

Fire Detection and Alarm Systems



What are we going to review?

- 1) Why are fire detection & alarm systems installed?
- 2) Types of alarm systems
- 3) Automatic alarm initiating devices
 - 3.1) Heat detectors
 - 3.2) Smoke detectors
 - 3.3) Flame detectors
 - 3.4) Fire - gas detectors

What are we going to review? cont.

- 4) Combination detectors
- 5) Indicating devices
- 6) Automatic alarm systems
 - Remote station system
 - Proprietary system
 - Central station system

What are we going to review? cont.

7) Supervising fire alarm systems

8) Auxiliary systems

9) Fire alarm systems - general info.

1) Why are fire detection and alarm systems required?

- ◎ Notify building occupants to take evasive action to escape the dangers of a hostile fire
- ◎ Summon organized assistance to initiate or assist in fire control activities
- ◎ Initiate automatic fire control & suppression systems & to sound alarm

1) Why are fire detection and alarm systems required? cont.

- ⦿ Supervise fire control & suppression systems to assure operational status is maintained
- ⦿ Initiate auxiliary functions involving environmental, utility & process controls
- ❖ Systems may incorporate one or all of these functions

Fire detection & alarm system's components

◎ System components may operate :

- mechanically
- hydraulically
- pneumatically or
- electrically

2) Types of fire alarm systems

- ◎ Most basic type is designed to only be initiated manually - known as a local system or protected premises (pull station & bell)
- ◎ Typically, this system is expanded to include fire detection devices to sense the presence of a fire and initiate a signal

3) Automatic alarm initiating devices

3.1) Heat detectors - fixed temp. & rate-of-rise

- ◎ Fixed-temperature devices

- > Oldest types in use
- > Relatively inexpensive
- > Least prone to false alarms
- > Activation temperature slightly above highest ceiling temperature

Fixed temp. heat detectors cont.

- ❖ Detect heat by one or more of 3 primary principles of physics:
 - Expansion of heated material
 - Melting of heated material
 - Changes in resistance of heated material

Fixed temp. heat detectors cont.

Fusible devices and frangible bulbs can be used but are typically found in???

- o Automatic sprinklers

(Review this section on page 560)

Fixed temp. heat detectors cont.

- ◎ Most detectors are of the *spot* type
- ◎ Designed to detect heat in only in a relatively small area surrounding the spot they are located
- ◎ May find *continuous line detection devices* - detect heat over a linear area parallel to the detector (eg. conveyors, electric cable trays etc.)

Fixed temp. heat detectors cont.

- ◎ May also find *bimetallic detectors*
- ◎ Uses 2 metals with different thermal expansion characteristics
- ◎ When heated, 1 metal expands faster than the other causing the strip to bend or arch
- ◎ Deflection of strip makes or breaks alarm circuit, initiating an alarm
- ◎ Bimetallic detectors will reset automatically when cooled (but should be checked after a fire for damage)

Rate-of-rise heat detectors

- ◎ Operate on the principle that the temperature in a room will increase faster from fire than from atmospheric temperature
- ◎ Will initiate an alarm when the rise in temp. exceeds 12-15F (7-8C) per minute
- ◎ Alarm can be initiated at a temp. far below that required for a fixed-temp. device

Rate-of-rise heat detectors

- ◎ Reliable devices, not subject to false activations
- ◎ But if not properly installed, they can be activated under nonfire conditions (eg. detector located too close to doorway and subject to extreme fluctuations in temperatures)

Rate-of-rise heat detectors

- ◎ Several different types of detectors:
 - > Pneumatic rate-of-rise spot detector
 - > Pneumatic rate-of-rise line detector
 - > Rate compensated detector
 - > Thermoelectric detector

(Review details on pages 562 & 563)

3.2) Smoke detectors

- ◎ Can initiate an alarm much quicker than a heat detector because it responds to smoke generated very early in a fire's development (incipient stage)
- ◎ 2 basic types:
 - > Photoelectric
 - > Ionization

3.2) Smoke detectors cont.

- Photoelectric smoke detector
 - Uses a photocell coupled with a specific light source
 - Basically smoke entering the smoke detector chamber disrupts the light beam causing an alarm signal to be initiated
 - More sensitive to smoldering fires

3.2) Smoke detectors cont.

- Ionization smoke detector
 - Invisible products of combustion enter the chamber decreasing the current between the -ve & +ve plates, thereby initiating an alarm signal
 - Generally responds faster to flaming fires versus smoldering fires
 - Automatically resets when the atmosphere clears

Power sources for smoke detectors

- Can be batteries or household power
- Battery operated are easy to install and are economical to purchase
- Independent of house power so they will operate during power failures
- BC Fire Code will permit battery operated units (existing buildings)

Power sources for smoke detectors cont.

- ◎ BC Building Code requires hard wired smoke alarms for new construction
- ◎ Should install both on every level of home plus in the sleeping rooms
- ◎ Lack of maintenance (ie. not replacing batteries) is greatest concern
- ◎ Change your clock - change your battery

3.3) Flame detectors

- ◎ 3 basic types of flame detectors:
 - Ultraviolet light (UV)
 - Infrared (IR)
 - Can detect both types of light
- ❖ Most sensitive to detect fires but also easily activated by nonfire conditions (eg. welding, sunlight etc.)

3.3) Flame detectors cont.

- ◎ Must be positioned with an unobstructed view of the protected area
- ◎ Will not activate if line of site is blocked
- ◎ IR detectors are designed to require the flickering motion of a flame
- ◎ UV detectors insensitive to sunlight so they can be used in areas not suitable for IR detectors

3.4) Fire-gas detectors

- ◎ Monitors levels of carbon dioxide and carbon monoxide (common to all fires)
- ◎ More discriminating than other detectors - can be designed to be sensitive only to gases produced by specific types of hostile fires and ignores gases produced by friendly fires
- ◎ Not many in use - very specialized applications

4) Combination detectors

- ◎ Single device can be designed to have more than 1 function eg. heat/smoke, smoke/carbon monoxide detectors
- ◎ Different combos make the detectors more versatile and more responsive to fire conditions

5) Indicating devices

- ◉ Audible and visible alarms
- ◉ Audible: could be bells, horns, chimes
- ◉ Visible: strobes
- ◉ May be used together

6) Automatic alarm systems

- ◎ Depending on the BC Building Code requirement, some occupancies (eg. schools) are required to transmit an alarm signal to an off-site location
- ◎ Purpose: notify fire departments
- ◎ Signal produces an automatic response upon activation of local alarm on protected property

6) Automatic alarm systems

- ◎ Can use dedicated wire pairs, leased telephone lines, fiber-optic cable or wireless communication links
- ◎ Refer to BC Building Code for occupancies required to transmit a signal off-site
- ◎ Still request occupants call 9-1-1 should there be a problem with link

Auxiliary Systems

- ◎ 3 types of systems:
 - Local energy (municipal fire alarm boxes installed-wired directly to fire dept.)
 - Shunt (circuits from municipal fire alarm system extended into protected property)
 - Parallel telephone (alarm directly to center over municipally controlled telephone line)

6) Automatic alarm systems - Remote station system

- ◎ Remote station system transmits alarm, supervisory and trouble signals from protected property to a remote location where action is taken
- ◎ Owners pay a monthly fee to a monitoring company
- ◎ Most popular method of off-site monitoring

6) Automatic alarm systems - proprietary system

- Used to protect large commercial and industrial buildings
- Each building has its own system that is wired into a common receiving point somewhere on the site
- Receiving point must be in a separate building or area remote from any hazardous operations
- Constantly staffed with special training to handle all types of calls

6) Automatic alarm systems - central station system

- ◎ Similar to a proprietary system
- ◎ Primary difference: receiving location for calls is off-site, at a central station, and monitored by non-staff
- ◎ Central station is an alarm company that contracts with individual customers
- ◎ Alarm received, info taken, and initiate emergency response

6) Automatic alarm systems - central station system cont.

- ◎ Call fire department and property contacts
- ◎ May have supervised telephone lines

7) Supervising fire alarm systems

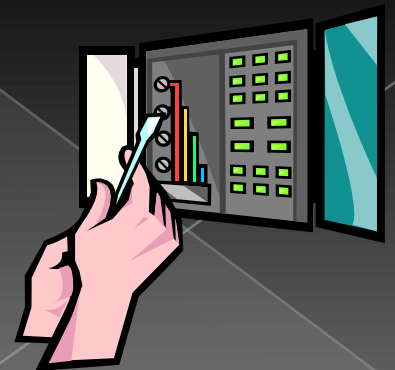
- ◎ Fire alarm systems designed to be self-supervising (ie. if system not operating normally, a trouble signal is generated)
- ◎ May happen when system switches to battery back-up during a power outage, break in a detector or notification circuit etc.

7) Supervising fire alarm systems cont.

- ◎ Fire alarm and supervisory systems may be installed to complement wet or dry sprinkler systems
- ◎ Flow and pressure devices are installed to supervise the systems
- ◎ Movement in the devices would indicate a sprinkler head activation due to a fire or water leak due to pipe break etc.

8) Auxiliary services

- ◎ Technological improvements in fire alarm systems have enhanced their capabilities
- ◎ Systems now integrate process and environmental controls, security and personnel access controls etc.



8) Auxiliary services cont.

- ◎ Some of the auxiliary services available are:
 - > Smoke control in HVAC systems
 - > Closing fire doors and dampers
 - > Assisting with evacuation by increasing air pressure in stairwells
 - > Overriding elevator controls
 - > Controlling personnel access to hazardous areas etc. etc.

9) Fire alarm systems - general info.

- ◎ 30% of calls with alarm bells ringing and no fire in 1999
- ◎ Zones indicated on fire alarm panel
- ◎ Re-setting alarm systems - who?
- ◎ Silencing of bells - who?