



National Fire Academy

R0264 – Plans Review of Fire Alarm Systems
Version: 2nd Edition, 1st Printing, November 2023

Quarter:

ACE Credit:

IACET Continuing Education Units:

Length of Course: 5 Days (35 contact hours, Monday – Friday)

Prerequisite: Yes

Curriculum: Fire Prevention: Technical

Training Specialist: Keith Heckler

Instructor:

Instructor email/phone:

Classroom: J-

Meeting Time: 8 AM – 5 PM

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Course Description (Catalog)

R0264 – “Plans Review of Fire Alarm Systems,” an advanced-level course, will describe the plan review process and show students how to conduct a plan review in a rigorous, systematic approach. This course is not intended as a general overview of a fire alarm system review but is instead focused on detail-oriented, very specific “down in the weeds” components associated with the proper design of a system.

This process will provide:

- Plan review checklists.

- Spreadsheets to determine battery and voltage drop calculations.
- Exercises to determine proper spacing of smoke detectors.
- Exercises to determine proper audibility spacing of fire alarm notification appliances.
- Proper sizing and placement of visible notification appliances.

This course will also review the codes that affect where detection is required and how to provide it, help identify what is involved with determining performance of the detection system, and be able to identify correct and incorrect methods of detector spacing in a given application. It covers:

- Definitions of listed spacing.
- Nominal spacing.
- Design spacing.
- Radius of coverage.

Student Qualifications (Primary and Secondary Audience)

The target audience for this course includes individuals presently assigned to review fire alarm shop drawings.

Course Scope (Goal)

The scope of this course spans instruction in the knowledge and skill necessary to evaluate the soundness and code compliance of engineering and architectural plans for fire alarm systems proposed as part of facility and occupancy construction plans. The course will enable students to perform a plans review to evaluate the suitability of the fire alarm system in accordance with nationally recognized standards for design and installation. Course content covers fire protection standards, plans reading, parts of a submittal package, classifying hazards, battery and voltage drop calculations, and fire alarm system components.

While there is no prerequisite coursework needed, students will be assigned pre-course activities they must complete prior to the first day of the course.

Course Objectives (Course Learning Outcomes – TLOs)

After successfully completing this course, you will be able to accomplish the following:

- Evaluate the materials for completeness and compliance with locally and nationally recognized design standards, given a sample fire alarm plan submittal package.
- Compare the materials used with the appropriate codes and standards and manufacturers' data sheets to determine if the system is suitable for the building, given fire alarm shop drawings.

- Assess the proper placement of initiating devices for the occupancy and hazard based on the knowledge of initiating device functions, given a set of fire alarm shop drawings.
- Assess the proper placement of notification appliances for the occupancy and hazard based on the knowledge of notification appliance functions, given a set of fire alarm shop drawings.
- Assess if the interface to supplemental systems is compliant with the code, given fire alarm shop drawings.
- Evaluate if the calculation inputs and outputs, as well as assumptions, are accurate given a set of battery and voltage drop calculations.
- Verify that fire alarm system plans comply with nationally recognized standards, given fire alarm shop drawings.

Course Delivery Method

The National Fire Academy (NFA) offers specialized training courses and advanced management programs of national impact in an academic classroom environment [on campus at the National Emergency Training Center \(NETC\) in Emmitsburg, Maryland](#). This classroom course is designed for the national level fire service officer from State and local fire service organizations. During this 5-day delivery, students will reside in dormitories provided on campus with classes conducted in classrooms designed for critical student/instructor interaction. All course materials are designed for interactive classroom environments, in either paper notebook or electronic formats.

Course Schedule

The purpose of the course schedule is to give you, at a glance, the required preparation, activities, and evaluation components of your course.

DAY 1	DAY 2
Introduction, Welcome, and Administrative	Unit 2: Fire Alarm System Fundamentals
<i>Break</i>	<i>Break</i>
Unit 1: Preparing for Plans Review	Unit 2: Fire Alarm System Fundamentals (cont'd)
<i>Break</i>	<i>Break</i>
Unit 1: Preparing for Plans Review (cont'd)	Unit 2: Fire Alarm System Fundamentals (cont'd) Activity 2.1: Determining Fire Alarm System Requirements
<i>Lunch Break</i>	<i>Lunch Break</i>
Unit 1: Preparing for Plans Review (cont'd) Activity 1.1: National Fire Protection Association 72®, <i>National Fire Alarm and Signaling Code</i> ®, Design and Installation Documentation	Unit 2: Fire Alarm System Fundamentals (cont'd) Activity 2.2: Evaluating Input/Output Matrix
<i>Break</i>	<i>Break</i>
Unit 1: Preparing for Plans Review (cont'd) Unit 2: Fire Alarm System Fundamentals	Unit 2: Fire Alarm System Fundamentals (cont'd) Activity 2.3: Reviewing Fundamentals for Fire Alarm System Information Unit 3: Initiating Devices

Note: This schedule is subject to modification by the instructors and approved by the training specialist.

DAY 3	DAY 4
Unit 3: Initiating Devices (cont'd)	Unit 4: Notification Appliances (cont'd)
<i>Break</i>	<i>Break</i>
Activity 3.1: Smoke and Heat Detector Spacing Unit 3: Initiating Devices (cont'd)	Unit 4: Notification Appliances (cont'd) Activity 4.1: Verification of Notification Layout
<i>Break</i>	<i>Break</i>
Unit 3: Initiating Devices (cont'd)	Unit 4: Notification Appliances (cont'd) Activity 4.1: Verification of Notification Layout (cont'd) Unit 5: Ancillary Interconnection
<i>Lunch Break</i>	<i>Lunch Break</i>
Unit 3: Initiating Devices (cont'd) Activity 3.2: Device Placement	Unit 5: Ancillary Interconnection (cont'd)
<i>Break</i>	<i>Break</i>
Unit 3: Initiating Devices (cont'd) Unit 4: Notification Appliances	Unit 5: Ancillary Interconnection (cont'd) Activity 5.1: Reviewing for Interface Requirements Unit 6: Battery and Voltage Drop Calculations

DAY 5
Unit 6: Battery and Voltage Drop Calculations (cont'd) Activity 6.1: Battery Backup Calculations
<i>Break</i>
Unit 6: Battery and Voltage Drop Calculations (cont'd) Activity 6.2: Verify Voltage Drop Calculations
<i>Break</i>
Activity 6.2: Verify Voltage Drop Calculations (cont'd) Unit 7: Deficiency Letter
<i>Lunch Break</i>
Unit 7: Deficiency Letter (cont'd) Activity 7.1: Writing the Deficiency Letter
<i>Break</i>
Unit 7: Deficiency Letter (cont'd) Final Exam Course Evaluation Course Graduation

Course Resources (Instructional Materials)

In order to be fully prepared, obtain a copy of the required textbooks and other instructional materials prior to the first day of class.

Required Readings

The student must complete required readings during the course to be able to thoughtfully participate in discussions and activities.

None.

Suggested Reading/Resources

Suggested readings and resources are not evaluated, but may enhance the student's understanding, serve as additional sources for citation and promote discussion of course material.

None.

Required Resources (Course Textbook)

Student Manual.

Supplemental Resources (Supplemental Course Textbook)

None.

Grading Methodology (Evaluation Procedures)

The students' final grades will be computed using the final exam. The final exam will include 56 multiple-choice questions. The exam covers all information in the Student Manual (SM), as well as the concepts presented during presentations and class discussions. In addition, certain activities in the course will be evaluated using points (i.e., 60 points total for 60% of the total grade).

Grading rubrics are provided for all graded assignments. Grading rubrics can be accessed at the end of the Course Syllabus and within the SM. Each rubric is labeled according to the activity name.

A minimum grade of 70% is required to pass the course. The complete grading scale is provided here:

Letter grade	Point range
A	90-100
B	80-89
C	70-79
F	69 or lower

Students who do not obtain an end-of-course passing score face possible sanctions for up to 12 months regarding acceptance or placement in future NFA course offerings.

Students who do not complete the entire course will be awarded an Incomplete (I) grade. In accordance with NFA academic policies, an Incomplete (I) grade must be removed by the end of the next semester following the course, or it automatically becomes a Failing (F) grade.

The final course grade will be comprised of these elements:

Element	Completion/ formal grade	Grade points	Percent of final course grade
Activities			
• Pre-course Activity 1	Grade	7	5%
• Pre-course Activity 2	Grade	5	5%
• Activity 3.1	Grade	10	10%
• Activity 4.1	Grade	10	10%
• Activity 6.2	Grade	10	10%
• Activity 7.1	Grade	15	30%
Final exam	Grade	56	30%
		Total	100%

Required Reading Assignments

Student completion of reading assignments will be done via evaluation of their class participation and will not be a separately graded activity.

Suggested Readings

Suggested readings are not evaluated, but may enhance the student's understanding and promote discussion of course material.

Course Outline

Introduction

Objectives

None

Unit 1: Preparing for Plans Review (Day 1)

Objectives

Terminal Objective

The students will be able to:

- 1.1 Evaluate the materials for completeness and compliance with locally and nationally recognized design standards, given a sample fire alarm plan submittal package.

Enabling Objectives

The students will be able to:

- 1.1 Verify the appropriate sections of the International Code Council (ICC) and National Fire Protection Association (NFPA) codes relating to fire alarm submittals are selected.
- 1.2 Identify plan symbols, notes and details found on the shop drawings.
- 1.3 Validate the basic submittal package for compliance with locally adopted rules and standards or special rulings.
- 1.4 Identify special supplemental information that may be required.
- 1.5 Evaluate the basic submittal package completeness to accept or reject the submittal for review.

Unit 2: Fire Alarm System Fundamentals (Day 1)

Objectives

Terminal Objective

The students will be able to:

- 2.1 Compare the materials used with the appropriate codes and standards and manufacturers' data sheets to determine if the system is suitable for the building, given fire alarm shop drawings.

Enabling Objectives

The students will be able to:

- 2.1 Describe the required elements that establish a fire alarm system.
- 2.2 Determine if the system provided is appropriate for use and occupancy.
- 2.3 Describe the operations of a fire alarm control unit (FACU).
- 2.4 Verify that FACU location is acceptable.
- 2.5 Determine if the primary and secondary power sources provided are allowed for the system.
- 2.6 Analyze circuit and pathway arrangements for code compliance.
- 2.7 Determine if the fire alarm is monitored and the type of monitoring provided.

Unit 3: Initiating Devices (Day 2)

Objectives

Terminal Objective

The students will be able to:

- 3.1 Assess the proper placement of initiating devices for the occupancy and hazard based on the knowledge of initiating device functions, given a set of fire alarm shop drawings.

Enabling Objectives

The students will be able to:

- 3.1 Describe the functions of initiating devices.

- 3.2 Identify if the detection technology is suitable for the application.
- 3.3 Identify correct and incorrect methods of detector spacing in a given application.
- 3.4 Identify possible sources of unintended activation of detection devices.

Unit 4: Notification Appliances (Day 3)

Objectives

Terminal Objective

The students will be able to:

- 4.1 Assess the proper placement of notification appliances for the occupancy and hazard based on the knowledge of notification appliance functions, given a set of fire alarm shop drawings.

Enabling Objectives

The students will be able to:

- 4.1 Describe the basic functions of notification appliances.
- 4.2 Identify if the notification device technology is suitable for the application.
- 4.3 Determine the method of notification used for system design.
- 4.4 Determine proper audibility of fire alarm notification appliances.
- 4.5 Determine proper sizing and placement of visible notification appliances.
- 4.6 Identify correct and incorrect methods of notification device spacing in a given application.
- 4.7 Describe other means for notification.

Unit 5: Ancillary Interconnection (Day 4)

Objectives

Terminal Objective

The students will be able to:

- 5.1 Assess if the interface to supplemental systems is compliant with the code, given fire alarm shop drawings.

Enabling Objectives

The students will be able to:

- 5.1 Evaluate where an interface is required for different types of system interconnection with fire alarm systems.
- 5.2 Analyze the wiring methods for fire alarm control functions.
- 5.3 Determine that a layout for smoke detection is correct for fire-rated doors.
- 5.4 Conclude that code requirements for system interconnection have been met.

Unit 6: Battery and Voltage Drop Calculations (Day 4)

Objectives

Terminal Objective

The students will be able to:

- 6.1 Evaluate if the calculation inputs and outputs, as well as assumptions, are accurate given a set of battery and voltage drop calculations.

Enabling Objectives

The students will be able to:

- 6.1 Determine that the required battery storage for system type is appropriate.
- 6.2 Validate the accuracy of battery calculations using spreadsheets or other methods.
- 6.3 Validate the accuracy of voltage drop calculations using spreadsheets or other methods.

Unit 7: Deficiency Letter (Day 5)

Objectives

Terminal Objective

The students will be able to:

- 7.1 Verify that fire alarm system plans comply with nationally recognized standards, given fire alarm shop drawings.

Enabling Objective

The students will be able to:

- 7.1 Apply knowledge gained from previous units to prepare a response to the submitter of the plan set, identifying deficiencies in the submittal.

Policies

Class Attendance and Cancellation Policy

Attendance

- You are required to attend all sessions of the course. If you do not, you may not receive a certificate, and your stipend may be denied.
- If you need to depart campus early and miss any portion of the course and/or graduation, you must make the request in writing to the NFA training specialist. The training specialist, in collaboration with the superintendent, may waive the attendance requirement in order to accommodate you with extraordinary circumstances as long as you complete all course requirements. If you receive approval for departing early, you must forward the approval to the Admissions Office so your stipend reimbursement is not limited.

Student Substitutions

Substitutions for NFA courses are made from waiting lists; your fire department can't send someone in your place.

Cancellations or No-Shows

NFA's mission for delivery of courses is impaired significantly by cancellations and no-shows. It is very difficult and costly to recruit students at the last minute. Currently there is a two-year ban on student attendance for students who are no-shows or cancel within 30 days of the course start date without a valid reason. If you receive such a restriction, your supervisor needs to send a letter to our Admissions Office explaining the cancellation/no-show.

Course Failure

If you fail an on-campus course, you will not be issued a stipend for that course. You can reapply for the failed course or any other NFA course and go through the random selection process. You don't have to successfully complete the failed course before attending another NFA course.

Student Code of Conduct Policy

Students, instructors and staff are expected to treat each other with respect at all times. Inappropriate behavior will not be tolerated and may result in removal from campus and denial of stipends.

Writing Expectations

Student writing will conform to the generally accepted academic standards for college papers. Papers will reflect the student's original work and give appropriate credit through citations for ideas belonging to other authors, publications, or organizations. Written student work should be free of grammatical and syntax errors, profanity, obscene language or concepts, and reflect critical thinking related to the course subject matter.

Citation and Reference Style

Students **will** follow the *Publication Manual of the American Psychological Association, Seventh Edition*, as the sole citation and reference style used in written work submitted as part of course work to the National Fire Academy (NFA). Formal writing assignments must follow the citation style cited in the American Psychological Association (APA) style manual, Seventh Edition. You may refer to the [APA Style](#) or [Purdue Online Writing Lab](#).

Late Assignments

Students are expected to submit classroom assignments by the posted due date and complete the course according to the published class schedule. As adults, students, and working professionals, you must manage competing demands on your time. Assignments submitted after the deadline will receive a "0" grade for that assignment.

Netiquette

Online learning promotes the advancement of knowledge through positive and constructive debate – both inside and outside the classroom. Forums on the Internet, however, can occasionally degenerate into needless insults and "flaming." Such activity and the loss of good manners are not acceptable in a professional learning setting – basic academic rules of good behavior and proper "Netiquette" must persist. Remember that you are in a place for the rewards and excitement of learning which does not include descent to personal attacks or student attempts to stifle the forum of others.

- **Technology Limitations.** While you should feel free to explore the full-range of creative composition in your formal papers, keep e-mail layouts simple. The NFA Online classroom may not fully support MIME or HTML encoded messages, which means that bold face, italics, underlining, and a variety of color-coding or other visual effects will not translate in your e-mail messages.

- Humor Note. Despite the best of intentions, jokes and especially satire can easily get lost or taken seriously. If you feel the need for humor, you may wish to add “emoticons” to help alert your readers: ;-), :), ☺ .

Disclaimer Statement

Course content may vary from the outline to meet the needs of this particular group.

Grading

Please review the following rubrics that explain how grades will be awarded.

Students who do not complete the entire course will be awarded an Incomplete (I) grade. In accordance with National Fire Academy academic policies, an Incomplete (I) grade must be removed by the end of the next semester following the course, or it automatically becomes a Failing (F) grade.

If you fail an on-campus course, you will not be issued a stipend for that course. You can reapply for the failed course or any other NFA course and go through the random selection process. You don't have to successfully complete the failed course before attending another NFA course.

http://www.usfa.fema.gov/training/nfa/admissions/student_policies.html

Academic Honesty

Students are expected to exhibit exemplary ethical behavior and conduct as part of the NFA community and society as a whole. Acts of academic dishonesty including cheating, plagiarism, deliberate falsification, and other unethical behaviors will not be tolerated.

Students are expected to report academic misconduct when they witness a violation. All cases of academic misconduct shall be reported by the instructor to the Training Specialist.

If a student is found to have engaged in misconduct and the allegations are upheld, the penalties may include, but are not limited to one or a combination of the following:

- expulsion,
- withholding of stipend or forfeiture of stipend paid,
- exclusion from future classes for a specified period; depending on the severity it could range from 1-10 years, and/or
- forfeiture of certificate for course(s) enrolled in at NETC.

Refer to NFA-specific Standard Operating Procedure 700.1 – *Academic Code of Conduct and Ethics* for more information.

GRADING RUBRICS

PRE-COURSE ACTIVITY 2: CONSEQUENCES OF IMPROPER FIRE ALARM SYSTEM DESIGN AND INSTALLATION

Assignment: Students will research two fire incidents that have resulted from an error(s) in fire alarm system installation and/or design.

The table below details the point distribution for the pre-course activity 2. (Maximum points: 5.)

Element of performance	No submission: 0 points	Deficient: 0.5 point	Exemplary: 1 point
Submission of the research.	No attempt made at completing the research.	One fire incident researched and submitted.	Two fire incidents researched and submitted.

Element of performance	Acceptable: 1 point	Exemplary: 2 points
Research quality and analysis (evaluated for each fire incident researched).	Fire incident research needs more detailed information or includes inaccurate information. The cause of the incident has vague or no correlation to fire alarm design and/or installation.	Fire incident research includes sufficient and accurate background details. The cause of the incident is identified and correlated to fire alarm design and/or installation.

ACTIVITY 3.1

SMOKE AND HEAT DETECTOR SPACING

Assignment: Students will be provided with a set of plans with which they will review spacings for smoke and heat detection and the duct smoke detection placements.

The table below details the point distribution for Activity 3.1. (Maximum points: 10.)

Element of performance	No submission: 0 points	Deficient: 1 point	Acceptable: 2 points	Exemplary: 3 points
Verification of areas protected with area smoke detection.	No response provided.	Incorrect verification of compliance made.	Correct verification of compliance made but with incorrect or lack of supporting details.	Correct verification of compliance made with supporting details.
Verification of areas protected with area heat detection.	No response provided.	Incorrect verification of compliance made.	Correct verification of compliance made but with incorrect or lack of supporting details.	Correct verification of compliance made with supporting details.

Element of performance	No submission: 0 points	Deficient: 1 point	Acceptable: 2-3 points	Exemplary: 4 points
Verification of areas protected with duct smoke detection.	No response provided.	Incorrect verification of compliance made.	Correct verification of compliance made but with incorrect or lack of supporting details.	Correct verification of compliance made for all required systems.

ACTIVITY 4.1

VERIFICATION OF NOTIFICATION LAYOUT

Assignment: Students will use a set of plans that they will review and determine if audibility and visibility requirements are met.

The table below details the point distribution for Activity 4.1. (Maximum points: 10.)

Element of performance	No submission: 0 points	Deficient: 1 point	Acceptable: 2 points	Acceptable: 3 points	Exemplary: 4 points
Determination of code compliance for visual coverage.	No attempt made at determining code compliance.	Determination and justification are incorrect.	Correct determination for code compliance is made, but insufficient justification is provided.	Sufficient justification is provided, but final determination for code compliance is incorrectly determined.	Correct determination for code compliance is made, and sufficient justification is provided.
Determination of code compliance for audible coverage.	No attempt made at determining code compliance.	Determination and justification are incorrect.	Correct determination for code compliance is made, but insufficient justification is provided.	Sufficient justification is provided, but final determination for code compliance is incorrectly determined.	Correct determination for code compliance is made, and sufficient justification is provided.

Element of performance	No submission: 0 points	Deficient: 1 point	Exemplary: 2 points
Identify the difference for residential occupancy alarm notification.	No attempt made at identifying difference.	No attempt or incorrect information is provided.	Correct information is provided.

ACTIVITY 6.2

VERIFY VOLTAGE DROP CALCULATIONS

Assignment: Students will analyze the voltage drop to determine if devices will function correctly given a sample circuit.

The table below details the point distribution for Activity 6.2. (Maximum points: 10.)

Element of performance	No submission: 0 points	Deficient: 1-5 points	Acceptable: 6-9 points	Exemplary: 10 points
Determination for maximum number of devices in an assigned scenario.	No attempt made at determining the maximum number of devices, or calculation provided is less than 10% correct.	Incorrect determination for maximum number of devices is made, but calculation provided is partially correct (10%-50%).	Incorrect determination for maximum number of devices is made, but calculation provided is mostly correct (more than 50%).	Correct determination for maximum number of devices is made along with correct calculations.

ACTIVITY 7.1

WRITING THE DEFICIENCY LETTER

Assignment: Students will prepare a written deficiency letter to the designer stating issues of concern and appropriate code sections.

The table below details the point distribution for Activity 7.1. (Maximum points: 15.)

Element of performance	No submission: 0 point	Deficient: 1 point	Standard: 2 points	Exemplary: 3 points
Sender and receiver information.	Sender and receiver information are missing in the letter.	Sender and receiver information is presented incorrectly in the letter.	Only a portion of the sender and receiver information is presented correctly in the letter.	Detailed sender and receiver information are presented correctly in the letter.
Identification of the deficiencies.	None of the correct deficiencies are identified in the letter.	At least one correct deficiency is identified in the letter.	At least 50% of the deficiencies are identified in the letter.	All correct deficiencies are identified in the letter.
Location of the deficiencies.	Locations of the deficiencies are not identified in the letter.	At least one correct location of a deficiency is identified in the letter.	At least 50% of the deficiency locations are identified in the letter.	All correct locations of the deficiencies are identified in the letter.
Supporting codes or standards.	None of the correct codes or standards related to the deficiencies are provided in the letter.	At least one correct supporting code or standard relevant to a deficiency is provided in the letter.	At least 50% of the deficiencies are supported by relevant code(s) or standard(s).	All correct codes or standards relevant to the deficiencies are provided in the letter.
Recommended action.	No recommendation for action is provided in the letter.	An incorrect recommendation is made in the letter.	A recommendation is made in the letter, but it is not actionable or vague.	A clear and actionable recommendation is made in the letter.