Inspection, Testing, and Maintenance

- Identify the different types of activities for ITM of alarm systems.
- Distinguish between the roles of different stakeholders for ITM of alarm systems.
- Explain the processes and differences between acceptance, sensitivity, and functionality testing.

It’s All About Ensuring Reliability

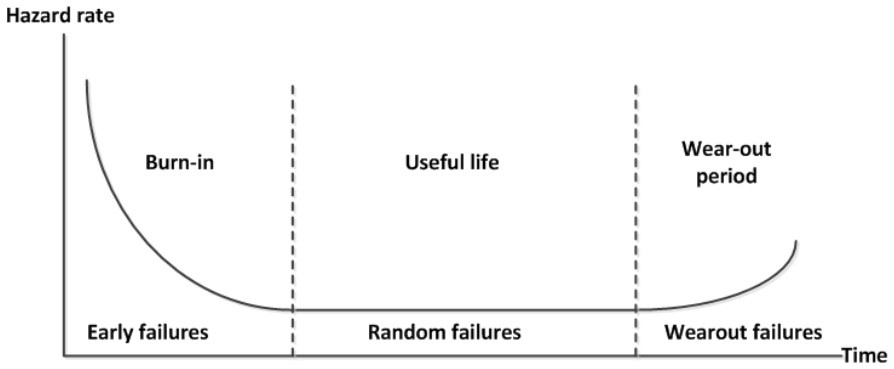
- A Reliable System
  - Detects and correctly responds to every occurrence of fire and does not give a fire alarm except when the fire actually occurs
- Fire alarm system objectives
  - Ensure life safety
  - Conserve property
  - Ensure continuity of the mission of the site
    - Example: production

ITM

- Inspection
  - Visual observation
- Testing
  - Component Activation
- Maintenance
  - Fixing deficiencies

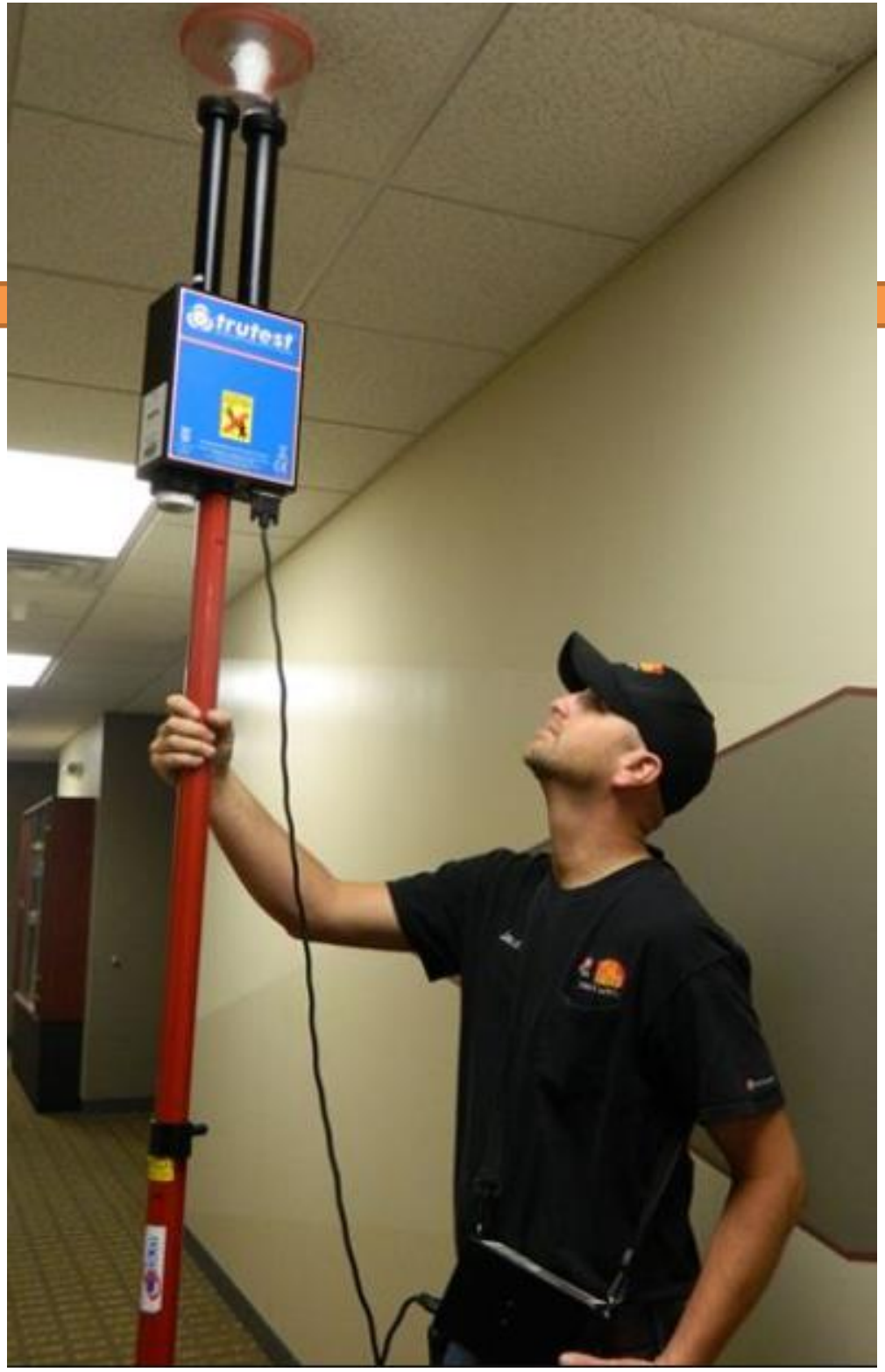
Reliability

- Design
  - Proper placement
- Installation
  - Proper technique
- Equipment
  - Bathtub curve
- Maintenance
  - Identify problems



Testing

- Acceptance
  - Before system in service
  - Every device
- Reacceptance
  - Acceptance test after modifications
  - All directly impacted
  - 10 % of others
- Functionality
  - Has the correct response
- Sensitivity
  - Responds to the intended stimulus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Typical Failure Modes

- Semi conductors
  - Short or open circuit
    - Three causes
      - Internal flaw
      - Overcurrent
      - Overvoltage
- Circuit board solder bonds
  - Broken during shipping and installation

Typical Failure Modes

- Relays
  - Electromechanical switch is activated by current flowing through and electromagnet such that the magnet poles a switch from one contact to another
  - Involves in mechanical parts that move and will eventually wear out
- Switches
  - Failed to operate when they should
  - Operate when they should not
- Screw terminals
  - Occasionally they vibrate lose

Typical Failure Modes

- Fuses
  - Fail to an open circuit resulting in trouble signal
- Batteries
  - Batteries can lose capacity and can lose output voltage
  - Numerous failure modes
- Wires
  - Conductor breakage
  - Damaged insulation

Interconnections

- Monitoring sprinkler systems
- Controlling auxiliary functions
- Alarms, faults, supervisory
  - Each type on own circuit

Coordination

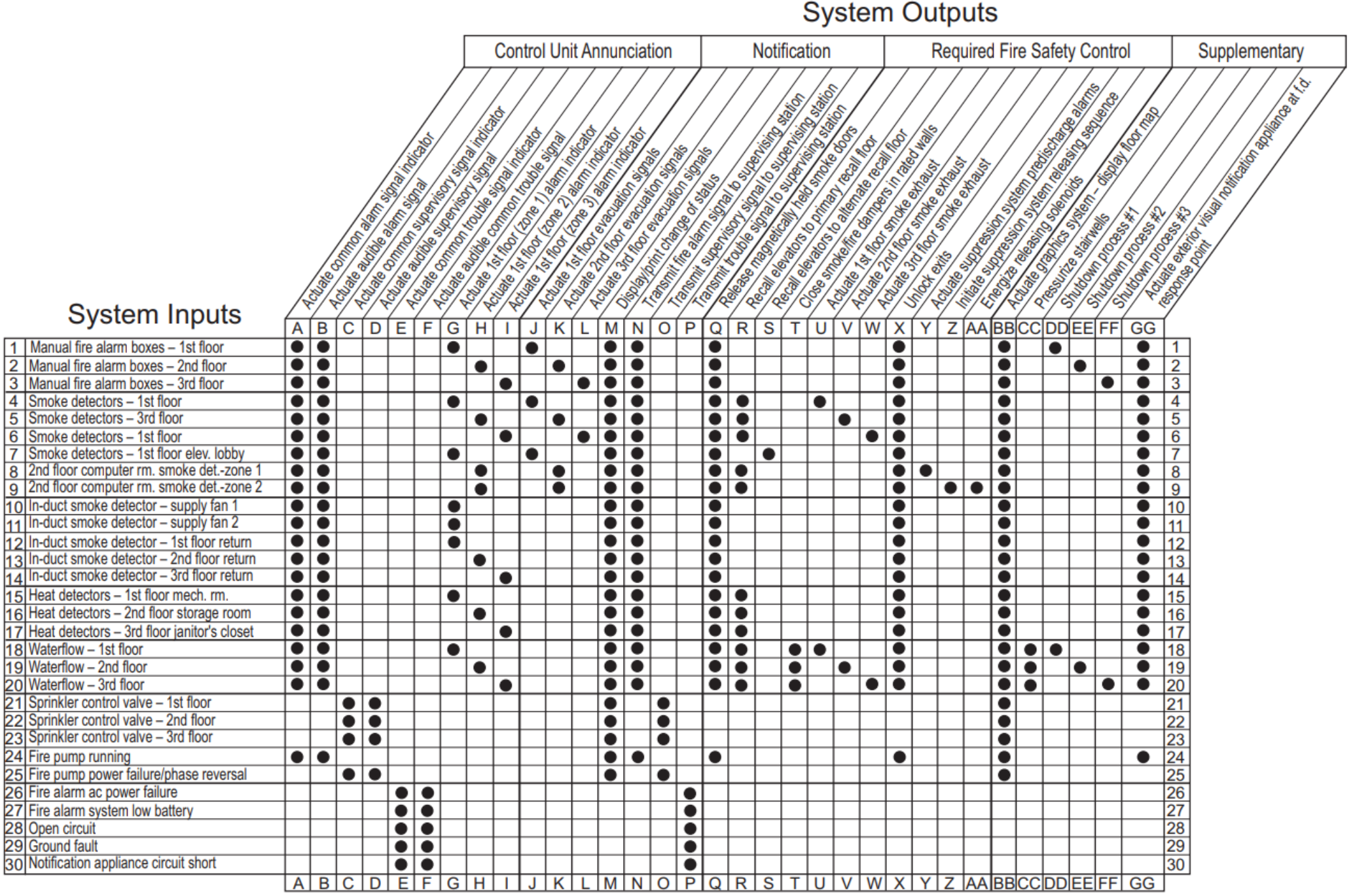
- Ideally test all components
- Avoid
  - Downtime
  - Significant cleanup
  - Non restored impairments

ITM

- Preparation and coordination of ITM
  - Notify, notify, notify
  - Interruptions to site operations will occur but tests are critical safety and must be conducted
- Test plan
  - NFPA 72 chapter 10 is organized to facilitate the development of a formal test plan
  - Test frequencies very depending on the general class of device

ITM

- Fire Alarm Control Unit (alarm panel)
  - Test the units capability of checking its relays, fuses, main power, back up power, etc.
    - These will result in what kind of signal?
    - Test system response functions that occur as a result of each input
      - Results in the completion of what document?



Δ FIGURE A.14.6.2.4 Typical Input/Output Matrix.

ITM

- Testing Initiating Devices
  - Detector testing methods are established by the manufacturer
  - Restorable
    - Spot type, and line-type heat detectors
  - Non-restorable
    - Spot type, line-type detectors
      - Either all are replaced or a sample is removed and sent for testing

ITM

- Smoke detectors
  - Ensure three things
  - Spot-type
    - Can accumulate dust
    - Are commonly painted
  - Line-type
    - Accumulation of dust and dirt on the optical surfaces
    - Sensitivity must be measurable and is tested with filters that simulate smoke
- Sprinkler water flow alarms
  - Tested with inspectors test connection
  - Alarm initiates within 90 seconds
  - Delay is to accommodate surges in the water supply

ITM

- Manual pull stations
  - Inspect the mechanical portion
  - Activate to verify internal switch operation
- Supervisory initiating devices
  - Require close physical inspection followed by a temporary simulation of a change in the status to verify the signal is transmitted

ITM

- Notification appliances
  - Simply require the use of a sound meter and/or a light meter to verify operation
- Household fire warning equipment
  - Systems involve detectors, notification appliances and a control panel
  - Smoke detectors must be tested monthly
  - Entire system must be tested every 3 years by a qualified technician

Responsibilities

- Owners
  - Manufacturer's recommendations
  - Provide information
  - Keep records
- Inspectors
  - Qualified

Ensuring Reliability

- Reliability is the measure of the certainty that the system will provide the appropriate response to the conditions that occur, as they occur, during the defined lifetime of the system
- Reliability can be computed because the reliability of the individual electronic components has been thoroughly studied and documented (MTBF)
- These calculations give the ability to recommend maintenance intervals based on the knowledge of when the system or components will fail

Ensuring Reliability

- NFPA 72 dictates inspection testing and maintenance schedules
- It is a consensus opinion of what an average system requires, not the actual result of reliability calculations

A system cannot be expected to achieve its design objectives if the inspection, testing and maintenance program does not confirm the reliability of the system