



## National Fire Academy

**R0137 – Water-based Fire Protection System Plans Review**

**Version: 1st Edition, 4th Printing, June 2018**

**Quarter:**

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

**IACET Continuing Education Units: 4.1**

**Length of Course: 6 Days (32 hr., 15 min. contact hours, Sunday – Friday)**

**Prerequisite: Yes**

**Curriculum: Fire Protection: Technical**

**Training Specialist: Keith Heckler**

**Instructor:**

**Instructor email/phone:**

**Classroom: J-**

**Meeting Time: 8 AM – 5 PM**

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### Course Description (Catalog)

R0137 – “Water-based Fire Protection System Plans Review.” This six-day course will enable students to perform a plan review to evaluate the suitability of the fire sprinkler, pump, and standpipe plans and calculations in accordance with nationally recognized standards for design and installation. Course content covers fire protection standards, plan reading, water supplies, building envelope features, fire protection hydraulics mathematics, fire pumps, sprinkler systems, and standpipe systems.

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

The target audience for this course includes fire service prevention and allied public officials who are responsible for the review and approval of plans for water-based fire protection systems in their jurisdictions.

## **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 water-based fire protection systems proposed as part of facility and occupancy construction plans. The course will enable students to perform a plan review to evaluate the suitability of the fire sprinkler, pump and standpipe plans and calculations in accordance with nationally recognized standards for design and installation. Course content covers fire protection standards, plan reading, water supplies, building envelope features, fire protection hydraulics mathematics, fire pumps, sprinkler systems, and standpipe systems.

Students should be familiar with water-based fire protection systems equipment and nomenclature and have prior experience in fire prevention inspection programs and community goals and priorities. It is recommended that students either possess International Code Council (ICC) or National Fire Protection Association (NFPA) Plan Examiner certifications or have attended the NFA course “Fire and Life Safety Plan Review” (R0132) or equivalent instruction. It is also recommended that students complete NFA’s online course, “Testing and Evaluation of Water Supplies for Fire Protection” (Q0218) prior to attending “Water-based Fire Protection System Plans Review” (WBFPSR). The online course is available on the U.S. Fire Administration’s (USFA’s) NFA Online at [usfa.fema.gov/nfa/nfaonline](http://usfa.fema.gov/nfa/nfaonline).

The purpose of this course is to prepare qualified students to review and evaluate water-based fire protection systems plans as part of the public code compliance and enforcement functions of the community fire prevention mission.

## **Course Objectives (Course Learning Outcomes – TLOs)**

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

- Given a set of drawings and calculations, apply recognized mathematical calculations and formulas, and interpret and use standardized symbols and terminology in the review and approval process of plans for water-based fire protection systems.
- Given a set of national standards, fire protection system plans, and occupancy identification, verify that the selected fire protection system design is matched to the occupancy classification and provides appropriate levels of protection in accordance with recognized water-based fire protection standards and equipment listings and limitations due to types of construction and other physical obstructions.

- Given the design criteria of a water supply system and a set of plans, evaluate the water supply system to ensure it is in compliance with nationally recognized standards for a fire protection system.
- Given the design criteria of a water supply system and a set of plans, verify the adequacy of water-based fire protection system components for the intended use and compliance with recognized listings, standards and manufacturers' specifications.
- Given a set of design drawings and occupancy hazard classification, verify that the design of the water-based fire protection system provides adequate coverage and required levels of protection in compliance with recognized standards.
- Given a set of plans with hydraulic calculations, verify that the calculation methods are in compliance with recognized standards and that water-based fire protection systems design calculations are accurate.

### **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 6-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.

<b>DAY 1</b>	<b>DAY 2</b>
Introduction, Welcome and Administrative	Unit 2: System Design
<i>Break</i>	<i>Break</i>
Unit 1: Basic Design Criteria Activity 1.1: Find and Identify on the Drawing by Grid or Drawing Designation	Activity 2.1: Sprinkler Hazard Classifications Unit 2: System Design (cont'd) Activity 2.2: Building Construction
<i>Break</i>	<i>Break</i>
Unit 1: Basic Design Criteria (cont'd)	Unit 2: System Design (cont'd) Activity 2.3: Obstructed Construction
<i>Lunch Break</i>	<i>Lunch Break</i>
Unit 1: Basic Design Criteria (cont'd) Activity 1.2: Selecting Standards	Unit 2: System Design (cont'd) Activity 2.4: Compartments and Small Rooms Unit 3: Water Supplies and Delivery Systems Activity 3.1: Available Stored Water Supply
<i>Break</i>	<i>Break</i>
Unit 1: Basic Design Criteria (cont'd)	Unit 3: Water Supplies and Delivery Systems (cont'd) Activity 3.2: Water Supplies for Combined Sprinkler and Standpipe Systems

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

<b>DAY 3</b>	<b>DAY 4</b>
Unit 4: System Components and Materials	Unit 5: Fire Protection System Plans Methods of Design
<i>Break</i>	<i>Break</i>
Unit 4: System Components and Materials (cont'd)	Unit 5: Fire Protection System Plans Methods of Design (cont'd) Activity 5.1: Determine Design Hazard Classification
<i>Break</i>	<i>Break</i>
Unit 4: System Components and Materials (cont'd) Activity 4.1: Verifying Sprinkler Water Flows	Unit 5: Fire Protection System Plans Methods of Design (cont'd)
<i>Lunch Break</i>	<i>Lunch Break</i>
Unit 4: System Components and Materials (cont'd)	Unit 5: Fire Protection System Plans Methods of Design (cont'd)
<i>Break</i>	<i>Break</i>
Activity 4.2: Pump Combination Curve Exercise Activity 4.3: Verifying Sprinkler Selection	Activity 5.2: Storage Exercise Activity 5.3: Exterior Shade Structure

<b>DAY 5</b>	<b>DAY 6</b>
Unit 6: Evaluating Sprinkler Hydraulic Calculations	Unit 6: Formula/Hydraulic Calculation Review
<i>Break</i>	<i>Break</i>
Unit 6: Evaluating Sprinkler Hydraulic Calculations (cont'd)	Final Exam
<i>Break</i>	<i>Break</i>
Activity 6.1: Formula Exercise Unit 6: Evaluating Sprinkler Hydraulic Calculations (cont'd)	Final Exam (cont'd)
<i>Lunch Break</i>	<i>Lunch Break</i>
Activity 6.2: Hydraulic Calculations	Administrative (Course evaluation)
<i>Break</i>	<i>Break</i>
Activity 6.2: Hydraulic Calculations (cont'd)	Administrative (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 written final exam will include 25 multiple-choice questions. The exam covers all the information in the Student Manual (SM), as well as the concepts presented during presentations and class discussions.

Grade		Correct Answers
A	=	22-25
B	=	20-21
C	=	18-19
F	=	17 or less

Passing is a C (70 percent).

## **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: Basic Design Criteria**

#### **Objectives**

#### **Terminal Objective**

The students will be able to:

- 1.1 Given a set of drawings and calculations, apply recognized mathematical calculations and formulas, and interpret and use standardized symbols and terminology in the review and approval process of plans for water-based fire protection systems.

#### **Enabling Objectives**

The students will be able to:

- 1.1 Recognize common terms used within the National Fire Protection Association (NFPA) standards specific to water-based fire protection systems.
- 1.2 Identify accepted symbols used in the fire protection system plan process.
- 1.3 Explain plan symbols, notes and details found on site drawings and shop drawings.
- 1.4 Verify the basic plan information to approve or reject submitted system designs.
- 1.5 Identify basic mathematical functions related to water-based fire protection systems.



- 1.6 Apply the appropriate mathematical functions necessary for the review and verification of system design.
- 1.7 Given the physical dimensions of a water storage tank and a volume formula, calculate the water storage capacity of a cylindrical suction tank.
- 1.8 Given the physical dimensions of a water storage reservoir and a volume formula, calculate the water storage capacity of a water storage reservoir.
- 1.9 Determine pressure losses due to friction loss and elevation changes.
- 1.10 Determine the size and orientation of the hydraulically most remote area.

## **Unit 2: System Design**

### **Objectives**

#### **Terminal Objective**

The students will be able to:

- 2.1 Given a set of national standards, fire protection system plans, and occupancy identification, verify that the selected fire protection system design is matched to the occupancy classification and provides appropriate levels of protection in accordance with recognized water-based fire protection standards and equipment listings and limitations due to types of construction and other physical obstructions.

#### **Enabling Objectives**

The students will be able to:

- 2.1 Given the hazard class of a specific occupancy, verify that the intended water-based fire protection system provides the appropriate levels of protection.
- 2.2 Given a set of plans, relate actual occupancy uses with standard classification terminology.
- 2.3 Given the intended use of a specific area of occupancy, verify that the extent of the water-based fire protection system is intended for installation in all areas of the hazard as required.
- 2.4 Given the intended construction types and arrangements, verify that the design of the water-based fire protection system provides adequate coverage for all areas as required.

## **Unit 3: Water Supplies and Delivery Systems**

### **Objectives**

#### **Terminal Objective**

The students will be able to:

- 3.1 Given the design criteria of a water supply system and a set of plans, evaluate the water supply system to ensure it is in compliance with nationally recognized standards for a fire protection system.

#### **Enabling Objectives**

The students will be able to:

- 3.1 Given a copy of National Fire Protection Association (NFPA) 13, *Standard for the Installation of Sprinkler Systems*, and 14, *Standard for the Installation of Standpipe and Hose Systems*, compare the volume, reliability, functionality and features of the sources available to supply fire pumps, standpipes and sprinklers.
- 3.2 Given a copy of NFPA 13 and 14, identify the minimum required water supply for a combined sprinkler and standpipe system.
- 3.3 Given the physical dimensions of a water storage tank and a volume formula, calculate the water storage capacity of a cylindrical suction tank.
- 3.4 Given a set of plans, identify the components of the private water supply system and their interrelationship.
- 3.5 Given a site plan, verify the installation details and flow capabilities of fire hydrants.
- 3.6 Given the contractor's material and test certificate documentation, verify that the underground piping provided meets nationally recognized standards.

## **Unit 4: System Components and Materials**

### **Objectives**

#### **Terminal Objective**

The students will be able to:

- 4.1 Given the design criteria of a water supply system and a set of plans, verify the adequacy of water-based fire protection system components for the intended use and compliance with recognized listings, standards and manufacturers' specifications.

## **Enabling Objectives**

The students will be able to:

- 4.1 Verify that specified pipe meets all requirements and listings for its intended use and installation in accordance with recognized codes and standards.
- 4.2 Identify the characteristics and limitations of various types of pipe in accordance with the listings and approvals.
- 4.3 Interpret the information on a product data sheet in relation to required specifications and listings intended for use as a part of a water-based fire protection system design.
- 4.4 Recognize and interpret the differences and limitations of information provided by those documents supplied from a variety of recognized testing and approval agencies.
- 4.5 Use provided data sheets to identify the corresponding components and equipment on system design drawings.
- 4.6 Determine the arrangement of the fire pump.
- 4.7 Verify the appropriate size of the pump for required pressure and flow characteristics of the design of the water-based fire protection system.

## **Unit 5: Fire Protection System Plans Methods of Design**

### **Objectives**

#### **Terminal Objective**

The students will be able to:

- 5.1 Given a set of design drawings and occupancy hazard classification, verify that the design of the water-based fire protection system provides adequate coverage and required levels of protection in compliance with recognized standards.

#### **Enabling Objectives**

The students will be able to:

- 5.1 Given intended use and occupancy, identify the appropriate design method for the intended use area (room/area/storage).
- 5.2 Given a set of plans, identify the hydraulically most demanding area based upon the use, occupancy and location of the space.

- 5.3 Given a set of plans, determine whether the system design provides adequate protection for the intended hazard classification.
- 5.4 Given a set of plans and hydraulic calculations, verify the consistency of information shown on the design documents for that water-based fire protection system.
- 5.5 Given a set of sprinkler plans and design area characteristics and sprinkler components, identify design area modifications (reductions and increases) as identified in the recognized codes and standards.
- 5.6 Given a set of sprinkler plans and occupancy hazard classification, determine the appropriate water flow rate in order to satisfy required levels of protection based on design density or area application as per recognized standards.

## **Unit 6: Evaluating Sprinkler Hydraulic Calculations**

### **Objectives**

#### **Terminal Objective**

The students will be able to:

- 6.1 Given a set of plans with hydraulic calculations, verify that the calculation methods are in compliance with recognized standards and that water-based fire protection systems design calculations are accurate.

#### **Enabling Objectives**

The students will be able to:

- 6.1 Given a set of sprinkler plans and associated hydraulic calculations, complete a basic hydraulic calculation.
- 6.2 Given a set of sprinkler plans and associated hydraulic calculations, calculate the flow characteristics from each identified node point based on required system densities and associated pressure losses due to friction and elevation.
- 6.3 Given a set of plans and hydraulic calculations, evaluate the design of the water-based fire protection system from remote area to water supply source for approval or rejection.
- 6.4 Given a set of plans and hydraulic calculations, recognize certain optional methods which may not be incorporated into the design process but which are accepted by recognized standards.

## **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 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**

Students are expected to submit classroom assignments by the posted due date (11:59 p.m. EDT/EST) and to complete the course according to the published class schedule. As adults, students, and working professionals, you must manage competing demands on your time. Discussion board postings submitted within 3 days after the submission deadline will receive up to a 20% deduction. Those that do not submit their discussion board postings within this timeline will receive a “0” grade for the week. Final assignment papers will not be accepted after the deadline. Any paper 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](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.