BFAAM Apprenticeship Program

Period 2

Related Training Instruction (RTI)

Module 1 – NFPA 72 - Fundamentals

Reading material associated with this module: Chapters 1, 2, 3, 7, 10 & 12 of NFPA 72, *National Fire Alarm Code,* 2013 edition

NFPA 72
National Fire Alarm Code
2013 Edition
Fundamentals

NFPA 72 Editions

- 2013 - Referenced by the 2015 Michigan Building Code
- 2019 - Current edition
- Many AHJ's accept the use of the current edition requirements, but legally only the referenced edition can be enforced

NFPA 72-2013 Structure

- Chapter 1 - Administration
- Chapter 2 - Referenced Publications
- Chapter 3 - Definitions
- Chapter 7 – Documentation
- Chapter 10 - Fundamentals
- Chapter 12 – Circuits and Pathways
- Chapter 14 – Inspection, Testing & Maintenance

NFPA 72-2013 Structure

- Chapter 17 – Initiating Devices
- Chapter 18 – Notification Appliances
- Chapter 21 – Emergency Control Functions
- Chapter 10 - Inspection/Test/Maintenance
- Chapter 23 – Protected Premises Systems
- Chapter 24 – Emergency Communications Systems
- Chapter 26 – Supervising Station Systems

NFPA 72-2013 Structure

- Chapter 27 – Public Emergency Alarm Reporting Systems
- Chapter 29 – Single and Multiple Station Alarms and Household Fire Alarm Systems

NFPA 72-2013 Structure

- Chapters 1, 2 & 3 apply to the entire code
- Chapters 10 - 27 apply to fire alarm systems generally, Chapter 7 applies where referenced by Chapter 10
- Chapter 29 applies only to household equipment and systems, and the requirements of chapters 7 - 27 apply only where referenced in Chapter 29

10.1.2

Chapter 1 - Administration

- Defines minimum level of performance, but does not limit methods of achieving required performance
- Shall not be interpreted to require a level of fire protection greater than required by the applicable building or fire code
- * Indicates explanatory material in Annex A
- | Indicates revised language

1.2.3, 1.2.4

Chapter 1 - Administration

- Not intended to be retroactive to existing systems unless the authority having jurisdiction determines the existing situation involves a distinct hazard to life or property

Chapter 2 - Referenced Publications

- Chapter 2 documents the specific edition for referenced NFPA, ANSI and other publications

Chapter 3 - Definitions

- Chapter 3 contains definitions for terms used throughout the document
- Terms that are not defined shall use the ordinarily accepted meanings, as defined by *Merriam-Webster's Collegiate Dictionary, 11th edition* as referenced in Chapter 2 - Referenced Publications

3.1

Chapter 7 - Documentation

- AHJ shall be notified of installation or alteration of equipment or wiring, and provided with:
  - Written narrative with system intent and description
  - Shop drawings including floor plan layout and riser diagram
  - Input/Output matrix
  - Equipment data sheets

10.20.2, 7.2.1

Documentation continued

- Battery calculations
- Voltage drop calculations for notification appliance circuits

7.2.1

Chapter 7 - Documentation

- Completed systems require:
  - Completed record of inspection and testing
  - Completed record of completion
  - Copy of site specific software, where applicable
  - Manufacturers operation and maintenance instructions
  - Record (as-built) drawings

Record of Completion

- Record of completion, with installer certification of compliance, service contractor certification of compliance, central station certification of compliance, and property owner and AHJ acknowledgements

7.2.1

Chapter 7 - Documentation

- Complete record of tests shall be kept until next test, plus one year 7.7.1.1
- Records may be archived by any means if hard copies can be provided promptly upon request 7.7.1.2
- Supervising station records must be maintained for not less than 1 year 7.7.1.3

Chapter 10 - Fundamentals

- Equipment shall be listed for the purpose, and installed per manufacturers instructions

  10.3.1

- System design shall be performed by qualified persons, and identified on the documents

  10.5.1.1, .3

- System installation personnel shall be qualified, or supervised by qualified personnel

  10.5.2.1

Chapter 10 - Fundamentals

- All detection devices that receive their power from the initiating device circuit or signaling line circuit of a control unit shall be listed for use with the control unit

10.3.3

Chapter 10 - Fundamentals

- Equipment designed and installed for environments not exceeding:
  - At 85% and 100% of the nameplate primary and secondary input voltages
  - Temperatures of 32° F and 120° F
  - Relative humidity of 85% at 86° F

10.3.5

Chapter 10 - Fundamentals

- In areas not continuously occupied, smoke detectors required at:
  - Fire Alarm Control Unit(s)
  - Notification Appliance Power Supplies
  - Supervising Station transmitting equipment
- Exceptions:
  - Where ambient conditions prohibit use of smoke detectors, heat detectors OK

10.4.4

Chapter 10 - Fundamentals

- Inspections shall be performed by competent personnel 10.5.3.1
- Testing personnel shall be experienced and knowledgeable of testing requirements 10.5.3.2
- Service personnel shall be qualified in the maintenance and service of systems 10.5.3.3
- Supervising station operators shall demonstrate competence 10.5.4

Chapter 10 - Fundamentals

- Two independent power supplies shall be provided, primary and secondary 10.6.3.2

- A uninterruptable power supply (UPS) can be provided instead. It must be configured in accordance with NFPA 111 as a Type O (no interruption in power), Class 24 (minimum operating time in hours), Level 1 (life safety) system 10.6.4

Chapter 10 - Fundamentals

- The branch circuit supplying the fire alarm equipment shall supply no other loads, and shall be supplied by one of the following:
  - Commercial light and power
  - Engine driven generator with trained operator
  - Combination of above when arranged for cogeneration, with a trained person on duty at all times

10.6.5.1

Primary Power

- Disconnect means shall be permanently marked at the control unit 10.6.5.2.1
- Circuit disconnect to have red marking, be accessible only to authorized persons and identified as "FIRE ALARM" 10.6.5.2.2, .3, .4
- The circuit and connections shall be mechanically protected against damage 10.6.5.3

Primary Power

- Where a circuit breaker is used, a breaker lock shall be provided 10.6.5.4
- Overcurrent protection shall be provided on each ungrounded conductor 10.6.5.5

Secondary Power

- Separate requirements for protected premises systems and supervising stations
- Secondary power shall be provided to a protected premises system within 10 seconds of failure of primary power 10.6.6.1
- Secondary power shall be provided to a supervising station within 60 seconds of failure of primary power 10.6.6.2

Continuity of Power Supplies

- Required signals shall not be lost or delayed more than 10 seconds by a primary power supply failure

10.6.6.3

- Storage batteries or a UPS configured per NFPA 111 shall be permitted, to ensure proper operation during transfer to secondary power

10.6.6.3.1

Secondary Power

- When a UPS is used, a means of disconnecting the input and output of the UPS while maintaining continuity of power is required (bypass switch) 10.6.6.3.2
- Secondary power shall have capacity to operate the system in a non-alarm condition for 24 hours, then operate in alarm condition for 5 minutes 10.6.7.2.1

Secondary Power

- When an emergency voice alarm communications system or mass notification system is used, the secondary power shall be capable of operating the system in alarm condition for a period of 15 minutes (instead of 5) at maximum connected load 10.6.7.2.1

Secondary Power

- Protected Premises secondary power shall be one of the following:
  - Storage battery
  - Automatic start generator configured for 24 hours of operation and configured in accordance with NEC Article 700, plus batteries with 4 hours of capacity

10.6.7.3.1

Secondary Power

- Supervising Station secondary power shall be one of the following:
  - Storage batteries
  - Automatic start generator configured for 24 hours of operation and configured in accordance with NEC Article 701, plus batteries with 4 hours of capacity
  - Multiple generators, at least one arranged for automatic start

10.6.7.4.1

Remote Power Supplies

- Power supply requirements also apply to control equipment and power supplies located remotely from the main control unit (such as strobe power supplies and remote transponders) 10.6.8.1
- Remote power supplies shall have their locations identified at the main control unit (identification on the display OK) 10.6.8.2, .3

Monitoring Integrity of Power Supplies

- All primary and secondary power supplies shall be monitored for the presence of voltage at the point of connection to the system. Failure of either supply shall result in a trouble signal

10.6.9.1

Monitoring Integrity of Power Supplies

- Supervising station systems shall delay transmission of primary power failure for 60 to 180 minutes

10.6.9.3

- Power supervisory devices shall be arranged so as to not impair the receipt of fire alarm or supervisory signals

10.6.9.4

Storage Batteries

- Batteries shall be permanently marked with date of manufacture in a month/year format 10.6.10.1
- Batteries not located in or next to the FACP shall have their location permanently identified at the FACP 10.6.10.2.5
- Battery chargers shall be capable of fully recharging a battery within 48 hours 10.6.10.3.2

Storage Batteries

- Batteries shall be protected against excessive load current by overcurrent devices 10.6.10.4.1
- Batteries shall be protected against excessive charging current by overcurrent devices or automatic current limiting design 10.6.10.4.2
- Battery chargers shall be supervised to detect a failure of battery charging 10.6.10.6.2

Generators

- Generators provided as a primary supply shall be installed in an approved manner 10.6.11.2.1
- Generators provided as a secondary supply for a FACP shall comply with NFPA 110 requirements for a Type 10 (starts in 10 seconds), Class 24 (24 hours of fuel), Level 1 (Life Safety) system, and shall be installed per NEC Article 700

10.6.11.3.1.1, .2

Generators

- Generators provided as a secondary supply for a supervising station shall comply with NFPA 110 requirements for a Type 60 (starts within 60 seconds), Class 24 (24 hours of fuel), Level 2 (less critical to human safety) system, and shall be installed per NEC Article 701

10.6.11.3.2.1

Generators

- Manual starting generators provided as a secondary supply for a supervising station shall comply with NFPA 110 requirements for a Type M, Class 24, Level 2 system, and shall be installed per NEC Article 702

10.6.11.3.2.3

Generators

- A separate storage battery and separate automatic charger shall be provided for starting the automatic engine driven generator and shall not be used for any other purpose

10.6.11.7

Signal Priority

- Fire alarm signals take priority over all other signals
- Mass notification signals are permitted to take priority over fire alarms per Chapter 24
- Carbon monoxide signals take priority over supervisory and trouble signals
- Pre-alarm signals take priority over supervisory and trouble signals

Signal Priority

- Hold up alarms or other life threatening signals take priority over supervisory and trouble signal where acceptable to the AHJ
- Supervisory signals take priority over trouble signals

Distinctive Signals

- Audible alarm devices for a fire alarm system shall be distinctive sounds from similar appliances in the same area that are not part of the fire alarm system
- Same requirement for carbon monoxide systems
- Control unit sounder is permitted to use the same sound for different conditions if a visible indicator indicates the condition

Alarm Signals

- Notification appliance activation at the protected premises shall occur within 10 seconds of the activation of the initiating device
- The audible and visible alarm signal at the control unit only, shall reactivate every 24 hours until alarm condition is restored to normal

Alarm Signal Deactivation

- Both audible and visible notification appliances shall be simultaneously deactivated (can't silence audibles and keep visuals active)
- Means shall be key operated or within locked enclosure, or equivalent
- Visible indicator shall be provided

10.13

Alarm Signal Reactivation

- Subsequent activation of devices on other initiating device circuits, or other addressable initiating devices shall reactivate the notification appliances
  - Exception: Addressable devices in the same room or space not required to cause reactivation
- A means that is left in the off position when there is no alarm shall sound an audible trouble signal until restored to normal

10.13.5

Supervisory Signals

- Permitted to be either self-restoring or latching
- Visible and audible indication of activation required at the following:
  - Local control panel for local systems
  - Fire Command Center for EVACS
  - Supervising station for supervising station systems

Supervisory Signals

- Restoration required to be indicated within 90 seconds of device restoration or system reset for latching signals
- Visible indication of restoration required at the same locations activation indication required

10.14.2

Supervisory Signal Reactivation

- The audible and visible alarm signal at the control unit only, shall reactivate every 24 hours until the supervisory condition is restored to normal

10.14.6

Supervisory Signal Deactivation

- Deactivation of supervisory signals is permitted
- Subsequent activation of supervisory devices in other building zones shall reactivate the notification appliances
- A means that is left in the off position when there is no supervisory alarm shall sound an audible trouble signal until restored to normal

10.14.7

Trouble Signals

- Trouble signals shall be indicated within 200 seconds by distinctive audible and visible signals, and visual indication of their restoration to normal, at:
  - Fire alarm control unit for protected premises
  - Fire Command Center for EVAC systems
  - Supervising station location for supervising station systems installed in compliance with Chapter 26

10.15.7

Trouble Signals

- Visible and audible indication of restoration to normal required for Proprietary Supervising Station Systems, all others only require visible indication of restoration

10.15.8

Supervisory/Trouble Signal Deactivation

- Means shall be key operated or within locked enclosure, or equivalent
- Indication shall be transferred to visible indicator
- Visible indicator shall persist as long as condition is active
- Resound required for additional supervisory signals, 24 hrs for trouble

10.15.10

Emergency Control Function Status Indicators

- All controls provided to override any automatic fire safety control function shall provide visible indication of the status of the circuits, and shall reflect the actual status of the associated equipment or function

10.16

NAC and Control Circuits

- An open, ground, or short circuit fault on the installation conductors of one alarm notification appliance circuit shall not affect the operation of any other alarm notification circuit (Keep in mind when using NAC extender panels...) 10.17.1
- Notification appliance circuits that do not have notification appliances directly connected are control circuits 10.17.2

NAC and Control Circuits

- Control circuits are not required to comply with 10.17.1 provided that the circuit is monitored for integrity, and a fault in the installation conductors results in a trouble signal 10.17.3

Alarm Annunciation

- All required annunciation means shall be readily accessible to responding personnel
- All required annunciation means shall be located as required by the AHJ to facilitate an efficient response to the situation

10.18.3

Monitoring Integrity for EVACS

- Failure of an audio amplifier shall result in a trouble signal if:
  - AC power is on, or 10.19.1.1
  - if AC power is off, only when an alarm is present 10.19.1.2
- Failure of tone generating equipment shall result in a trouble signal, unless it is enclosed as an integral part and serves only a single, listed loudspeaker (self amplified speaker) 10.19.1.3

Two Way Telephone Circuits

- Firefighter phone circuits shall be monitored for open circuit faults and short circuit faults
- An open or short circuit fault shall cause a trouble signal

10.19.2

Impairments

- System owner shall be notified when the fire alarm system or any part is impaired
- System owner shall maintain a record of impairments for one year after correction
- Mitigating measures acceptable to the AHJ must be implemented
- System owner shall be notified when impairment is resolved

Chapter 12 - Circuits and Pathways

- All wiring, cabling and equipment installation shall be in compliance with NFPA 70 - National Electrical Code

12.2.4

Chapter 12 - Circuits and Pathways – Ground Faults

- All fire alarm systems shall test free of grounds
- Operational capability shall be maintained with the presence of a single ground fault

12.2.5

Chapter 12 - Circuits and Pathway Designations

- Pathways shall be designated as Class A, Class B, Class C, Class D, Class E or Class X based on their performance

12.3

Chapter 12 - Circuits and Pathway - Class A

- Includes a redundant path
- Works with a single open circuit fault
- Conditions that affect the intended operation are annunciated as a trouble signal
- Works with a single ground fault
- Open circuits and ground faults create a trouble signal

12.3.1

Chapter 12 - Circuits and Pathway - Class B

- Does not include a redundant path
- Works up to the point of a single open
- Conditions that affect the intended operation are annunciated as a trouble signal
- Works with a single ground fault
- Open circuits and ground faults create a trouble signal

12.3.2

Chapter 12 - Circuits and Pathway - Class C

- Includes one or more pathways where operational capability is verified by end to end communication, but individual paths are not monitored
- A loss of end to end communication is annunciated
- (Typical of Computer IP based communications)

Chapter 12 - Circuits and Pathway - Class D

- Fail safe operation where no fault is annunciated but the intended operation is performed in the event of pathway failure
- (Typical of Door hold open circuits, where the doors close on loss of power. A short circuit or open circuit results in the door closure)

12.3.4

Chapter 12 - Circuits and Pathway - Class E

- Pathways with no monitoring for integrity are designated as Class E

12.3.5

Chapter 12 - Circuits and Pathway - Class X

- Includes a redundant path
- Works with a single open circuit fault
- Works with a single short circuit fault
- Works with a single ground fault
- Conditions that affect the intended operation of the path are annunciated as a trouble
- An open circuit, short circuit, or ground fault condition creates a trouble signal

12.3.6

Chapter 12 - Circuits and Pathway - Class A, X

- Installed so that the outgoing and return conductors are routed separately. Permitted in the same raceway or cable only when:
  - Within 10’ when entering an initiating device, notification appliance or control unit
  - For single raceway drops to individual devices or appliances
  - For single raceway drops to multiple devices or appliances in a single room not exceeding 1,000 square feet

12.3.7

Chapter 12 – Pathway Survivability Levels

- Level 0 – No provisions for survivability
- Level 1 – Cables and conductors installed in raceway in a fully sprinklered building
- Level 2 – Two hour rated cable or electrical system, or installed in a two hour rated enclosure or protected area
- Level 3 – A Level 2 installation in a fully sprinklered building

Chapter 12 - Circuits and Pathways

- All means of interconnecting equipment, devices, appliances and wiring connections shall be monitored for integrity so that the occurrence of a single open or a single ground fault condition shall create a trouble signal within 200 seconds
- Restoration to normal shall be indicated within 200 seconds

12.6.1, .2

Chapter 12 - Circuits and Pathways

- Exceptions to monitoring for integrity are:
  - Shorts between conductors, except for telephone circuits and notification appliance circuits 12.6.3
  - NAC installed in the same room as the control panel, if in raceway or equivalent protection 12.6.6
  - Trouble notification appliance circuit 12.6.7
  - Interconnection between equipment in a common enclosure 12.6.8

Chapter 12 - Circuits and Pathways

- Exceptions to monitoring for integrity are:
  - Interconnections between enclosures within 20’ of each other, with conductors in conduit 12.6.9
  - Conductors for ground fault detection where a single ground fault does not prevent normal system operation 12.6.10
  - Central station notification appliances within the central station 12.6.11
  - Computer keyboard, monitor, mouse or touch screen wiring less than 8’ in length 12.6.13

Chapter 12 - Circuits and Pathways

- A short circuit fault on any NAC shall result in a trouble signal (except for prior exceptions)

12.6.16

BFAAM Apprenticeship Program

Period 2
Reading Assignment for
Module 2 – NFPA 72 – Initiating Devices
Reading material associated with this module: Chapter 17 of NFPA 72, *National Fire Alarm Code,* 2013 edition