South Carolina Municipal Insurance Trust and South Carolina Municipal Insurance and Risk Financing Fund

Hazard Identification and Assessment Training
Property Loss Control

February 27, 2024
Ken E Botes, Vice President, Atlanta, GA

SOLUTIONS...DEFINED, DESIGNED, AND DELIVERED.

MARSH & McLENNAN COMPANIES

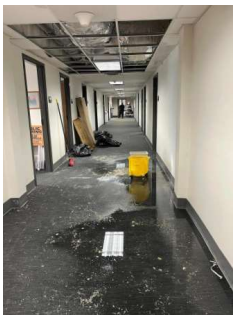
What and Why

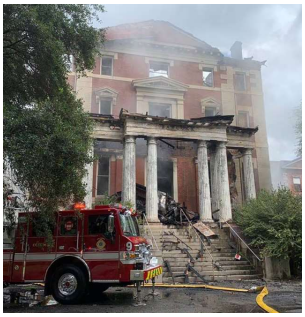
Discuss why property inspections are important, how often they should be conducted, what documentation is required, and how to address any issues that may be found during the inspection

We will cover both property risk control and natural hazards risk analysis.

- Fire prevention – Property Loss Control
- Assess hazards associated with donated and unoccupied buildings

WHAT WE WANT TO PREVENT





Understand and Prioritize the Property Risk

Understand and Prioritize the Property Risk – Reported Fires

Figure 1. Reported fires by year

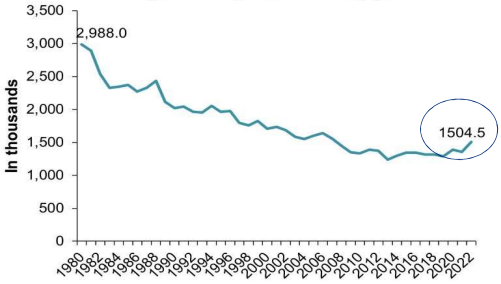


Figure 2. Civilian fire deaths by year

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5

Understand and Prioritize the Property Risk

Figure 1. Presence of sprinklers in US structure fires by occupancy: 2015–2019

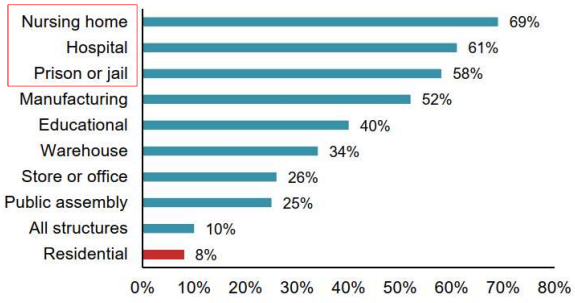


Figure 2. Types of sprinklers present at US structure fires: 2015–2019

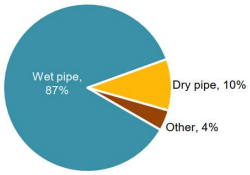
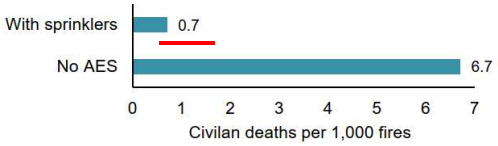


Figure 4. Civilian death rates per 1,000 reported fires in properties with sprinklers and with no AES 2015–2019



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6

Understand and Prioritize the Property Risk

Figure 8. Sprinkler operation and effectiveness: 2015–2019

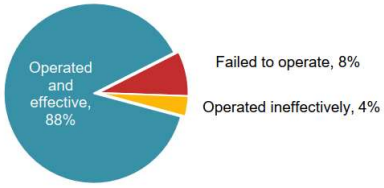
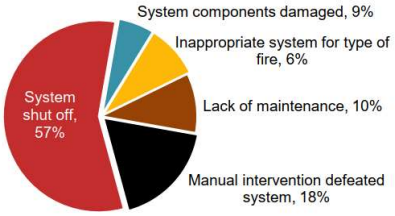


Figure 11. Reasons for sprinkler failure: 2015–2019



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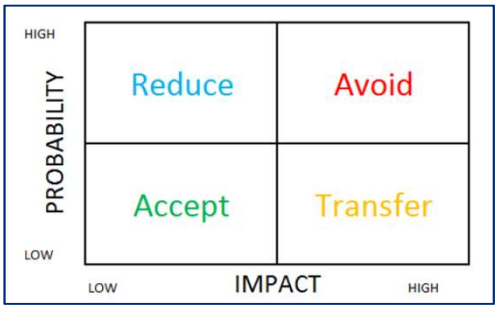
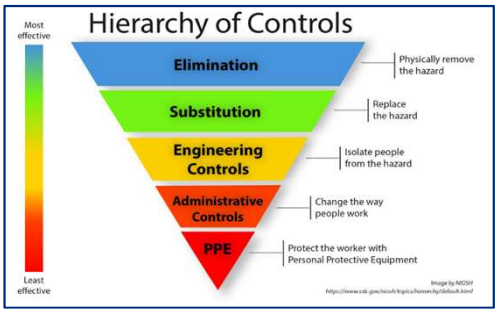
7

Understand and Prioritize the Property Risk





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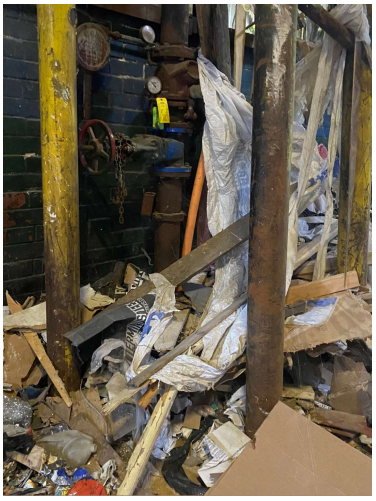
8

Understanding Property Fire Loss Control Visits

From a location Visit – not what we want to see…



<u>Five top items found</u>, (focusing on Human Element, importance, and cost) that should completed at the Site Level (little to no cost)

1) Implementing a Hot Work Permitting System, following National Fire Protection Association [NFPA]- 51B, 2019- Standard for Fire Prevention During Welding, Cutting, and Other Hot Work

- Reason: Hot Work is the leading cause/ payout of all insurance companies, carriers write this as the number one recommendation.

Cost: FREE

2) Implementing the an Impairment Tagging System, following NFPA 25, 2023- Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

- Reason: Improperly monitored fire protection equipment represents **<u>57%</u>** of all system failures during a fire, which were shut.
- Cost: FREE

3) Implementing a Housekeeping Program for the Electrical and Telecommunication Rooms, following NFPA 75, 2020- Standard for the Fire Protection of Information Technology Equipment and NFPA 76, 2020- Standard for the Fire Protection of Telecommunications Facilities

- Reason: Server room and telecommunication rooms control all of the communications and functionalities of the hotels/ resorts. Critical for sales, production, and day-to-day operation.
- Cost: FREE (time commitment from in-house personnel, as well as regular in-house audits)

4) Conducting IR Scans of Electrical Equipment on an Annual Basis, following NFPA 70B, 2023- Standard for Electrical Equipment Maintenance

- Reason: Hot spots can cause, failure of electrical equipment, which in turn could result in a fire. This also could determine hot spots on equipment before the point of failure, preventing equipment failure/ loss of production.
- Cost: $3,000 to $7,000 per location (based on US market price and moderately sized property, as contractors charge by the day)

5) Implement a Fire Protection Inspection, Testing, and Maintenance Program, following NFPA 25, 2023- Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

- Reason: Fire safety inspections can identify potentially hazardous situations and ensure they are corrected continuously. Fire equipment and system inspection and testing will help ensure the protection equipment is properly placed, is serviceable, and will operate if needed. This is listed within NFPA, International Fire Code and the International Building Code.
- Cost for in-house checks: FREE (time commitment from in-house personnel)
  - Cost for inspections by licensed fire protection contractors: dependent upon equipment and location

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11

Sprinkler Heads

Upright

Upright

Pendent

Pendent

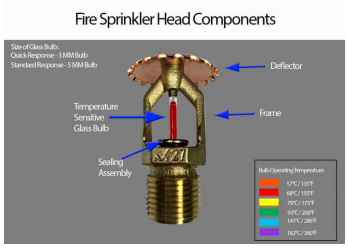

TABLE FOR TEMPERATURE RATINGS AND COLORS FOR FIRE SPRINKLERS						
MAX CEILING TEMPERATURE		TEMPERATURE RATING		TEMPERATURE CLASSIFICATION	GLASS BULB COLORS	COLOR CODE
°F	°C	°F	°C			
100	38	135-170	57-77	ORDINARY	ORANGE or RED	UNCOLORED or BLACK
150	66	175-225	79-107	INTERMEDIATE	YELLOW or GREEN	WHITE
225	107	250-300	121-149	HIGH	BLUE	BLUE
300	149	325-375	163-191	EXTRA HIGH	PURPLE	RED
375	191	400-475	204-246	VERY EXTRA HIGH	BLACK	GREEN
475	246	500-575	260-302	ULTRA HIGH	BLACK	ORANGE
625	329	650	343	ULTRA HIGH	BLACK	ORANGE

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12

Automatic Sprinklers

Suppression Mode vs Control Mode

ESFR (Early Suppression Fast Response)

Standard Response – Control Mode

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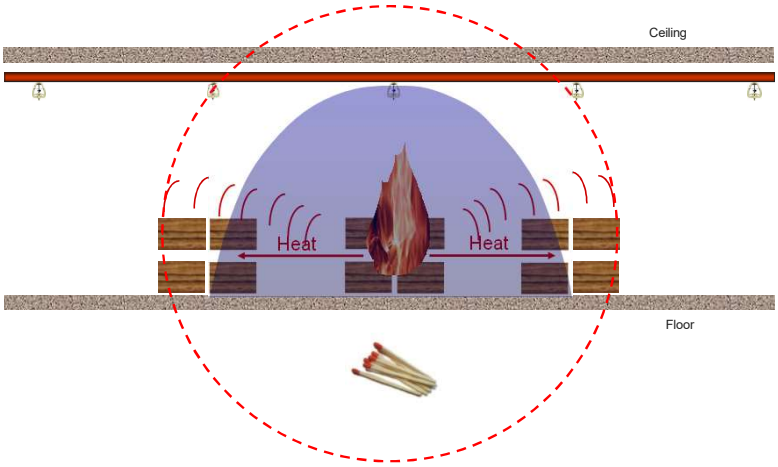
13

Sprinkler Activation

- How does a sprinkler work?



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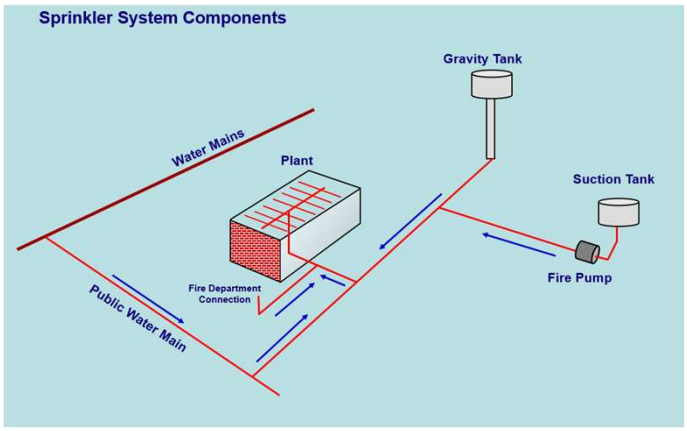
14

Sprinkler System Components



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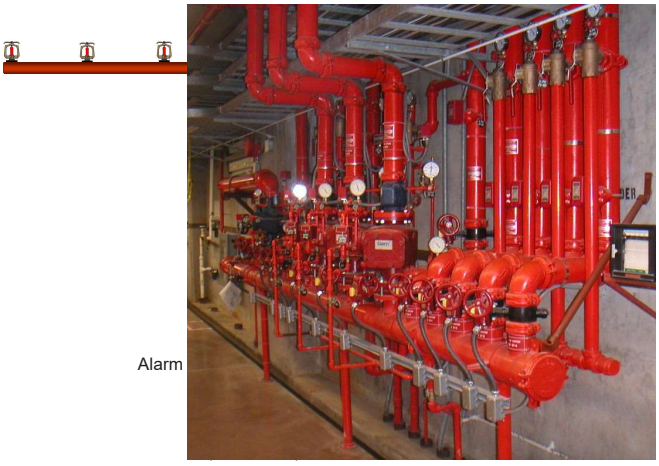
15

Automatic Sprinkler Systems



Alarm

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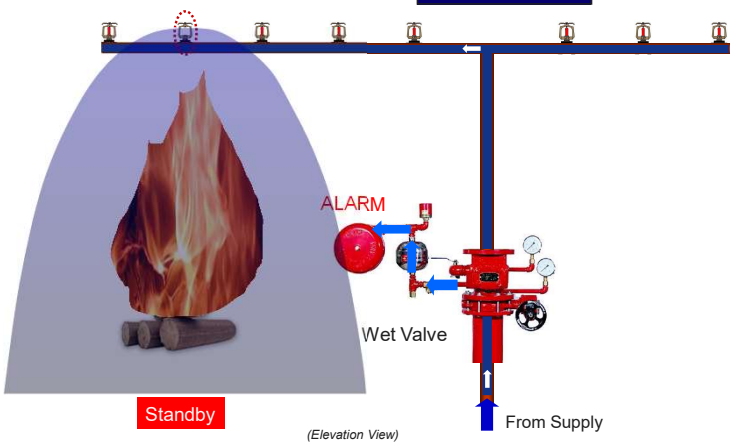
16

Automatic Sprinkler Systems

Wet System



(Elevation View)

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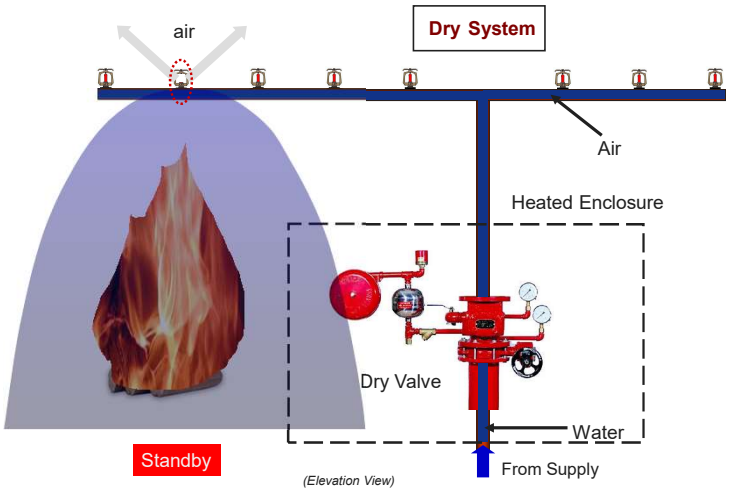
17

Dry System



(Elevation View)

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18

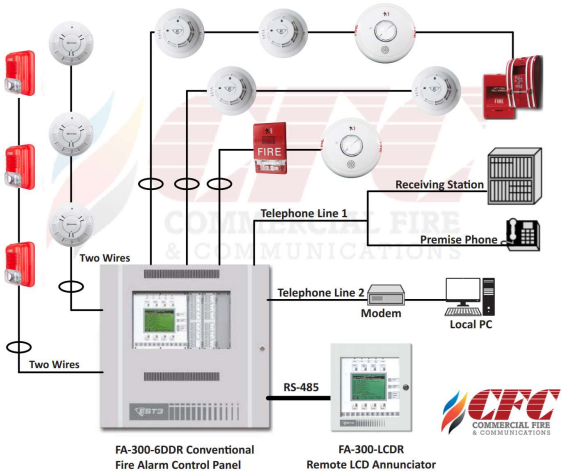
Special Extinguishing Systems

Gaseous Extinguishing Systems

Foam Extinguishing Systems

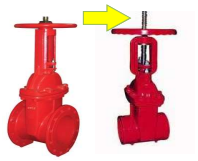
Dry Chemical Extinguishing Systems

Alarm and Notification Systems



FIRE PROTECTION VALVES

Outside Screw & Yoke (OS&Y)

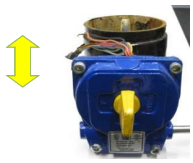


Stem Down = Closed

Stem Up = Open ✓

Inspector's Test Valve

Indicating Butterfly Valve (IBV)



Indicator in same direction as pipe = Open ✓

Non-indicating Valve (NIV)

Handle shows direction of Open ✓

Post Indicator Valve (PIV)

Window shows open= Open ✓

Window shows shut = Closed

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21

FIRE PROTECTION VALVES

Underground Valve (UV)

Also known as curb box valve

Use "T bar" to check if Open ✓

Wall Post Indicator Valve (WPIV)

Window shows Open= Open ✓

Post Indicator Valve Assembly (PIVA)

Unobstructed hole = Open ✓

Main drain valve

Auxiliary valve (Dry pipe sprinklers)

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22

General Fire Protection Inspection Frequency Reference

Inspection, Testing and Maintenance of Water-Based Fire Protection Equipment per NFPA 25 (2022) based on Frequency

Frequency	Activity	Category	Sub Category	Item
a. Weekly	Inspection	Fire Pumps		Fire Pump house & system
		Sprinkler system	Dry Pipe System	Dry pipe valve enclosure - during freezing weather (with low temp alarm)
		Standpipe and Hose Systems	Automatic dry standpipe standpipe systems	Gauges
		Valves	Backflow Prevention Assemblies	Reduced pressure assemblies/reduced-pressure detector assemblies
			Control Valves	Control Valve-roadway box valve
				Control Valves-sealed
			Preaction/Deluge Type	Preaction/Deluge Valves-Enclosure (temp supervised)
			Pressure reducing and Relief Valves	Fire Pump pressure-relief valves
				Fire Pump casing relief valve (follows churn test for electric/diesel)
				Master Pressure-Regulating Devices
		Water Mist Systems	Plant air	Plant air-air pressure (unsupervised)
		Water Spray Fixed Systems		Deluge Valve House-heat
		Water Storage Tank	Heating System	Water storage tank-heating system (unsupervised low water temp)
			Supervision	Water storage tank-low water temperature unsupervised
	Test	Fire Pumps		Fire Pumps –diesel engine no flow test
				Fire Pumps-no flow test (electric servicing high rise or limited service controllers, uses vertical turbine pumps, or ground level tank supply)

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23

General Fire Protection Inspection Frequency Reference

Inspection, Testing and Maintenance of Water-Based Fire Protection Equipment per NFPA 25 (2022) based on Frequency

Frequency	Activity	Category	Sub Category	Item
b. Monthly	Inspection	Fire Alarm/Detection		Batteries
		Sprinkler system	Dry Pipe System	Gauges (protection for freezers)
			Preaction Type	Gauges (protection for freezers)
			Preaction/Deluge Type	Preaction/Deluge Valve-Exterior
			Sprinkler system	Gauges - Verify gauge operable, undamaged
			Dry Pipe/Preaction/Deluge Systems	Gauges (air unsupervised)
		Standpipe and Hose Systems	Automatic dry standpipe systems	Gauges (if air supervised continuously)
		Valves	Control Valves	Control Valves-locked
			Dry Pipe Valves	Dry pipe valves-gauge on air side (if pressure unsupervised)
				Dry pipe valves-gauge on wet side
				Dry pipe valves -exterior inspection
			Preaction/Deluge Type	Preaction/Deluge Valves-exterior
		Water Storage Tank	Automatic Tank Fill Valves	Auto tank fill valve-exterior
			Supervision	Water storage tank water level (level alarm unsupervised)
		Portable Fire Extinguishers-Rechargeable	General	Fire extinguisher manual inspection
		Portable Fire Extinguishers-Non Rechargeable	General	Fire extinguisher manual inspection
	Maintenance	Foam-Water Sprinkler Systems		Foam concentrate pump operation
	Test	Fire Pumps		Fire Pumps-electric driven no flow test

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24

General Fire Protection Inspection Frequency Reference

Inspection, Testing and Maintenance of Water-Based Fire Protection Equipment per NFPA 25 (2022) based on Frequency

Category	Activity	Item	a. Weekly	b. Monthly	c. Quarterly	e. Annually
Fire Protection Valves	Inspection	Control Valve-roadway box valve	●			
		Control Valves-sealed	●			
		Valve supervisory alarm devices			●	
		Control Valves-locked		●		
		Control Valves-electrically supervised			●	
	Maintenance	Control Valves				●
	Test	Control Valves-position testing & operation				●

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General Fire Protection Inspection Frequency Reference

System Type	Annually	Quarterly	3 Year	5 Year	10 Year	20 Year	50 Year
Wet	Full visual inspection of all heads, piping and other components, simulate alarms, flow water, exercise all valves.	Simulate alarms, flow water, exercise all valves.	N/A	In addition to the annual inspection, perform internal investigation of pipe network and check valves, hydrostatically test FDC connections, replace or recalibrate gauges.	A sample of **dry pendent** and **dry sidewall** sprinkler heads must be sent to U.L. for testing.	A sample of **quick response** sprinkler heads must be sent to U.L. for testing.	A sample of **standard response** sprinkler heads must be sent to U.L. for testing.
Dry	Full visual inspection of all heads, piping and other components, simulate alarms, flow water, exercise all valves and partially trip dry valve.	Simulate alarms, flow water, exercise all valves.	Full visual inspection of all heads, piping and other components, simulate alarms, flow water, exercise all valves and fully trip dry valve.	In addition to the annual inspection, perform internal investigation of pipe network and check valves, hydrostatically test FDC connections, replace or recalibrate gauges. clean or replace strainers, filters and orifices.	N/A	A sample of **quick response** sprinkler heads must be sent to U.L. for testing.	A sample of **standard response** sprinkler heads must be sent to U.L. for testing.
Preaction	Full visual inspection of all heads, piping and other components, simulate alarms, flow water, exercise all valves and fully trip preaction valve.	Simulate alarms, flow water, exercise all valves.	N/A	In addition to the annual inspection, perform internal investigation of pipe network and check valves, hydrostatically test FDC connections, replace or recalibrate gauges, clean or replace strainers, filters and orifices.	N/A	A sample of **quick response** sprinkler heads must be sent to U.L. for testing.	A sample of **standard response** sprinkler heads must be sent to U.L. for testing.
Deluge	Full visual inspection of all heads, piping and other components, simulate alarms, flow water, exercise all valves and fully trip deluge valve.	Simulate alarms, flow water, exercise all valves.	N/A	In addition to the annual inspection, perform internal investigation of pipe network and check valves, hydrostatically test FDC connections, replace or recalibrate gauges clean or replace strainers, filters and orifices.	N/A		

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High Level Risk Assessment Support

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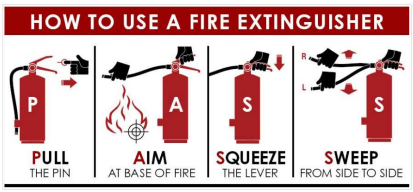
FIRE PREVENTION

- Fire Extinguishers
  - Extinguishers located throughout the building
  - Located in unobstructed areas – 3 feet clearance
  - Extinguishers hung on hangers attached to walls - 3 ½ to 5 feet above the floor.
  - Inspect Gauge
    - No cracked glass
    - Fully charged: arrow in 12:00 position
    - Discharged unit: arrow in 9:00 position
  - Check hose for cracks or cuts
  - Check that safety pin is not missing
  - Inspection tag is attached, monthly inspections are documented, and extinguisher has been inspected and certified by a fire protection equipment professional within the last year.



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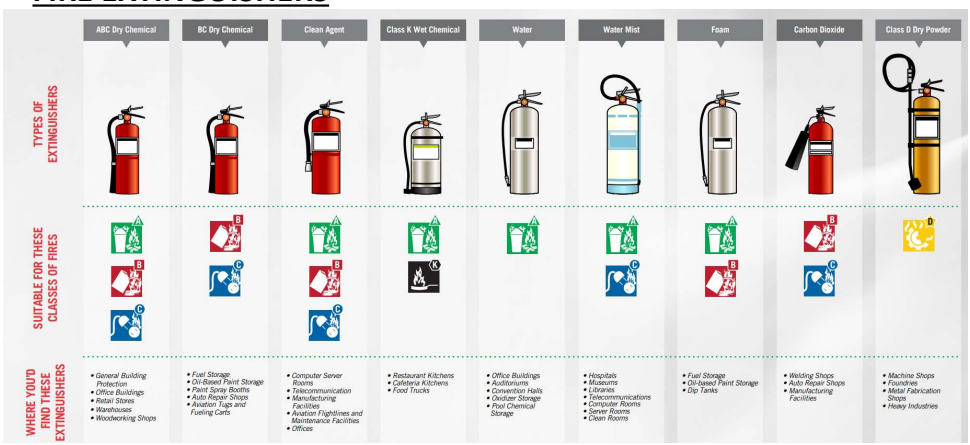
FIRE EXTINGUISHERS



Extinguisher Types	Hydrostatic Test Period
Dry chemical	12 years
Carbon dioxide	5 years
Stored water pressure	5 years
Halon	12 years

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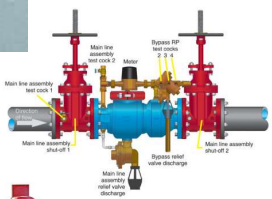
FIRE PREVENTION

- **Sprinkler System**

  Sprinkler risers
  - Annual inspections with inspection tags attached to main risers
  - Valves
    - Sprinkler valves accessible
    - Valves not damaged or leaking
    - Valves open and locked
  - Check for water leaks
  - Gauges
    - Replaced in the last 5 years
    - Not damaged
  - Riser must have no obstructions by 36 inches
  - Nothing hanging from any exposed sprinkler pipes

  Sprinkler heads
  - Sprinkler heads have >18 inch clearance from head to storage
  - No sprinkler heads damaged



- **Fire Pumps**
  - Not damaged (overall condition)- any leaks or damaged pipes or sprinkler heads
  - Fire Pump Electric or Diesel? _____
  - Pump inspected by a contractor in the last 12 months
  - Electrical Fire Pump
    - Fire pump flowed and tested weekly – 10 min
  - Diesel Fire Pump
    - Fire pump flowed and tested monthly – 30 min
    - Diesel tank ¾ full? If not needs to be filled

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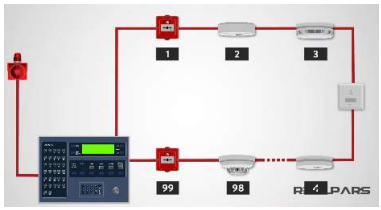
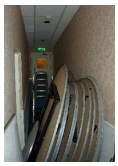
Property Risk Management

FIRE PREVENTION

- **Fire Detectors**
  - Verify system is in normal condition – no faults indicated on the main fire panel.
  - Monthly tests completed and documented
    - Control panels and equipment (power supply, fuses, LEDs, trouble signals)
    - Batteries (corrosion)
  - Tested annually by a vendor and report on file
- Detection units
  - No defective detectors – Smoke OR Heat detection
  - No detectors covered with tape / paint or covers
  - Properly secured
- Manual fire alarm box - free with no damage and not obstructed
- Check batteries of fire alarm box (Replace every 3 – **5** years)
- **Fire Exits**
  - Illuminated exit signs are operational throughout building
  - Signs are tested monthly on all exit doors
  - Exits not blocked interior and exterior
  - Fire Doors
    - Roll-up exit doors are inspected to ensure they are functioning, and fusible links are in place and not dated





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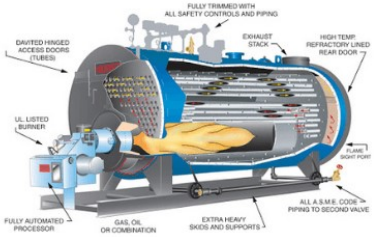
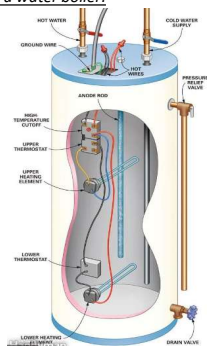
FIRE PREVENTION

- **Boiler Rooms**
  - Empty rooms, not to be used for storage
  - Boiler inspection tags are visible and annual inspections are current
  - Daily and monthly log sheets completed by maintenance staff
  - Visual inspection of the entire system for leaks or damage
  - Safety Shut-off valves in place
  - Gas trains in-order



A water-heating device that exceeds any one of the following should be classified as a water boiler:

- *120 gallons nominal water storage capacity;*
- *160 psi operating pressure;*
- *210 degrees Fahrenheit operating temperature; or*
- *200,000 Btu/hr. heat input.*



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Property Risk Management

FIRE PREVENTION

- **Electrical Inspection**
- Infrared / thermographic testing completed on electrical boxes and motors annually – New NFPA 2023 code

Electrical systems should be enclosed and kept clean

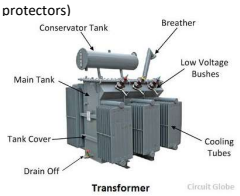
- Systems sealed and maintained to keep loose dirt, dust, and debris out
- Systems cleaned regularly using a vacuum (NOTE: This poses high risk for electrocution. Either contract with a professional or verify the system is de-energized by a trained electrician and all employees are trained in lock-out/tag-out.)
- Vents and fan grills cleaned regularly

Switchgears, Breakers, transformers and Motor Control Boxes

- Electrical rooms clear of any combustible materials
- Inspected regularly for signs of cracking or physical damage, arcing or overheating, and moisture
- Bolts and connectors show no signs of corrosion or overheating and are tightened to manufacturer's specifications
- Critical circuit breakers and switchgear easily accessible
- No damage for the oil filled transformer
- Transformer has been inspected in the last 24 months with oil testing

Electrical Safety in the building

- No exposed wires
- No loose conduits
- No electrical cords in pathways (cord protectors)
- No over loaded power cords
- No space heaters beneath desks



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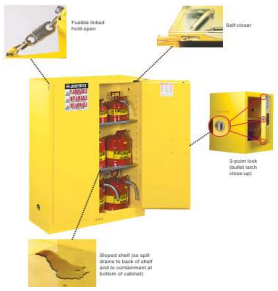
Property Risk Management

FIRE PREVENTION



- **Generators**
  - Run weekly or Monthly for 30 min
  - Log been updated on run time and maintenance
  - Annual inspections completed by vendor
  - Generator protected against the elements

- **Hot Work Permit**
  - Is there a current hot work permit at the building
  - Copies of completed permits kept with all details completed
  - Fire watch on the permit longer than 60 min
  - Hot work permit complies with NFPA 51B 2023

- **Flammable Liquid**
  - Flammable liquids stored in proper container
  - Any large quantities of flammable liquids stored on site if so additional info to be provided:

HOT WORK PERMIT

HOT WORK PERMIT

Post this permit at the site of any work involving open flames or the production of heat and sparks. Return all completed permits to the General Manager for retention.

PERMIT GOOD FOR ONE SHIFT ONLY!

HOT WORK PERFORMED BY:		
DATE:		
BUILDING:		
LOCATION:		
DESCRIPTION OF HOT WORK:		
NAME OF HOT WORK OPERATOR(S):		
I verify the above location has been examined, the precautions checked on the Required Precautions Checklist have been taken to prevent fire, and permission is authorized for work.		
NAME of local Contact or designee (Print): **Contact phone #:**		
Permit Request	**DATE**	**TIME**
PERMIT EXPIRES	**DATE**	**TIME**
I certify that I have personally checked the hot work area and that the necessary items of preparation are present and that I have found them satisfactory. **SIGNATURE of local Contact or designee:** **Date & Time:**		

REQUIRED PRECAUTIONS CHECKLIST¶

- ☐ Available sprinklers and extinguishers are in service.
- ☐ Hot work equipment in good repair.

REQUIREMENTS WITHIN 35 FT. OF WORK¶

- ☐ Flammable liquids and combustible materials removed or covered with fire retardant tarps or metal shields.
- ☐ Floors swept clean of combustibles.
- ☐ Explosive atmosphere in area eliminated.
- ☐ All walls and floor openings covered.

WORK ON WALLS OR CEILINGS/ENCLOSED EQUIPMENT

- ☐ Construction is noncombustible and without covering or insulation.
- ☐ Combustibles on other side of walls moved away.
- ☐ No danger exists by conduction of heat into another room or area.
- ☐ Enclosed equipment cleaned of all combustibles.
- ☐ Containers purged of flammable liquids and vapors.

FIRE WATCH/HOT WORK AREA MONITORING

- ☐ Fire watch will be provided during and continuously for 60 minutes after work, including any work break.
- ☐ Fire watch is supplied with suitable extinguisher(s).
- ☐ Fire watch is trained in use of this equipment and sounding alarms.
- ☐ Hot work area inspected 60 minutes after job is completed.

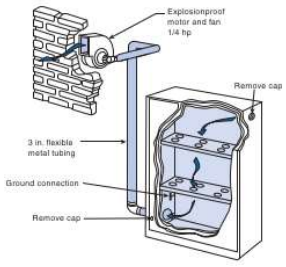
OTHER PRECAUTIONS TAKEN

- ☐ Ample ventilation to remove smoke/vapor from work area.
- ☐ Welding screens in place if required.
- ☐ Proper PPE being worn

Source: NFPA 51B, Fire Prevention During Welding, Cutting, and other Hot Work.

WHENEVER HANDLING FLAMMABLE LIQUIDS ALWAYS THINK OF THESE EIGHT BASIC TIPS:

1. Know your chemical —consult the safety data sheets (SDSs)
2. Remember it's not the liquid itself that burns, but rather, the invisible vapor
3. Maintain adequate ventilation, avoid confined areas where vapors can accumulate
4. Eliminate potential ignition sources
5. Think "covered" or "closed" for containers
6. Properly bond and ground containers when transferring
7. Keep liquids segregated by type and store according to governing / local codes
8. Use approved storage, transfer, use and disposal equipment, i.e., FM or UL listed



NFPA KITCHEN HOOD CLEANING REQUIREMENTS TO IMPROVE FIRE SAFETY

The National Fire Protection Association's NFPA 96, 2024 (NFPA Kitchen Hood Cleaning Requirements) requires trained and certified personnel to clean restaurant kitchen hoods and exhausts on a regular basis (NFPA 96-12.4).

Pin Header

Table 12.4 Schedule of Inspection for Grease Buildup

Type or Volume of Cooking	Inspection Frequency
Systems serving solid fuel cooking operations	Monthly
*Systems serving high-volume cooking operations	Quarterly
Systems serving moderate-volume cooking operations	Semiannually
†Systems serving low-volume cooking operations	Annually

*High-volume cooking operations include 24-hour cooking, charbroiling, and wok cooking.
†Low-volume cooking operations include churches, day camps, seasonal businesses, and senior centers.

KITCHEN HOODS

<<Facility Name>>

Kitchen Hood Fire-extinguishing System – Monthly Inspection Log for (Year): __

Indicate whether the following conditions passed inspection.
Y = Yes **N** = No (Explain in Comments) **N/A** = Not applicable

Date												
Inspector Exhaust fan operating properly												
Grease filters in place/clean												
Extinguishing system in armed/ready condition												
No obvious physical damage												
Nozzle blow off caps in place/undamaged												
Manual actuators unobstructed												
Tamper seals intact												
Pressure gauges in operable range												
Maintenance tag in place												
Portable fire extinguisher(s) unobstructed												

MARSH

FIRE PREVENTION

- ❑ **Building Exterior**
  - ❑ No combustibles stored alongside building walls
  - ❑ Trees not overhanging roof
  - ❑ No vegetation growing up exterior wall
  - ❑ No visual damage from outside
  - ❑ No loose material – debris
  - ❑ Hail guards installed over ground equipment

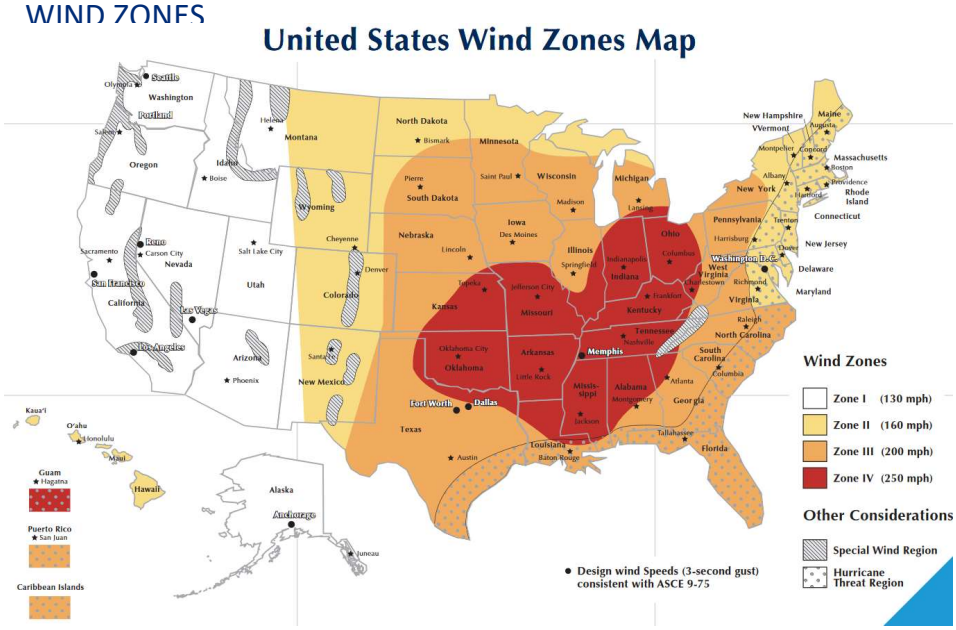
Smoking

- ❑ No smoking within 25-feet of building (Check local / state code)
- ❑ Designated smoking area with a non-combustible receptacle

(WOWT)

NATURAL HAZARDS

WIND ZONES

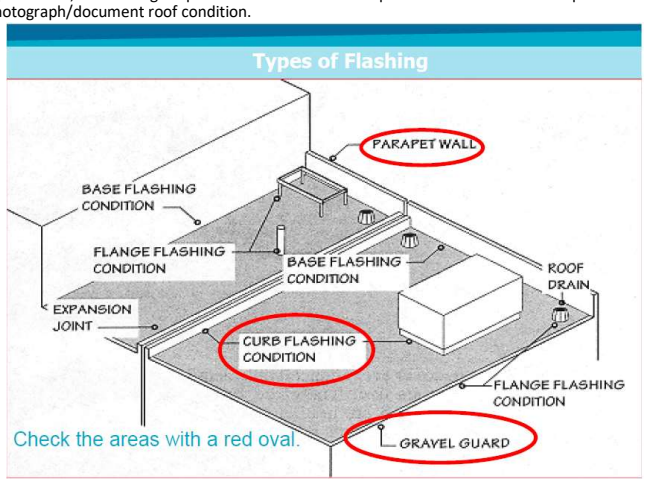


WIND ZONES

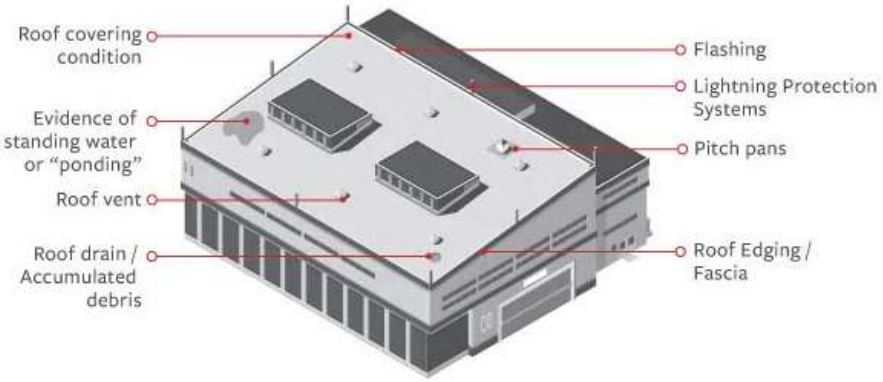
MARSH Property Risk Management

ROOF INSPECTION

Due to varying degrees of roof pitches, conducting inspections on roofs can be dangerous. Recommend being trained on and using fall prevention and protection, contracting for preventive maintenance inspections of roofs with an experienced professional, or the use of a drone to photograph/document roof condition.



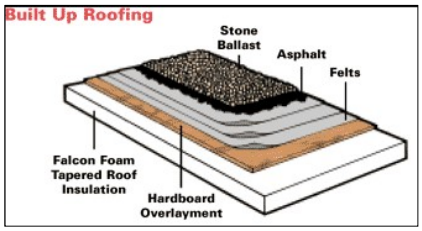
INSPECTION AREAS

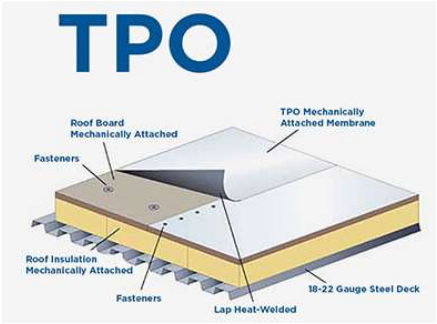


ROOF INSPECTIONS

Roof Covering

- Metal Roof:
- ✓ *Metal Sheathing with Exposed Fasteners*
- ✓ *Metal Sheathing with Concealed Fasteners*
- Built-Up Roof – *(built-up roof cover composed of several layers of roofing felt bonded to the roof substrate with asphalt. Built-up roofing is often topped with gravel to prevent degradation from sunlight.)*
- Single Ply Membrane Roof (TPO) - Single-ply membranes are flexible sheets of compounded synthetic materials that are manufactured in a factory. These are commonly known as rubber sheet roofing products, but are more accurately referred to as: EPDM, PVC, or Modified bitumen sheets. For steel and concrete buildings, this is the most common type of roof covering.
- (Built-Up Roof or Single Ply Membrane Roof with or without the Presence of Gutters)
- Concrete and Clay Tiles
- Wood Shakes
- Normal Shingle
- Shingle Rated for High Wind Speeds (110 mph)





WHY DO ROOF INSPECTIONS

Common Roof Problems

Roof inspections not only detect common roofing problems but also can help building owners prioritize improvement projects. A few of the most common roof problems are:

- Missing shingles
- Roof membrane lifted of bulged
- Plants or moss growth
- Leak or crack in the roof
- Shingles curling or buckling
- Shingle granules in gutters
- Roof sagging or drooping
- Roof top equipment damages
- Roof top equipment securement not installed or loose
- Loose flashing
- Scrubbers blocked
- Housekeeping

ROOF INSPECTIONS

Common signs of roofing damage at your building,

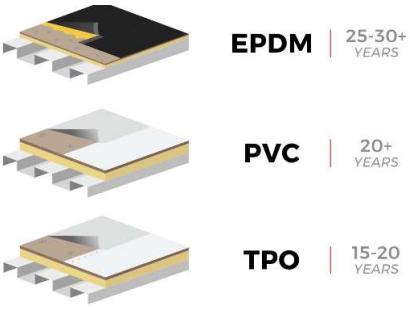
- ❖ **Rips in EPDM Membrane**
- ✓ EPDM rubber roofs are one of the most common types of commercial roofs. If the protective rubber roof membrane of your EPDM roof is visibly ripping, that means it is no longer watertight and won't be offering the same protection.
- ❖ **TPO Roof Coating Cracks**
- ✓ White TPO roofs offer energy efficiency as well as lightweight roof protection. As your TPO roof ages, the TPO coating can crack. If you see cracks in your white roof, get assistance to protect your roof before serious damage can occur. This is one of the most common causes of failure on TPO roofs and tends to happen at around the 15-year mark.

- ❖ **Ponding Water**
- ❖ **Flashing Separated from Roof**
- ❖ **Membrane Waving in the Wind**
- ❖ **Loose Fasteners**
- ❖ **Water Spots on the Ceiling**
- ❖ **Roof Leaks**

WHY DO ROOF INSPECTIONS

Why Roof Inspections Are Important

- ➢ Warranty Repairs
- ➢ Property damage - interior
- ➢ Weathering and Aging
- ➢ Needed Improvements
- ➢ Routine Maintenance Damage
- ➢ Storm Damage
- ➢ Leak Assessment
- ➢ Stopping the Damage Before It Starts
- ➢ Proper Drainage
- ➢ Vegetation Damage
- ➢ Roof Cleaning
- ➢ Security



A comprehensive roof maintenance program should include, at minimum, the following basic steps:

- ❑ Keep roofs clean and free of debris.
- ❑ Keep drainage systems clear and functional.
- ❑ Eliminate / make repairs to areas with standing water or "ponding."
- ❑ Train maintenance personnel on roof construction and related ongoing maintenance needs.
- ❑ Restrict roof access to authorized personnel only.
- ❑ Limit penetrations of the roof system.
- ❑ Monitor sloped roofs with overhangs for the creation of ice dams and add insulation to the attic as necessary.

MARSH

ROOF INSPECTION

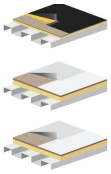
- ❑ Year of roof; build or reroofed: _____
- ❑ Type of Roof:_____
- ❑ Roof Surfacing:_____
- ❑ Parapets around roof and how high:_____FT
- ❑ Name of person who is responsible for the roof maintenance?

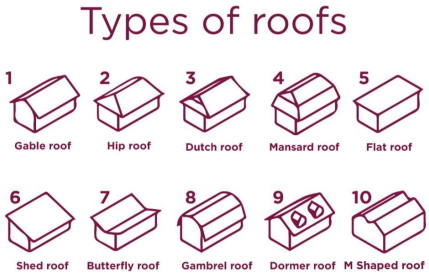
_____

- ❑ Roof have hail impact rating:_____

Visual interior inspections of roof decking

- ❑ Check ceilings for any sign of water leaks or damage
- ❑ Discoloration of interior walls
- ❑ No loose roof panels
- ❑ No daylight seen from below



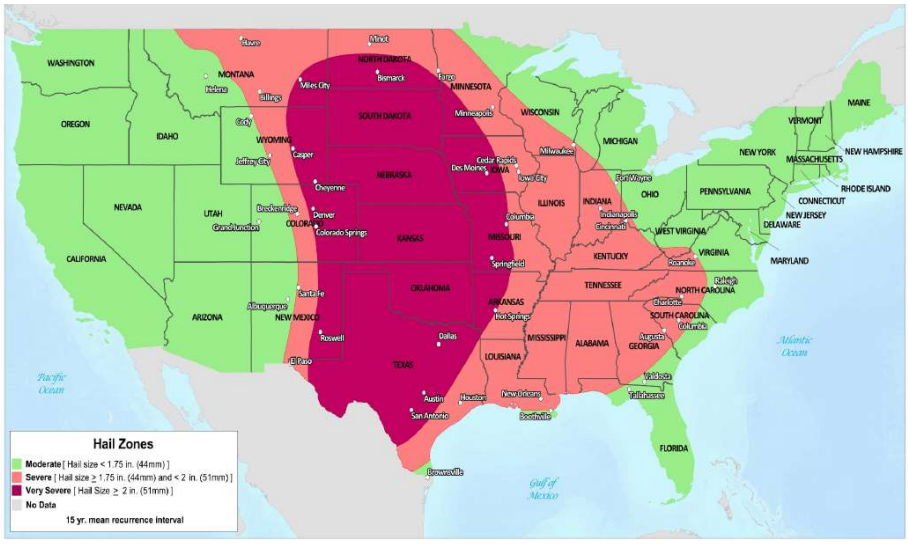


MARSH

ROOF INSPECTION

- ❑ Roof inspected at least monthly
- ❑ Access to rooftop safe and secured
- ❑ Rooftop equipment securely fastened
- ❑ Missing screws on equipment housing or strapping
- ❑ Satellite dishes secured by concrete blocks
- ❑ No loose flashing, shingles or parts gutter systems around edges of rooftop
- ❑ Gutters clear of all obstructions and no loose or disconnected parts
- ❑ Debris removed from roof surface after storm
- ❑ No storage of materials on the roof surface
- ❑ No sign of hail damage
- ❑ Hail guards installed to protect roof-mounted HVAC equipment
- ❑ Any skylights on roof; Rated for hail impact:_____
- ❑ No standing water on the roof surface (Note: Water should be gone within 48 hours of most recent water event)
- ❑ Snow not permitted to accumulate
- ❑ Discoloration of the roof surface
- ❑ No sign of cracks or areas for water penetration
- ❑ No cracks or gaps in caulked areas
- ❑ Photos of roof taken

HAIL DAMAGE



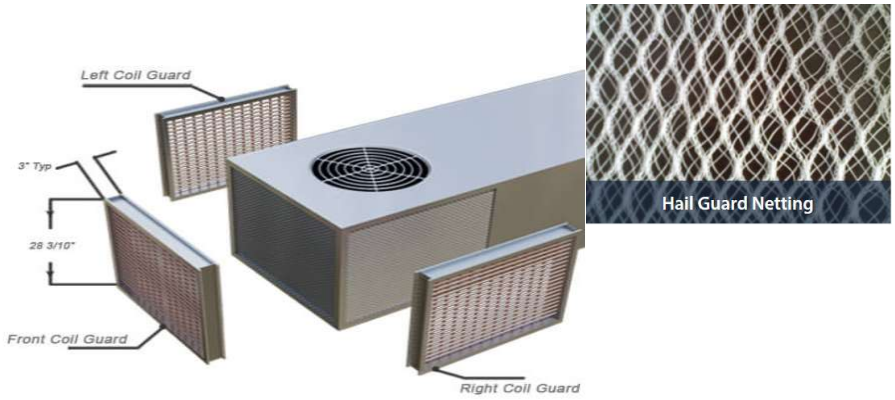
FM Global - Hailstorm hazard map for the contiguous United States (ρ= 0.7g/cm$_3$)

HAIL DAMAGE

Hail impacts most horizontal surfaces damaging those that are not properly designed for hail impact. Most of the damage is to roofs, followed by damage to cooling fins and condenser coils of rooftop heating, ventilating, and air conditioning equipment, and skylights. There is much less damage to windows and walls.

HAIL DAMAGE

Hail guards are available in several different materials, but maximum openings should be 0.5 by 1.0 in. They can also be constructed from minimum No. 11 gauge (0.1205 in.) diameter steel wire mesh with a maximum mesh opening size of 0.5 by 1.0 in. supported on a steel framework. Increase the wire size by one gauge if the shortest span (distance between supporting frame members) exceeds 6 ft.



HAIL DAMAGE

Skylights

Properly rated and maintained skylights are needed to reduce interior water damage from hail storms because hail-punctured skylights are one of the main causes of water damage to buildings and contents. There have been many instances in which hail has punctured all the skylights in a building, and caused water damage (rain accompanies most hail storms).

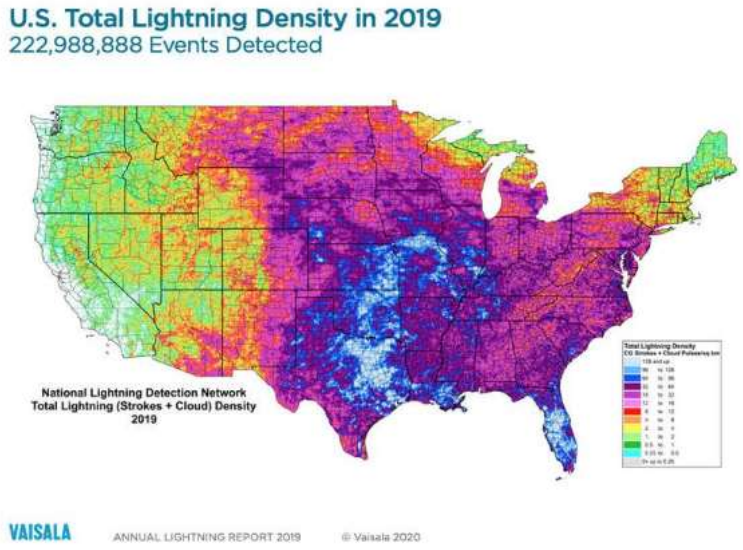
HVAC Equipment

Cooling fins and condenser coils on heating, ventilating, and air conditioning (HVAC) equipment are extremely susceptible to damage from small hail. The majority of this hail damage can be prevented by installing hail guards over the condenser cooling fins. These are usually available as an option from the HVAC equipment manufacturer, but can also be obtained from other suppliers.

Outdoor Equipment

Fragile outdoor equipment, such as those with exposed glass or plastic components, can be cracked or penetrated by hail, requiring replacement and possibly affecting operations. Smaller hail can dent exterior insulation on pipes and vessels, although this usually does not affect operations.

LIGHTNING STRIKE

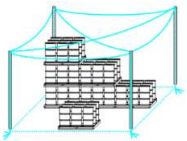


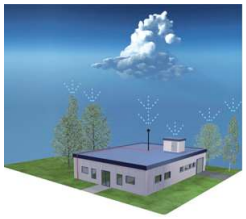
LIGHTNING PROTECTION

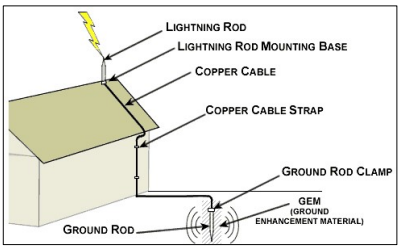
Lightning is an electrical discharge occurring in nature. Electric charges build naturally within a cloud, between clouds, and between clouds and the earth. Storm conditions increase these potential differences. The voltage between a cloud and the earth can exceed 30 MV.

Protect buildings and structures from direct lightning strikes by installing lightning protection systems:

- Rods,
- Surge Protectors
- Meshed conductors,
- Catenary wires,
- Early streamer emission lightning protection system,
- Protection by natural components,







LIGHTNING PROTECTION

▶ Rods:
Tapered metal rod that dominates the structure to be protected and which is connected to minimum two down conductors and two earthing system.

▶ Surge Protectors
Surge protector or surge suppressor is an appliance or device designed to protect electrical devices from voltage spikes. A surge protector attempts to limit the voltage supplied to an electric device by either blocking or shorting to ground any unwanted voltages above a safe threshold.

▶ Meshed conductors:
This lightning protection, derived from the Faraday cage, consists of meshed conductors that cover the roof and walls of the structure to be protected.

▶ Catenary wires:
This lightning protection system, using a similar principle to that of the mesh cage, consists of a mesh of conductors, but at a distance from the structure to be protected. The aim is to avoid the lightning current coming directly into contact with the structure.

▶ Early streamer emission lightning protection system:
The principle of an early streamer emission lightning conductor is to artificially generate, with the aid of an ionization device, an early upward leader occurring before the other «natural» upward leaders, in order to establish a privileged impact point of the lightning strike.

▶ Protection by natural components:
Components that have a lightning protection function but that were not installed for this purpose.
- ❑ The frame of metal constructions;
- ❑ Metal parts such as gutters, decoration, guardrails, etc, provided that their cross-section is not less than that specified for normal components

MARSH

LIGHTNING PROTECTION

Lightning protection systems should be inspected annually, as well as after major storms, when work is performed on the protected structure (e.g., roof renovations, electrical or HVAC system updates), and when equipment is installed or serviced (e.g., satellite dishes, security cameras, telephone lines, television cables). Inspections may be contracted with a lightning protection company, preferably UYL certified.

- ❑ Are buildings equipped with lightning protection systems (lightning rods, conductors, bonding, shielding, and grounding)
- ❑ Lightning protection inspected in the last 18 months
- ❑ Are surge protection devices used at all electrical outlets?
  - ❑ All components are in good condition
  - ❑ No part of the system has been weakened by corrosion or vibration
  - ❑ All down conductors and grounding electrodes are intact (not severed)
  - ❑ All conductors and components are fastened securely to their mounting surfaces and are protected against accidental mechanical displacement
  - ❑ There have been no additions or alterations to the protected structure that would reconfiguration or expansion of the lightning protection system
  - ❑ There have been no equipment installations that require bonding
  - ❑ There is no visual indication of damage to surge suppression devices

Air terminal penetrating roof cover

CAT - WILDFIRE

A primary focus of such efforts should be best practice defensible space creation activities such as the following:

• Conducting a structure assessment per NFPA 1144, which at a minimum includes:

1. Identification and documentation of wildland fire hazards in the ignition zone(s) for each structure within wildland fire hazard areas.

2. Determination of mitigation measures for vegetation, other combustibles, and the structure, including the periodic maintenance associated with such measures.

3. Establishment of priorities relative to mitigating wildland fire risks.

4. Evaluation of the site for conflagration hazards associated with the property to provide information for fire operations strategies.

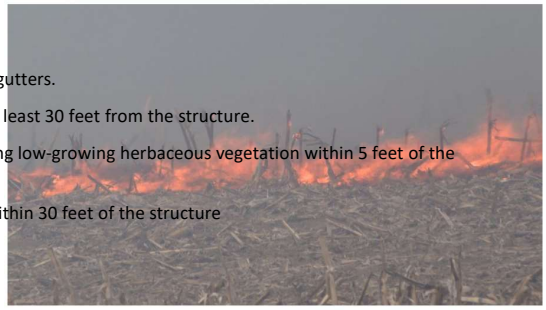
• Using fire resistant roofing material.

• Clearing dead leaves and twigs from roof and gutters.

• Keeping wood piles and other combustibles at least 30 feet from the structure.

• Providing noncombustible surfaces and planting low-growing herbaceous vegetation within 5 feet of the structure.

• Removing tall grass and dead plant material within 30 feet of the structure



Brush fire. (Bo Peterson, FOX 42)

CAT - WILDFIRE

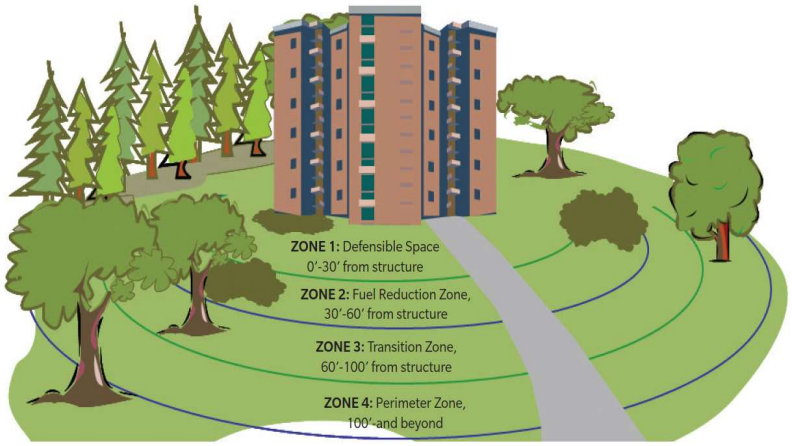


Illustration of Defensible Space (from Wildfire Risk Reduction in Florida, Florida Department of Agriculture and Consumer Services)

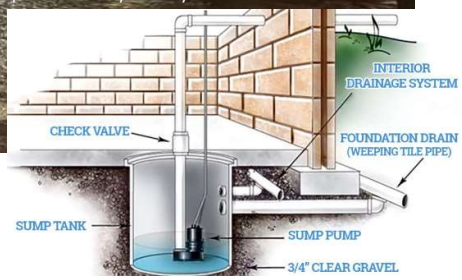
MARSH

WATER DAMAGE

- ❑ Doors and windows should be properly sealed and have no cracks or holes
- ❑ Any cracks that form in walls and floors should be sealed as soon as possible
- ❑ Exterior drains should be kept clear and free of debris
- ❑ Sump pumps should have a backup power supply

Plumbing

- ❑ Pipes should have enough insulation to keep them from freezing in colder temperatures
- ❑ Buildings should be kept at a minimum of **40°** during winter months
- ❑ During especially cold spells, all faucets should be kept at a slow drip to prevent water from freezing
- ❑ Water heater inspected and flushed by licensed plumber every 1 to 2 years
- ❑ Pipes show no signs of corrosion, rust or leaks



SNOW LOADS

1. Ensure you have and follow an occupational fall prevention plan
2. Clearly identify safety protocols.
3. Train your emergency response team and contractors.
4. Ensure generators are working and their fuel tanks are full.
5. Affix electrical heat tracing along the roof edge
6. Check roof drains and downspouts.
7. Mark roof drains.
8. Check condition of rooftop
9. Check changes in roof elevation.
10. Clearly mark fire hydrants and fire protection system control valves

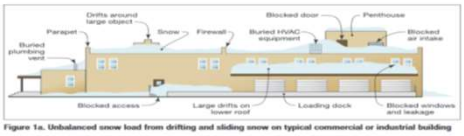


Figure 1a. Unbalanced snow load from drifting and sliding snow on typical commercial or industrial building

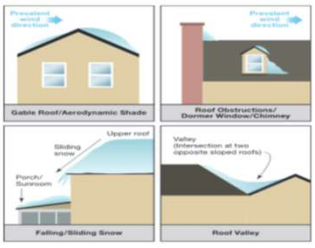
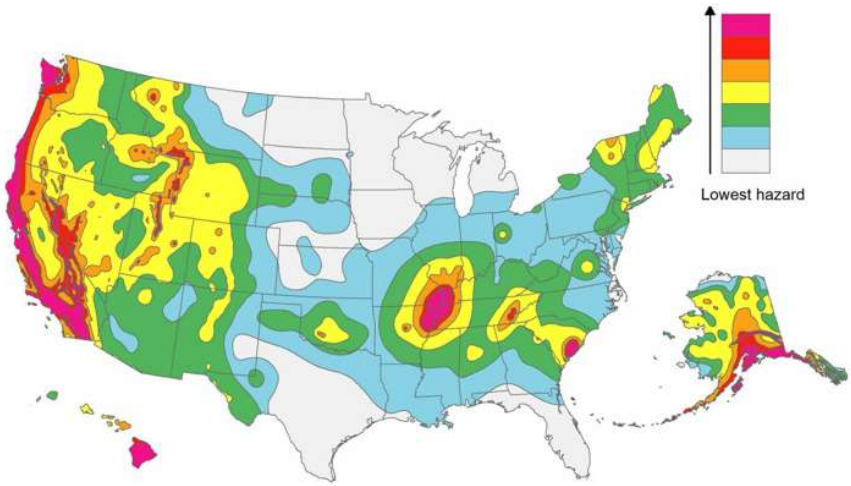


Figure 1b. Unbalanced snow load from drifting and sliding snow on residential structure

EARTHQUAKE MAP



HAZARDS ASSOCIATED WITH DONATED AND UNOCCUPIED BUILDINGS

UNDERSTANDING THE RISK

Increased Fire Risk

Idle and vacant buildings are frequent targets for fires and vandalism. If left unsupervised, vacant buildings are often used for playgrounds or sleeping quarters, and in such cases, the risk of fire is particularly high.

If the exterior of a building and the adjacent grounds are allowed to deteriorate, the probability of arson and vandalism increases. A run-down appearance may cause a perpetrator to rationalize that no one will lose anything or care if the property is destroyed.

Although fires started in unoccupied premises are commonly arson related, they can also result from electrical faults in fixed wiring. If the building exterior or surrounding property is not maintained and becomes rundown, the chances of arson increase significantly. Inadequate maintenance and a lack of routine site inspections may also lead to water damage.

MANAGING THE RISK

Human Element Programs

- Emergency Response
- Facility Maintenance
- Proper Housekeeping
- Business Continuity and Disaster Recovery Plans

Physical Protection Measures

- Active Protection Measures like: Automatic Sprinkler Systems
- Passive Protection Measures like: Security, Alarm Systems and Electronic Supervision

Natural Perils Resilience

- All drainage systems are fully functional
- Maintain proper snow removal practices in winter
- Roof inspections

MARSH

Property Risk Management

VACANT BUILDINGS

- Check building Security
  - Locks and windows are in working order and are not compromised
    - Exterior shows no sign of breaches
  - Visual inspections for signs of vandalism/forced entry
  - "No Trespassing" posted and visible
- Roof hatches are properly secured
- Burglar alarm system in working order
- Automatic sprinkler system is functional and inspections are up to date
  - Sprinkler valves open and locked
  - Has local AHJ been notified if system is not in operation
- Fire alarms are functioning and inspections are up to date
- Standpipe system is operational
- Fire Department Connection is free of obstructions
- Hydrants been opened in the last 18 months and accessible
- Exterior lights in working order, system on a dawn timer or photocell
- Roof inspection for sitting water, debris, loose/missing shingles, etc.
  - Winter: any heavy snow accumulation and ice on the roof or overhangs
- Plumbing inspected for signs of water leaks or corrosion
- Inspect for signs of pests/vermin

RESOURCES

NFPA LINK™

Training on how to use LiNK™

- NFPA LiNK™ - Dashboard: https://bcove.video/308JUtX
- NFPA LiNK™ - Bookview: https://bcove.video/3tDTpie
- NFPA LiNK™ - Reference Panel: https://bcove.video/3wSk9eV
- NFPA LiNK™ - MyLiNK: https://bcove.video/3kJzp8c
- NFPA LiNK™ - DiRECT™: https://bcove.video/3j2HT9U
- NFPA LiNK™ - Offline Mode: https://bcove.video/395Qg12
- NFPA LiNK™ - Team Management: https://bcove.video/330GgnB

RESOURCES

FM Global

- FM Global Data Sheets – All free and downloadable
  - → https://www.fmglobal.com/research-and-resources/fm-global-data-sheets
- FM Global Approval Guide
  - → https://www.fmapprovals.com/approval-guide
- FM Global RoofNav
  - https://www.roofnav.com/Account/Login
- FM Global Property Protection
  - https://www.fmglobal.com/research-and-resources/tools-and-resources/property-protectio

Any questions or queries contact

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