

Fire Inspector Certification Program

New Jersey Uniform Fire Code Inspector Training Program

Module 10 Fire Protection Systems Part 2



1

In Part –2 we will cover

- *Water supply- Private Mains*
- *Fire booster pumps*
- *Alternate fire suppression systems*
- *Kitchen range hood systems*
- *Low, medium, high expansion foam systems*
- *Fixed foam systems*
- *Fire detection systems*
- *Smoke and Carbon Monoxide alarms*
- *Portable fire extinguishers*

Water Supply & Private Mains

NFPA-25

IFTSA Chapter 11 Water Supply Distribution systems

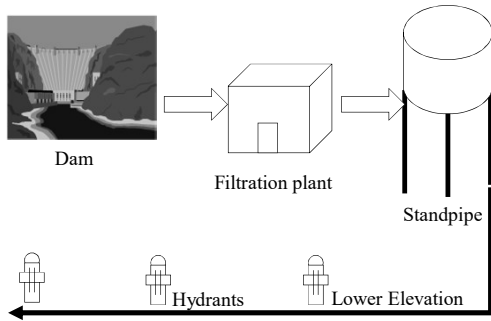
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Where the supply comes from...

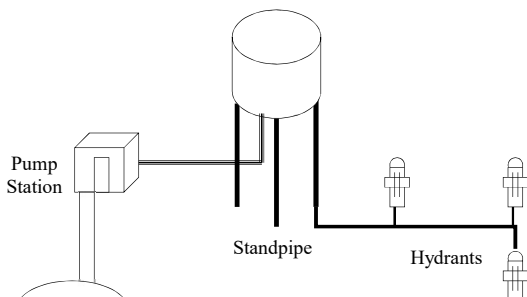


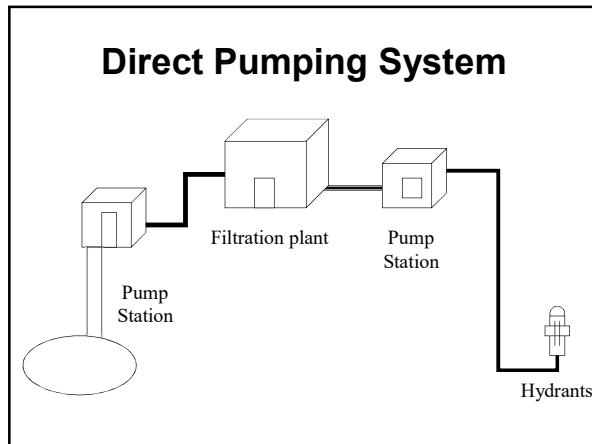
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Pumping Station Gravity Feed



Pumping Station Gravity Storage

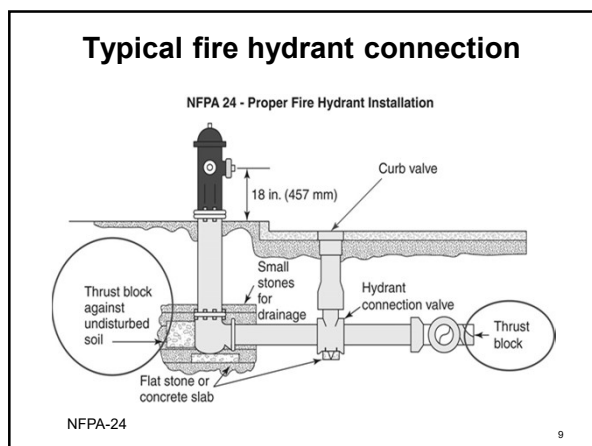




Water Supplies and Testing

- *Water supply availability on Private water services may come from municipal systems or storage tanks installed at the facility and likely both.*
- *Private water mains are installed under NFPA-24 and storage tanks under NFPA 22 through the UCC.*
- *Flow should be determined by Testing*

8



Private Water Mains

■ **Maintenance requirements:**

- 5 year flow tests on underground pipes
- Hydrants inspected annually or after use
- Strainers annually or after large flows
- Hose stations quarterly
- Monitor nozzles -annually

Testing IFSTA pp 477 - 488

Fire Booster Pumps

NFPA -20

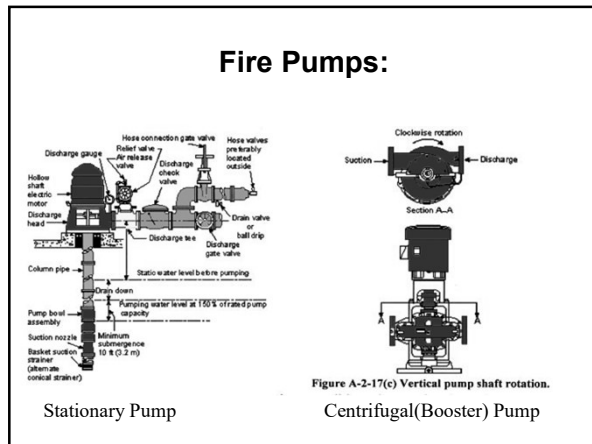
IFSTA Chapter 12 pp 532 - 538

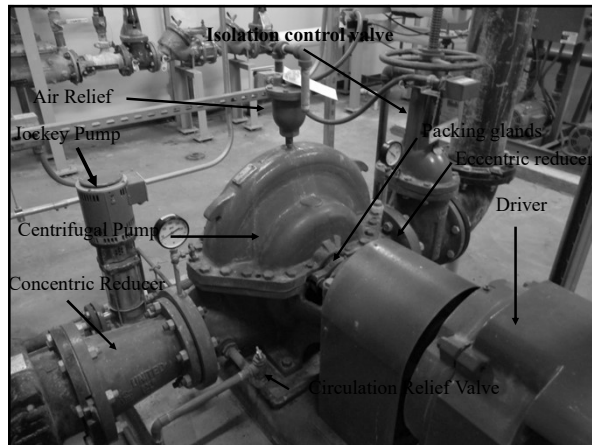
11

Fire Pumps May be Required

- *Fire booster pumps must comply with NFPA-20*
- *Fire booster pumps provide additional pressure and flow for sprinkler and standpipe systems*
- *Fire Booster pumps may be electric or diesel*

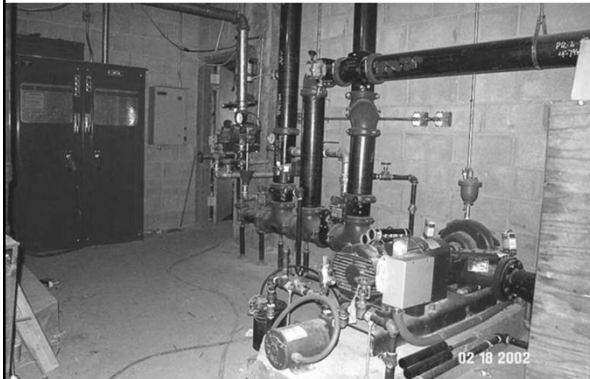
12







Electric Fire Pump Installation



Fire Pump Housing and Gauges

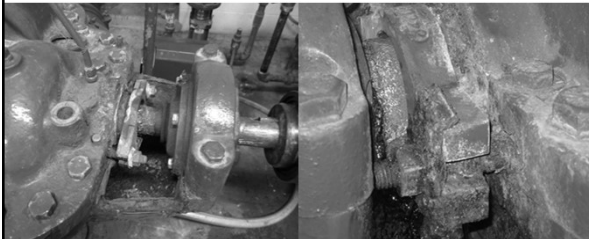


Diesel Fire Pump Installation





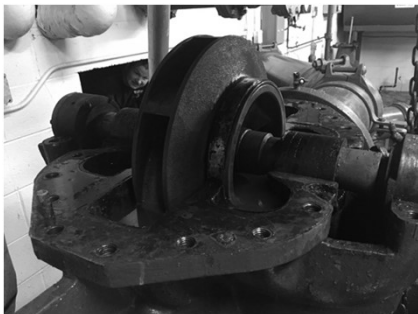
Fire Pump Maintenance



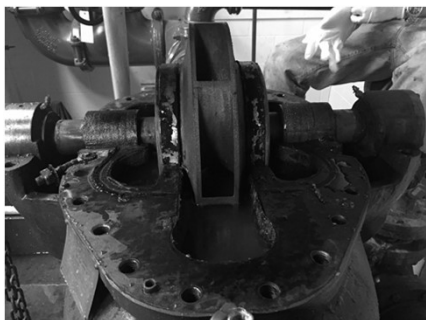
Shaft Seized – wear rings dry

Shaft corroded – packing missing

Fire Pump Maintenance



Fire Pump Maintenance



Jockey Pump



Fire Pump Bypass Piping

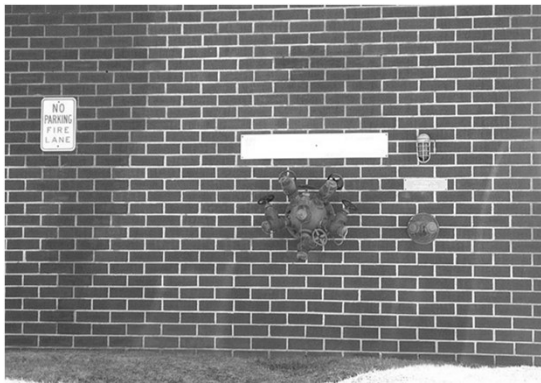


Fire Pump Controller



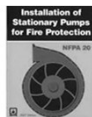
25

Fire Pump Test Header



Fire Pumps

- Installed and tested to NFPA 20
- Performance rated:
 - Churn test (pressure between 100%-140% of rated pressure)
 - Peak performance –(150% of rated flow at 65% rated pressure)



Fire Pumps

- *Electric run time – 10 minutes weekly*
- *Diesel run time – 30 minutes weekly*
- *Automatic starts* (Mercury pressure switches)
- *Annual tests:*
 - *Churn*
 - *Rated pump capacity*

Alternate Fire Suppression Systems

Alternate Fire Suppression Systems

- | | |
|------------------------|--------------------------|
| ■ <u>System</u> | ■ <u>Standard</u> |
| – <i>Halon</i> | – <i>NFPA-12A</i> |
| – <i>CO2</i> | – <i>NFPA-12</i> |
| – <i>Clean Agent</i> | – <i>NFPA-2001</i> |
| – <i>Dry Chemical</i> | – <i>NFPA- 17</i> |
| – <i>Wet chemical</i> | – <i>NFPA-17A</i> |
| – <i>Water Mist</i> | – <i>NFPA - 750</i> |

IFSTA Chapter 13 pp 563-584

HALON

- *Very Effective Fire Suppression Agent*
- *First used during WWII*
- *Widely used 1940-1980*
- *Montreal protocol 1987*
 - *CFC effect the earth's ozone layer*
 - *Halon production limited to 1987 levels*
 - *Clean air act 1990 - exempted Halon fire suppressants*
 - *Production required to cease by 2000*

Halogen Extinguishing Agents

- *Also known as:*
 - *Halon 1301 – Used in Total Flooding Systems*
 - *Halon 1211 – Primarily fire extinguishers*



Halogen Extinguishing Agents

- *Vaporizing liquids or liquefied gas*
- *Requires proper application rate and concentration*
- *Halon 1301 is five times heavier than air*
- *Range determined by boiling point*
- *Extinguishes fire by breaking the chemical reaction*

Application of Halon 1301

- Computer rooms
- Telephone exchanges
- Race cars
- Oil processing buildings
- Mines
- Super tankers
- Museums
- Art collections



Alternate Halon Replacement Agents

- *Water Mist*
- *Pre-action Automatic Sprinklers or on/off sprinkler heads*
- *Clean Agents*



Clean Agent Substitutes

- Two main types of Clean Agents:
 - *Halocarbon Agents – Extinguish by chemical action*
 - *Inert Gas Agents –displace available oxygen*



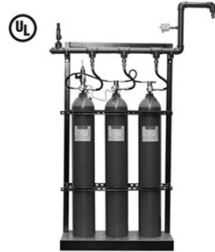
Inert Agents

■ ***Inert Gases:***

- Nitrogen
- Neon
- Argon

Lower O₂
concentration

■ 12-13%



Halocarbon Agent

■ FE-232 Dichloro-trifluoro-ethane

■ FE-25 Penta-fluoroethane

■ FE-13 Trifluoro-methane

- FE-232 replaces 1211
- FE-25 & 13 replace 1301

■ ***There is No Drop In substitute Gas for Halon***

HCFC Halocarbons

■ Novec 1230

■ Liquid agent

■ Dispersed through
special nozzles

Video : 3M Novec 1230



Intergen Fire Suppressant

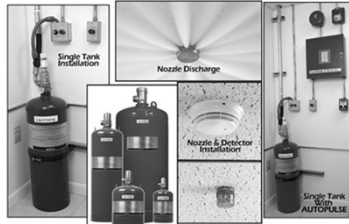
- 52% Nitrogen
- 40% Argon
- 8% Carbon Dioxide
- Stored under high pressure
- System Design Concentrations:
 - 35-50%

Intergen –Halon replacement

- | | |
|--|--|
| ■ Ansul Intergen System Industrial Applications: <ul style="list-style-type: none"> ■ Hazardous Storage Buildings ■ Dip Tanks ■ Paint Lockers ■ Flammable Liquid Storage Facilities ■ Stock Rooms ■ Printing Machines ■ Mixing Tanks ■ Electrical Motors ■ Pumps ■ Switchgear Rooms ■ Indoor Transformers ■ Wood Finishing Operations | ■ Ansul Intergen Fire Suppression System Features <ul style="list-style-type: none"> ■ UL Listed ■ Complies with UL 1254 Standard, September 29, 1998 ■ 25 lb., 50 lb., and 100 lb. size tanks available with FORAY dry chemical for total flooding applications ■ 25 lb. and 50 lb. size tanks available with PLUS-FIFTY C dry chemical for local application overhead and local application tank side. ■ Three Basic Application Methods: Total Flooding, Local Application – Tank side, Local Application – Overhead ■ Mechanical or Electrical Detection ■ Low Temperature Total Flooding Application –20 °F (-29 °C) ■ Multiple Total Flooding Options |
|--|--|

Clean Agent Components

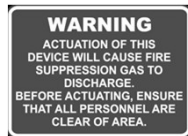
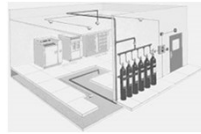
- Concentrations 8% to 24%



Clean Agent Systems

Fire Inspection Points:

*Storage systems
piping & nozzles
Smoke detectors
Manual pull stations
Abort switches
Pre & post discharge alarms
Signage*



NFPA 750



■ Performance Objectives

- *Fire Control*
- *Fire Suppression*
- *Fire Extinguishment*

Water Mist Performance

Water mist is also effective for:

- *Temperature Control*
- *Exposure Protection*
 - *Class A Fuel – Larger Droplet*
 - *Class B Fuel – Smaller Droplet*



Types of Water Mist Systems



■ **Low Pressure:**

– 175 psi or less

■ **Intermediate Pressure:**

– 175 to 500psi

■ **High Pressure:**

– 500 psi or more

High Pressure Water Mist



Video: water mist demo

NFPA 11 Low /Medium/ High Expansion Foam Systems



IFSTA Chapter 13 pp 578 to 584

Foam Expansion Ratios

Class Foam	NFPA 11 Ratio	Typical Ratio
Low	under 20:1	8:1
Medium	20:1-200:1	100:1
High	200:1 –1000:1	300:1

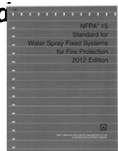
Foam Types

- *Flouro-protein - easy flowing foam*
- *FFFP – creates a film barrier*
- *AFFF – fast spreading –quick knockdown*
- *AR-AFFF – alcohol resistant*

Flammable Liquid Loading Racks:

NFPA 15 & NFPA 16

- *System installation is based upon the Design professionals judgment for the system best suited to protect the hazard*



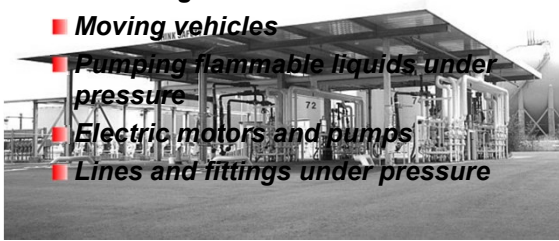
NFPA 15-12



NFPA16-15

Loading Rack Hazards

- *No diking*
- *Moving vehicles*
- *Pumping flammable liquids under pressure*
- *Electric motors and pumps*
- *Lines and fittings under pressure*



Fixed Foam Sprinklers

Foam Sprinklers are installed at the roof of the loading rack

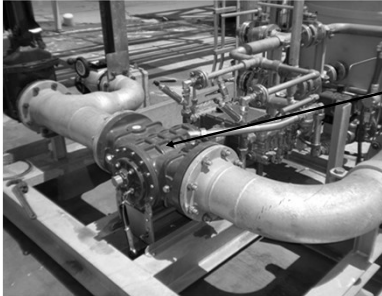


Foam Tank & Pump



Foam Tank

Foam Fire Pump



1,580 GPM

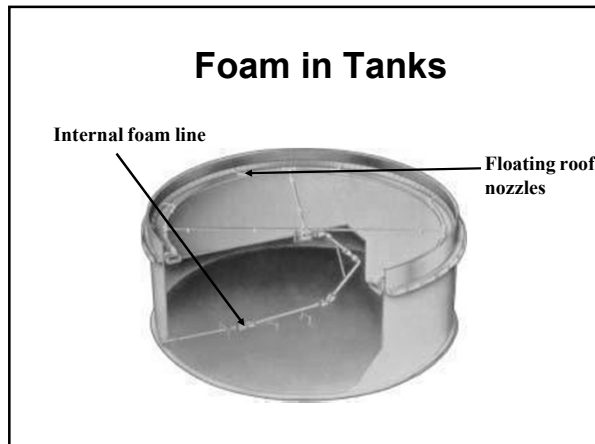
Fixed Foam Systems

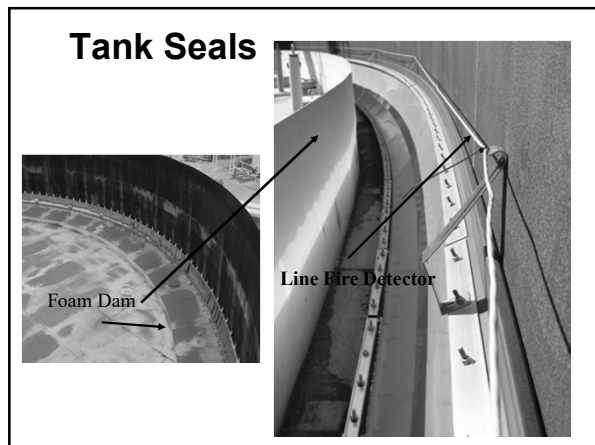


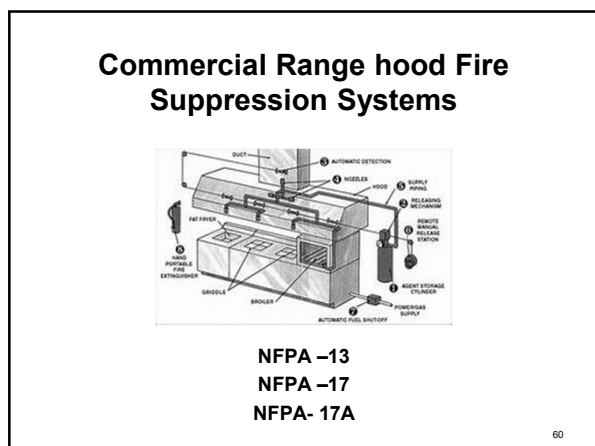
Automatic Fixed Foam Systems

- Subsurface injection
- Surface application
- Seal protection
- Dike protection

Tank Diameter (feet)	Application Rate (gpm/sq.ft.)
Up to 150	0.16
150 to 200	0.18
201 to 250	0.20
251 to 300	0.22
More than 300	0.24 or higher



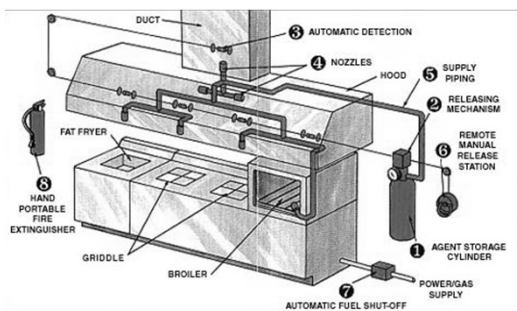




Types of systems

- Dry chemical
- Wet chemical
- Water sprinklers
- Carbon dioxide
- Combination wash down / wet chemical

Dry Chemical Local Application



Dry Chemical Storage

- Stored pressure cylinder
- Non stored pressure - cartridge type
- Nitrogen gas most common propellant
- Cylinder has "bursting disk" to fluidize powder.

Wet Chemical Systems

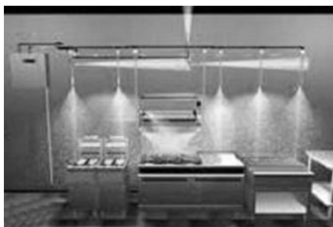
Wet Chemical Systems

- UL 300 Fire test –Wet systems
- 1994 –Dry powder equipment no longer manufactured
- Existing Dry Powder will be replaced



Wet Chemical Agents

- Potassium:
 - Acetate or
 - Citrate or
 - Carbonate
- Cooking Grease
 - ignition temperature 685F
- Discharges over each appliance



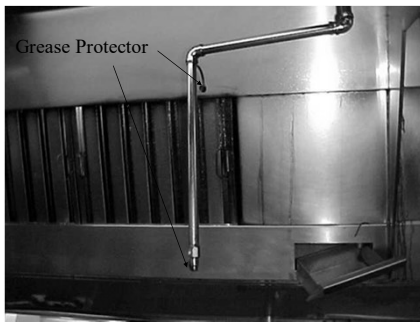
Fire inspection points

■ *Fire Inspectors must examine the following on kitchen systems*

- Test date on fire suppression system
- Fusible link dates
- Nozzle coverage of cooking surfaces
- Filters and hood plenum
- Duct and plenum nozzles
- Duct and roof fan
- Cleaning schedule
- Review report

Standard 3 page report –Appendix N
IFC-2015 NJ Edition

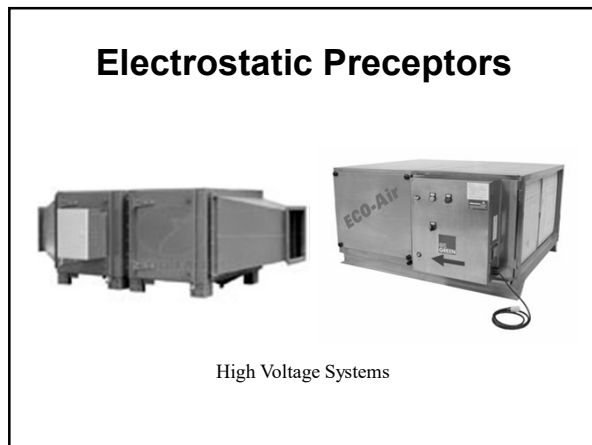
Fire Suppression Nozzle

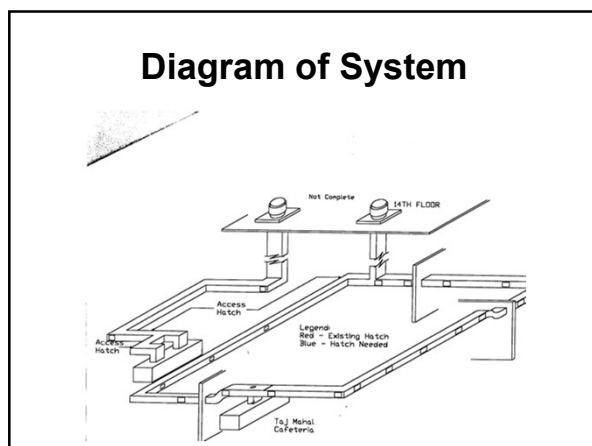


Hood Plenum and Filter Rack









Inspection Records

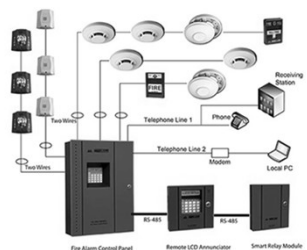
NFPA 7.3.1

"A trained person who has undergone the instructions necessary to perform the maintenance and recharge service reliably and has the applicable manufacturer's listed installation and maintenance manual and service bulletins shall service the wet chemical fire-extinguishing system 6 months apart as outlined in 7.3.2."

Fire detection and alarm systems

IFSTA Chapter 14

Fire Alarm Systems




Various components

75

Purpose of Detection

- **Notify of an incipient fire**
- **Initiate a visual and audible signal**
- **Alert the building occupants to evacuate**
- **Alert the Fire Department to respond**

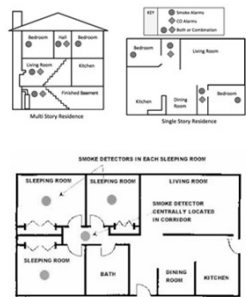


Commercial buildings primary focus of UFC

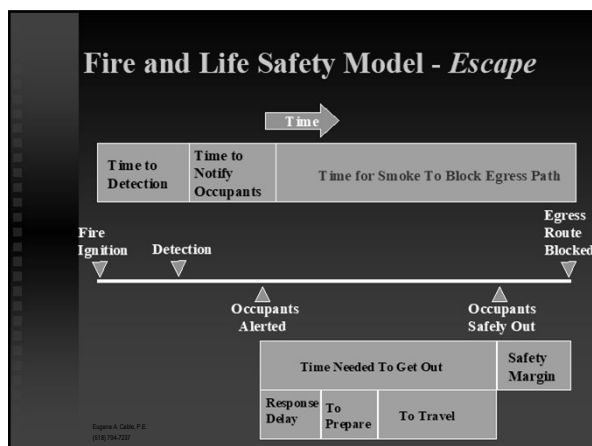
76

Purpose of Detection

- **UFC does not apply to owner occupied one and two family or attached single family**
- **5:70-2.3 only requires an inspection prior to change of occupant**
- **Specific technical requirements listed in 5:70-4.19**
 - Pre-1977 – Battery only every level
 - Post 1977 – hard wired 110 system based on UCC at time of construction
- **Carbon Monoxide Alarms within 10 feet of bedroom when CO source present**



LOCATION OF SMOKE DETECTORS WITHIN A RESIDENCE 7



Where are Fire Alarms Required?

- Use Group and Occupancy
 - Determined by UCC or 5:70-4
- High hazard uses and occupancy
 - Number of occupants
 - Age
 - Building features including height
- UCC responsible for proper installation
- UFC maintains

79

Components of Fire Alarm Systems

- **Alarm initiating devices**
 - Connected to Initiating Device Circuits (IDC)
- **Alarm notification appliances**
 - Connected to Notification Appliance Circuits (NAC)
- **Fire Alarm Control panel (FACP)**
 - primary power
 - secondary power
 - trouble power
 - communicator if monitoring required

80

Components of Fire Alarm Systems

- **Alarm initiating devices**
 - Smoke detectors
 - Heat detectors
 - Line detectors
 - Infrared detectors
 - UV detectors
 - VESDA detectors
 - Manual pull stations
 - Carbon Monoxide Detectors



81

Components of Fire Alarm Systems

- **Alarm Alerting devices**
 - Strobe lights
 - Auditory alarms with decibel requirements

82

Components of a Fire Alarm System

- **Wiring – National Electrical Code NFPA 70 article 760**
 - Power limited 12-24 volts
 - Non Power Limited 120 volts



83

Carbon Monoxide Alarms

NFPA -720



84

Carbon Monoxide law

- *Two Clifton residents die of Carbon Monoxide Poisoning in a Passaic Music Studio and 12 others are injured*
- *NJ Legislature passes the Korman/ Parks Law*



85

Carbon Monoxide

- *Required in all uses with fuel burning equipment or attached garages*
- *Open parking structures excluded.*
- *Use R-1,R-2,R-3,R-4, I-1*
 - *Buildings compliance with 1999 UCC are exempt*



Variety of options for compliance

86

Smoke Management Systems

NFPA – 92-15

Smoke Control Purpose

- Smoke Control & Smoke Management were introduced into codes in the Late 1970's
- Purpose:
 - To limit smoke migration through passive systems
 - Fire and smoke barrier, fire doors, high ceilings
 - To actively reduce smoke and extend evacuation time for occupants through active or passive systems

88

Passive Systems

- **Passive systems are defend in place systems**
 - Fire walls
 - Fire Barrier walls
 - Smoke barriers
 - Fire doors
 - Fire & smoke dampers
 - High ceilings
 - Draft stops



All must be maintained

89

Active Systems

- **Dedicated mechanical systems**
- **HVAC**
- **Smoke banks with active exhaust**
- **Stairway pressurization systems**

Testing and documentation required

90

Portable Fire Extinguishers

IFSTA Chapter 13

Portable Fire Extinguishers

NFPA -10



92

Classification of Portable Fire Extinguishers

- Class A –ordinary combustibles
- Class B – Flammable & combustible liquids
- Class C – non –conductive agent
- Class D – Metal specific agents
- Class K – Kitchen applications for fats and oils

93

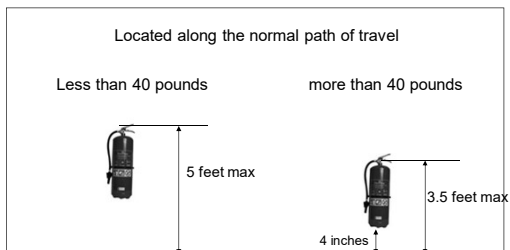
Placement

- Accessible
- Highly Visible
- Marked with signs & symbols



94

Hanging Extinguishers



95

Maintenance and testing

- *Portable fire extinguishers must be inspected on an annual basis and appropriately tagged by a certified New Jersey fire equipment contractor.*
- *Portable fire extinguishers must be hydrostatic tested in accordance with NFPA 10 based upon the type of extinguisher cylinder that holds the agent.*
- *Hydrostatic test dates must be identified on the portable extinguisher*

96

Fire Protection Systems

In this module we discussed...

- Fire alarm systems
- System monitoring,
- Hood protection systems,
- Smoke removal systems, and
- Fire extinguishers

97

Homework Assignments

For next module as stated in the syllabus

98

Module 10
End of Part -2
