
BFAAM Apprenticeship Program

Related Training Instruction (RTI)

Module 6 – Fire Alarm Signaling Systems

Reading material associated with this
module: Chapters 12, 13, 14 of Fire Alarm
Signaling Systems, Third Edition; or Chapters
13, 14, 17 of the Fourth Edition

BFAAM Apprenticeship Program

BFAAM Gratefully acknowledges the efforts of
Gordy Balcom, of Engineered Protection
Systems in developing the material for this
module

Chapter 12

Fire Alarm System Testing

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- After installation a program for testing a fire system is crucial. Where testing does not prevent failures it can identify failures that have occurred so repairs can be made.
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- Top 10 reasons a fire system has failed to operate as needed:
 - ❑ Faulty flow switch
 - ❑ Lack of maintenance
 - ❑ Water in conduit
 - ❑ Power failure
 - ❑ Telephone line trouble
 - ❑ Detector failure
 - ❑ Vandalism (not repaired)
 - ❑ Battery failure
 - ❑ Detectors too sensitive
 - ❑ Poor installation
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Testing procedures

2 categories

Acceptance /reacceptance

ACCEPTANCE TESTING

Every fire alarm is required to be thoroughly tested after installation or significant changes to the system. This is to ensure it's all operational. This should include alarms, troubles, power outages etc.

Testing procedures

- Test as follows:
 - Test control unit to verify it is in the normal supervisory condition per manufacturers specs.
 - Initiating and indicating circuits should be tested to confirm conductors are properly monitored.
 - Initiating device / indicating appliance devices should be tested for proper operation.
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Reacceptance Testing

- Should be performed on all equipment and circuits effected after additions, deletions or damage to the system has occurred.
 - Central station acceptance testing should be done by qualified personnel.
 - Complete records should be kept for all systems, these records should include specifications, wiring diagrams , floor plans etc.
 - All devices should be approved for their intended purpose.
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Testing other systems

- Audible appliances –for emergency voice /alarm systems should be tested per manufacturers specifications. Testing should be done using a sound meter.
 - Visible appliances –should be tested per manufacturers specifications and recommendations.
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Acceptance testing for automatic fire detectors.

- The owner should assign responsibility for testing , inspections and maintenance programs.
 - Records should be kept for 5 years and kept on site.
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Device Testing

- Heat Detectors
 - Restorable heat detectors should be tested by exposing the detector to a heat source (hair dryer/ heat lamp)
 - Pneumatic tube line type detector
 - Test with a heat source or with a pressure pump according to manufacturers instructions.
 - Line type or spot type non restorable fixed temperature heat detectors
 - Test mechanically or electrically.
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Testing continued

- Detectors with fusible alloy element
 - Test by removing the element to be certain the contacts work. Reinstall element to restore.
 - Smoke, flame and other fire detectors
 - Test each detector with smoke or aerosol. This shows that smoke can enter the chamber to activate the device.
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Sensitivity Tests

- A specific level of smoke is needed for a proper test, use the factory calibration method to test the smoke detector sensitivity. Detectors with a sensitivity out of range should be replaced.
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Testing Flame detectors

- Flame and gas detectors should be tested per manufacturers instructions. The inspection should include the following on initial tests:
 - Date
 - Name of property
 - Address
 - Installer / company doing the service, address of that company
 - Name and address of approving agency
 - Number and type of detectors per zone
 - Functional tests of detectors
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Initial test continued

- ❑ Check of all smoke detectors
 - ❑ Loop resistance for all fixed temp line type detectors
 - ❑ Other tests as required by equipment manufacturers
 - ❑ Signature of tester
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Periodic testing

- Maintenance
 - Use manufacturers recommendations for a proper maintenance program
 - Periodic testing of Automatic fire detectors
 - Visually inspect each detector to ensure its physical condition
 - Clean detectors periodically to ensure proper operation. Follow manufacturers recommendations
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Smoke ,flame, other detectors testing

- All smokes should be visually inspected at least semi annually. This is to ensure they are in place and not blocked
 - Smoke should be tested annually
 - Smoke sensitivity should be checked within the first year after install and every alternate year after that
 - Replace or clean and recalibrate any detector out of sensitivity
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Air Duct detector testing

- ❑ Should visually inspect the devices
 - ❑ Verify response to smoke in the air stream as per manufacturer's recommendations
 - Flame detector – sensitivity is affected by dust and dirt buildup on the lenses. These should be cleaned periodically
 - ❑ All flame, gas and other fire detectors should be tested semi annually per manufacturer's recommendations
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Heat detector testing

- Non restorable type
 - After 15 years two (2) detectors out of 100 should be removed every 5 years and sent to a lab that runs testes on these devices. Replace these removed units with new ones. If failure on the tested devices occurs, remove more devices for testing
 - Restorable heat detectors
 - Test one or more on each circuit at least semi annually, each detector should be tested within 5 years
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Testing continued

- Pneumatic line type detectors
 - Test for leaks and proper operation at least semi annually
 - Non restorable line type fixed temperature detectors should be tested for alarm function at least semi annually
 - Measure loop resistance and record results
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Testing

- Fire alarm signaling systems
 - the owner is responsible for providing proper system maintenance by facility personnel or with an outside company through a maintenance program agreement. Keep records for at least one year
 - Central station systems
 - Must have two persons on duty to handle signals received
 - Provide prompt runner service
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Inspection frequency

- ❑ Repairs should be started within 4 hours of notification
 - ❑ Test of all circuits extending from the central station should be at intervals not more than 24 hours
 - Systems and devices should be tested annually EXCEPT:
 - ❑ Semiannually for water flow activated devices and valve supervisory devices (Error in textbook, quarterly is not correct for waterflow and valve supervisory switches per NFPA 72-2002)
 - ❑ Quarterly for tank water level devices, building and tank water temperature supervisory devices, and other sprinkler supervisory devices.
 - ❑ Automatic fire detection devices on the system should be inspected and tested according to NFPA72
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Testing continued

- ❑ Test water flows by use of inspector valve
 - ❑ Test circuits for grounds and opens
 - ❑ Primary power (turn off) and operate on batteries
 - ❑ Automatic fire detectors should be tested as well as alarm transmitters and supervisory switches according to their schedule
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Systems testing

- Local systems

- Periodic testing and inspections should be done. This should be done at the discretion of the person in charge of the system

- Auxiliary systems

- Test monthly to observe the condition of the devices and to see if anything on the premise has changed that would affect the system or devices
 - Monthly test the initiating devices and transmitting devices including the transmission of signals
 - Non – coded manual alarm boxes should be tested yearly per NFPA 72
 - Test engine driven generator weekly under load
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Systems testing

- Remote station and proprietary systems
 - Test operator controls at the remote station at the end of each shift
 - Annually test all automatic fire detection systems and devices except: water flow activated devices
 - Test water flow actuated devices at least every six months by flowing water thru the test valve
 - Semiannually test valve switches and tank level devices
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Remote station continued

- ❑ Test the water flow for dry pipe, deluge or pre - action systems using the bypass test valve
 - ❑ Test wet sprinkler systems by using the inspector test valve. This test will be done by running water thru an orifice, sized to the smallest sprinkler head in the system and be located in accordance with NFPA 13
 - ❑ Test engine driven generators weekly under load for ½ hour. This should be done by disconnecting the normal supply to the system. This is for generators used for the signaling system
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Emergency Voice

- Emergency voice / alarm systems
 - Annually test with phones, both functionally and operationally
 - Test all elements of the system at least annually
 - Notification appliances
 - Test every 6 months for the private operating mode
 - Identification placard
 - The placard should be located near the system control and should have the following:
 - Names and addresses of the servicing company, reference to the standard it was installed to, description and location of power, as built, battery calcs etc.
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Public fire service communications systems

■ Public fire service

- ❑ Emergency power source (other than batteries) should be operated for 1 hour a week.
- ❑ Weekly tests should be done on incoming circuits and telephone receiving equipment
- ❑ Test the dispatch circuit instruments every 24 hours manually
- ❑ Test power supplies every 24 hours for current, voltage between ground and circuits, voltage across batteries
- ❑ Coded radio boxes should transmit a test signal every 24 hours

■ Records

- ❑ Should be kept by the municipality including dates and times
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Multiplex systems

- Multiplex systems and circuits style
 - Test communication between the CPU and the Central supervising station devices
 - Test initiating devices and circuits when a style of circuit requires alarm signaling in the presence of a fault
 - Test circuits to ensure the signal gets through
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Chapter 13

Fire Alarm Signaling Systems

Public Fire Service Communication
Systems

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- This chapter covers the installation, maintenance and use of a public fire service communication system, including the facility it is in, the communication center operation and transmitting of alarms
 - Public service communication systems include:
 - Public reporting
 - Dispatching
 - Telephone
 - Two way radio
 - Microwave
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Chapter 13

- The previous page list covers two functions
 - Receipt of alarms
 - Retransmission of these alarms to the proper agency (fire dept)
 - A public fire service center is a building that houses the central operating portion of the fire alarm system. The receiving and transmitting equipment is usually housed here.
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Chapter 13

- **Communications Centers**
 - ❑ Should be protected from fire
 - ❑ Openings should be protected and secure
 - ❑ Entry should be restricted
 - ❑ Provided with proper heat and air conditioning
have proper fire extinguishers
 - ❑ Have emergency lighting
 - ❑ Have two sources of power
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Chapter 13

- Operation of the communication center
 - Commercial telephone facilities
 - Most commonly used method of reporting a fire
 - Good means of communication
 - Municipal fire alarm systems
 - These fire alarms must provide a means to get an alarm from a street box alarm to the communications center
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Chapter 13

- There are two types of reporting systems
 - Type A
 - Alarm is received and retransmitted manually or automatically
 - Usually permitted in any size municipality
 - Type B
 - Alarm automatically transmitted to fire stations and possibly to outside alerting devices
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Chapter 13

- Dispatch circuits and equipment
 - This is the circuit used by the dispatcher to notify the fire dept
 - Two separate means should be provided (only one is necessary if fewer than 600 alarms are received in a year)
 - Each alarm should have the date and time automatically recorded
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Chapter 13

- CAD – computer aided dispatch
 - Process by which a computer is used to provide dispatch data to the fire department
 - Should not use this computer for other functions
 - Three classes of CAD
 - Class 1 – computer technology selects and dispatches fire service personnel
 - Class 2 – used to support dispatch operation to voice or graph type dispatch systems
 - Class3 – supports fire dispatching with status and logging information
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Chapter 14

Code Requirements

Code Requirements

- This chapter will cover several requirements contained in codes and standards
 - Testing labs – it is important that equipment used in a fire alarm system be listed by an independent agency for its appropriate use
 - A sample of each component is tested
 - Two such agencies that test products are:
 - FM - Factory Mutual
 - UL - Underwriters Laboratories
 - Local occupancy code will specify the type of system required (Michigan Building Code statewide in Michigan)
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Code Requirements

- NFPA
 - National Fire Protection Association develops fire safety codes and standards
 - Model Building codes are developed by:
 - BOCA-Building Officials and Code Administrators
 - ICBO- International Conference of Building Officials
 - SBCCI-Southern Building Code Congress International
 - These organizations have worked together to form the International Code Council (ICC)
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Code Requirements

- Code Requirements for fire alarm systems generally define :
 - ❑ Occupancy descriptions and classifications
 - ❑ Locations for smoke detectors
 - ❑ Function of the fire alarm system and emergency communication system (if an emergency system is determined necessary for the occupancy protected)
 - ❑ Operation of the voice/alarm function of a system
 - ❑ Provision for a fire dept communication system
 - ❑ Components of the fire command station
 - ❑ Emergency power requirements
 - ❑ Manual fire alarm station location and use
 - ❑ Exit door unlocking components
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Use Group definitions

- **USE GROUP B, Business**

- Business are defined to include all buildings and structures or parts there of that are used for the transaction of business, the rendering of professional services, or other services that involve stocks or goods. Business also include offices, banks, outpatient clinics, and telephone exchanges
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Use Group definitions

- USE GROUP R1, Residential and Hotel Occupancies
 - Defined to include all hotel, motel and dorms, that are arranged for shelter and sleeping accommodations of more than 20 persons
 - USE GROUP R2, Residential Multi family occupancies
 - Defined to include all multi family dwellings having more than two dwelling units. This also includes dorms, boarding and lodging houses that are arranged for shelter of more than 5 but not more than 20 persons
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Fire Alarm Code requirements

- Smoke Detection Systems – an approved smoke detection system may be required in certain occupancies such as high rise buildings, to cover:
 - Boiler and furnace rooms
 - Return air duct of HVAC systems serving floors other than the floor on which the HVAC equipment is located
 - Corridor areas
 - Elevator Lobby areas
 - Elevator penthouses
 - Other areas deemed necessary
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Fire Alarm Code requirements

- The detection system must be designed to activate the voice / alarm system on a selective basis
 - In use group R1 and R2 occupancies an approved single station smoke detector must be installed in each room and residential dwelling
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Emergency voice/alarm communication system (EVACS)

■ VOICE/ALARM Systems

- Voice alarm systems are generally required in buildings where the fire emergency plan does not contemplate the immediate evacuation of all occupants
 - The voice / alarm system must provide a predetermined message on a selective basis to the area where the alarm originated
 - The message must also provide information and give directions to the occupants
 - The alarm must be heard clearly by all hearing able occupants
 - Voice/alarm system controls must be located within the fire station and operated from that station
 - Installation wiring must be supervised for opens, shorts and grounds
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Fire Department Communications System

- **FIRE DEPARTMENT COMMUNICATION SYSTEM**
 - A two way fire department communication system must be provided for fire department use. This system must operate between the fire command station and every elevator, elevator lobby and entry – enclosed exit stairway



Fire Department Communications System

- FIRE COMMAND STATION
 - A fire command station for fire dept operations must be provided in a location approved by the fire dept. The command station must have the following components:
 - Voice alarm system panel
 - Fire dept communication panel
 - Fire detection and alarm system annunciation
 - Status indicators for elevators
 - Status indicators and controls for air handling controls and to unlock doors
 - Sprinkler valve and water flow display panels
 - Status indicators for emergency power
 - Telephone for fire dept use (must have controlled access to the public telephone system)
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Manual Fire Alarm Stations

- **MANUAL FIRE ALARM STATIONS**
 - Manual fire alarm stations must be provided and used only for fire protective signaling purposes. These stations must be provided in the path of escape near the exit from each area of the occupancy protected. Additional manual fire stations must be located within 200 feet (61 m) from any point in the protected building.
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Door locking system interface requirements

- DOORS

- All exit stairway doors that are locked from the stairway side must have an approved lockset. This lockset must be able to be unlocked from the fire command center by the operator and unlocked automatically upon activation of the fire alarm system. The locks must be fail safe so in an event of a power failure, they will automatically open.
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NFPA CODES AND STANDARDS

- NFPA 70 – National Electrical Code - Wiring requirements for fire alarm signaling systems
 - NFPA 72 - National Fire Alarm Code – Installation requirements for fire alarm signaling systems
 - NFPA 101 – Life Safety Code – Occupancy based fire alarm requirements, used by the State of Michigan Bureau of Fire Services
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NFPA CODES AND STANDARDS

- NFPA 110 – Standard for Emergency and Standby Power Systems - Installation and performance of emergency generator equipment
 - NFPA 1221 - Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems - Municipal fire alarm and communication systems
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BFAAM Apprenticeship Program

Reading assignments for Module 7 – Fire Alarm Signaling Systems

Reading material associated with this
module: Chapters 15 & 17 of Fire Alarm
Signaling Systems, Third Edition; or Chapters
18 & 20 of the Fourth Edition
