



# National Fire Academy

**W0142 – Residential Sprinkler Plan Review**  
**Version: 2nd Edition, 2nd Printing, October 2019**

**Quarter:**

**ACE Credit:** In the lower division baccalaureate/associate degree category, two semester hours in fire science or fire prevention.

**IACET Continuing Education Units: 1.2**

**Length of Course: 2 Days (12 hr., 40 min. contact hours)**

**Prerequisite: None**

**Curriculum: Fire Protection: Technical  
Training Specialist: Keith Heckler**

**Instructor:**

**Instructor email/phone:**

**Classroom:**

**Meeting Time: 8 AM – 5 PM**

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## Course Description (Catalog)

W0142 – “Residential Sprinkler Plan Review.” The scope of this course looks at the following as the primary guidance for the approval of residential sprinkler systems:

- National Fire Protection Association 13, *Standard for the Installation of Sprinkler Systems*.
- NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*.

- NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies*.
- International Residential Code Standard P2904.
- Manufacturer's Data Sheets.
- The ability to read and interpret the design is an essential element of preventive fire safety.

### **Student Qualifications (Primary and Secondary Audience)**

The target audience for the “Residential Sprinkler Plans Review” (RSPR) course is code officials whose responsibility is to review residential sprinkler plans. Such officials include fire inspectors, fire marshals and building code inspectors with at least one year of experience on the job.

### **Course Scope (Goal)**

The goal of this course is to provide the students with the ability to verify that the design of the residential fire sprinkler system complies with national standards and a manufacturer's product data sheets. It does not address differences that may be adopted in any state and/or local ordinances. Discussions will revolve around the differences among the application of National Fire Protection Association (NFPA) 13, *Standard for the Installation of Sprinkler Systems*; 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*; 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies*; and International Residential Code (IRC) P2904 that can be used as models in their own communities.

The students will examine sample plans in order to identify the technical components of residential sprinkler systems and to identify the sprinkler types that are required. Sample plans and manufacturer's product literature will be used to evaluate sprinkler locations, to verify calculations of sprinkler flow, to determine if the correct number of sprinklers is accounted for, and to calculate the minimum pressure suggested by the manufacturer's specifications.

Students should possess the ability to read and comprehend standard residential sprinkler plans at a basic level. They should be able to identify symbols, trace the system, differentiate between construction plans and residential sprinkler system plans, and read and interpret sprinkler plan notes and their accompanying legend. The students should have a conceptual understanding of existing standards NFPA 13, 13D, 13R and IRC P2904.

The purpose of this course is to provide students with the ability to verify that the design of the residential fire sprinkler system is in compliance with national standards and codes to aid in the detection and control of residential fires and, consequently, to provide protection against injury, loss of life and property damage.

## Course Objectives (Course Learning Outcomes – TLOs)

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

- Explain the scope of residential sprinkler system design and installation standards for National Fire Protection Association (NFPA) 13, *Standard for the Installation of Sprinkler Systems*; 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*; 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies*; and International Residential Code (IRC) P2904, given scoping statement examples.
- Evaluate residential sprinkler system water supply components for compliance with national standards.
- Evaluate the residential sprinkler system pipe, valves and trim components and the design for compliance with national standards.
- Evaluate the residential sprinkler system's overhead pipe, sprinklers and design for compliance with national standards and codes.
- Evaluate the accuracy of computations on a set of plans with associated hydraulic calculations.
- Evaluate the accuracy of computations on an International Residential Code (IRC) P2904 prescriptive design worksheet.
- Verify compliance with national design and installation standards, given a set of plans and hydraulic calculations.

## 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](#) and through their State, local, and tribal training partners. This classroom course is designed for the national level fire service officer from State and local fire service organizations. 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.

<b>DAY 1</b>	<b>DAY 2</b>
Introduction, Welcome and Administrative	Unit 3: Pipe, Valves and Trim (cont'd) Activity 3.2: Identifying Head-Loss Values Caused by Domestic Water Meters
<i>Break</i>	<i>Break</i>
Unit 1: Design and Installation Standards Activity 1.1: Selecting Sprinkler Design and Installation Standards	Unit 4: Sprinklers and Sprinkler Layout
<i>Break</i>	<i>Break</i>
Unit 2: Water Supplies Activity 2.1: Calculating Minimum Water Supply Requirements — Residential Activity 2.2: Calculating Minimum Water Supply Requirements	Unit 4: Sprinklers and Sprinkler Layout (cont'd) Activity 4.1: Sprinkler Installation, Omissions and Configurations Unit 5: Verify Sprinkler Coverage and Hydraulic Design
<i>Lunch Break</i>	<i>Lunch Break</i>
Unit 3: Pipe, Valves and Trim	Unit 5: Verifying Sprinkler Coverage and Hydraulic Design (cont'd) Activity 5.1: Verify Hydraulic Design Assumptions Unit 6: Prescriptive Design
<i>Break</i>	<i>Break</i>
Unit 3: Pipe, Valves and Trim (cont'd) Activity 3.1: Identifying Residential Sprinkler System Components	Unit 6: Prescriptive Design (cont'd) Activity 6.1: Completing a Residential Sprinkler System Available Pressure Equation Unit 7: Conclusion Activity 7.1: Plans Review Assessment Final Exam

Note: Times listed reflect approximate instructional time blocks and may be adjusted to meet individual course preferences.

## 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.

Unit 1: Design and Installation Standards, Appendix C: The Makeover

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

### Suggested Reading/Resources

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

Bryan, J. L. (2007). Residential sprinkler systems. In Dubay, C. (Ed.) *Automatic sprinkler systems for residential occupancies handbook* (pp 223-269). Retrieved from [https://www.nfpa.org/~media/Files/forms%20and%20premiums/NF13DR07\\_CHS4.pdf](https://www.nfpa.org/~media/Files/forms%20and%20premiums/NF13DR07_CHS4.pdf)

Hugo, J. (2017-2018). *Guide to fire sprinkler changes in the 2018 IFC, IBC, IRC and IEBC*. Retrieved from <https://nfsa.org/wp-content/uploads/2018/03/2018-IFC-IBC-IEBC-Guide.pdf>

Hugo, J. (2018, May 8). #107-*The use of antifreeze in fire protection systems*. Retrieved from <http://www.qrfs.com/107--Antifreeze-in-Fire-Protection-Systems>

Koffel, W. (2013). The latest in antifreeze sprinkler systems. *emerging Trends enewsletter*. Retrieved from [https://www.sfpe.org/page/FPE\\_ET\\_Issue\\_59/The-Latest-in-Antifreeze-Sprinkler-Systems-.htm](https://www.sfpe.org/page/FPE_ET_Issue_59/The-Latest-in-Antifreeze-Sprinkler-Systems-.htm)

Rodriguez, M. (June 22, 2015). *Tech topic: Residential fire sprinkler system design*. Reeves Journal. Retrieved from <https://www.reevesjournal.com/articles/88439-tech-topic-residential-fire-sprinkler-system-design>

Sweet, J. (July 7, 2014). *Residential fire sprinklers: Required in California for a while, what do contractors think?* Reeves Journal. Retrieved from <https://www.reevesjournal.com/articles/88025-residential-fire-sprinklers>

### Required Resources (Course Textbook)

Student Manual.

### **Supplemental Resources (Supplemental Course Textbook)**

None.

### **Grading Methodology (Evaluation Procedures)**

The outcome of this course is measured in three areas: (1) class activities, (2) the student's overall participation and (3) the final open-book examination.

The activities, class participation and the final exam employ grading rubrics to assess student performance. The rubrics compare the student's performance to the activity's learning objective.

### **Final Course Grade**

<b>Activity</b>	<b>Percent of Final Grade</b>
Discussion	10
Student Activities	36
Final Examination	54

<b>Score Range</b>	<b>Letter Grade to be Assigned to Student</b>
90-100	A
80-89	B
70-79	C
69 or less	F

### **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: Design and Installation Standards**

#### **Objectives**

##### **Terminal Objective**

The students will be able to:

- 1.1 Explain the scope of residential sprinkler system design and installation standards for National Fire Protection Association (NFPA) 13, *Standard for the Installation of Sprinkler Systems*; 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*; 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies*; and International Residential Code (IRC) P2904, given scoping statement examples.

##### **Enabling Objectives**

The students will be able to:

- 1.1 Differentiate one- and two-family dwellings, townhouses, manufactured homes, and other residential occupancies.
- 1.2 Differentiate the sprinkler system design and installation standards.

### **Unit 2: Water Supplies**

#### **Objectives**

##### **Terminal Objective**

The students will be able to:

- 2.1 Evaluate residential sprinkler system water supply components for compliance with national standards.

### **Enabling Objectives**

The students will be able to:

- 2.1 Differentiate water supply configuration options.
- 2.2 Calculate the minimum water supply requirement for a known flow sprinkler.
- 2.3 Calculate the minimum static water supply requirement, given a known flow from four sprinklers.

### **Unit 3: Pipe, Valves and Trim**

#### **Objectives**

#### **Terminal Objective**

The students will be able to:

- 3.1 Evaluate the residential sprinkler system pipe, valves and trim components and the design for compliance with national standards.

#### **Enabling Objectives**

The students will be able to:

- 3.1 Identify the location of components in a residential sprinkler system.
- 3.2 Differentiate types of unlisted and listed pipe.
- 3.3 Evaluate head-loss values caused by domestic water meters from a sample flow characteristic curve.

### **Unit 4: Sprinklers and Sprinkler Layout**

#### **Objectives**

#### **Terminal Objective**

The students will be able to:

- 4.1 Evaluate the residential sprinkler system's overhead pipe, sprinklers and design for compliance with national standards and codes.



### **Enabling Objectives**

The students will be able to:

- 4.1 Evaluate pipe configurations used for water distribution.
- 4.2 List where the national standards permit omissions from sprinkler coverage.
- 4.3 Describe the following distribution arrangements: tree, grid, loop and network.
- 4.4 Differentiate the type and location of sprinkler pipe hangers and restraints, as well as sprinkler types and Sprinkler Identification Numbers (SINs).
- 4.5 Explain the requirements for thermal protection for nonmetallic pipe and the different performance characteristics between property protection and residential sprinklers.

## **Unit 5: Verifying Sprinkler Coverage and Hydraulic Design**

### **Objectives**

#### **Terminal Objective**

The students will be able to:

- 5.1 Evaluate the accuracy of computations on a set of plans with associated hydraulic calculations.

#### **Enabling Objectives**

The students will be able to:

- 5.1 Verify that sprinkler spacing is in accordance with listing requirements, and that design assumptions have been included in hydraulic calculations.
- 5.2 Differentiate the flow characteristics of the four types of sprinkler pipe.
- 5.3 Verify that hydraulic calculations include a sufficient number of sprinklers (one- and two-head designs) and that all hydraulic reference points are identified on the plans.
- 5.4 Verify the calculation of a single sprinkler flow.

## **Unit 6: Prescriptive Design**

### **Objectives**

#### **Terminal Objective**

The students will be able to:

- 6.1 Evaluate the accuracy of computations on an International Residential Code (IRC) P2904 prescriptive design worksheet.

#### **Enabling Objectives**

The students will be able to:

- 6.1 Verify the accuracy of variables that are used in the IRC P2904 prescriptive design sprinkler worksheet.
- 6.2 Identify water system additions that might affect the outcome of the prescriptive design formula.

## **Unit 7: Conclusion**

### **Objectives**

#### **Terminal Objective**

The students will be able to:

- 7.1 Verify compliance with national design and installation standards, given a set of plans and hydraulic calculations.

## **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.
- If you need to depart the training facility early and miss any portion of the course, you must make the request in writing to the sponsoring agency (e.g., State training director, etc.). The State training director may waive the attendance requirement in order to accommodate you with extraordinary circumstances as long as you complete all course requirements.

### **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**

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.

### **Writing Expectations**

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

### **Citation and Reference Style**

Attention Please: Students will follow the APA, Sixth Edition as the sole citation and reference style used in written work submitted as part of coursework to NFA. Assignments completed in a narrative essay, composition format, abstract, and discussion posts must follow the citation style cited in the APA, Sixth Edition.

### **Late Assignments**

All assignments must be turned in by the established deadline. Late submissions could result in a 10 percent decrease in grade.

### **Disclaimer Statement**

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

## **Grading**

Please review the above grading methodology that explains 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.

[https://www.usfa.fema.gov/training/nfa/admissions/student\\_policies.html](https://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 State training director or host agency and to the NFA 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 Rubric

Student Activity Grading Rubric (Group or Individual Activity)					
Excellent	Good	Average	Fair	Poor	
<p>Performed at an exceptional level of mastery.</p> <p>Required no assistance or prompting.</p> <p>Thoroughly answered questions and participated in discussion while also directing other students to other sources of information.</p>	<p>Performed at an above average level of mastery.</p> <p>Required minimal assistance or prompting.</p> <p>Answered questions and participated in discussion sufficiently while providing other pertinent information.</p>	<p>Performed at an adequate level of mastery.</p> <p>Required some assistance or prompting.</p> <p>Answered questions and participated in discussion sufficiently.</p>	<p>Performed at a minimal level of mastery.</p> <p>Required a fair amount of assistance and prompting.</p> <p>Answered questions and participated in discussion with difficulty.</p>	<p>Performed at an inadequate level.</p> <p>Required significant assistance and prompting.</p> <p>Was unable to answer questions and participate in discussion.</p>	
<b>5 Points</b>	<b>4 Points</b>	<b>3 Points</b>	<b>2 Points</b>	<b>1 Point</b>	
Exceptionally competent	Highly competent	Competent	Somewhat competent	Not competent	
Student number	Student name	Activity 1.1: Demonstrate understanding of the different installation standards.	Activity 2.1: Demonstrate understanding with the necessary calculations required to complete the activity.	Activity 5.1: Demonstrate the data needed and steps taken to complete an available pressure equation for a prescriptive design.	Activity 6.1: Identify relevant components on sprinkler plans that are required to complete the activity.
1.				Overall: Participates with group and encourages others to share; listens attentively.	Total
2.					
3.					
4.					
5.					