

Fire Detection and Alarm Systems



Fire Detection and Alarm Systems

Fire Protection



About NFPA - <https://www.nfpa.org/About-NFPA>

The National Fire Protection Association (NFPA)

Originated in 1896

Sets Guidelines for Fire Protection

OSHA also sets Standards

Fire Marshal Oversees Inspection

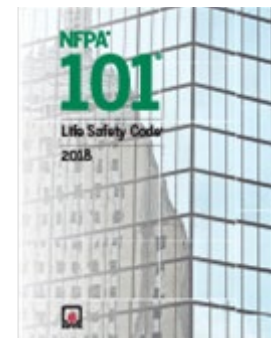
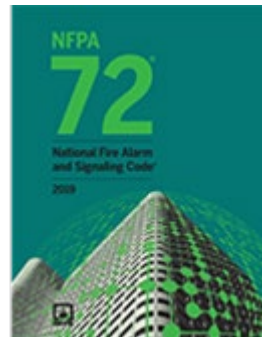
Our vision: We are the leading global advocate for the elimination of death, injury, property, and economic loss due to fire, electrical and related hazards.

Our mission: To help save lives and reduce loss with information, knowledge, and passion.

Fire Detection and Alarm Systems

NFPA Codes and Standards

<https://www.nfpa.org/Codes-and-Standards>



Fire Detection and Alarm Systems

Referenced Standards in Action

NFPA 10. Portable fire extinguishers are required in many occupancies by both NFPA 1 and the *IFC*. For instance, when verifying field compliance with NFPA 10, you need to ensure that the proper portable fire extinguisher has been selected and installed for the hazard it is intended to protect and is readily accessible with a sign posted to note its location.

NFPA 25. Referenced documents found in NFPA 1, NFPA 101, and the *IFC* place the responsibility for ITM of water-based fire protection systems on the building owner. NFPA 25 establishes combinations of frequencies, actions, and reporting methods for the different systems a building may have. The building owner is obliged to produce the ITM reports upon request from the AHJ.

NFPA 70® (NEC®). The *National Electrical Code*® is referenced by all of the building and fire codes in the United States. While the *NEC* contains many design and layout requirements for the electrical systems, it also contains requirements that relate to the quality of the installation. You must make sure that the installation itself is done in a neat and workmanlike manner that meets the level of quality required by the *NEC*.

NFPA 285. If you intend to apply an exterior wall system comprised of a metal composite material (MCM), you need to know the extent that compliance with NFPA 285 is required by Chapter 14 of the *IBC*.

Commonly Referenced Codes and Standards

NFPA 13, *Installation of Sprinkler Systems*

NFPA 13R, *Installation of Sprinkler Systems in Low-Rise Residential Occupancies*

NFPA 30, *Flammable and Combustible Liquids Code*

NFPA 72®, *National Fire Alarm and Signaling Code*®

NFPA 80, *Fire Doors and Other Opening Protectives*

NFPA 90A, *Installation of Air-Conditioning and Ventilating Systems*

NFPA 92, *Smoke Control Systems*

NFPA 96, *Ventilation Control and Fire Protection of Commercial Cooking Operations*

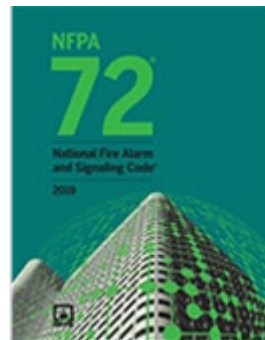
NFPA 241, *Safeguarding Construction, Alteration, and Demolition Operations*

NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*

Fire Detection and Alarm Systems






NFPA 72 – National Fire Alarm and Signaling Code

NFPA 72 provides the latest safety provisions to meet society's changing fire detection, signaling, and emergency communications demands. In addition to the core focus on fire alarm systems, the Code includes requirements for mass notification systems used for weather emergencies; terrorist events; biological, chemical, and nuclear emergencies; and other threats.



Fire Detection and Alarm Systems

Classification of Fires

FIRE	FUEL	NOTES
Class A 	<ul style="list-style-type: none">• Ordinary combustibles, such as:<ul style="list-style-type: none">◦ Paper◦ Cloth◦ Wood◦ Rubber	These fuels leave ash after they burn up.
Class B 	<ul style="list-style-type: none">• Flammable liquids, such as oil and gasoline• Combustible liquids, such as charcoal lighter fluid and kerosene	These fuels burn only at the surface because oxygen can't penetrate the depth of the fluid. Only the vapor burns when ignited.
Class C 	<ul style="list-style-type: none">• Electrical equipment, such as wiring and motors	When the electricity is turned off and is no longer feeding the fire, the fire becomes a Class A or B fire, depending on the type of fuel.
Class D 	<ul style="list-style-type: none">• Combustible metals, such as:<ul style="list-style-type: none">◦ Aluminum◦ Magnesium◦ Titanium◦ Potassium◦ Zirconium	Class D fires are not normally found in residential areas.
Class K 	<ul style="list-style-type: none">• Cooking oils (vegetable or animal)• Fats used in cooking appliances	Class K fires are technically flammable liquid/gas fires (Class B), but because of their special characteristics, they are placed in a separate class. Class K can occur in commercial food preparation locations, such as restaurant kitchens, where large quantities of cooking oils are used.

Fire Detection and Alarm Systems

Building Types

A – Assembly: Auditoriums, Theaters

B – Business: Office, Retail, Restaurants

E – Educational: Schools

F – Factories

H – Hazardous Uses

I – Institutional: Hospitals, Nursing Homes

R – Residential: Apartments, Hotels

<https://www.youtube.com/watch?v=zJgQ2kfwhoA>

Fire Detection and Alarm Systems

Life Safety Design

- Detect Danger
- Warn the building occupants
- Provide safe egress
- Control the fire
- Eliminate the fire
- Assist firefighters



Fire Detection and Alarm Systems

What does it take for a fire to burn?

Three elements:

1. **Fuel**, or material to be burned, which may be a liquid, a solid, or a gas
2. **Heat** that raises the temperature of the fuel to its ignition point
3. **Oxygen**: In an atmosphere of less than 20% oxygen, most fuels can be heated until they entirely vaporize, without burning.



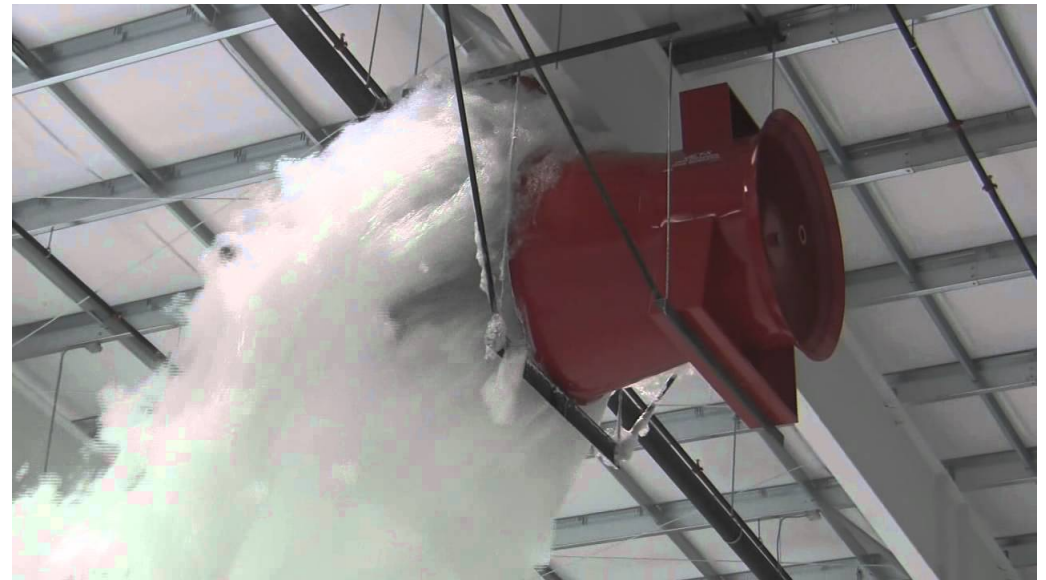
Fire Detection and Alarm Systems

Firefighting Resources

One important reason for identifying the fire classification is to select the most effective means of suppressing the fire.

























Four types of firefighting resources are available:

1. Portable fire extinguishers
2. Interior wet standpipes
3. Confinement
4. Creative resources



Using The Correct Fire Extinguisher

1. Portable

				
<h3>Water</h3>	<h3>Dry Powder</h3>	<h3>Foam</h3>	<h3>CO2</h3>	<h3>Wet Chemical</h3>
<p>For use on</p> <p> CLASS A Wood, Paper, Textiles etc</p> <p> Do not use on</p> <p> CLASS B Flammable liquid</p> <p> Live electrical equipment</p>	<p>For use on</p> <p> CLASS A Wood, Paper, Textiles etc</p> <p> CLASS B Flammable liquids</p> <p> CLASS C Gaseous fires</p> <p> Live electrical equipment</p>	<p>For use on</p> <p> CLASS A Wood, Paper, Textiles etc</p> <p> CLASS B Flammable liquids</p> <p> Do not use on</p> <p> Live electrical equipment</p>	<p>For use on</p> <p> CLASS B Flammable liquids</p> <p> Live electrical equipment</p> <p> Do not use on</p> <p> CLASS A Wood, paper and textiles</p> <p> CLASS D Flammable metal fires</p> <p>Do not use in a confined space</p>	<p>For use on</p> <p> CLASS F Cooking oil fires</p> <p> CLASS A Wood, Paper, Textiles etc.</p> <p>Discharge entire contents on to fire from at least 1 metre distance</p>

Fire Detection and Alarm Systems

2. Interior Wet Standpipes

- Typically found in commercial and apartment buildings.
- Usually consist of 100 feet of 1-inch jacketed hose with a nozzle tip
- Deliver up to 125 gallons of water per minute
- Should be used by three-person teams (one person to handle the hose, one to bleed air from the line, and one to control water pressure)

Interior Dry Standpipe



Fire Detection and Alarm Systems

3. Confinement

Confining an interior fire by closing doors to rooms and hallways may help restrict the spread of smoke and heat, and it limits the amount of oxygen available to the fire.

4. Creative Resources

In certain circumstances you can make use of resources on hand to fight fires.

Such as:

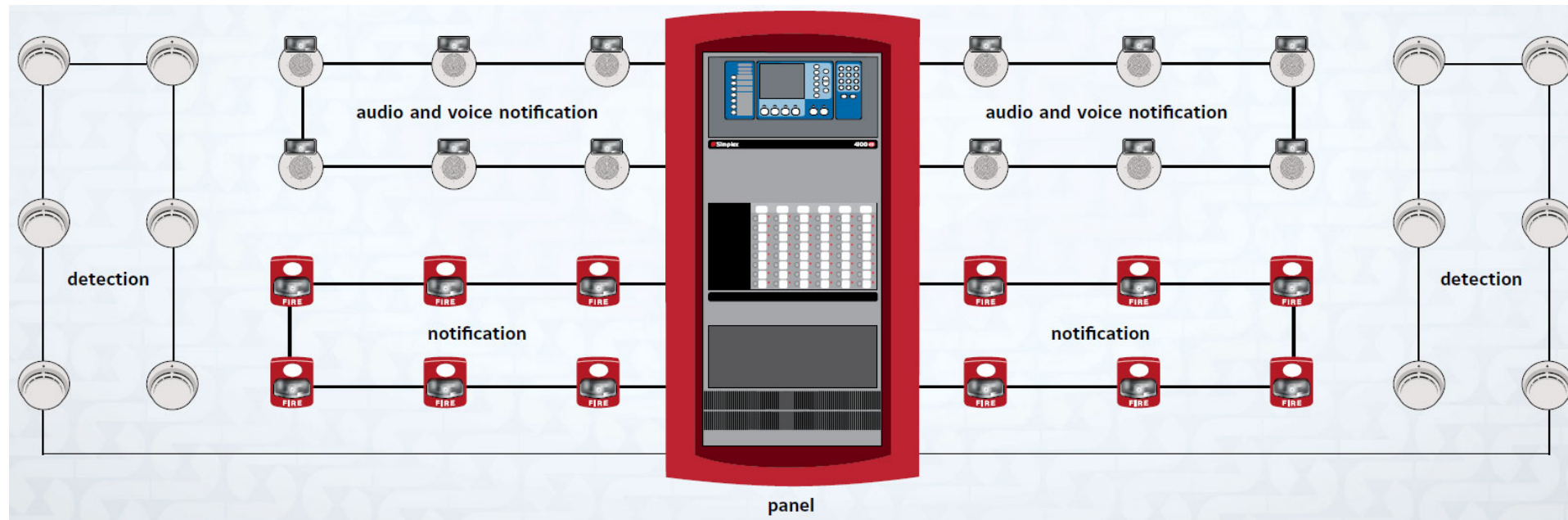
- Swimming pool or spa water and buckets
- Sand or dirt and shovels
- A garden hose



Fire Detection and Alarm Systems

Fire Alarm System Components

Fire Alarm Control Panel (FACP) – The main fire alarm system component that monitors equipment and circuits, receives input signals from initiating devices, activates notification appliances, and transmits signals off-site. Also called the Fire Alarm Control Unit (FACU).



Controls for the system are in the FACP.

Fire Detection and Alarm Systems

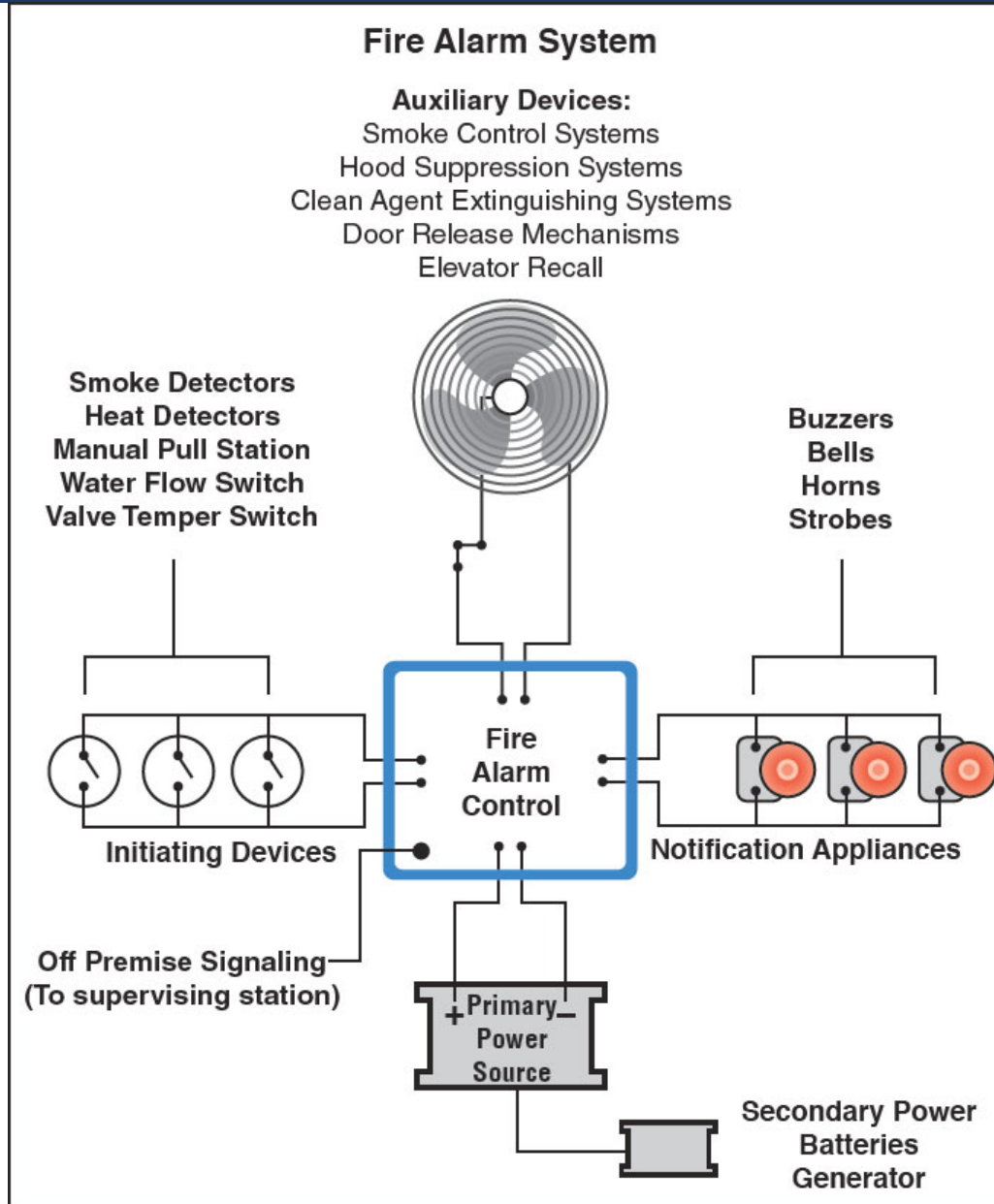
The FACP can also perform other functions, such as:

- Providing two-way firefighter communication
- Providing remote annunciator integration
- Controlling elevators, HVAC, fire doors, dampers, locks, or other fire protection features

The FACP can also provide public address messages and mass notification alerts through prerecorded evacuation messages or independent voice communications.

NOTE: Some fire alarm control units are designed for both security and fire protection. In these types of systems, fire protection is engineered into the system to assume the highest priority.

Fire Detection and Alarm Systems



Fire Detection and Alarm Systems

Types of Fire Alarm Systems

Conventional

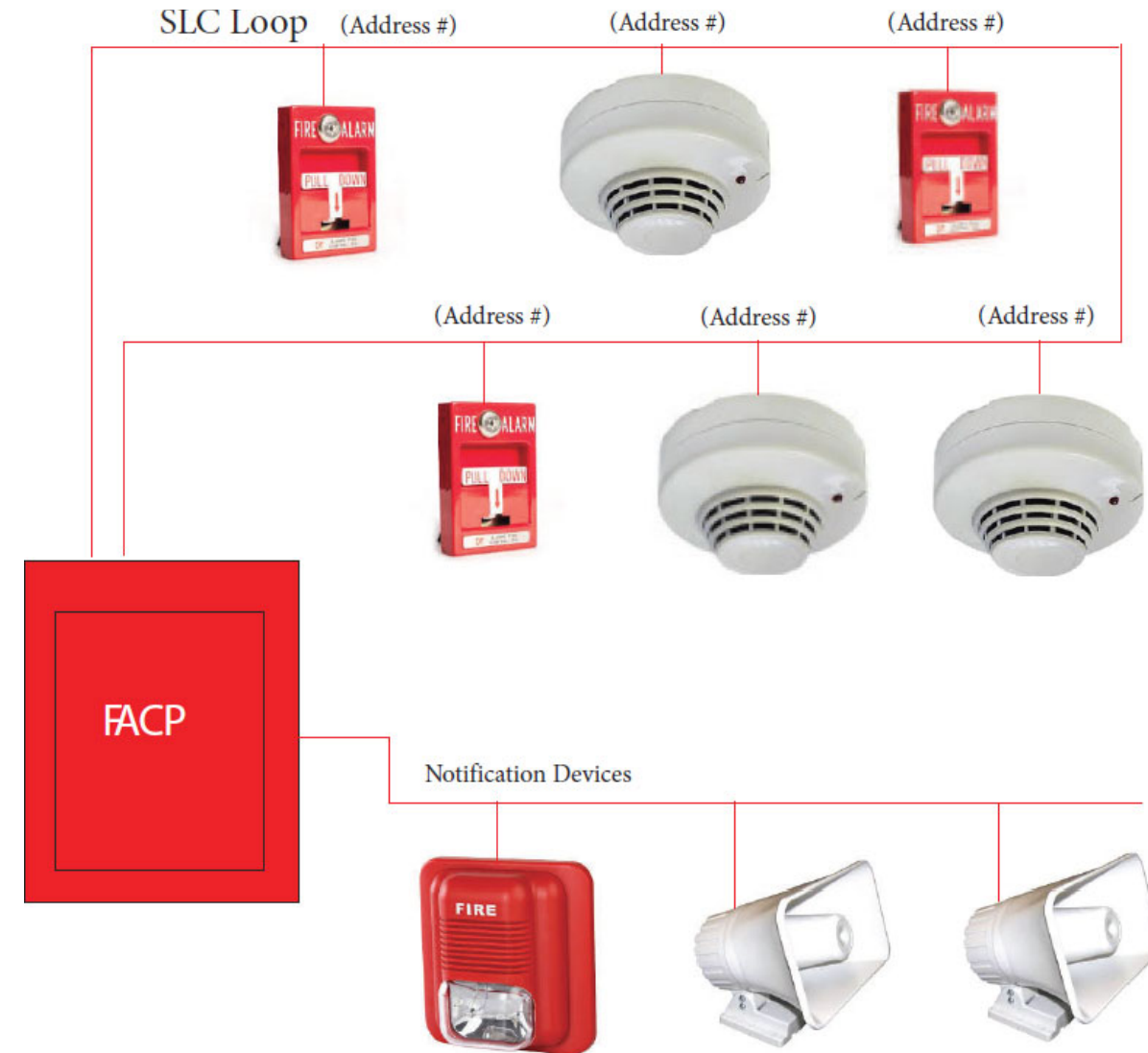
- Simplest type of protected premises alarm system
- Initiating device sends a signal to the FACP
- All the alarm-signaling devices operate simultaneously until the FACP is reset
- The FACP is incapable of identifying which initiating device triggered the alarm; building and fire department personnel must walk around the entire facility and visually check to see which device was activated.
- Practical for small occupancies with a limited number of rooms and initiating devices



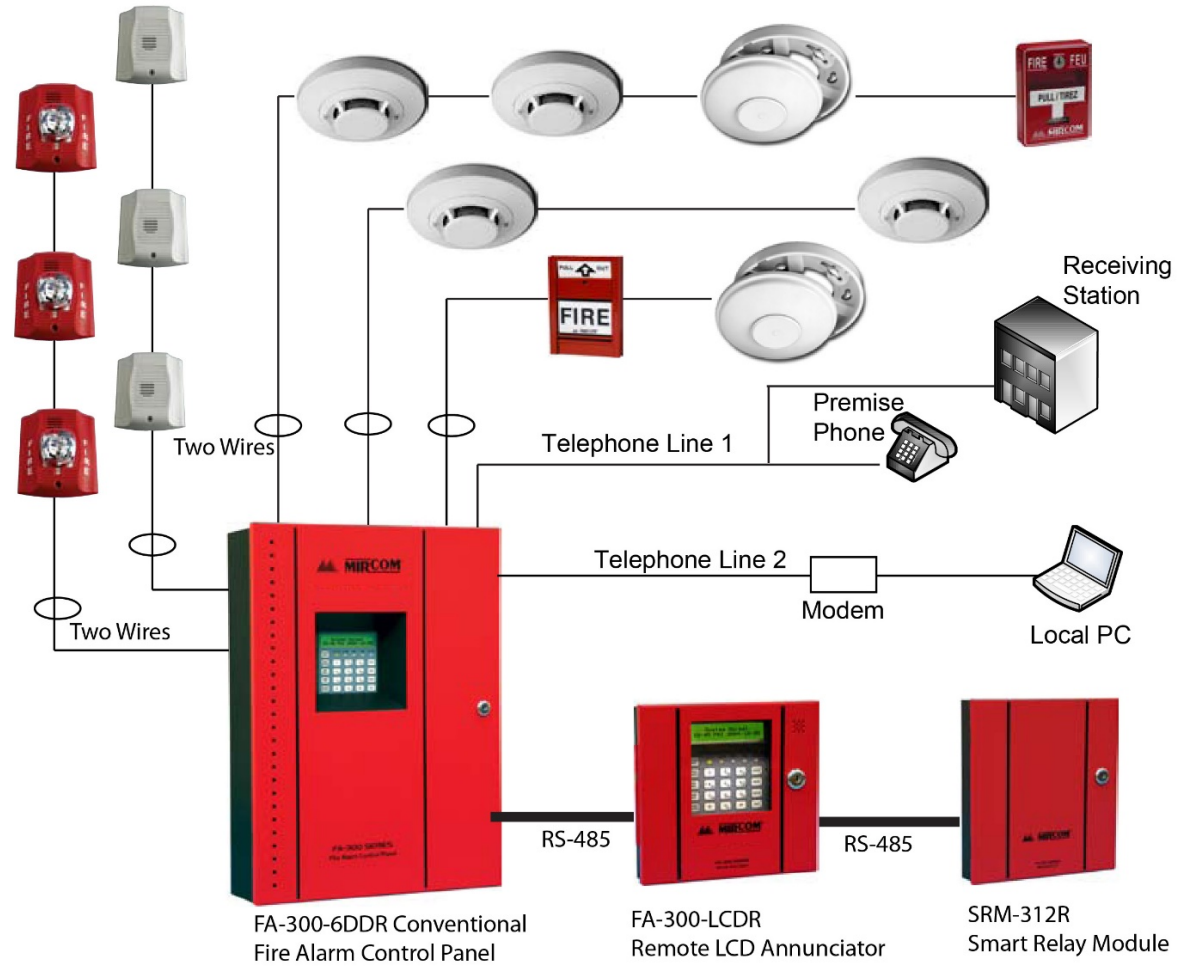
Fire Detection and Alarm Systems

Addressable Alarm Systems

- Each component has individual unique identifiers
- Displays the location of each initiating device on the **FACP** and on **fire alarm annunciator panel (FAAP)**
- Exact location of the specific device that has been activated is identified on the FACP and FAAP
- Large facilities utilize these systems because they can quickly pinpoint where the trouble signal originated



Fire Detection and Alarm Systems



Fire Detection and Alarm Systems

Supervising Station Alarm Systems

Fire alarm systems are required by model fire codes to be monitored at a constantly attended location. For buildings that are not constantly attended by qualified personnel, initiating device signals are required to be transmitted to a supervising station. A supervising station is a facility that receives signals from a protected premises fire alarm system and where the signal is processed by personnel.



Fire Detection and Alarm Systems

NFPA® 72 designates supervising stations as:

Central — A central supervising station is an independent business that is also listed by a nationally recognized testing laboratory. A central station is recognized as the most reliable type of supervising station.

Proprietary — A proprietary supervising station is a supervising station under the same ownership as the buildings protected by the fire alarm systems. At a proprietary supervising station, personnel are constantly in attendance to supervise and investigate fire alarm system signals.

Remote — A remote supervising station is not listed and operates as a business. Personnel are in attendance at all times to supervise and investigate signals.

Fire Detection and Alarm Systems

Alarm Initiating Devices



Fire Detection and Alarm Systems

Alarm Signaling Devices



Fire Detection and Alarm Systems

Fire Alarm System Wiring

Initiating Device Circuits (IDCs)

Notification Appliance Circuits (NACs)

Signaling Line Circuit (SLC)

Addressable Systems

Addressable systems use a Signaling Line Circuit (SLC) to communicate with detectors and modules. SLCs are a huge benefit because the fire panel can be expanded to perform more remote relay functions, dry contact monitoring, remote power control, releasing service and conventional zone monitoring.

SLCs provide 2-way communication between a device and the panel via a SLC circuit. The panel and a device "talk" to each other every 4–5 seconds, referred to as "polling."

Fire Detection and Alarm Systems

Circuit Types Overview

Addressable system panels can be wired as either Class A or Class B. The circuit type determines how a break in the loop affects the system's operation.

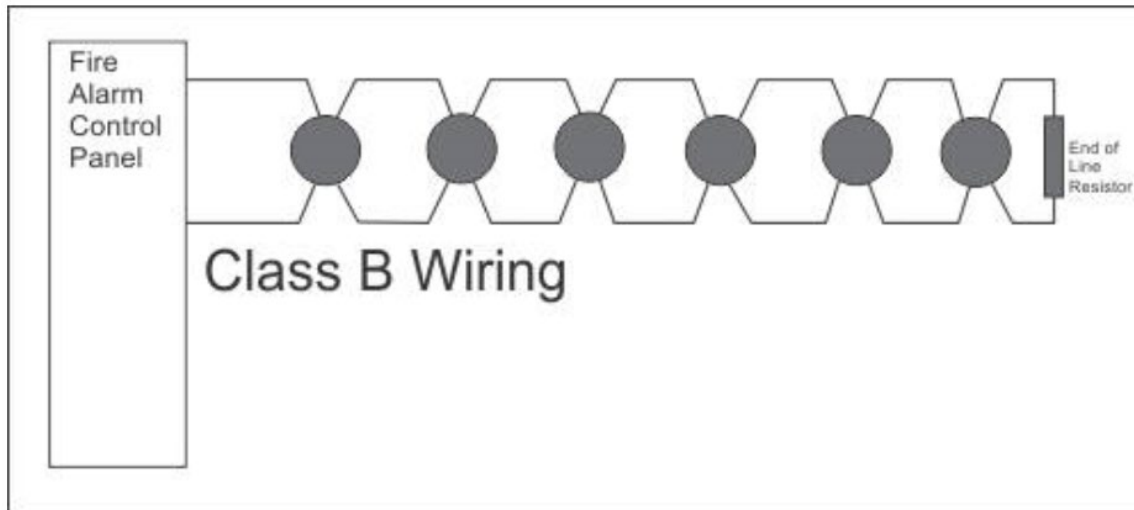
Class B Wiring

Most fire alarm system installations use Class B circuits. They provide the minimum level of protection that most facilities require. Class B circuits are characterized by the following features:

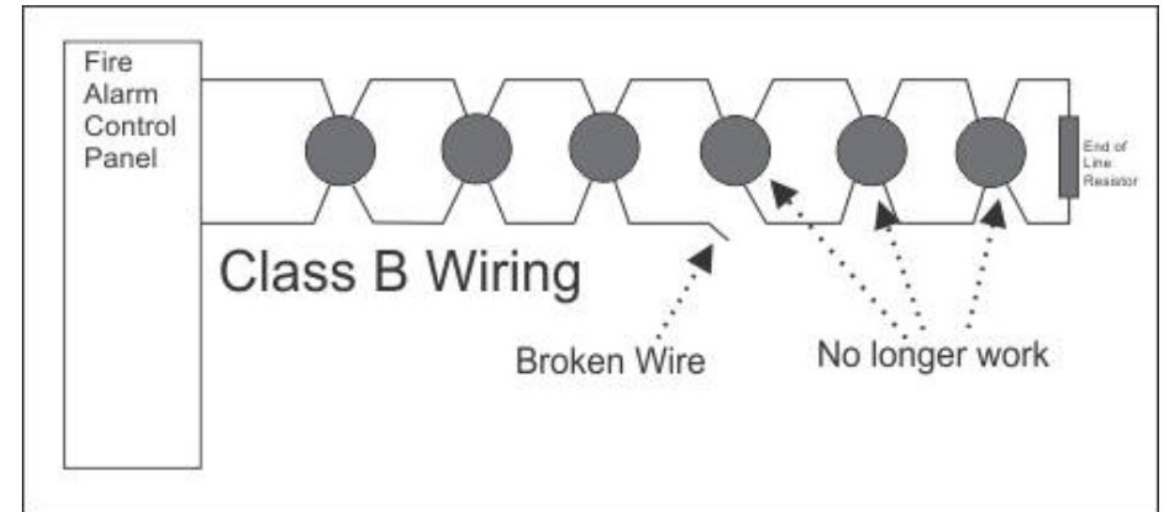
1. The circuit does not include a redundant path.
2. A single open on the circuit will render the devices located behind the location of the open circuit inoperable.
3. Any condition that affects the operation of the circuit will be annunciated as a trouble signal at the fire alarm control panel.
4. A single ground fault will not render the circuit inoperable. The presence of a single ground fault will be annunciated at the fire alarm control panel.

Fire Detection and Alarm Systems

Class B Wiring



Normal Class B wiring - All devices are supervised and working.



Open Fault in the Class B wiring. Supervision tells the panel that the wiring does not go through, but also the devices further from the panel don't work.

Fire Detection and Alarm Systems

Class A Wiring

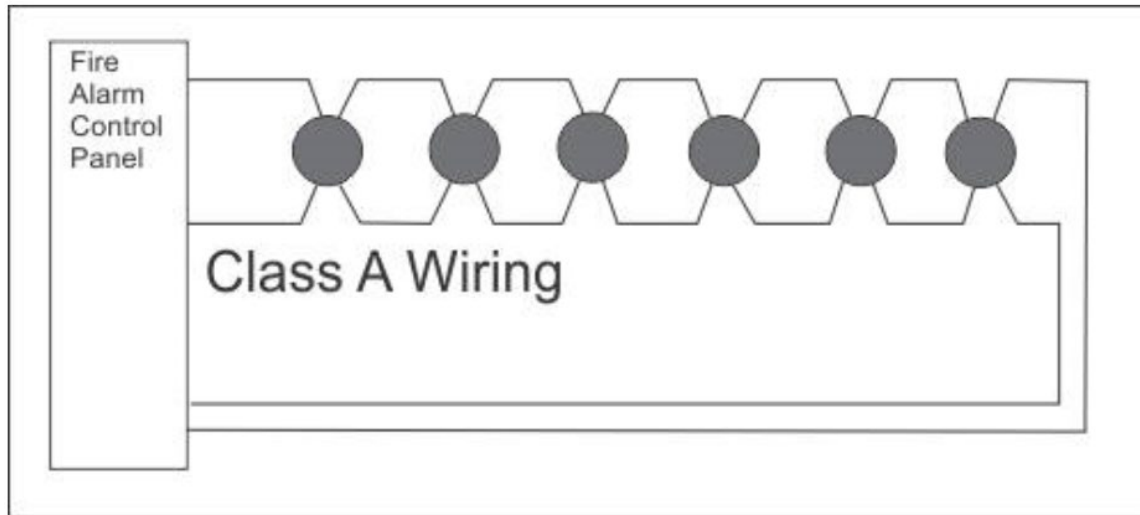
Class A circuits are used on certain types of installations (i.e., government, schools, hospitals, etc.), and when insurance authorities require it at a facility. Class A circuits can provide a higher level of system survivability.

Class A circuits are characterized by the following features:

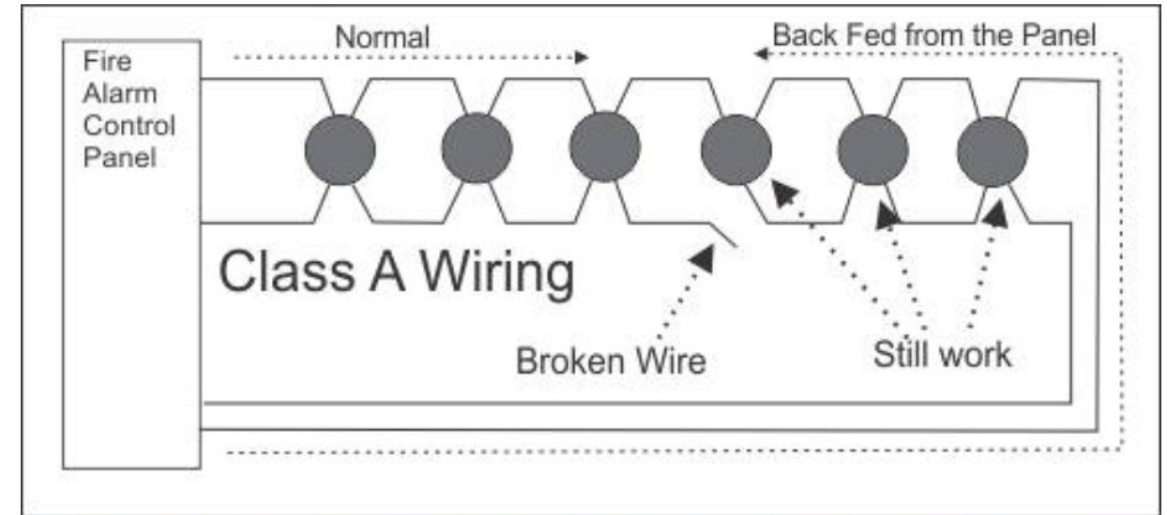
1. The circuit includes a redundant path.
2. The circuit will remain operable when there is a single open. The open will annunciate the fire alarm control panel as a trouble condition.
3. Any condition that affects the operation of the circuit will be annunciated as a trouble signal at the fire alarm control panel.
4. A single ground fault will not render the circuit inoperable. The presence of a single ground fault will be annunciated at the fire alarm control panel.

Fire Detection and Alarm Systems

Class A Wiring






Normal Class A wiring - All devices are supervised and working.



Class A wiring takes error detection further than Class B. If a wire breaks, the panel uses a redundant wire path to maintain communication with devices beyond the break. Here even though a wire is broken, all devices work.

Fire Detection and Alarm Systems

SYMBOLS	
	PULL STATION
	HORN STROBE
	SMOKE DETECTOR

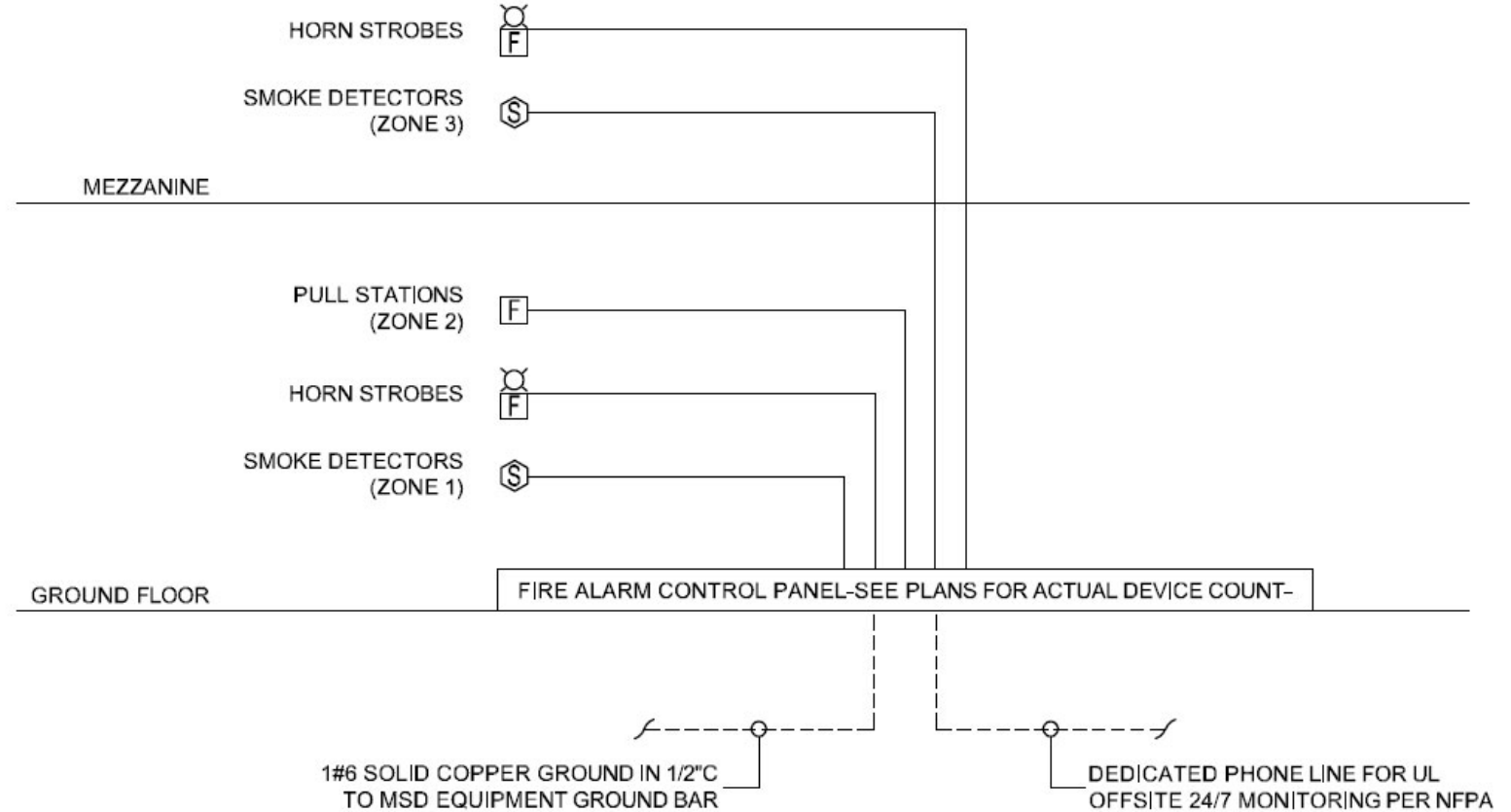
FIRE ALARM NOTES:

FIRE ALARM CONTRACTOR SHALL SUBMIT PLANS TO FIRE MARSHAL AND OBTAIN APPROVAL BEFORE ORDERING EQUIPMENT OR BEGINNING WORK. ALL SYSTEM WIRING SHALL BE IN CONDUIT

NOTES:

1. WHEN TWO SMOKE DETECTORS ARE ACTIVATED, GENERAL ALARM MUST BE SOUNDED IN THE BUILDING.

ALL FIRE WALL/CEILING PENETRATIONS TO BE FIRE STOPPED BY ELECTRICAL CONTRACTOR.


















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FIRE ALARM RISER DIAGRAM

SCALE: N.T.S

Fire Detection and Alarm Systems

FIRE ALARM SYMBOLS LEGEND	
	HORN STROBE; 80" AFF TO BOTTOM OR 6" BELOW CEILING TO TOP (WHICHEVER IS LOWER)
	GUESTROOM MINI HORN; 80" AFF TO BOTTOM OR 6" BELOW CEILING TO TOP (WHICHEVER IS LOWER)
	GUESTROOM MINI HORN STROBE; 80" AFF TO BOTTOM OR 6" BELOW CEILING TO TOP (WHICHEVER IS LOWER)
	FIRE ALARM PULL STATION; MANUAL; 48" TO TOP
	SMOKE DETECTOR; BETWEEN 4" AND 12" DOWN FROM CEILING TO TOP OF DETECTOR
	SMOKE DETECTOR; WITH SOUNDER BASE; BETWEEN 4" AND 12" DOWN FROM CEILING TO TOP OF DETECTOR
	HEAT DETECTOR; BETWEEN 4" AND 12" DOWN FROM CEILING TO TOP OF DETECTOR
	CARBON MONOXIDE DETECTOR; TIED INTO FIRE ALARM SYSTEM
	DUCT MOUNTED SMOKE DETECTOR
	STROBE LIGHT; 80" AFF TO BOTTOM OR 6" BELOW CEILING TO TOP (WHICHEVER IS LOWER)
	TAMPER SWITCH
	FLOW SWITCH
	PRESSURE SWITCH
	MAGNETIC DOOR HOLDER; TIED INTO FIRE ALARM SYSTEM
	FIRE ALARM CONTROL PANEL

Fire Detection and Alarm Systems

Fire Suppression Systems

A fire suppression system is any product designed to stop a fire from spreading. It gets the name suppression system as it aims to hold back the fire and the damage it may cause. Preventing the fire from spreading mitigates losses and allows time for emergency personnel to respond.



Fire Detection and Alarm Systems

Fire Suppression Systems

There are four basic types of automatic sprinkler systems that an alarm system may be connected to:

- [Wet Pipe](#)
- [Dry Pipe](#)
- [Pre-Action](#)
- [Deluge](#)

<https://www.youtube.com/watch?v=-3JlcgqmKII>

<https://www.youtube.com/watch?v=NCtM0kicwqE>

Fire Detection and Alarm Systems

Fire Stop Installations

<https://www.youtube.com/watch?v=whK7CCR1uRg>



Fire Detection and Alarm Systems

Other fire fighting equipment Fire Safety Signs



**PRESS HERE TO SOUND THE
FIRE ALARM**



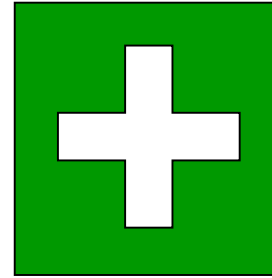
FIRE HOSE REEL

Fire Detection and Alarm Systems

Safety Signs



Blue/White = Must Do



Green/White = Safety Information



Red/White = Must NOT Do



Yellow/Black = Health & Safety Hazard Warning

Fire Detection and Alarm Systems

Safety Signs



Any Red and White sign with a line through means:

“ Not Allowed or Must Not”



NO SMOKING

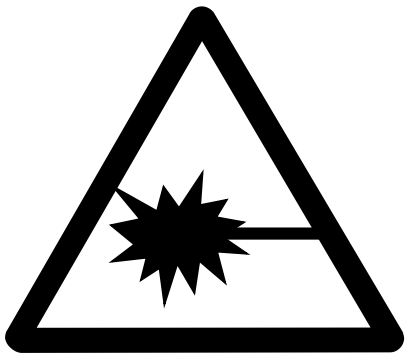
Fire Detection and Alarm Systems

Safety Signs

Yellow + Black = HAZARD WARNING



FLAMMABLE SUBSTANCE



WARNING - LASER BEAMS

Fire Detection and Alarm Systems

Safety Signs



**BEWARE
ELECTRICITY**



TOXIC



EXPLOSIVE

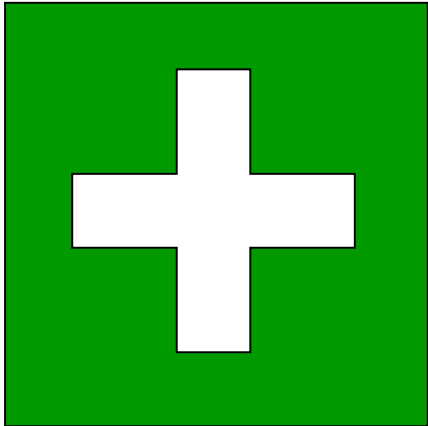
Fire Detection and Alarm Systems

Safety Signs

Green + White = SAFETY Information



Safe Route to Fire Exit



First Aid Kit

Fire Detection and Alarm Systems

Safety Signs

Blue + White = Mandatory or Must Do



YOU MUST WEAR OVERALLS



YOU MUST WEAR SAFETY GLOVES



YOU MUST WEAR EAR DEFENDERS

Fire Detection and Alarm Systems

