BURGLAR & FIRE ALARM ASSOCIATION OF MICHIGAN

ESTABLISHED 1981

APPRENTICESHIP PROGRAM

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Period 1
Related Training Instruction (RTI)
Module 7 – Fire Alarm Signaling Systems

Reading material associated with this module:
Chapters 18 and 20
Fire Alarm Signaling Systems, Fourth Edition 2010

Chapter 18 – Basic Fire Alarm System Plans Review

- Plan review is typically conducted by governmental jurisdiction(s) or their agent(s), and may also be performed by the electrical contractor, general contractor, and architect/engineer on construction projects. Plan review may also be completed by the owner or their representative when contracting directly with the owner.
- The purpose of plan review is to verify compliance with applicable codes and project specifications, as well as allow coordination with other systems and equipment.
- Providing complete and correct information as required on documents submitted for review (submittals) is the first step in a successful submittal process.
- The building code is generally the code document that determines what the fire alarm system requirements are, and this is based on the “occupancy classification” of the building or area of the project.

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- The size of the space involved can affect the fire alarm requirements, so it is important for the plan reviewer to be able to readily determine the dimensions, including height, of the building shown on the drawings. The best method to provide this information is with the use of “scale” drawings, typically at a minimum scale of 1/8”=1’-0”.
- All structural features such as walls, doors, and windows should be shown on the drawings, and any non-structural items (such as moveable partitions) that may impact smoke movement or the visibility and audibility of notification appliances, should also be shown and noted on the drawings.

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- Ceiling heights can be indicated either by notation or with a cross-sectional view of the space. Cross-sectional views are preferred when there is a change in elevation within the space.
- Reflected ceiling plans, showing the location of all items on the ceiling, are useful in determining the proper number and spacing of heat and smoke detectors.
- Where duct smoke detectors are provided, the plans should indicate the location of the air handling unit (furnace or air conditioner) with which they are associated as well as the CFM of the unit.
- HVAC supply and return diffusers and ceiling fans should be shown in areas where ceiling smoke detectors are used, as the air movement could affect the operation of the smoke detectors.

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- All fire alarm devices proposed for the project should be shown on the submittal drawings. This makes it easier for the plan reviewer to determine if the requirements of the codes and specifications will be met by the proposed quantity and layout of equipment.
- All interconnecting wiring for fire alarm devices proposed for the project should be shown on the submittal drawings. This allows review that a sufficient number of circuits have been provided and becomes the basis for supporting the wire lengths shown in the voltage drop calculations.

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- The plan review submittal typically consists of drawings, manufacturer data sheets, and supporting calculations.
- The drawings should include *plan views*, indicating the building layout, fire alarm components and interconnecting wiring, a *riser diagram*, which is a two-dimensional drawing that illustrates the connections between components of the system, a *line diagram* showing the devices and interconnecting wiring to the control unit, and *detail* drawings.
- *Data sheets* should be provided for each fire alarm component including control equipment, field power supplies, initiating devices, and notification appliances. The data sheets are typically provided by the equipment manufacturer and reflect the conditions for which the product is listed (such as occupancy and environmental limitations).

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- A *written narrative* providing intent and system description:
  - The narrative provides a description of the work to be performed (scope of work) and a basis for the system design which indicates the applicable codes and standards and how they will be met.
  - It is also desirable to indicate by whose direction the work is being done, such as “at owner’s request”, “per specifications”, etc.
- *Supporting calculations* include standby battery calculations, voltage drop calculations, and the sequence of operations
- The submittal documents should include information identifying the parties involved, the occupancy classification of the building, and the building address. This information can be on either the drawings or supporting documentation, or both

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- General drawing information:
  - All sheets should be of the same size.
  - Drawings to provide a graphic representation of the scale.
  - A compass point reference shown to simplify plan review comments or questions.
  - Drawing number, revision, and date on each drawing.
  - Name and address of project, installing contractor, and building owner.
  - NICET certification number and/or contractor license number.
  - Device legend and symbols in accordance with NFPA 170 *Standard for Fire Safety and Emergency Symbols*.
  - Uniform scale (1/8” = 1’-0” typically).
  - A “Key Plan” if the size of the building exceeds what can be shown on one page. This identifies which area of the overall building is being depicted.

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- *Plan view* drawings should include:
  - Identification of room names, room numbers and occupancy (a room used for a private office has different fire alarm requirements than a conference room).
  - Location of all fire alarm equipment and devices including:
    - Document box.
    - Location of control unit(s), emergency standby power cabinet if applicable, annunciator(s), power booster panels, and transmitting equipment.
    - Detection and notification devices and appliances including temperature ratings and candela ratings, as applicable.
    - Ancillary devices (door holders, door closers, fan shutdown, smoke dampers, shunt trips, etc.).
    - Fire sprinkler risers, waterflow switches, tamper switches, fire pumps, fire pump controllers, water level and temperature switches, and room temperature switches.

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- *Plan view* drawings should include:
  - Location of HVAC supply and return registers and ceiling fans (when smoke or heat detectors are used).
  - Location of all primary power sources, panel numbers, and breaker numbers for all pieces of equipment.
  - All partitions extending to within 15 percent of the ceiling height, where applicable and known.
  - Wire legend to identify line types, colors or notations to identify different wire sizes and types. Point to point wiring paths indicating number and size of conductors and wire type.

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- *Plan view* drawings should include:
  - Ceiling height and type of construction (can play a role in both automatic detection and notification appliance performance).
  - Full height cross-section of building (may be shown on a separate sheet).
  - Placement of all initiating devices, including mounting heights for wall mount devices. Addresses should be shown for addressable devices, and the circuit/sequence number shown for conventional devices. Temperature ratings for heat detectors should be shown.
  - Placement of all notification appliances, including mounting heights for wall mount devices. Addresses should be shown for addressable devices, and the circuit/sequence number shown for conventional devices. Strobe candela and speaker wattage should be shown.

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- *Plan view* drawings should include:
  - Placement of all interface and fire safety devices should be shown, such as AHU and damper interface relays, door holders, stair pressurization, and access control system interfaces.
  - If the building has fire or smoke barriers, these should be shown, as wiring zones must coincide with smoke and fire zones.

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- *Riser* drawings should include:
  - All devices on the system.
  - Riser should be specific for the submittal (not typical) showing the devices in the same order on each circuit as shown on the plan view.
  - Each device address (or circuit/sequence for zoned systems) and room number or name should be shown as well.
  - Wiring from each circuit or loop back to the control equipment.
  - Device symbols and wire legend should correspond to plan views.
  - NFPA 170 provides standard fire alarm symbols.

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- *Detail* drawings should include:
  - Typical wiring connections to each device.
  - Device setup details, such as setting strobe candela output, speaker wattage taps, device addressing and horn audibility levels.

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- *Data Sheets* should include:
  - Table of contents (each section should be tabbed):
    - Control equipment (make sure the listing is not only for residential use if the project is for commercial use), power supplies, and annunciators.
    - Initiating devices.
    - Audible and visual notification appliances.
    - System components, modules, and relays.
    - Compatibility listings (matrix, table, or information showing device compatibility).
    - Operating instructions for the entire system.
    - Manufacturers' inspection instructions.

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- *Supporting Calculations* should include:
  - Battery size calculations showing total current load in standby mode x standby time, plus total current load in alarm mode x alarm time, plus a correction factor of 1.25 to calculate minimum battery size.
  - Actual battery size larger than minimum.
  - Voltage drop calculations, either point to point or end load, showing the current load for all notification appliances on a circuit, the length of wire on the circuit, wire size, and total voltage drop. Voltage at the last device should exceed the minimum operating voltage for that device.

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- *Fire Alarm System Narrative* should include:
  - Scope of work.
  - Type of system.
  - Interface with other fire protection systems.
  - Sequence of Operations, in either a narrative format or a matrix, showing which system outputs are activated for each type of system input activated.
  - Testing criteria.

Chapter 20 – Fire Warning Equipment for Dwellings

- The primary function of fire warning equipment for dwelling units is to notify the occupants of the need to evacuate before their escape is prevented by fire conditions (smoke/heat/flames) in the normal path of exit.
- Early detection (smoke detection) is the basis for providing adequate occupant notification.
- The performance of fire warning equipment for dwelling units is provided in NFPA 72, Chapter 29 and depends on such equipment being properly selected, installed, operated, tested, and maintained in accordance with the provisions of the code and the manufacturers' instructions.

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- *Smoke alarms* are defined as devices responsive to smoke including a sensor, control components, and an alarm notification appliance in one unit operated from a power source either in the unit or obtained at the point of installation.
- *Smoke detectors* do not have internal notification appliances and are typically powered from a remote source (typically a fire alarm control panel). Smoke detectors connect to a control panel which activates notification appliances and may include off site monitoring.
- Smoke alarms are referred to as single-station smoke alarms. When interconnected so that all sound when one activates, they are referred to as multiple-station smoke alarms.
- Dwellings may also utilize systems consisting of a household fire alarm system, to which are connected individual initiating devices and notification appliances. Such systems may also include burglar alarm, panic, medical emergency, carbon monoxide, flood, freezing, or other monitoring functions.

Chapter 20 – Fire Warning Equipment for Dwellings

- The current Michigan Residential Building Code requires smoke alarms to be located:
  - In each sleeping room.
  - Outside each separate sleeping area in the immediate vicinity of the bedrooms.
  - On each additional story of the dwelling, including basements and habitable attics, but not including crawl spaces and uninhabitable attics.
  - In dwellings or dwelling units with split levels, and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

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- The current Michigan Residential Building Code requires the following for smoke alarms installed near cooking appliances:
  - Ionization smoke alarms shall not be installed less than 20 feet horizontally from a permanently installed cooking appliance.
  - Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet horizontally from a permanently installed cooking appliance.
  - Photoelectric smoke alarms shall not be installed less than 6 feet horizontally from a permanently installed cooking appliance.

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- The current Michigan Residential Building Code requires that the smoke alarms are powered as follows:
  - Primary power shall be provided from the building wiring where served from a commercial source and, where primary power is interrupted, shall receive power from a battery.
  - Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.
  - Smoke alarms shall be permitted to be battery powered where installed in buildings without commercial power.

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- Smoke alarms in rooms with sloped ceilings should be installed at the high side.
- They should be installed on the ceiling where practical.
- Where installed in the basement, they should be near the stairway.
- Where installed in the stairway, they should be at the top of the stairway.
- Where the ceiling is subject to being hot or cold, the smoke alarm should be located on the wall with the top of the device no greater than 12” from the ceiling surface.
- They should not be located within 36” of heating or air conditioning vents, or ceiling fan blade tips.
- They should not be installed within 36” horizontally from a door to a bathroom containing a shower or tub unless specifically listed for installation in close proximity to such locations.

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- Avoid locating smoke alarms in garages, where vehicle exhaust could trigger an alarm.
- Avoid locating smoke alarms on ceilings with radiant heating installed in the ceiling.
- Where more than one single station smoke alarm is provided in a dwelling unit, the current Michigan Residential Building Code require they be interconnected. Listed wireless alarms are allowed if all alarms sound upon activation of one alarm.
- In Michigan, a fire alarm system with smoke detectors and notification appliances is permitted to substitute for smoke alarms, if the same level of detection and notification is provided.
- Michigan code allows the use of combination smoke and carbon monoxide alarms in lieu of smoke alarms.

Chapter 20 – Fire Warning Equipment for Dwellings

- Manufacturers instructions for maintenance should be followed for smoke alarms and fire alarm systems.
- NFPA 72-2022 requires single and multiple station alarms and connected appliances to be tested monthly.
- NFPA 72-2022 requires household fire alarm systems to be tested annually. Permanent occupants (renters or owners) should be provided with training and information sufficient to operate, inspect, test, and maintain their own household fire alarm system. The installing contractor shall be required to provide this information in writing to the customer upon completion of the system installation.

Chapter 20 – Fire Warning Equipment for Dwellings

- NFPA 72-2022 requires sensitivity testing of smoke detectors, except for one and two-family dwellings. No sensitivity testing is required for single-station or multiple-station smoke alarms.
- Where notification appliances are provided for a fire warning system, they should produce a sound level of 15dB above the average ambient sound level or 5dB above the maximum sound level having a duration of 60 seconds or greater, or a sound level of at least 75dB, whichever is greater.
- Strobes may need to be provided where a hearing-impaired person occupies the residence. It is the responsibility of the homeowner or tenant to request strobes if needed.

END OF PERIOD 1 – MODULE 7