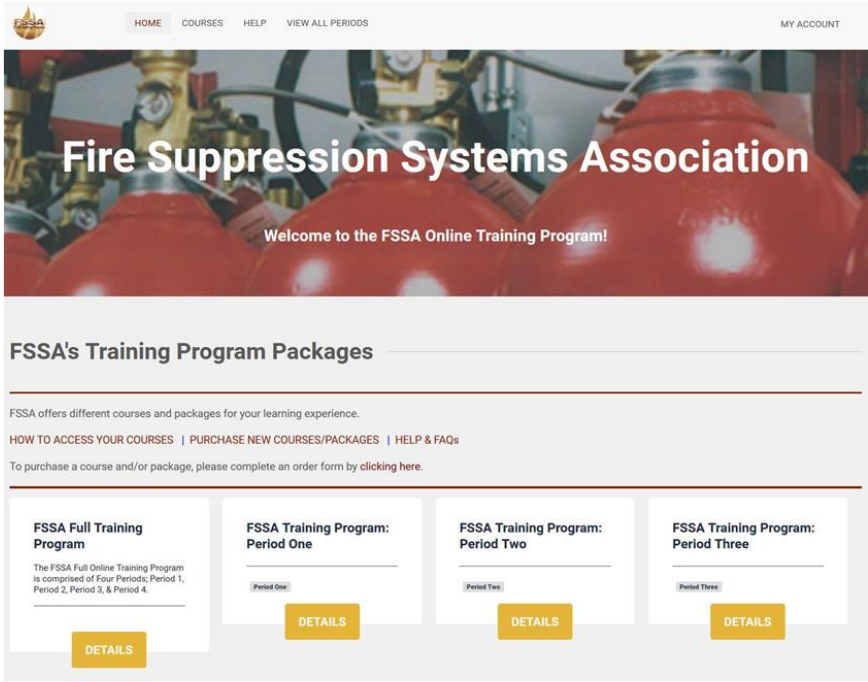

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FSSA Virtual Town Hall Meetings

In an effort to help each other stay in front of and overcome this COVID-19 challenge together, a facilitator will guide the weekly call with volunteer industry leaders to allow for conversation between members, share best practices, assist with questions, and more.

- Every Thursday at 2:00 pm Eastern Time
- Exclusively for FSSA members

Next Topic: Leading Through a Crisis
Presented by: Anna Gavin, President of Fireline Corporation

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NFPA 770

Hybrid Fire Extinguishing Water And Inert Gas Fire Extinguishing Systems

Robert Ballard
Fire Suppression Technology Manager
Victaulic

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DISCLAIMER

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Agenda

- NFPA 770 Standard
- Listings, Approvals, Codes, And Standards
- Applications
- Testing
- Chapters
- Performance Based Testing

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NFPA 72 Standard

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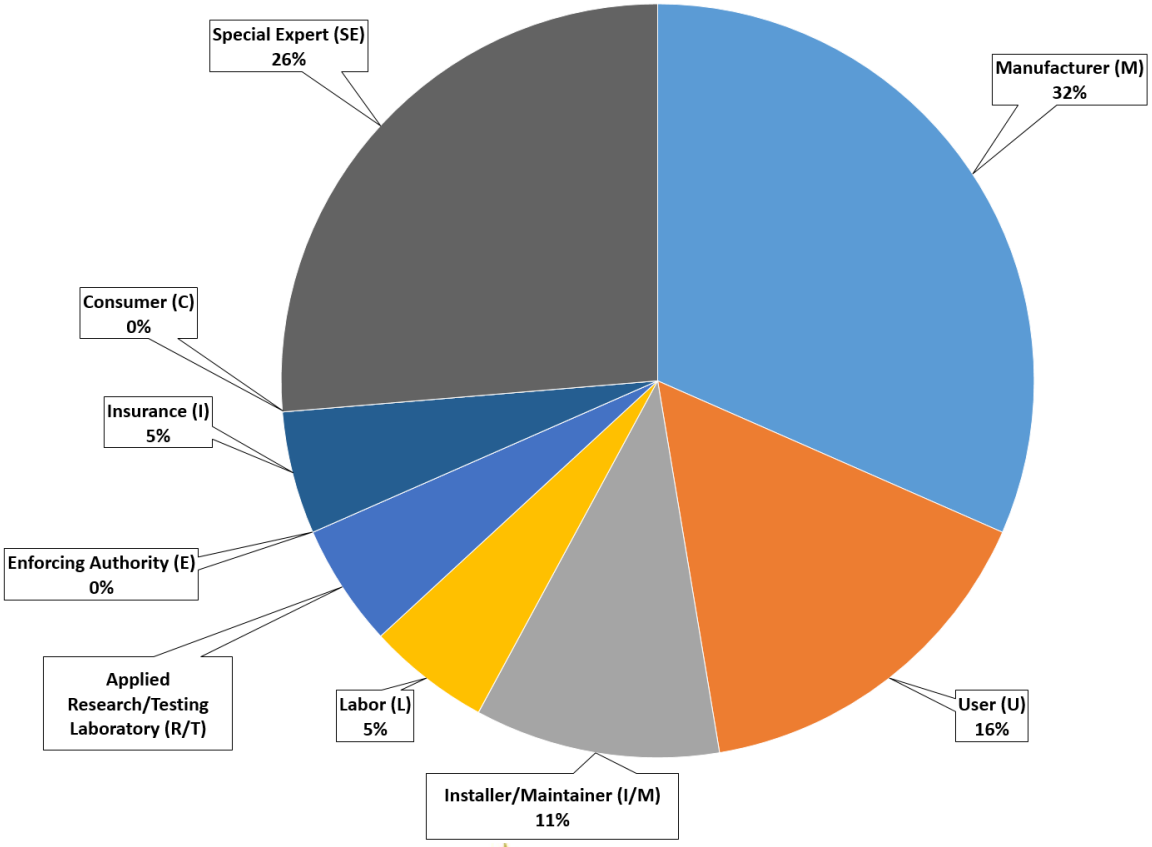
NFPA 770 Representation



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NFPA 770 Representation

3S Incorporated
AIG Global Technical Office
Dominion
Duke Energy
Ehmke Associates
Fire & Pump Service Group
FM Global
FSSA
Global Fire Protection Group, LLC
Harrington Group, Inc.
Jensen Hughes
Johnson Controls
Mitsubishi Hitachi Power Systems
National Fire Sprinkler Association
Road Sprinkler Fitters UA Local Union 669
Savannah River National Laboratory
Siemens
UL LLC
UTC/Marioff North America
Victaulic

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NFPA 770 Committee Principles

Member Name		Organization	Type	Member Since
Jeffrey	**Harrington**	Harrington Group, Inc.	**SE**	04/08/15
Robert	**Ballard**	Victaulic	**M**	04/08/15
Frank	**Broidy**	Fire & Pump Service Group	**IM**	04/08/15
John	**Campbell**	NRG Fire Consulting	**SE**	04/05/16
Jason	**Chou**	UTC/Marioff/Kidde	**M**	04/05/16
Brent	**Ehmke**	Ehmke Associates	**SE**	08/17/15
Thomas	**Euson**	3S Incorporated	**IM**	04/08/15
Eric	**Forssell**	Jensen Hughes	**SE**	04/08/15
Ian	**Jutras**	Tyco Fire Protection Products	**M**	04/05/16
Robert	**Kasiski**	FM Global	**I**	04/08/15
David	**Lindenschmidt**	Duke Energy	**U**	04/05/16
Shawn	**Mullen**	FSSA	**M**	04/08/15
Rob	**Plonski**	Savannah River National Laboratory	**U**	12/06/17
James	**Sharp**	Siemens Energy	**M**	04/08/15
Blake	**Shugarman**	UL LLC	**RT**	04/08/15
Ben	**Stewart**	National Fire Sprinkler Association	**M**	12/07/18
Matthew	**Taylor**	Mitsubishi Hitachi Power Systems	**U**	08/03/16
James	**Turner**	Road Sprinkler Fitters UA Local Union 669	**L**	12/08/15
Robert	**Upson**		**SE**	04/05/16

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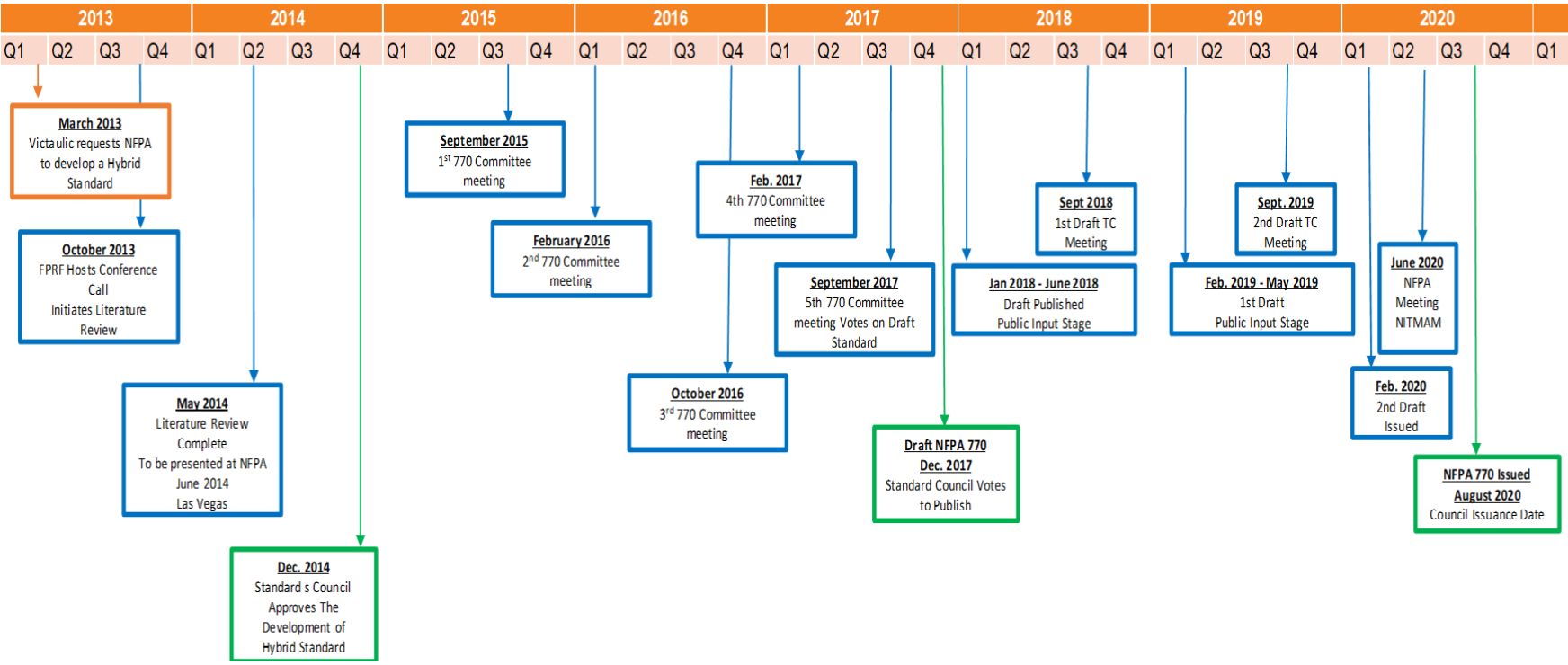
NFPA 770 Committee Alternates

Member Name		Organization	Type	Member Since
Joseph	**Barter**	Marioff North America	**M**	04/05/16
Lawrence	**Carmen**	Victaulic	**M**	12/08/15
Jonathan	**Carpenter**	FM Global (FM Approvals)	**I**	04/08/15
Sean	**Cutting**	Tyco Fire Protection Products	**M**	04/08/15
Kevin	**Hall**	National Fire Sprinkler Association	**M**	12/06/19
Jeff	**Hausmann**	Fire Equipment Company Inc.	**M**	11/30/16
Aaron	**Hinkle**	3S Incorporated	**IM**	12/08/15
Nolan	**McCarthy**	Harrington Group, Inc.	**SE**	12/06/19
Justin	**Perry**	Dominion	**U**	04/05/16
Kenneth	**Schneider**	UA - ITF	**L**	12/08/15
Daniel	**Steppan**	UL LLC	**RT**	08/17/15
Brandon	**Troc**	Fire & Pump Service Group	**IM**	04/08/15
Tom	**Zornes**	Siemens	**M**	08/08/19

NFPA 770 Timeline



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Meeting Update

Public Input Stage (First Draft)

- Public Input Closing Date 06/27/2018
- Post First Draft Report For Public Comment 02/27/2019

Comment Stage (Second Draft)

- Public Comment Closing Date 05/08/2019
- Second Draft Report Posting 12/12/2019

Motions Committee Report

- NITMAM Closing Date 02/19/2020
- NITMAM Posting Date 05/07/2020

Notice of Intent to Make a Motion

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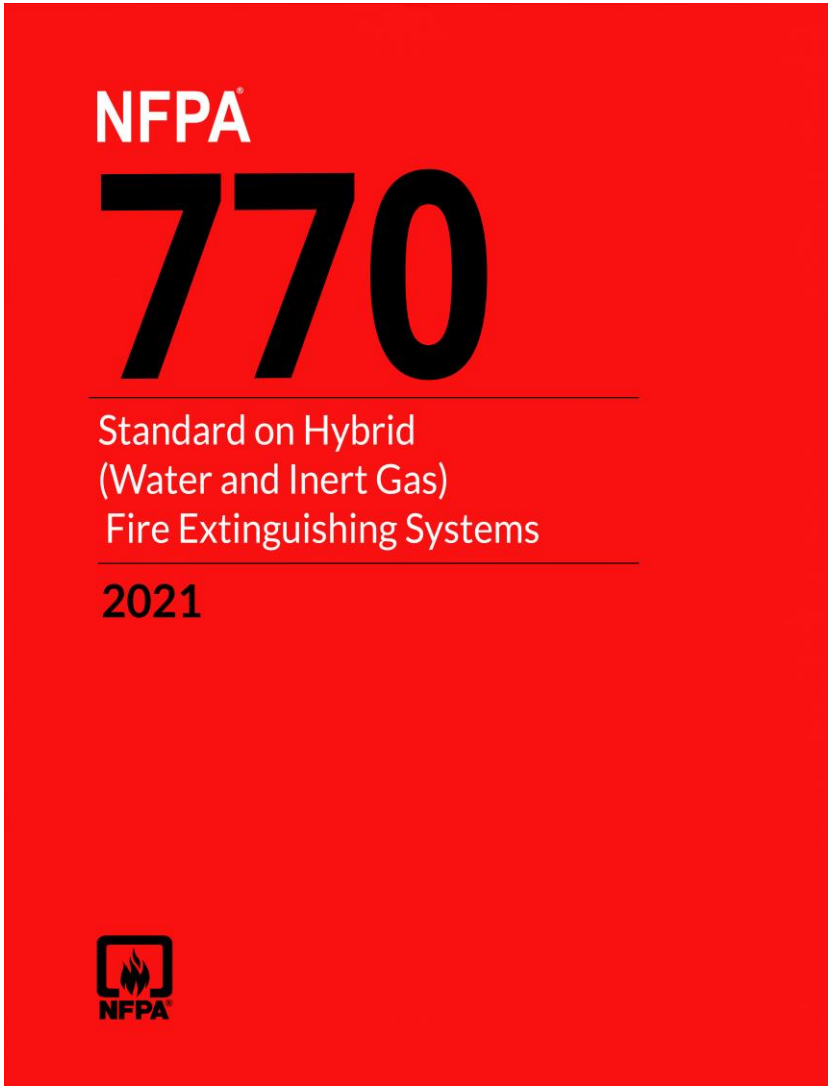

Scope

- Design
- Installation
- Acceptance
- Inspection
- Testing
- Maintenance

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Listings, Approvals, Codes, And Standards

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Listings Vs. Approvals

Listing

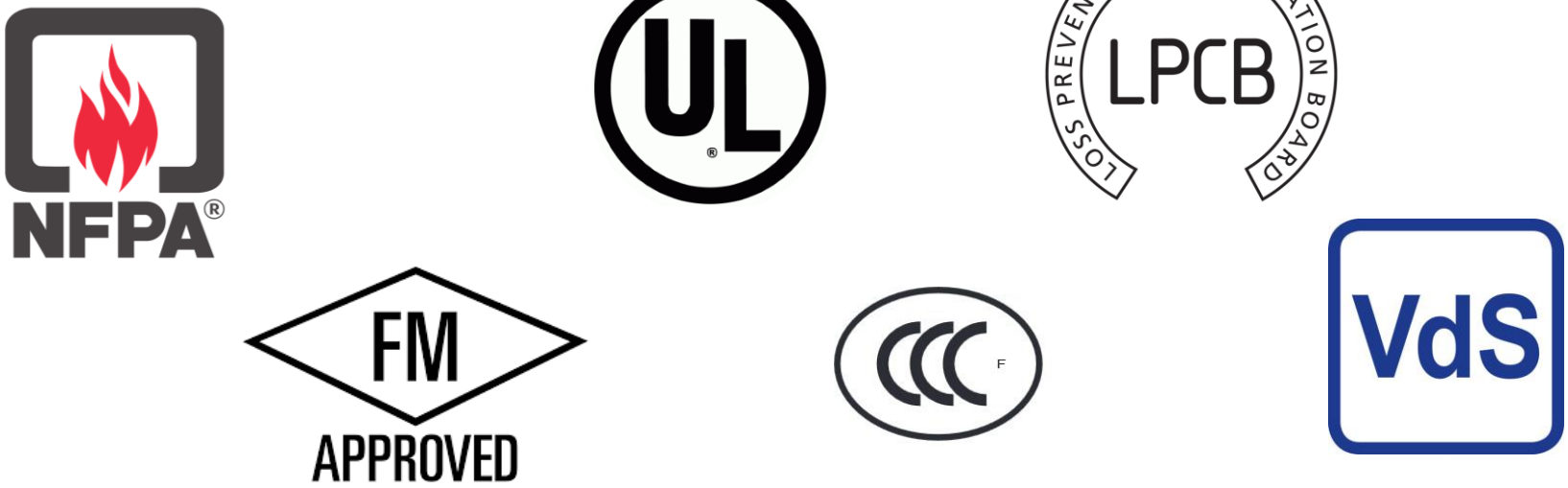
- Granted By An Agency Based On Established Product Standards
  - FM5580 Standard For Hybrid (Water And Inert Gas) Fire Extinguishing Systems
  - FM5560 Standard For Water Mist Systems
  - UL2127 Standard For Inert Gas Clean Agent Extinguishing Systems
  - UL1626 Standard For Residential Sprinklers For Fire-Protection Service
- Fire Test Protocols
- Mechanical Testing

Listings Vs. Approvals

Approval

- Granted By An AHJ Based On The Provided Information
  - Examples
    - Performance Based Testing
    - Fire Test Protocols
    - Agency Testing

Listings, Approvals, Codes, And Standards



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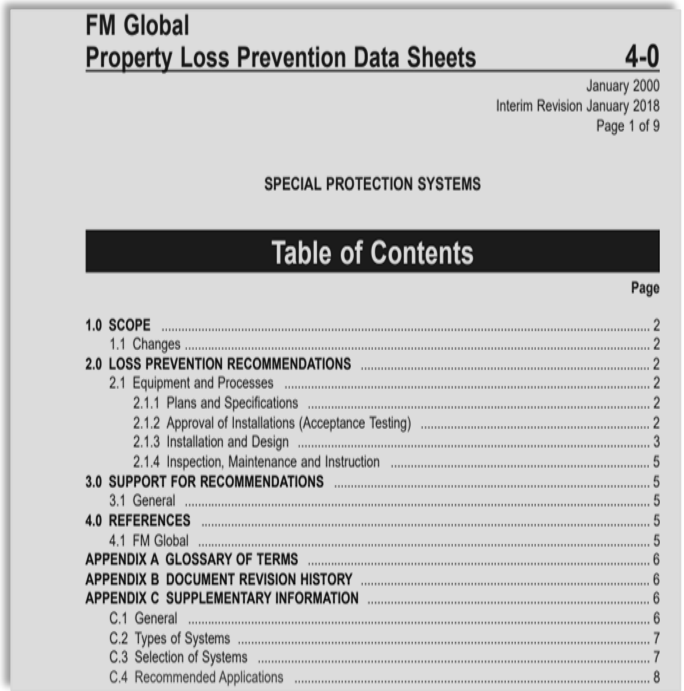
Listings, Approvals, Codes, And Standards

- NFPA 850 Fire Protection For Electric Generating Plants
  - What To Protect In Plant
- NFPA 770 Standard On Hybrid (Water And Inert Gas) Fire Extinguishing Systems
  - How To Design, Install, And Maintain A Listed Or Approved Hybrid System
- FM 5580 Standard On Hybrid (Water And Inert Gas) Fire Extinguishing Systems
  - How To Obtain A Listing For A Hybrid System

Applications

Approvals And Applications

- FM Global Property Loss Prevention Data Sheets
  - 4-0 Special Protection Systems
  - 5-3 / 13-2 Hydroelectric Power
  - 5-23 Emergency And Standby Power Systems
  - 7-3 Flight Simulator Systems
  - 7-7/17-12 Semiconductor Fabrication Facilities
  - 7-32 Ignitable Liquid Operations



FM Global
Property Loss Prevention Data Sheets 4-0

January 2000
Interim Revision January 2018
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SPECIAL PROTECTION SYSTEMS

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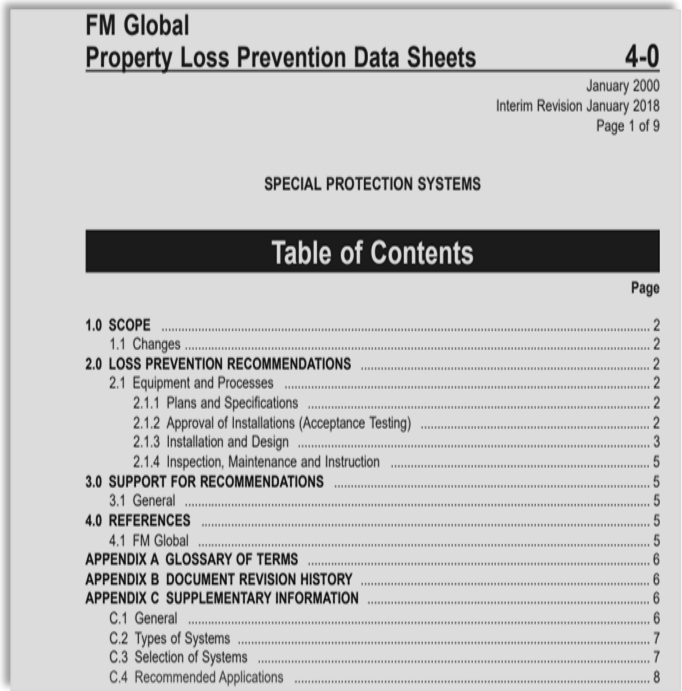
Approvals And Applications

- FM Global Property Loss Prevention Data Sheets
  - 7-37 Cutting Fluids
  - 7-79 Fire Protection for Gas Turbines And Electric Generators
  - 7-88 Ignitable Liquid Storage Tanks
  - 7-101Fire Protection For Steam Turbines and Electric Generators



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Property Loss Prevention Data Sheets 4-0

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SPECIAL PROTECTION SYSTEMS

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Applications

Information Technology Equipment Areas	Clean Rooms	Waste Disposal Equip
Server / Computer Rooms	Engine Test Cells	Ducts and Hoods
Data Storage Facilities	Paint Booths/ Lines	Cable Spread
Cable Trays	Textile	Enclosed Transformers
UPS	Mining	Chemical Storage
Telecommunications	Dip Tanks	Store Room
Motor Control Centers (MCC)	Dust Collectors	Hospitals
Switch Gear	Open Pits	Flammable Liquid Storage - non palletized
Control Rooms	Ovens	Archives
Internal combustion engines	Printing Presses	Libraries
Oil pumps	Process Equipment	Museums
Oil tanks	Quench Tanks	Vaults
Fuel filters	Drive shafts	Rolling Mills
Generators	Lubrication skids	Wet Benches
Transformers	Gear boxes	
Diesel engine driven generators and other similar equipment using liquid hydrocarbon fuel and/or hydraulic, heat transfer, and lubrication fluids	Enclosures with incidental use of hydrocarbon flammable liquids of not more than two 55 gal (208 L) drums arranged for dispensing with safety bungs.	

Testing

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Listing Tests

- Machine Space, Flammable, And Combustible Fluids
  - 580 m³ Space Testing

FM Approvals Class 5560	Test Description	IMO MSC/Circ.1165	Test Number
1	Low Pressure, Exposed, Diesel Spray	1	001
2	Low Pressure, Angled, Diesel Spray	2	002
3	Low Pressure, Concealed, Diesel Spray	---	003
4	High Pressure Diesel Spray	3	015
5	Low Pressure, Concealed, Diesel Spray and Pool Fires	---	004
6	Concealed, Heptane Pool Fire	---	008
7	Flowing Fire	6	010
8	Wood Crib and Heptane Pool Fire	7	012
9	Saturated Insulation Mat and Spray Fire	---	005
10	Saturated Insulation Mat	---	007
---	Low Pressure concealed spray with tray (Diesel)	4	006
---	Concealed fire tray on bilge plate (Diesel)	5	009
---	Low Pressure Spray on Steel Plate (Heptane)	8	011
---		Thermal Management Test	013
---		Thermal Management Test	014

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Performance Based Testing

- Steel Mill – Pickling Lines
  - Remove Impurities, Contaminants, Stains, Rust, And Scale
  - Acids
    - Hydrochloric
    - Sulfuric
    - Nitric
    - Hydrofluoric

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Performance Based Testing

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Performance Based Testing

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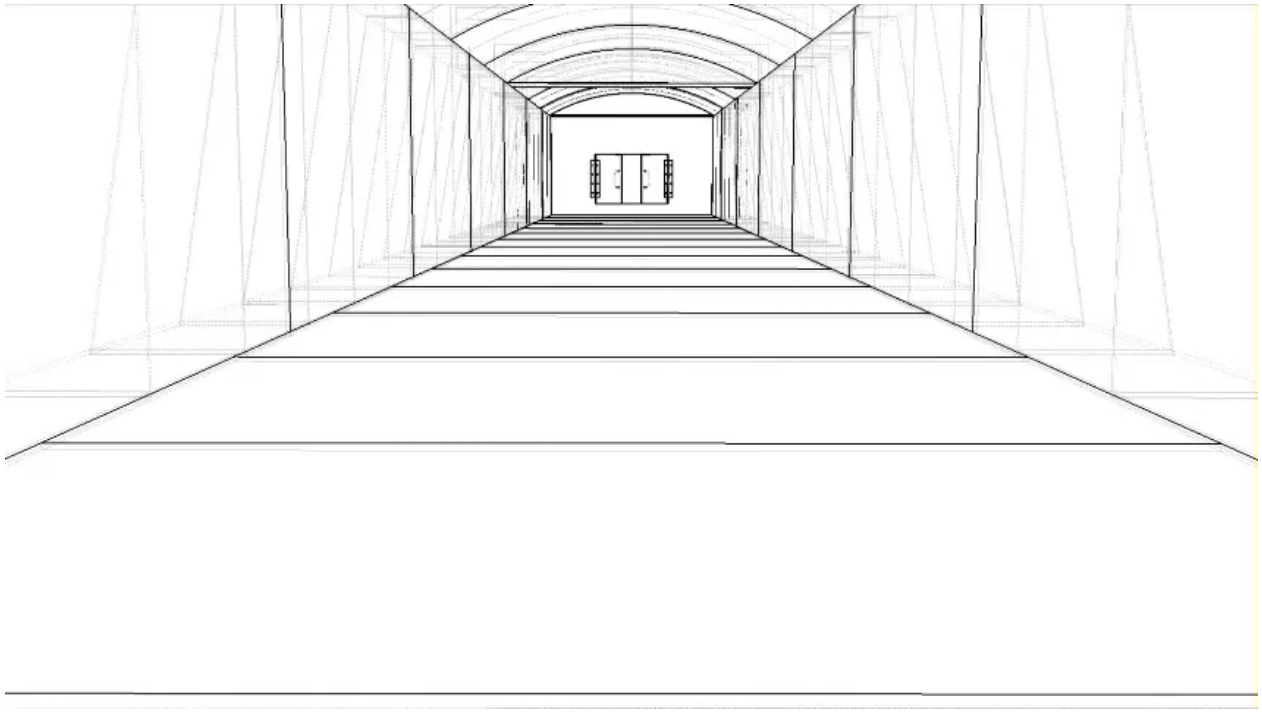
Performance Based Testing

- Pickling Line



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Hybrid Testing At High Elevation

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Testing At High Elevation

- Over 150 Tests
  - Elevation
  - Ventilation
  - Fire
  - Size

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Chapters

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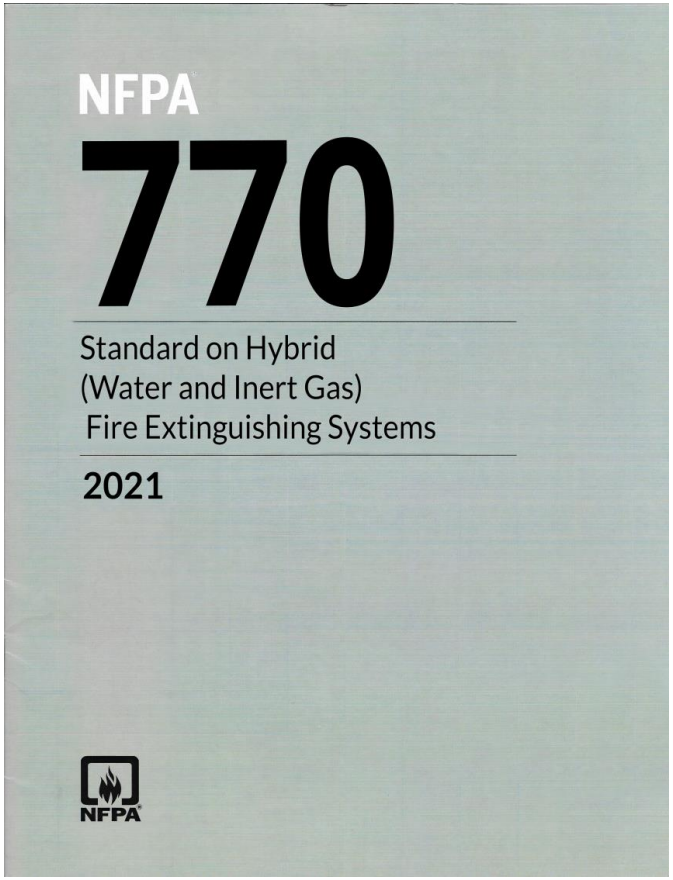

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Chapter 3 Definitions

- Hybrid Fire Extinguishing System
  - Extinguishing System Delivering Hybrid Media
- Hybrid Media
  - Extinguishing Media Resulting In An Atmosphere Less Than 16% Oxygen
- Hybrid Nozzle
  - A Device Designed To Deliver Hybrid Media

Chapter 4 General Information

- Permitted For Use For Class ABC Fires
  - In Accordance To Product Listings Or Approvals
- Normally Occupied Area
  - Above 12 % O_2 Limit To 5 Mins
  - O_2 >12% Egress time no greater than 5 minutes
  - Above 10 % O_2 Limit To 3 Mins
  - 10% < O_2 <=12% Egress time no greater than 3 minutes

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Chapter 5 Components

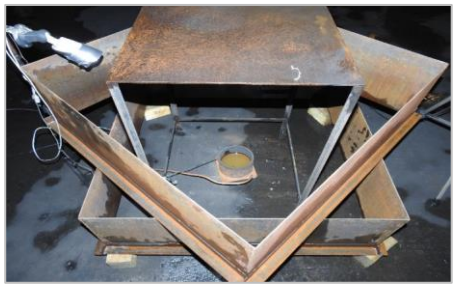
- Hybrid Nozzles
  - D_{v99} of 200µm
- Pre-Discharge Alarms
  - Required Unless Fire Growth or the Delay Threatens Life Safety or Property Damage

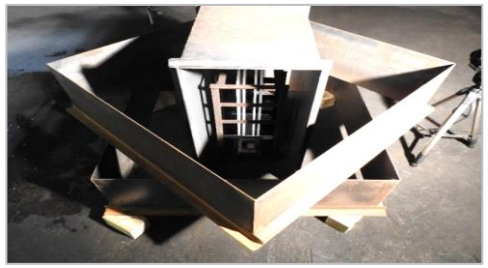
Chapter 6 Application And Fire Test Protocols

- Listing Or Approvals
  - Protection Objectives In Accordance With Listings Or Approved By The AHJ
- Fire Test Protocols
  - Protocols Shall Be Designed To Address The Performance Objectives
- Flooding Factor

Chapter 6 Application And Fire Test Protocols

- Fire Test Protocols
  - Class B Fire Tests
    - 6”, 10”, 14” Round Pan
      - 30 Second Pre-Burn





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Chapter 6 Application And Fire Test Protocols

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Chapter 6 Application And Fire Test Protocols

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Chapter 8 Design Requirements For Total Flooding Systems

$$Q_{min} = F_{S,IG} * V_{enc} * \frac{294.4}{273 + T_{min}} * X * F_{atm}$$

- Q_{min} = minimum volume of inert gas agent to be added [m^3]
- $F_{S,IG}$ = inert gas agent safety factor
- V_{enc} = volume of the enclosure [m^3]
- T_{min} = minimum expected ambient enclosure temperature (° K)
- X = flooding factor at 21°C ambient temperature [m^3/m^3]
- F_{atm} = atmospheric correction factor

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Chapter 8 Design Requirements For Total Flooding Systems

$$W = F_{S,H20} * (V_{pipe} + N * R_{D,H20} * t)$$

- W = quantity of water [L]
- $F_{S,H20}$ = water safety factor
- V_{pipe} = internal volume of water-filled pipe [L]
- N = minimum number of hybrid nozzles [nozzles]
- $R_{D,H20}$ = water discharge rate of the hybrid nozzle [L/min/nozzle]
- t = design discharge duration [min]

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Chapter 8 Design Requirements For Total Flooding Systems

- Uses
  - Permanent Enclosure
  - Enclosure Requirements
    - Refer To Listings
    - Manufacturer's Design Installation Operation and Maintenance Manual (DIOM)
- Forced Ventilation
  - Affects Performance Or Propagates Fire
  - Shutdown Or Dampened

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Chapter 8 Design Requirements For Total Flooding Systems

- Safety Factor
  - Class A, B, C
  - 20%
- Discharge Time
- Maximum “Discharge Time” Permitted to Discharge the Design Quantity of Hybrid Media
  - Three (3) Minutes
  - Unless The Hazard Requires A Longer Discharge

Chapter 9 Design Requirements For Local Application

- Uses
  - Protects An Object Or Hazard
    - Unenclosed Or Partially Enclosed
- Location Of Hazard
  - Indoors

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Chapter 9 Design Requirements For Local Application

- Discharge Rate
  - Dependent On Listings Or Approvals
- Discharge Time
  - Determined by Test
    - 2X The Extinguishment Time
    - Not Less Than 120 Seconds

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Chapter 11 System Documentation

- Summary Sheets
- Detailed Work Sheets
- Owners Documentation

Chapter 11 System Documentation

- Summary Sheets
  - Name And Address Of Plans Preparer And Installing Contractor
  - Hybrid Extinguishing System Manufacturer And System Designation
  - Date Of Preparation
  - Name Of Owner And Occupant
  - Property Location, Including Street Address And Site Elevation Relative To Sea Level
  - Description Of Occupancies And Hazards (Fuels) Being Protected
  - Type Of Application: Total Flooding Or Local Application
  - Total Flooding, Design Volume Of Space Protected
  - Local Application Area Of Water Application
  - Total Gas Requirement
  - Total Water Requirement

Chapter 11 System Documentation

- Detailed Work Sheets
  - Nozzle Description
  - Pipe Size
  - Pipe Lengths, Center To Center Of Fittings
  - Equivalent Pipe Lengths For Fittings And Devices
  - Calculated Nozzle Pressure
  - Maximum Calculated Pressure In The Pipe Network
  - Calculated Flow Rates:
    - Inert Gas Flow: slpm (scfm)
    - Water Flow: lpm (gpm)
  - Calculated Discharge Time
- Owners Documentation – Copy of DIOM

Chapter 12 Installation Requirements

- Qualifications
  - Systems Installed According To Manufacturers DIOM
- Qualified Personnel
  - Certified And Trained By The Manufacturer
  - Organization Accepted By The AHJ

Chapter 12 Installation Requirements

- System Review
  - Operating Devices
  - Auxiliary Devices
  - Operation Of Alarms
  - FACP And Connected Devices
  - Sensors
  - Piping Pressure Test
    - Pressure Test The Piping
    - 90% Of The Test Pressure After 10 Mins

Chapter 13 Acceptance Testing

- Approval Of Installations
  - Prior To Testing
  - Step-By-Step Procedure
  - Identifies All:
    - Devices
    - Controls
    - Functions

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Chapter 14 Inspection, Testing, And Maintenance

- Weekly Inspection
  - Inert Gas And Water Supply Lines Are Intact
  - Nozzles Are Not Obstructed
  - Protective Caps If Supplied Are In Place On Every Nozzle
  - Fire Alarm Control Panel Is In "Normal" Ready Condition
  - System Isolation Valves Are Locked In Full Open Position
  - Tamper Seals Are In Place

Chapter 14 Inspection, Testing, And Maintenance

- Semi-Annual
  - Check Inert Gas Supply Pressure
    - Correct For Ambient Temperature
    - Loss Greater Than 10%
  - Check The Water Level In The Storage Tank
  - Manufacturer’s DIOM

Chapter 14 Inspection, Testing, And Maintenance

- Annual
  - Check And Test All Time Delays For Operation
  - Check And Test All Audible Notification Appliances For Operation
  - Check And Test All Visual Notification Appliances For Operation
  - Check That All Warning Signs Are Installed And Visible
  - Check Operation Of All Manual Release Devices
  - Check And Test Each Automatic Detector Using Methods Specified In NFPA 72
  - Check And Verify Functional Operation Of System Interlocks

Examples Of Hybrid Systems

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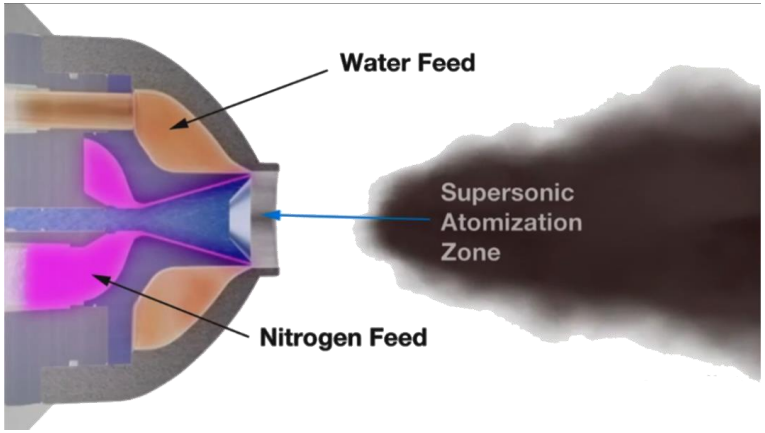
Examples Of Hybrid Systems



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Examples Of Hybrid Systems

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Performance Based Testing

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- NIOSH Test Facility In Morgantown WV
- Conveyor Belt / Drum Fire
- Maximum Wind Velocity, Local Application

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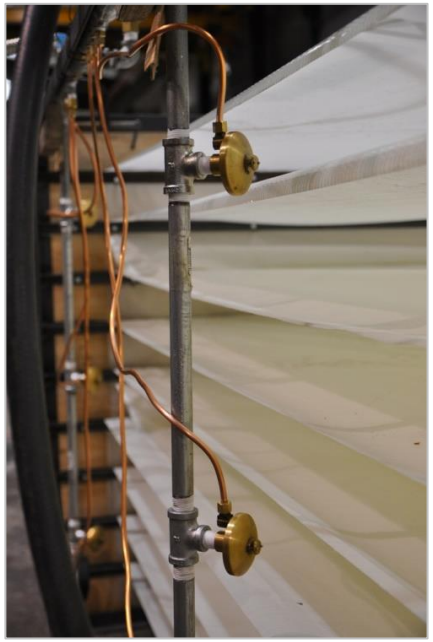

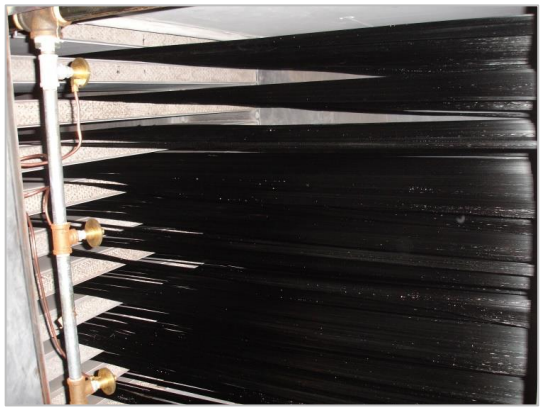

- Process Ovens, 500F
- Preliminary Testing Conducted At The Edison Facility Using 1/8” Emitters In A Local Application
- Final Testing Conducted At Manufacturing Facility

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- Acceptance Testing Conducted In A Cold Room Operating At 39F
- The Refrigeration Units Remained In Operation Throughout The Discharge

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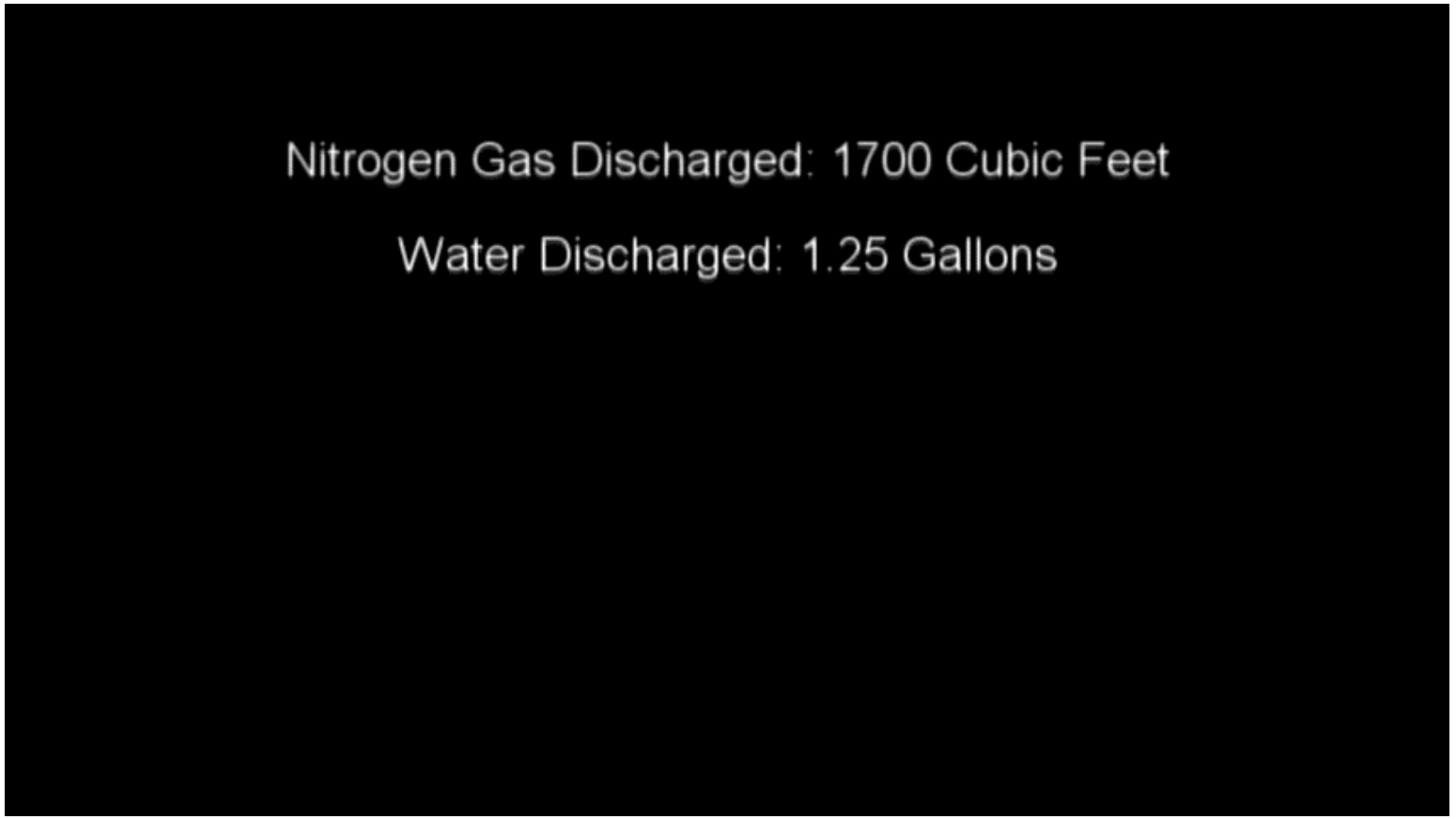

- Data Processing/Computer Equipment Operating While Exposed To A Hybrid Media Discharge

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- Local Application Testing Conducted At Factory Mutual (FM) Research Laboratory
- In The Video The First Test Is Conducted With A 1m Square Pan Of Heptane
- The Second Fire Test Is Conducted With A 2m Square Pan Of Heptane
- In Each Case, The Application Was Conducted Where Each Emitter Covers One Square Meter

- Local Application Testing Conducted With A Factory Mutual
- The Video Is Of A 3 Meter Square Pan Of Diesel Along With A Diesel Spray Fire
- The Application Was Conducted Where Emitter Covers One Square Meter

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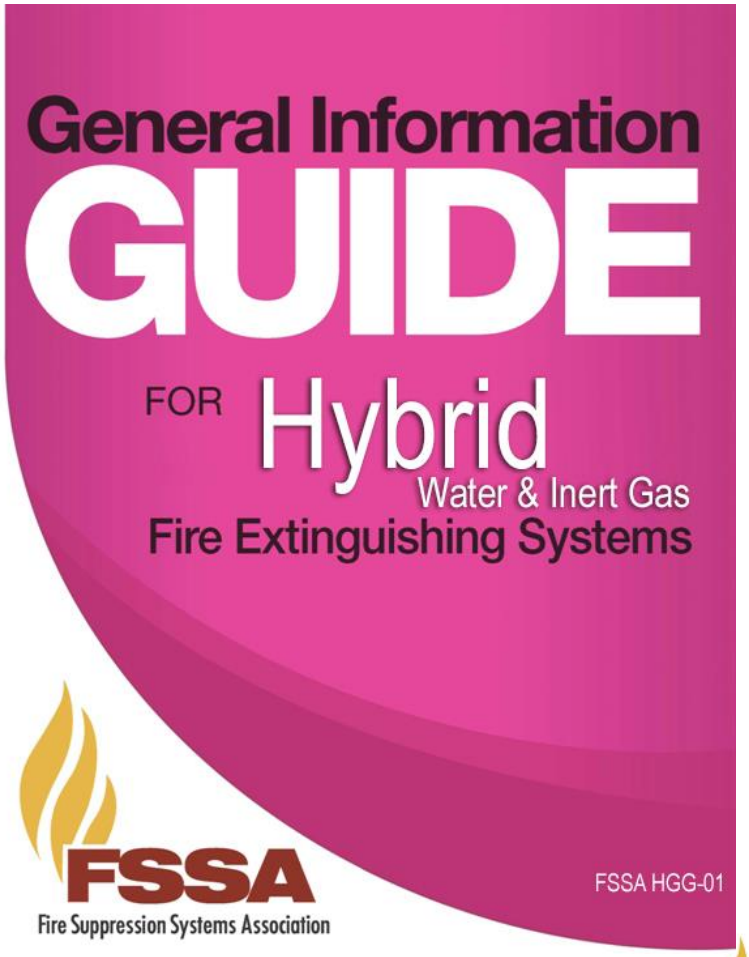
FSSA Publications

https://www.fssa.net/technicalpub



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FSSA Publications

https://www.fssa.net/technicalpub

General Information
GUIDE
FOR Hybrid
Water & Inert Gas
Fire Extinguishing Syst

APPLICATION
GUIDE
to Estimating Enclosure Pressure & Pressure Relief Vent Area
FOR USE WITH
Clean Agent
Fire Extinguishing Systems
FSSA PRG-01
Third Edition
October 2014

Design
GUIDE
FOR USE WITH
Fire Protection System
Inspection Forms
FSSA IFG-01
January 2012

Design
GUIDE
FOR USE WITH
Carbon Dioxide
Total Flooding Applications
FSSA CTF-01
First Edition
2011

Pipe Design
GUIDE
FOR USE WITH
Special Hazard
Fire Suppression Systems
Third Edition
August 2019
PDH-03

APPLICATION
GUIDE
Detection & Control
for Fire Suppression Systems
FSSA DCG-01
First Edition
November 2019

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Questions

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