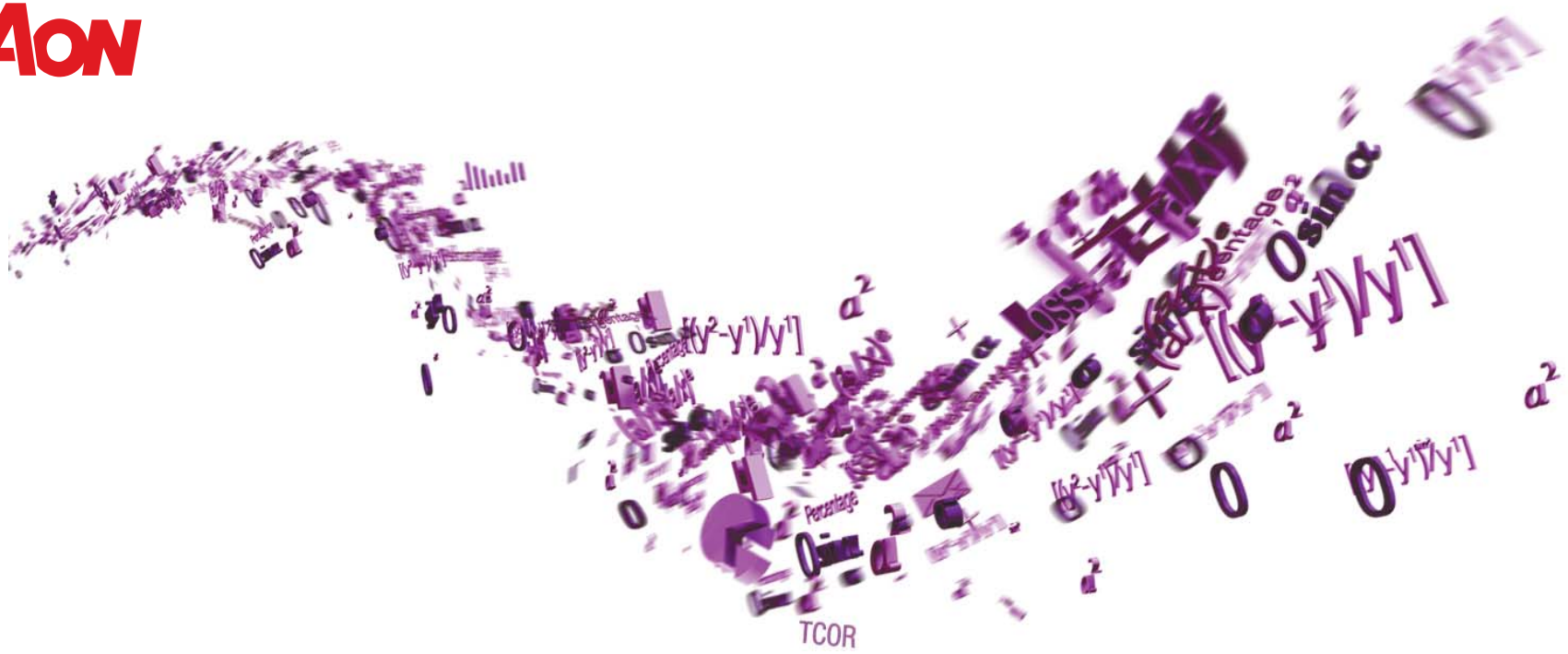


Solving the Fire Alarm Problem:

Design and Commissioning of Fire Detection and Alarm Systems

James A. Bychowski, P.E.
Senior Vice President – Middle East

Safety & Security Design in Buildings
Intersec Conference
Dubai Convention Centre Trade Centre 2, Sunday, January 17, 2016

Course Description

In the design and commissioning of fire alarm and detection system installations in the built environment, consideration of fundamental concepts is required to avoid nuisance alarms, yet maintain accurate notification in the event of an emergency. This presentation details critical aspects of design and installation of fire alarm systems to avoid nuisance alarms and other pitfalls in selected occupancies such as assembly, residential and high-rise facilities.

Presenter

James A. Bychowski, P.E.

Senior Vice President – Aon Fire Protection Engineering / Schirmer Safety Consultants

Mr. Bychowski is a Fire Protection Engineer with over 30 years of fire protection experience and has worked in the Middle East for the past 10 years.

Mr. Bychowski has served on both the NFPA 72 and NFPA 13 technical committees and is a founding board member of the International Chapter of the UAE Society of Fire Protection Engineers (SFPE). He has prepared fire strategies, and designed and commissioned fire suppression and alarm systems for all types of facilities.

Learning Objectives

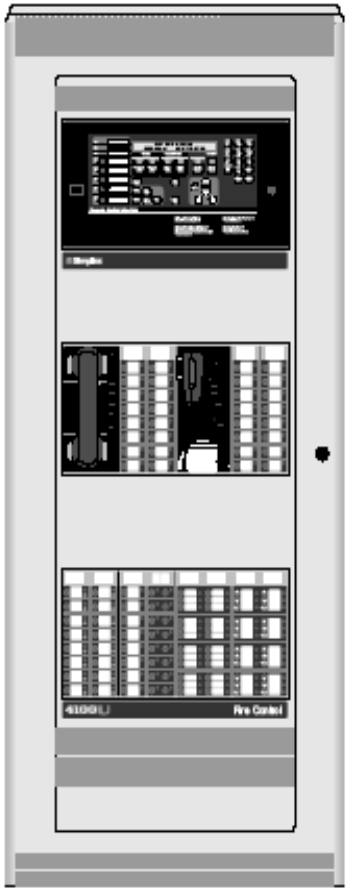
1. *Review fire safety concepts associated with fire alarm systems*
2. *Review key components of fire alarm systems*
3. *Investigate basic design strategies*
4. *Understand the impact of proper installation, inspection and testing to avoid nuisance alarms*

The purpose of this presentation is to convey technical knowledge to the conference participants.

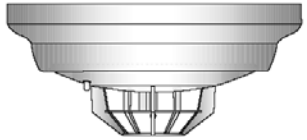
The presentation also contains slides with text that summarises the content of the presentation and the main learning objectives.

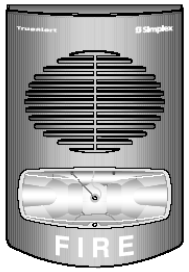
These may be used to update CPD records for relevant organisations including the Chartered Institute of Buildings (CIOB).

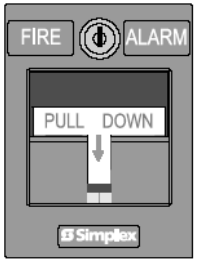
Overview

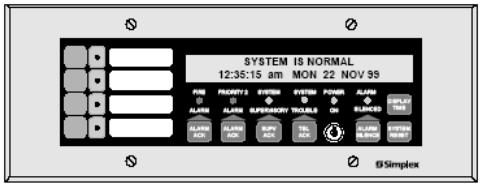


- Fire Safety Concepts
- Primary Fire Alarm Design Drivers
  - Codes
  - Standards
- Fire Alarm System Basics
  - Definition of a Fire Alarm System
  - Lifespan
  - How does it work
  - Components of Fire Alarm Systems
- Avoiding False or Nuisance Alarms
  - Design
  - Installation
  - Testing, Inspection and Maintenance









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Fire Safety Concepts Tree – NFPA 550

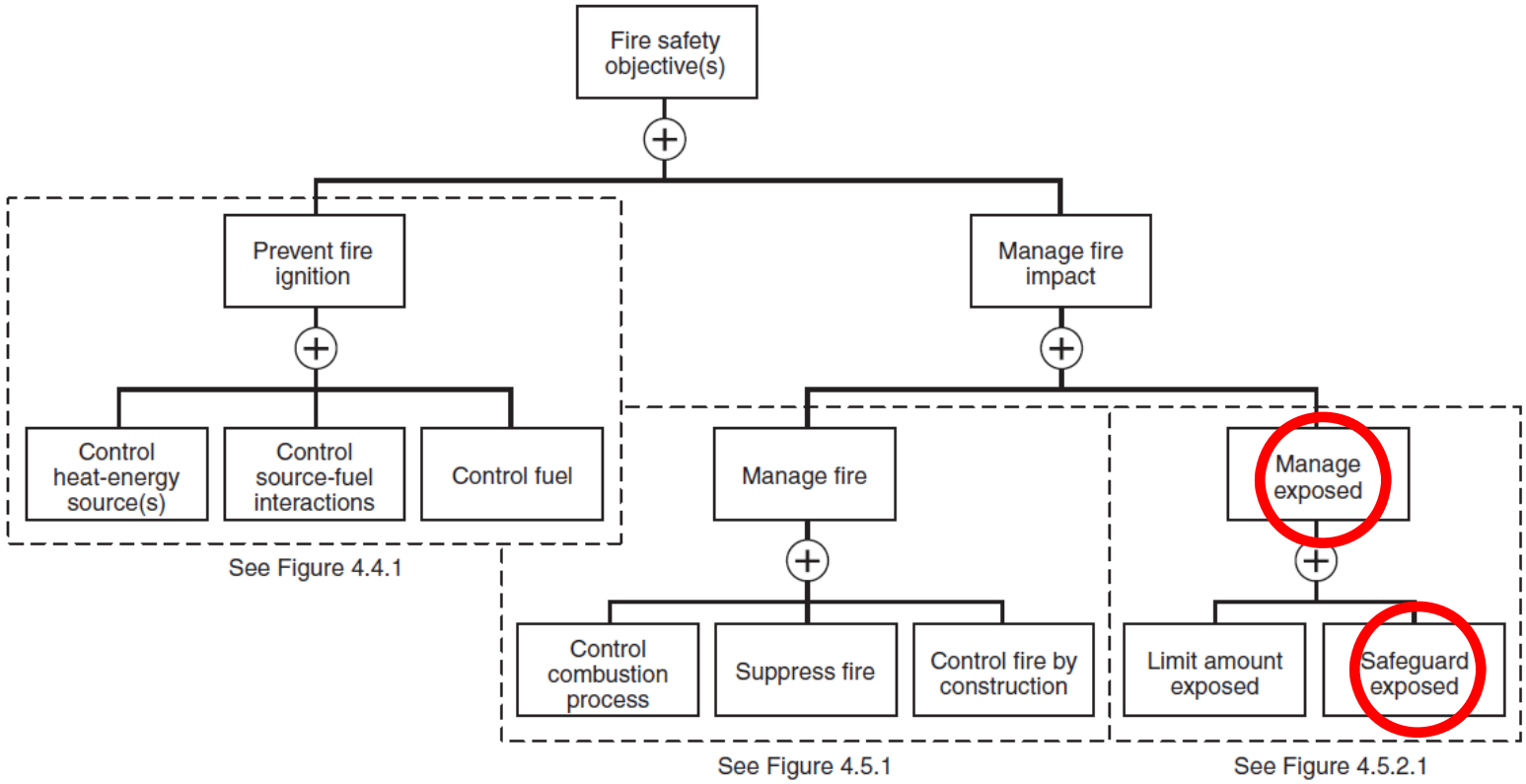

FIGURE 4.3 Top Gates of the Fire Safety Concepts Tree with Selected Lower-Tiered Gates.

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Fire Safety Concepts Tree – NFPA 550

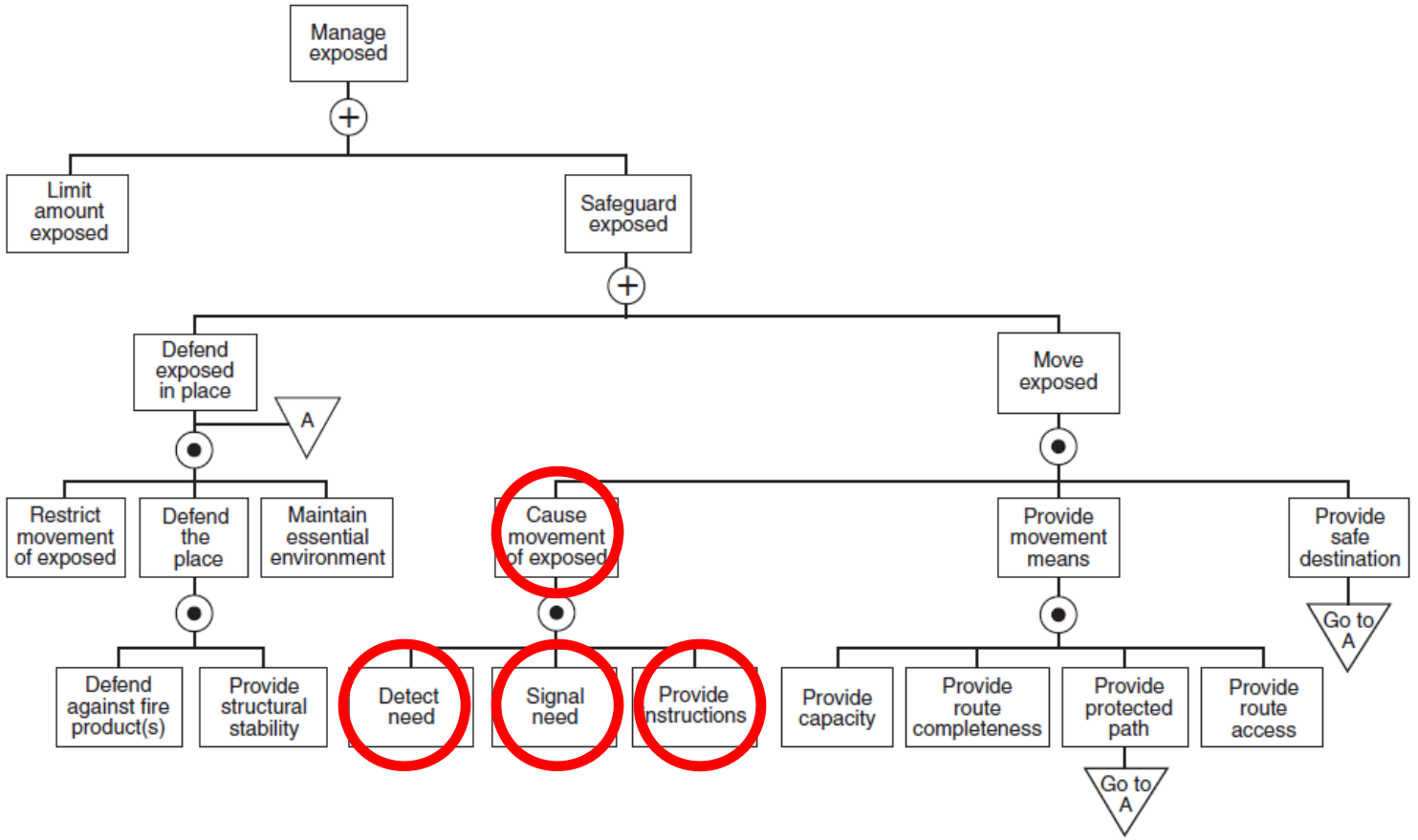

FIGURE 4.5.2.1 "Manage Exposed" Branch of Fire Safety Concepts Tree.

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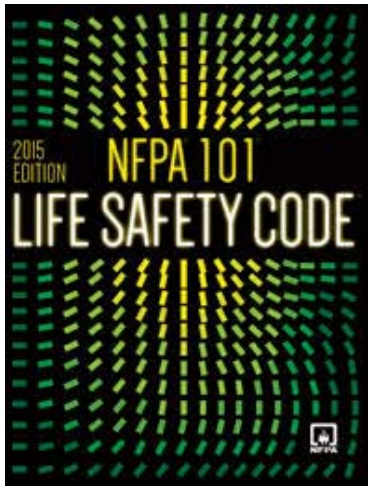
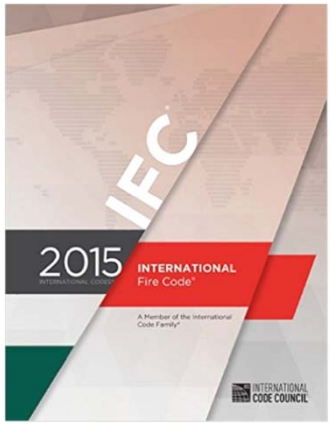
Fire Alarm Drivers – Codes & Standards

- Building Codes
  - Determine “what” is required for each building type
- Standards
  - Outline specific details on “where” and “how” to install various components or systems
- Fire Codes
  - Determine fire prevention for operating buildings.

Primary Design Drivers - Codes

- Adopted Building Code or Building Code of Record
  - IBC, NFPA 5000, GCC Code
  - Often supplemented by NFPA 101
- Adopted Fire Code
  - (IFC, NFPA 1)
- Local Civil Defense Requirements

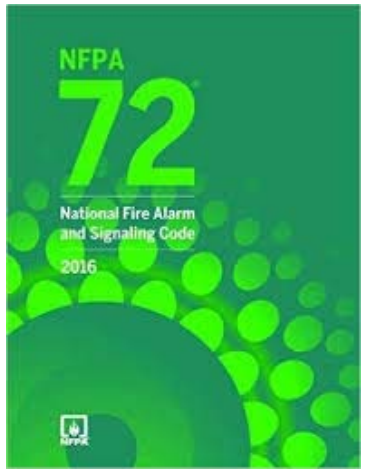




Primary Design Drivers - Standards

Adopted Standards or Referenced Standards

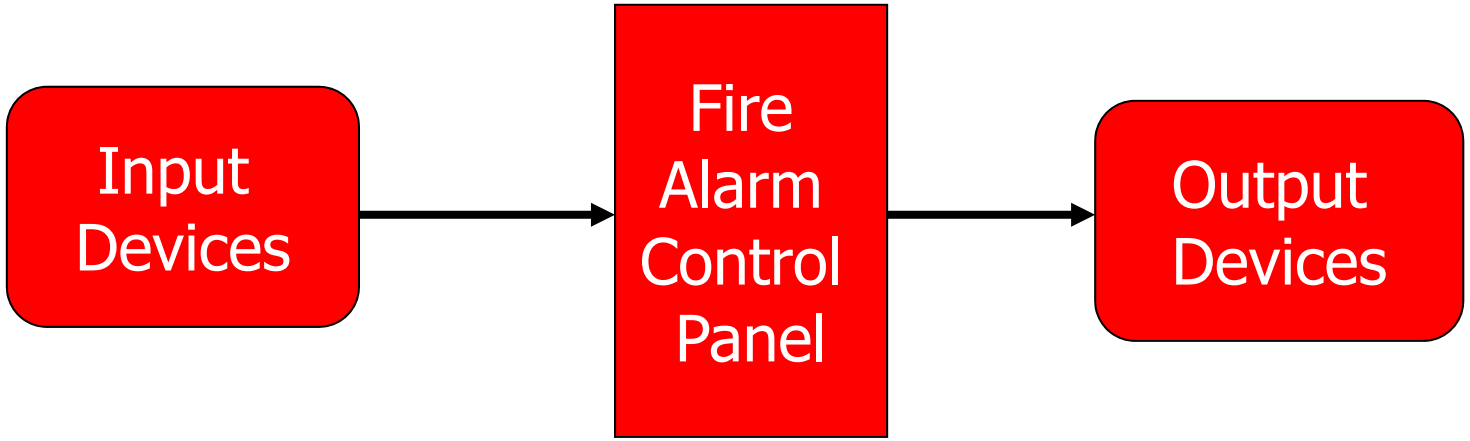
- NFPA 72 - National Fire Alarm and Signaling Code
- NFPA 13 – Standard for the Installation of Automatic Sprinkler Systems



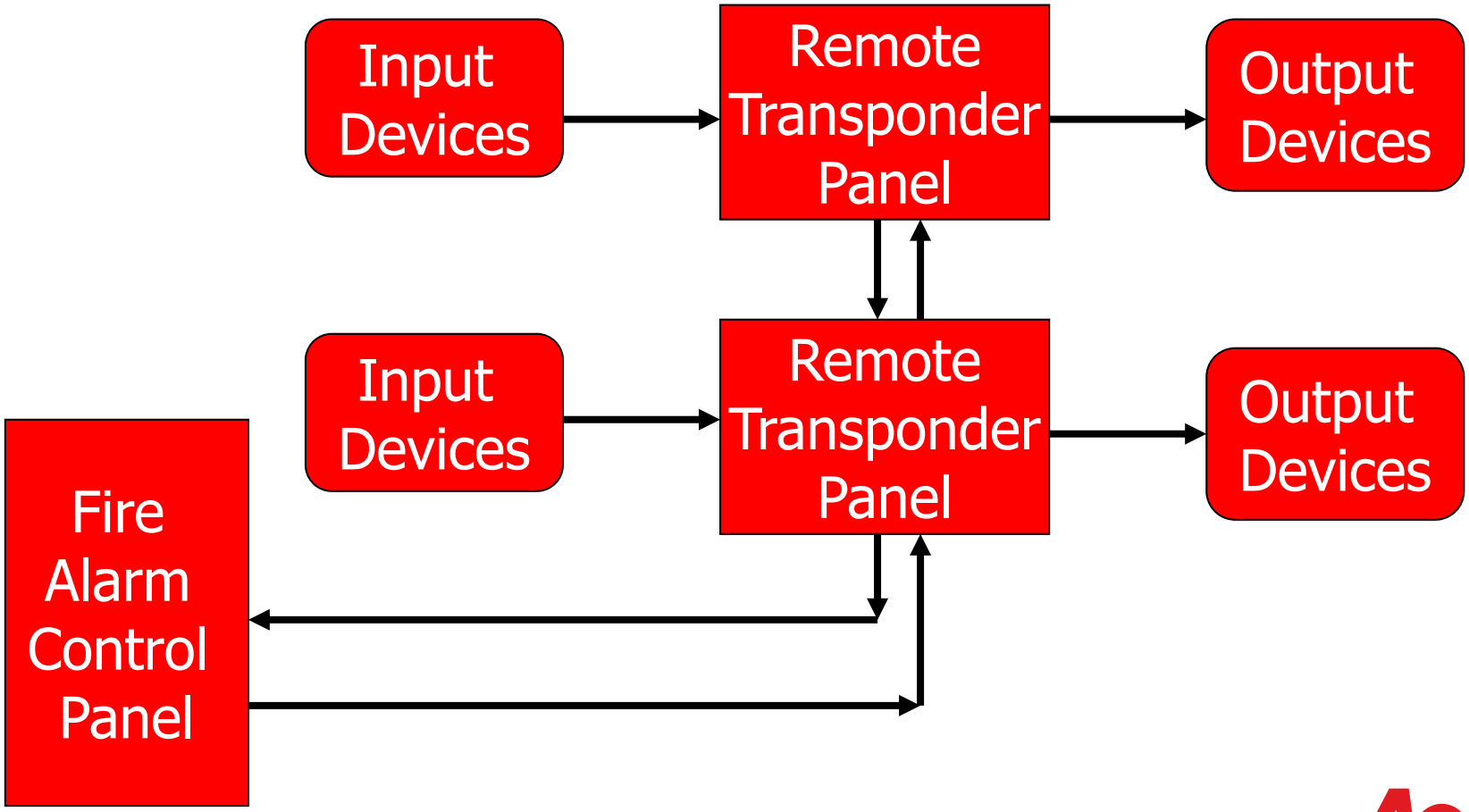
What is a Fire Alarm System?

Definition - NFPA 72-2016 Edition

A system or portion of a combination system that consists of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signaling-initiating devices and to initiate the appropriate response to those signals.



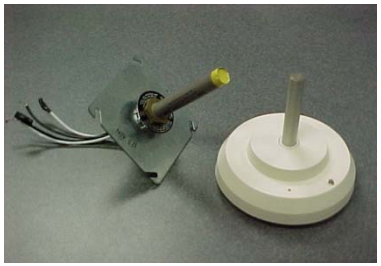
Networked Fire Alarm System

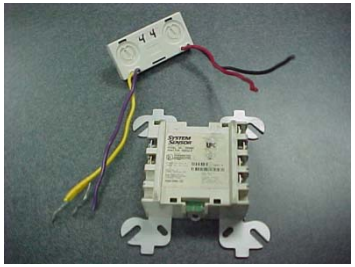


Fire Alarm System Components – Inputs and Outputs

- Input Devices
  - Smoke Detectors
  - Heat Detectors
  - Gas & Flame Detectors
  - Manual Pull Stations
  - Water Flow Switches
  - Valve Tamper Switches
  - Suppression System Releasing Panels (Kitchen Hood Suppression or Clean Agent Suppression)
  - Monitor Modules

- Input devices detect smoke or fire, or monitor status of other fire safety equipment





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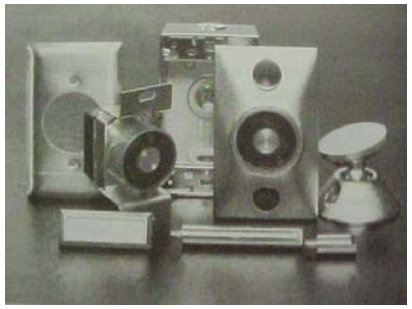
Fire Alarm System Components – Inputs and Outputs

- Output Devices
  - Horns
  - Speakers
  - Bells
  - Chimes
  - Control Modules
    - Elevator Recall
    - Door Release
    - Fan Control
    - Damper Control
    - Suppression System Solenoid Activation



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Cause and Effect Matrix

Fire Alarm System Input/Output Matrix Input \ Output	Activate audible alarm devices	Activate visual alarm devices	Notify fire department	Recall elevators	Release doors	Shut down fans
Smoke Detector Operation	X	X	X	X	X	
Manual Pull Station Operation	X	X	X	X	X	
Water Flow Switch Operation						
Kitchen Suppression System Operation						
Sprinkler Valve Operation			X			
Duct Smoke Detector Operation						X
Heat Detector Operation						

Cause and Effect Matrix (NFPA 72)

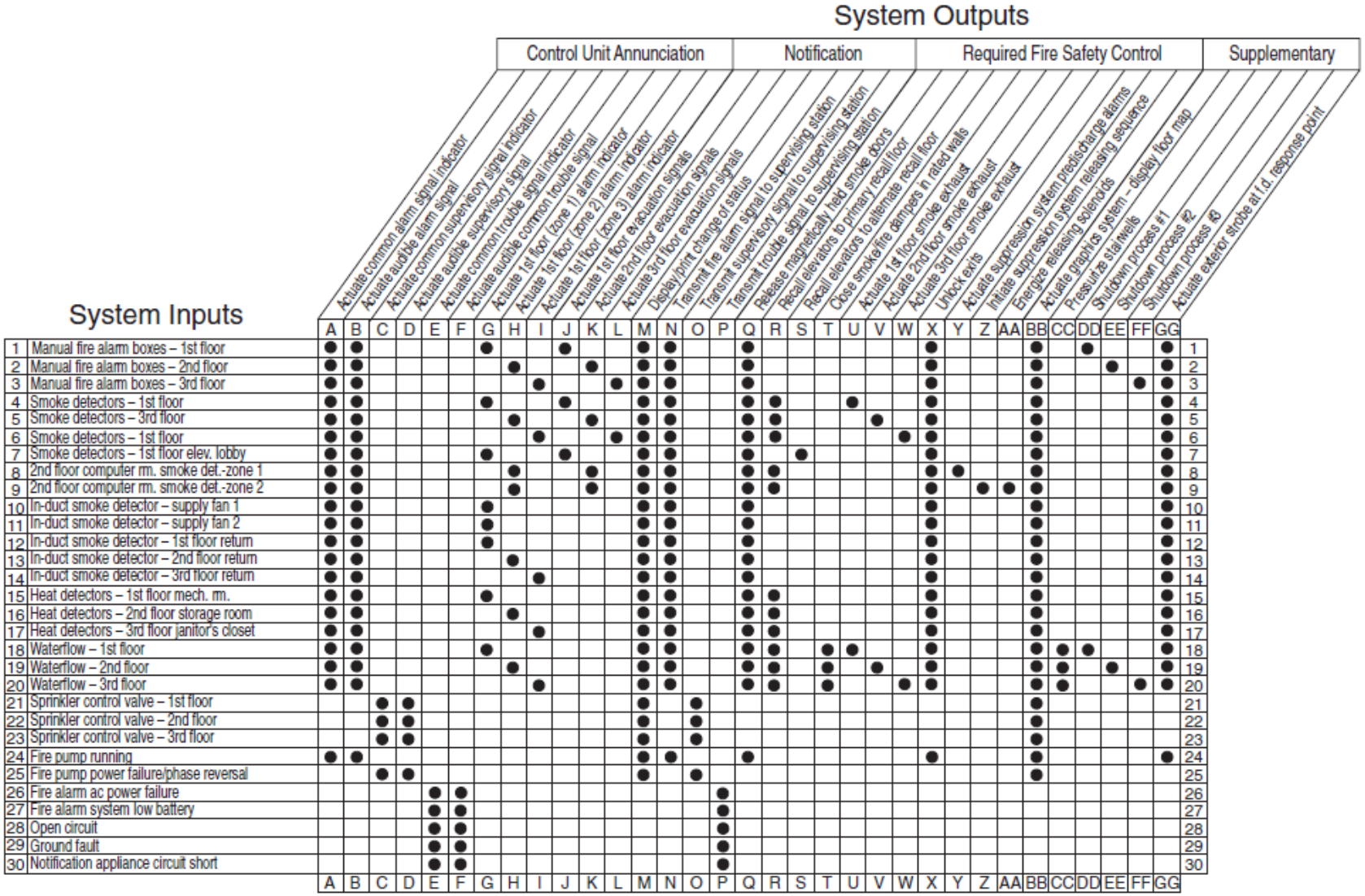
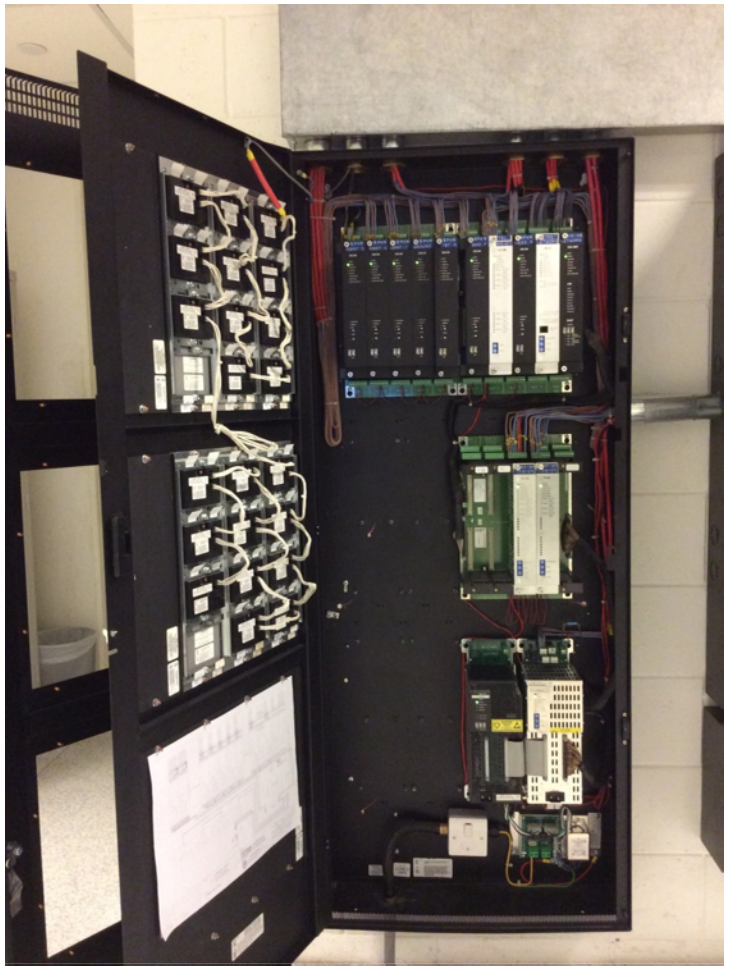


FIGURE A.14.6.2.4 Typical Input/Output Matrix.

False or Nuisance Alarms



3 main reasons for false or nuisance alarms:

1. Improper Design
2. Poor Installation
3. Poor Testing, Inspection, and Maintenance

Causes of False or Nuisance Alarms

Improper Design

– Placement of smoke detection devices in relationship to:

- High ceilings / stratification
- Locations with respect to diffusers and ceiling fans, 1.0 m
- Rooms with high airflows, and air velocity greater than 1.5 m/sec
- Doors leading to the exterior
- Temperature above 38°C
- Relative humidity above 93 percent.

Causes of False or Nuisance Alarms

Improper Programming

– Supervisory signal or Alarm?
  - Sprinkler valve supervisory switch
  - Kitchen hood extinguishing system
  - Fire pump supervision
  - Clean agent suppression system
  - Duct smoke detectors

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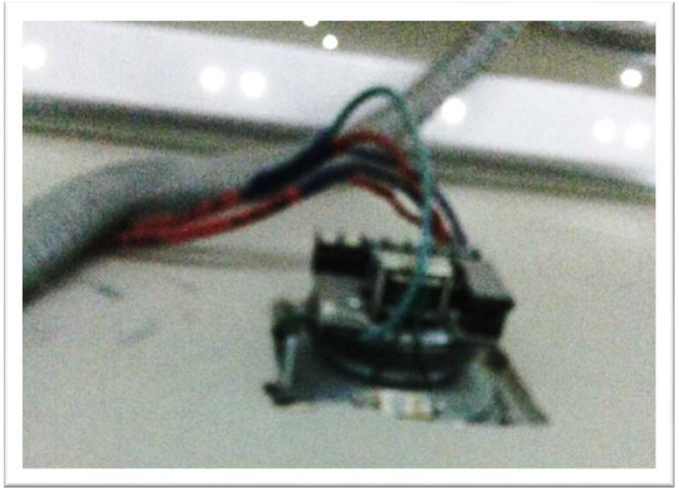
False or Nuisance Alarms which Impair System Operations – Cont'd

Poor Installations

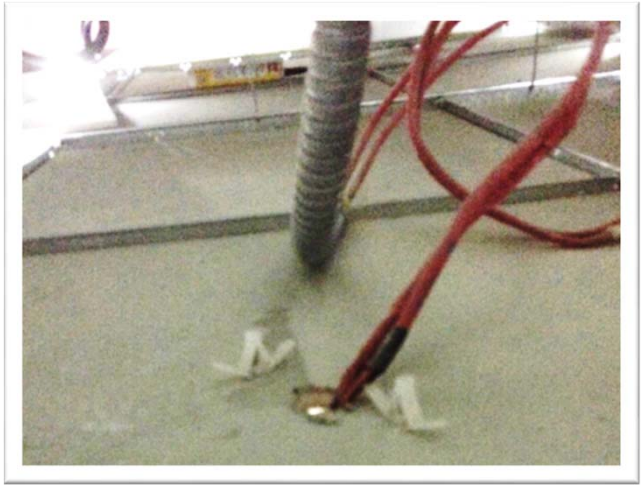
- Fire alarm wiring issues:
  - No electrical back boxes for devices
  - Wiring not properly secured above false ceilings
  - Devices or circuits not properly grounded
  - Electrical grounds not cleared prior to testing
  - Wiring not secured on terminal blocks

- Device installation issues:
  - Smoke detectors not kept clean during construction
  - Sensitivity/Dirty detector report not performed after commissioning
  - Devices not properly programmed and labeled.

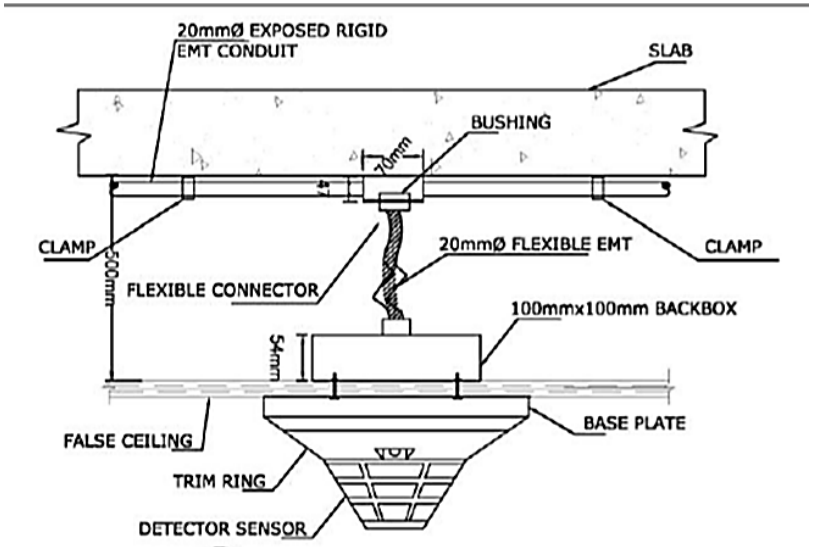
What's wrong here?



Speaker without back box



Smoke detector without back box



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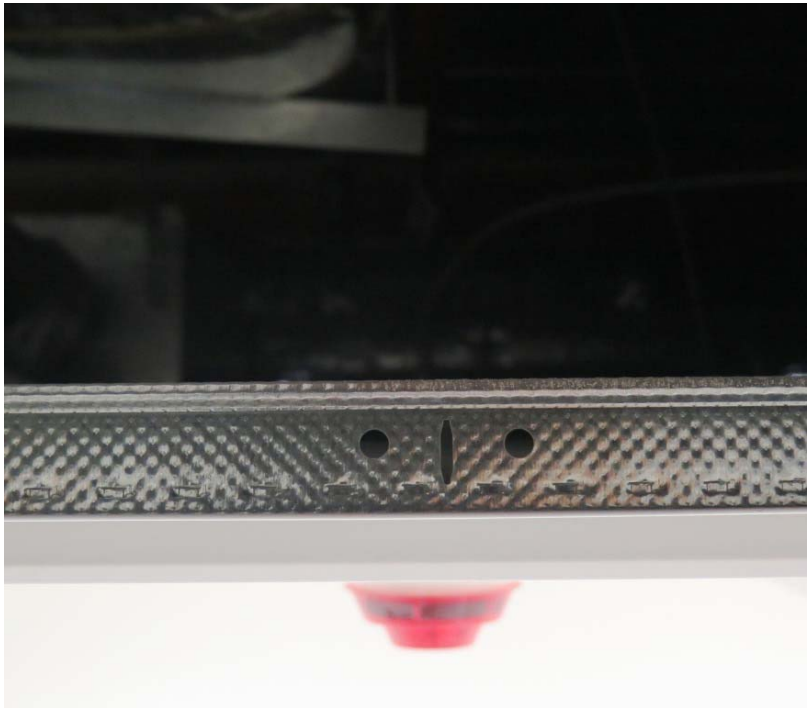

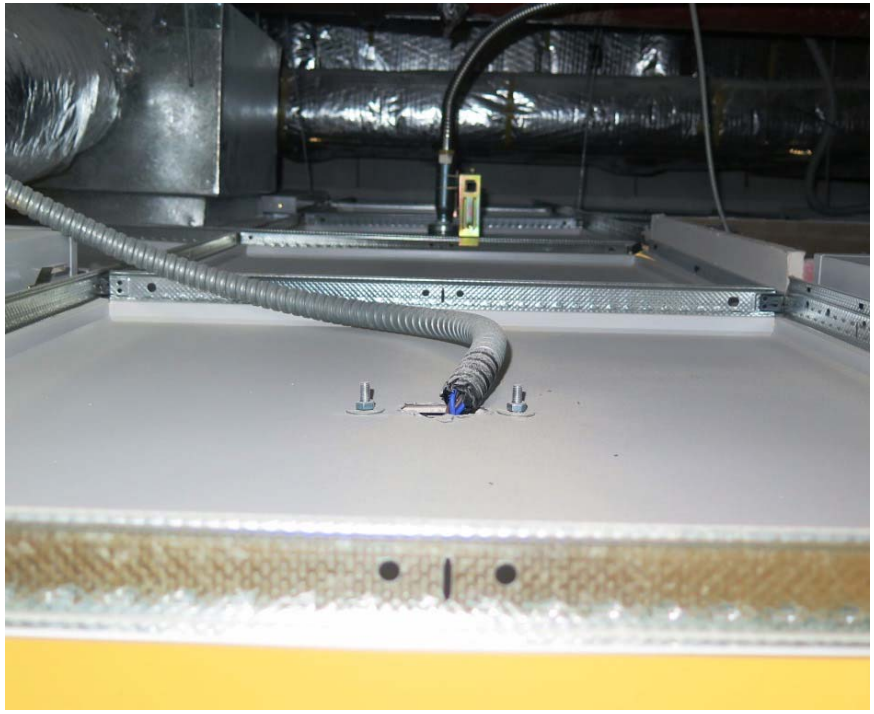

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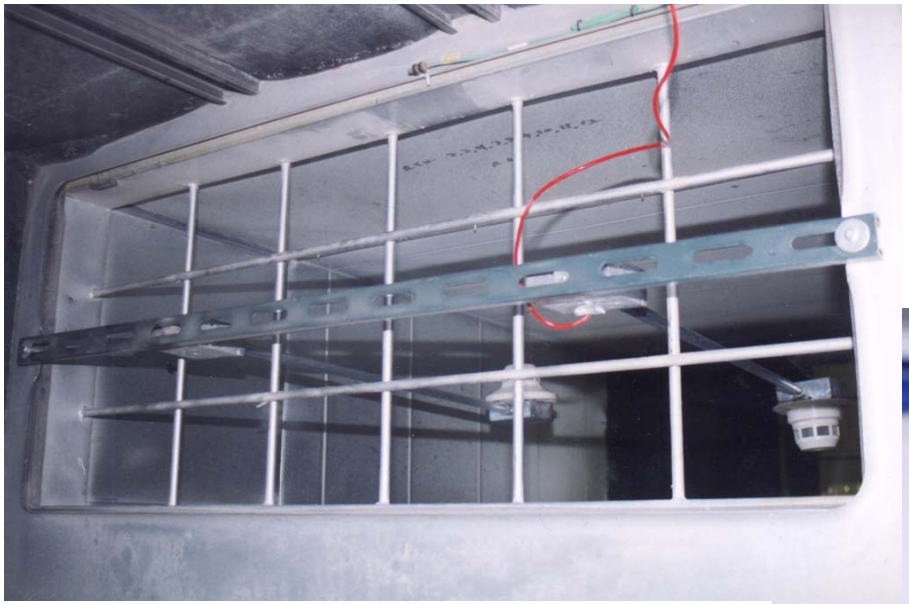

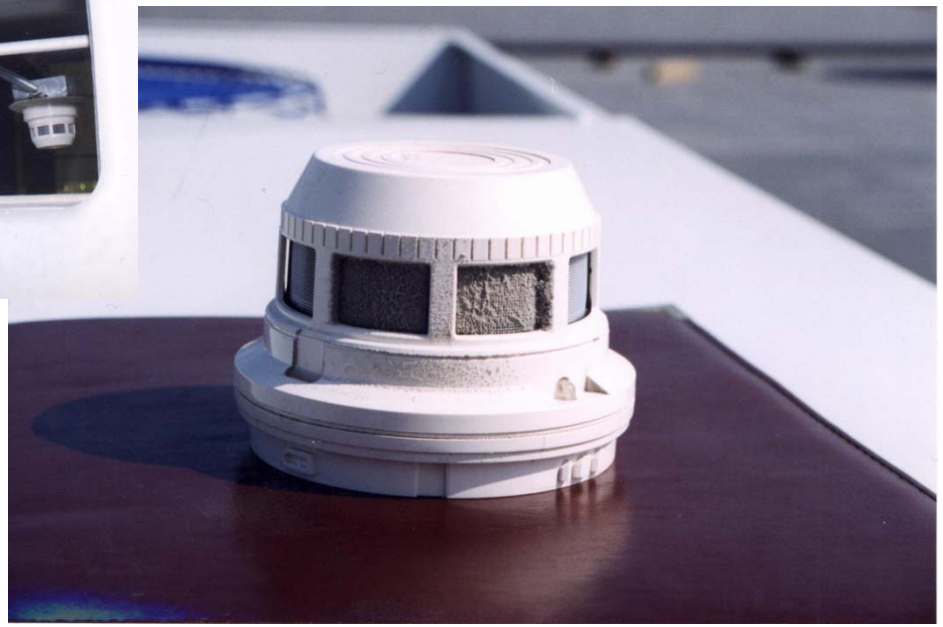

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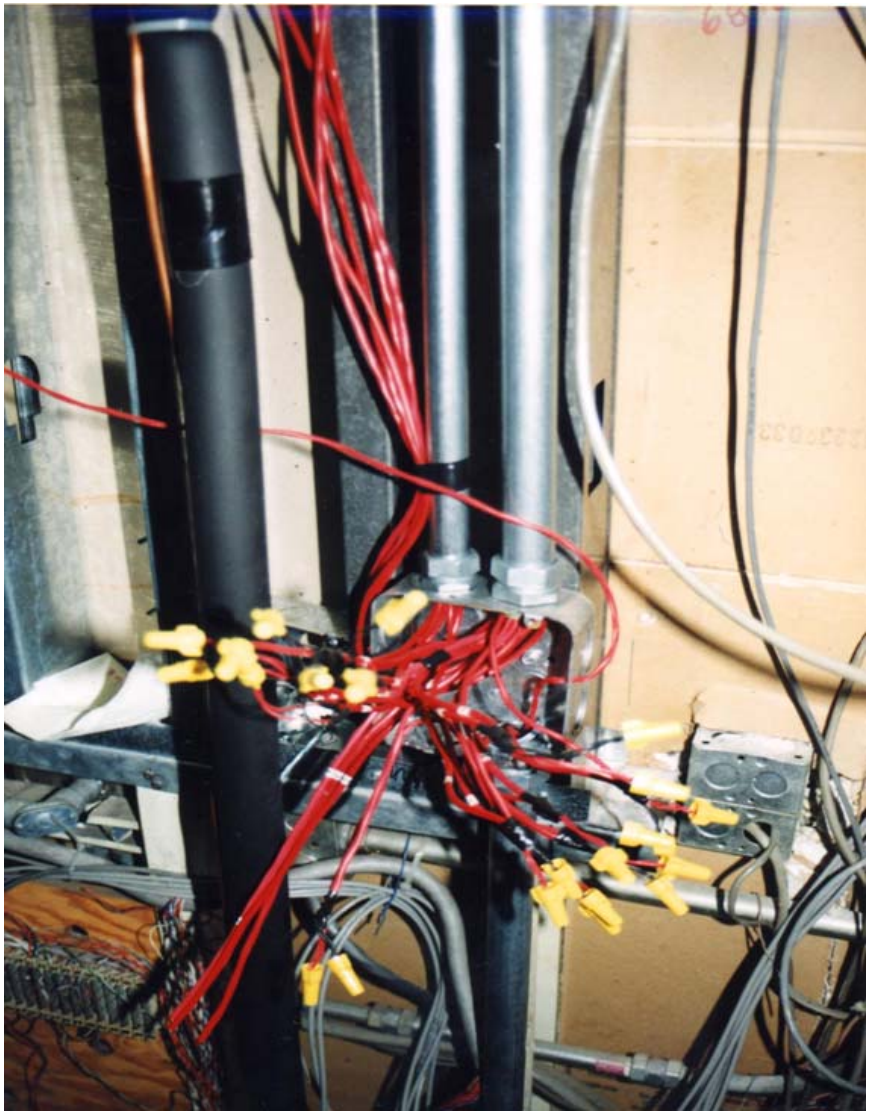

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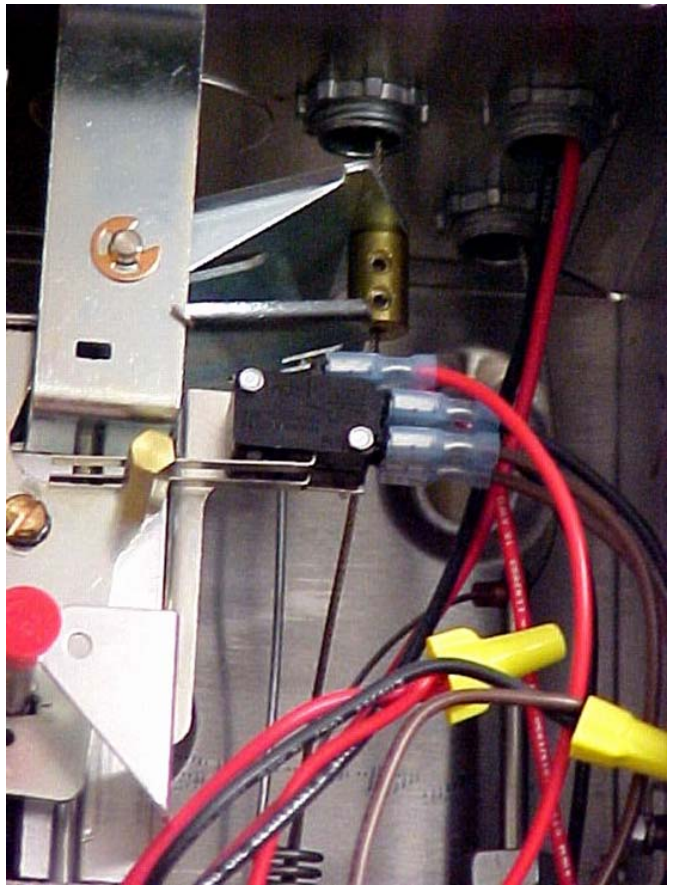

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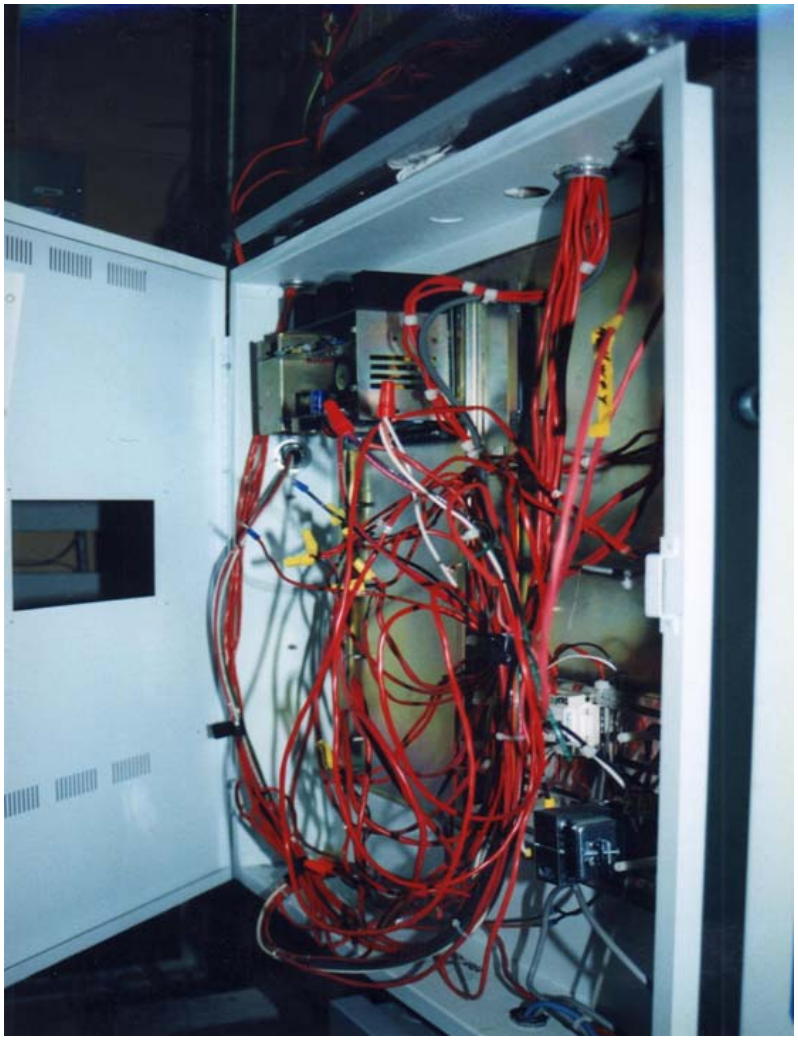

False or Nuisance Alarms which Impair System Operations

Poor Testing, Inspection and Maintenance

- Failure to perform 100% functional testing at commissioning
  - Testing systems with ground faults
  - Failure to check sensitivity or dirty detector report upon completion of testing
- Testing with the wrong tools or methods
  - Smoke detectors and heat detectors need to be tested with listed canned smoke and proper heating tools.
  - Bypassing equipment during testing
  - Failure to confirm proper point ID and location during testing
- Failure to repair deficiencies following inspection/test.
- Failure to inspect weekly and monthly, and test annually per NFPA 72.

Summary

- Building or Life Safety Codes – What is required
- NFPA 72 – How to design, install and test
- Include a Cause and Effect Matrix for all FA system designs
- Coordinate location of smoke detectors with regard to high ceilings, high airflows and environmental conditions
- Never test a fire alarm system if system faults are present
- Always perform a 100% functional test of all input/output functions
- Require contractors to provide NFPA 72 inspection, test and maintenance forms as part of as-built documentation.

Thank You

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