

# National Training School

## Fire Alarm Installation Methods

### Course Syllabus

July 1998

#### A. Course Description

This fourteen hour intensive classroom instruction, followed by a 2-hour examination, provides broad training based upon the NFPA codes as they apply to both household and commercial fire alarm systems.

#### B. Overall Outline, Objectives, & Hours

The Fire System Installation Methods Course has a total of (14) contact hours over a minimum of (2) days. Subject areas will be covered as follows:

Outline	16 Hrs.	Learning Objectives
<b>Overall Goal</b>		<p>The student shall be able to:</p> <ul style="list-style-type: none"> <li>• Identify the NFPA codes of concern to proper fire alarm installation, testing, and maintenance.</li> <li>• Identify the proper application of the most frequently used devices in a fire alarm system and their proper application.</li> <li>• Distinguish NFPA codes from personal beliefs &amp; hearsay.</li> <li>• Apply the NFPA fire alarm codes to real building applications.</li> <li>• Rank life safety above all other concerns when designing, installing, and servicing a fire alarm system.</li> </ul>
<b>0. Introduction</b>	47 min	<p>The student shall be able to:</p> <ul style="list-style-type: none"> <li>• Identify the basic safety facts everyone should determine for every building they enter.</li> <li>• Describe the class structure and what is needed to remain certified.</li> <li>• Indicate where to find definitions of words related to the fire alarm industry.</li> <li>• Identify who generally interprets the codes and standards.</li> <li>• Identify which of the following a court will recognize: recognized standards or adopted codes.</li> <li>• Describe the important point(s) of Olin's Law and what you should be prepared to answer if you are involved in a fire related court case.</li> <li>• Identify the principle purpose of a fire alarm system.</li> </ul>
<ul style="list-style-type: none"> <li>a) Instructor introduction</li> <li>b) Fire service industry associations</li> <li>c) Class structure</li> <li>d) Pre-test</li> <li>e) Alarm history</li> <li>f) Focus on life safety</li> <li>g) Reference breakdown</li> </ul>		

		<ul style="list-style-type: none"> <li>• Identify the three reasons for the failure of any life safety system.</li> <li>• Recognize that there should be written instructions, a code, or standard for everything we do or don't do.</li> <li>• Identify the most important aspects of fire alarm system planning.</li> <li>• Identify the most important aspects of fire alarm system code enforcement.</li> <li>• Identify different parts of a code reference.</li> </ul>
<b>1. Fundamentals Of Fire Alarm Systems</b>	65 min	The student shall be able to:
<ul style="list-style-type: none"> <li>a) Fire characteristics</li> <li>b) Introduction to codes &amp; standards</li> <li>c) Testing laboratory listings</li> <li>d) Types of service</li> <li>e) Types of alarm signals</li> <li>f) Nomenclature</li> </ul>		<ul style="list-style-type: none"> <li>• Identify the 4 stages of a fire.</li> <li>• Identify what conditions exist during each stage of a fire.</li> <li>• Indicate which type of detection will be activated in each stage of a fire.</li> <li>• Identify the primary influence of the color of smoke.</li> <li>• Determine who is the authority having jurisdiction.</li> <li>• Indicate the AHJ's role in fire alarm code enforcement.</li> <li>• Differentiate shall vs should as it applies to codes and standards.</li> <li>• Distinguish between a code and a standard.</li> <li>• Recognize the NFPA and UL standards that apply to fire alarm installation, testing, maintenance, and monitoring.</li> <li>• Recognize that all equipment must be listed for the purpose used and that the manufacturer's instructions are part of the listing.</li> <li>• Determine the proper occupancy for combination listed panels.</li> <li>• Distinguish between the symbol used to identify the following in the U.L Fire Protection Equipment Directory: <ul style="list-style-type: none"> <li>* local protective signaling systems</li> <li>* auxiliary protective signaling systems</li> <li>* remote station protective signaling systems</li> <li>* proprietary protective signaling systems</li> <li>* central station protective signaling systems</li> <li>* automatic detectors</li> <li>* manual devices</li> <li>* water flow devices</li> <li>* sprinkler supervisory devices</li> <li>* watchman supervisory equipment</li> </ul> </li> <li>• Differentiate between household and commercial systems.</li> </ul>

		<ul style="list-style-type: none"> <li>• Differentiate alarms signals, trouble signals, and supervisory signals.</li> <li>• Indicate examples of causes for alarm signals, trouble signals, and supervisory signals.</li> <li>• Identify where trouble signaling devices shall be located.</li> <li>• Identify some of the most common acronyms used by the NFPA codes.</li> <li>• Apply NFPA common nomenclature in solving word problems, reading drawings and reading codes.</li> <li>• Identify the common source of a fire alarm's primary power and secondary power.</li> <li>• Identify the type of devices connected to: initiating circuits, notification appliance circuits, supervisory circuits, and ancillary circuits.</li> <li>• Generalize the proper circuit wiring method of initiating circuits, notification appliance circuits, supervisory circuits, and ancillary circuits.</li> </ul>
<b>2. Household Fire Warning Equipment</b>	60 min.	In regards to household systems, the student shall be able to:
<ul style="list-style-type: none"> <li>a. What is a Household system</li> <li>b. Listings</li> <li>c. Audible Notification Devices</li> <li>d. Visual Notification Devices</li> <li>e. Primary/Secondary power supply</li> <li>f. Combination Panels</li> <li>g. Documents &amp; Manuals</li> <li>h. Automatic Detectors</li> <li>i. Wiring</li> <li>j. Testing</li> <li>k. Verification of Monitoring</li> <li>l. Alarm Signal Verification</li> </ul>		<ul style="list-style-type: none"> <li>• Define the scope of NFPA 72 chapter 2, Household systems.</li> <li>• Recognize the proper UL listing for equipment to be used in a household system.</li> <li>• Generalize what type of equipment may be substituted for required equipment and give an example of equipment substitution.</li> <li>• List the locations where an automatic detector should, shall, and shall not be installed.</li> <li>• Determine the proper spacing of smoke and heat detectors in joist construction.</li> <li>• Identify household audible notification device requirements and considerations</li> <li>• Identify why regular testing is so important with the type of notification circuit a household alarm system typically has.</li> <li>• Identify household visual notification device requirements and considerations.</li> <li>• Identify when wireless fire alarm devices/systems may be used.</li> <li>• Describe important power supply code requirements and considerations.</li> <li>• Identify when and under what conditions a combination panel may be used as part of a household fire alarm system.</li> <li>• Indicate the proper monitoring station alarm signal verification procedure for household fire alarm systems.</li> <li>• List the documents and information that must be</li> </ul>

		<p>provided the customer and where it typically can be found.</p> <ul style="list-style-type: none"> <li>• Identify the code and articles that govern wiring and installation and important wiring considerations.</li> <li>• Indicate the proper testing intervals for household systems and detectors.</li> <li>• Identify who the code indicates should do the testing of a household fire alarm system.</li> </ul>
<b>3. Protected Premises Fire Alarm Systems</b>	80 min.	The student shall be able to:
<ul style="list-style-type: none"> <li>a) Ancillary control relays</li> <li>b) Duct smoke detectors</li> <li>c) Door release service smoke detectors</li> <li>d) Elevator recall smoke detectors</li> <li>e) Door locking hardware</li> <li>f) Suppression system supervision</li> </ul>		<ul style="list-style-type: none"> <li>• Indicate the proper use of an ancillary control relay including; the proper location to install, methods of supervising, and the proper wiring methods.</li> <li>• Recognize the primary function of a duct smoke detector.</li> <li>• Indicate the appropriate building air handling equipment smoke detection requirements including the related installation requirements and codes.</li> <li>• Determine the appropriate installation methods for smoke detectors used for door release service.</li> <li>• Determine the appropriate installation methods and requirements for detectors used for elevator recall.</li> <li>• Identify fire alarm related door locking/unlocking requirements.</li> <li>• Identify fire alarm related sprinkler and other suppression system requirements.</li> <li>• Identify what type of building requires a central control station.</li> </ul>
<b>4. Supervising Stations</b>	58 Min.	The student shall be able to:
<ul style="list-style-type: none"> <li>a) Communication methods</li> <li>b) Derived channel</li> <li>c) Digital communication</li> <li>d) Central station</li> <li>e) Proprietary station</li> <li>f) Remote Station</li> <li>g) Auxiliary station</li> </ul>		<ul style="list-style-type: none"> <li>• Differentiate the many different meanings of the term "Central Station."</li> <li>• Identify when the monitoring of a fire alarm system must comply with NFPA 72, Chapter 4.</li> <li>• Identify what type of NFPA recognized supervising station is most commonly used.</li> <li>• Identify the different types of approved communication methods.</li> <li>• Identify the most common communication type used to communicate a fire alarm signal to a supervising station.</li> <li>• Describe the method of transmitting a signal via derived channel.</li> <li>• Identify the most common communication path of digital communication.</li> <li>• Identify the common acronyms used for digital communication equipment.</li> </ul>

		<ul style="list-style-type: none"> <li>• Identify the installation requirements for digital communicators.</li> <li>• Describe the digital communicator process of communicating.</li> <li>• Indicate the duties performed at a supervising station.</li> <li>• Indicate the period of time a supervising station has to respond to various signals.</li> <li>• Recognize what distinguishes a proprietary station from other supervising stations.</li> <li>• Indicate who must approve of a building fire alarm system being supervised by a remote supervising station.</li> <li>• Identify the different types of auxiliary systems.</li> <li>• Identify how to determine if emergency forces notification is required.</li> <li>• Indicate when the AHJ has to be notified of an out-of-service fire alarm system.</li> </ul>
<b>5. Initiating Devices</b>	<b>278 Min.</b>	The student shall be able to:
<ul style="list-style-type: none"> <li>a) Heat detectors</li> <li>b) Smoke detectors</li> <li>c) Duct smoke detectors</li> <li>d) Flame detectors</li> <li>e) Manual pull stations types</li> <li>f) Circuit styles/classes</li> <li>g) Smoke chamber</li> <li>h) Ceiling types</li> <li>i) Detector placement (conventional/.7 method)</li> <li>j) Potential false alarm locations &amp; conditions</li> <li>k) Side wall mounted Smoke Detectors</li> <li>l) Stratification/stack effect</li> </ul>		<ul style="list-style-type: none"> <li>• Indicate the proper use of heat detectors including the proper location, temperature rating and sources of false alarms.</li> <li>• Distinguish among the different types of heat detectors.</li> <li>• Compare 2 and 4 wire smoke detectors: including power consumption and wiring methods.</li> <li>• Indicate the process of alarm verification and why alarm verification is used.</li> <li>• Indicate the proper method of installing a duct smoke detector and indicate the main purpose of a duct smoke detector.</li> <li>• Recognize IR detector restrictions.</li> <li>• Identify the different types of manual fire alarm boxes.</li> <li>• Indicate the proper use of manual fire alarm boxes including, location and false alarm potentials.</li> <li>• Match circuit styles with circuit classes of fire alarm initiating circuits.</li> <li>• Describe the function of each style of fire alarm initiating circuits.</li> <li>• Define a smoke chamber and describe related controlling conditions/factors.</li> <li>• Determine the proper location of initiating devices using the conventional method and the .7 X method.</li> <li>• Indicate what effects obstructions such as light fixtures, ceiling fans, HVAC supply opens, etc. have on automatic initiating devices locations.</li> </ul>

- Determine automatic initiating device placement in an irregular shaped space.
- Identify a method of determining the minimum number of required detectors in a hallway.
- Describe the use of a compass to determine compliance of plans.
- Recognize that additional reduction in coverage applies to ceilings that are not smooth and flat and ceilings that are over 10' above the finished floor.
- Indicate several locations smoke detectors typically are not installed.
- Indicate the proper installation requirements and limitations for spot type smoke detectors.
- Indicate important photoelectric smoke detector beam installation requirements.
- Indicate the effect using mirrors in conjunction with a photoelectric smoke detector beam has.
- Recognize an irregular ceiling.
- Describe the effect of a high ceiling on smoke and hot air traveling to the ceiling.
- Describe what causes smoke to stratify substantially below the ceiling.
- Identify what smoke detector location change is used when stratification is expected.
- Describe and list causes of stack effect.
- Define and differentiate between a sloping ceiling, shed ceiling, and a peaked ceiling.
- Determine if a ceiling is flat, sloped, shed, peaked, or a high ceiling.
- Identify the proper location of smoke and heat detectors on a shed ceiling, peaked, and/or high ceiling.
- Determine the required locations of automatic detectors on a peaked ceiling.
- Define a solid joist ceiling.
- Determine the required locations of automatic detectors on a solid joist ceiling.
- Define a beam ceiling.
- Determine the required locations of automatic detectors on a beam ceiling.
- Indicate when a fire alarm control panel must be protected by a smoke detector. (When other types of automatic detectors are permitted to protect the fire alarm control panel).
- Indicate where fire alarm trouble signal indicators must be located.
- Identify when a fire alarm control panel must be locked.
- Indicate the proper primary power connections.
- Identify the proper power disconnect required

		labeling. <ul style="list-style-type: none"> <li>• Indicate where a manual fire alarm box must be located.</li> <li>• Identify what purposes a manual fire alarm box may have.</li> </ul>
<b>6. Notification</b>	<b>55 min.</b>	The student shall be able to:
a) Device examples b) Temporal 3 c) Notification circuit format d) Circuit styles/circuits e) EOL devices f) Sound levels g) Device mounting height h) Coded/non-coded i) Visual appliances		<ul style="list-style-type: none"> <li>• Identify several different types of common fire alarm notification appliances. Include types for each of the four senses addressed by the code.</li> <li>• Describe what temporal-three is.</li> <li>• Indicate why temporal-three is used.</li> <li>• Identify when the code changed requiring temporal-three standardized signaling.</li> <li>• Identify why alarm-signaling standardization is important.</li> <li>• Indicate where attendant signaling is used and indicate the difference between an attendant signal and pre-signal.</li> <li>• Generalize the "positive alarm sequence" signaling process.</li> <li>• Generalize the basics of a voice evacuation system.</li> <li>• Give examples of when voice evacuation systems are required.</li> <li>• Match fire alarm notification circuit styles with wiring classes.</li> <li>• Recognize drawings of each style and class of fire alarm notification circuits.</li> <li>• Identify what styles and classes of fire alarm notification circuits permit every device to function even when a single wire break exists in the circuit or ground fault.</li> <li>• Indicate the effect of using different circuit styles.</li> <li>• Indicate where an EOL device goes in a fire alarm notification circuit.</li> <li>• Specify db considerations of audible fire alarm notification circuit appliances.</li> <li>• Indicate the vertical mounting location requirements of fire alarm audible and visual appliances.</li> <li>• Indicate the light intensity and the spacing requirements of fire alarm visual appliances.</li> </ul>
<b>7. Inspection, Testing, and Maintenance</b>	<b>57 min.</b>	The student shall be able to:
a) Notification prior & after testing b) Definitions c) Central Station testing		<ul style="list-style-type: none"> <li>• Identify why testing is so important.</li> <li>• Indicate what one should do prior to testing a fire alarm system.</li> <li>• Recognizing what should be done in the event a</li> </ul>

<p>requirements</p> <p>d) Maintenance and record keeping</p> <p>e) Equipment to be tested, method, and frequency</p>		<p>fire alarm signal is received at the fire alarm control panel from an area not being tested.</p> <ul style="list-style-type: none"> <li>• Differentiate between testing, inspecting, and maintenance of a fire alarm system.</li> <li>• Identify what should be done prior to terminating any conductors to a fire alarm panel.</li> <li>• Recognize what may happen if a fire alarm system has more than one ground fault at one time.</li> <li>• Identify a central station's responsibility for testing a certificated system.</li> <li>• Identify where instructions for testing a fire alarm device may be found.</li> <li>• Match fire alarm devices with testing frequency.</li> <li>• Describe how to test different types of fire alarm devices.</li> <li>• Indicate what actions should be taken upon completion of testing a fire alarm system.</li> </ul>
<p><b>8. Plans and Specifications</b></p>	<p><b>40 min.</b></p>	<p>The student shall be able to:</p>
<ul style="list-style-type: none"> <li>a. Project documentation</li> <li>b. Riser diagrams</li> <li>c. Point to point drawings</li> <li>d. Equipment manuals</li> <li>e. As built drawings</li> <li>f. Certificate of completion</li> <li>g. Floor plans</li> </ul>		<ul style="list-style-type: none"> <li>• Identify what diagrams, manuals, certificates, and drawings are normally included as part of the project documentation.</li> <li>• Describe what a riser diagram shows and includes.</li> <li>• Describe what a point to point drawings shows and includes.</li> <li>• Describe what an as built drawing shows and includes.</li> <li>• Describe what a certificate of completion includes.</li> <li>• Indicate what a floor plan is and what it includes.</li> </ul>
<p><b>9. National Electrical Code</b></p>	<p><b>55 min.</b></p>	<p>The student shall be able to:</p>
<ul style="list-style-type: none"> <li>a) NFPA 70 = NEC</li> <li>b) NEC and fire alarms</li> <li>c) Wire/cable</li> <li>d) Mounting height, penetration, air handling spaces</li> <li>e) Hazardous locations</li> <li>f) Damp/wet locations</li> <li>g) Underground cable</li> <li>h) NEC 695</li> <li>i) Building control circuits</li> <li>j) Cable and wire protection and support, identification</li> <li>k) Terminating methods</li> <li>l) Effects of temperate</li> </ul>		<ul style="list-style-type: none"> <li>• Identify the main article of the National Electrical Code that directly applies to the wiring of fire alarm systems.</li> <li>• Identify articles of the National Electrical Code that effect the wiring of fire alarm systems.</li> <li>• Recognize that fire alarm systems are required by the NEC to be installed in a neat and workmanship manner.</li> <li>• Recognize that access via suspended ceiling tiles shall not be blocked by wiring methods including fire alarm cabling.</li> <li>• Recognize what types of wires/cables are permitted to be used for fire alarm circuit field wiring.</li> <li>• Indicate whether fire alarm cables are required to</li> </ul>

<p>m) Fire alarm power requirements</p>		<p>be solid, stranded, or either.</p> <ul style="list-style-type: none"> <li>• Indicate how fire alarm junction boxes must be identified.</li> <li>• Indicate what types of cables may occupy the same conduit as fire alarm circuit wires.</li> <li>• Identify acceptable methods of fastening fire alarm devices to walls and ceilings.</li> <li>• Identify what article of the NEC addresses wiring outside between buildings.</li> <li>• Indicate what must be done to conduit and cables that penetrate a fire rated wall, floor, or ceiling.</li> <li>• Indicate when and how wiring in air handling spaces is permitted.</li> <li>• Identify hazardous wiring locations.</li> <li>• Indicate proper wiring methods in wet and corrosive environments.</li> <li>• Indicate the minimum burial depths of cables run underground.</li> <li>• Indicate fire pump wiring requirements.</li> <li>• Identify remote control signaling circuits that relate to fire alarm installation.</li> <li>• Indicate wiring circumstances where fire alarm cable must be protected.</li> <li>• Indicate wire insulation requirements.</li> <li>• Indicate wire/cable support and spacing requirements.</li> <li>• Indicate the effect the environment has on wire/cable.</li> <li>• Identify fire alarm primary and secondary power requirements.</li> <li>• Calculate the proper battery size of a fire alarm system.</li> <li>• Indicate the proper method of terminating fire alarm circuits.</li> </ul>
<p><b>10. Review</b></p>	<p>15 min</p>	<p>The students shall be given an opportunity to ask questions.</p>
<p><b>11. Testing Information, evaluation, &amp; pre-exam break</b></p>	<p>30 min</p>	<p>The students shall be provided with testing rules and ethics. They shall complete forms evaluating the course and the instructors and they shall be given a short break prior to examination.</p>
<p><b>12. Written exam</b></p>	<p>120 min.</p>	<p>The student shall provide written evidence that they have gained a minimum amount of knowledge concerning fire alarm installation including NFPA fire alarm codes &amp; standards.</p>