NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES®
sponsored by the National Society of Professional Engineers

Fire Protection Engineering Technology

Inspection and Testing of Water-Based Systems

PROGRAM DETAIL MANUAL

Field Code: 003
Subfield Code: 04

First Edition
August 2005

Important Information

The Institute occasionally makes changes in its certification programs that will significantly affect the currency of individual program detail manuals. These changes could include any or all of the following:

- deletion, modification, or addition of work elements
- modification to the Examination Requirements Chart
- modification to crossover work element credit
- changes to the work experience requirement
- changes to the verification requirement

Such changes could affect the requirements for certification. Therefore, if this manual is more than a year old, NICET highly recommends that you check www.nicet.org (or, if you don't have access to the Internet, call NICET at 888-476-4238) to make sure that you have the current edition of the Program Detail Manual before applying for an examination. The date of publication of this manual is August 2005.

IT IS THE APPLICANT'S RESPONSIBILITY TO MAKE SURE HE/SHE IS USING THE CURRENT EDITION OF THE MANUAL.

KEEP YOUR MANUALS CURRENT

This first edition of the Inspection and Testing of Water-Based Systems program detail manual does not contain any substantive changes from the 2001 edition. Only the following minor changes have been made:

- revisions to the reference listings in work element descriptions
- addition of a "Relevant Standards" page

Whenever an exam requirement changes, individuals who are already certified and do not intend to upgrade their level of certification do not need to comply with any changes for the level(s) of certification they have already been awarded.

Individuals who wish to upgrade must satisfy any "new" exam or other certification requirements for the higher level once the deadline has passed. This reprinted first edition manual does not inaugurate any program changes.

Field Of Fire Protection Engineering Technology

Subfield Of Inspection and Testing of Water-Based Systems

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General Information

This Program Detail Manual contains the certification criteria for the Inspection and Testing of Water-Based Systems subfield of Fire Protection Engineering Technology.

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in Engineering Technologies (NICET)
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This certification program was designed for engineering technicians in the automatic fire sprinkler industry who are engaged in the physical and mechanical aspects of inspection, testing, and maintenance of water-based systems, including foam and foam-water systems. (The program does not cover systems that deal with CO_2, halon, and dry chemical.)

Technical areas covered include, but are not limited to, applicable codes and standards, types of systems, supervision requirements, building occupancy considerations, and basic physical science.

This certification does not entitle the certificant to practice engineering. The practice of engineering is defined and regulated by state engineering licensing boards; unlawful practice of engineering is a violation of state laws. When not exempted by state law, the performance of work by the engineering technician/technologist which constitutes the practice of engineering must be under the direct supervision and control of a licensed professional engineer.

This program became operational in 2000 with technical assistance provided by the National Fire Sprinkler Association, the American Fire Sprinkler Association, the Canadian Automatic Sprinkler Association, Oklahoma State University, the National Fire Protection Association, Underwriters Laboratories Inc, Factory Mutual Global, and the office of the Virginia State Fire Marshal.

Certification Requirements

Certification candidates must meet the following criteria:

- complete the written examination requirement
- work element verification by the immediate supervisor
- appropriate employment history
- technician recommendation by an acceptable recommender (required at Level III)

Simply passing the examination does not guarantee certification. All other components MUST be accepted and approved in order to achieve certification.

Level I is designed for entry-level technicians with very limited relevant work experience in the technical subfield. The Institute recommends that persons with eighteen or more months of relevant work experience set their initial certification goal at Level II. Certification at Levels II and III does not require prior certification at a lower level. The Examination Requirements Charts show how many elements must be passed to meet the exam requirement for Levels I, II, and III.

Work Element Examination

Inspection and Testing of Water-Based Systems

Descriptions

The typical job duties and associated responsibilities of Inspection and Testing engineering technicians have been broken down into discrete elements which form the basis for an evaluation of the candidate's knowledge. Each work element is written in sufficient detail to permit candidates to make reasonable assumptions about the types of questions likely to be asked.

In addition, the supervisor verifying the experience of the candidate should be able to interpret the scope of the activities associated with each work element.

Identification Numbers

In order for NICET to prepare individualized examinations for each applicant, identification numbers have been assigned to each technical field and to each work element. Each technical field is represented by a 3-digit number. The technical field code number for Fire Protection Engineering Technology is 003.

The identification number assigned to each work element is 5 or 6 digits long.
The first digits identifies the technical subfield within the field of Fire Protection Engineering Technology:

(1) Automatic Sprinkler Systems Layout
(2) Special Hazards Systems Layout (no longer available)
(3) Fire Alarm Systems
(4) Inspection and Testing of Water-Based Systems
(5) Special Hazards Suppression Systems

The second digit identifies the level (Levels I through III) and the work element type (General or Special):

General Work Elements	**Special Work Elements**
(1) Level I General	(2) Level I Special
(3) Level II General	(4) Level II Special
(5) Level III General	(6) Level III Special

The third, fourth and fifth digits identify the individual work element within each category. A sample of this numbering system is illustrated below for work element number 003/45001:

Technical Field Code:	003	(Fire Protection Engineering Technology)
Subfield:	4	(Inspection and Testing of Water-Based Systems)
Level/Type:	5	(Level III General)
Work Element Sequence:	001	(Water Flow Tests)
Work Element Number:	003/45001	(Field Code Number/ 5-Digit Work Element ID Number)

This eight-digit identification number is needed when using the application form to request a work element on an exam or to provide work element verification.

Selection

1. Refer to Examination Requirements Chart on the following page

2. Select the appropriate box for the level of certification desired.

3. Note the number/type of work elements required for certification, by category, as shown in the selected box.

4. Turn to the Work Element Listing section and carefully select work elements from the required categories, paying attention at each level to whether they are classified as **General** or **Special** work elements. When possible, select a few extra in each category so that failing one or more work elements leaves enough passed work elements to satisfy the examination requirements.

5. The maximum number of work elements for any single examination sitting is 34, due to time restrictions.

6. The Institute recommends that the maximum number of work elements (34) be selected for each examination. This provides the greatest opportunity for successful completion of the examination requirements with the least number of subsequent examinations. Recognize, however, that all elements selected on an exam application **will be scored**, even if no attempt is made to answer the questions. That is, a score of "0" will be assigned to the work element even if the questions are not answered and the work element will have one failure marked against it.

7. If the requirement for the desired level is more than 34, it is advisable to test first all lower-level work elements needed to achieve certification. Save the upper-level work elements for a subsequent examination.

8. Examination candidates should keep copies of their applications for their records.

9. It is not necessary to retest failed work elements if there are other work elements, in the appropriate categories, which can be selected. If you need to retest a failed work element, you must wait 120 days from the last time you failed it before you will be permitted to test that element again. **Retesting a failed work element will be limited to three attempts in a two-year span to achieve a passing score.**

10. If an adequate number of work elements has been selected to meet the desired certification requirement (with a few extra selected to provide a cushion), and there is room on the exam application to add more elements, it is appropriate to include work elements that will satisfy the examination requirement of the next level of certification or to include work elements from another field/subfield.

Examination Requirements Chart

Inspection and Testing of Water-Based Systems

You must pass the number of work elements shown in each box to complete the exam requirement for certification at that level.

Level I

Level I - General – 7 a Level I - Special - 2 TOTAL 9	You must pass this many work elements to complete the **Level I** requirement. **See Note (a) below.**

Level II

Level I - General – 15 b Level I - Special - 5 Level II - General – 9 c Level II - Special - 3 TOTAL 32	You must pass this many work elements to complete the **Level II** exam requirement. **See Notes (b) and (c) below.**

Level III

Level I - General - 15 b Level I - Special - 6 Level II - General - 15 b Level II - Special - 8 Level III - General - 6 b Level III - Special - 4 TOTAL 54	You must pass this many work elements to complete the **Level III** exam requirement. **See Note (b) below**.

Level IV

To be determined	NICET is researching the possible future development of a Level 4 certification.

NOTES:

(a) Work Elements 41001, 41002, 41003, 41004, and 41005 must be passed to achieve certification at Level I.

(b) All core work elements in this category must be passed to complete the exam requirement at this level.

(c) Work Elements 43002, 43003, 43004, 43005, 43007, and 43008 must be passed to achieve certification at Level II.

GENERAL NOTES:

(1) No more than 34 work elements can be scheduled for any single examination sitting.

(2) Work elements passed which are in excess of the requirement at a particular type and level, but which can be used to meet the requirement at the next higher level are automatically applied to that higher level requirement.

(3) Use the Personal Tally Sheet on page 14 of this manual to keep track of the number of work elements you have successfully passed.

Verification of Work Elements

Verification must be provided by the examinee's immediate supervisor as identified by the examinee in the employment history section of the NICET Test Application form. Verification of work elements is the acknowledgement that the verifier has personally observed the examinee repeatedly and correctly perform the task or utilize the knowledge required by the particular work element.

The verifier should read each work element description and then initial each work element. The verifier also completes and signs the statement of understanding that is part of the NICET Test Application form.

Lack of verification does not prevent testing a work element. However, work elements tested without verification are not counted for certification until acceptable verification is received and approved by the Institute.

If the examinee's immediate supervisor does NOT have technical expertise in the specialty area, or if the examinee has no supervisor, verification must be obtained from an individual who does have technical expertise in the specialty area AND has first-hand knowledge of the examinee's specific job skills. There is space on the application form for the verifier or examinee to explain how the verifier has been in a position to supervise, inspect and approve the work.

Employment History

Your work experience will not be evaluated until a written exam requirement has been met. Carefully consider your actual experience before testing in a technical area where you have limited or no experience **-- meeting an exam requirement does not guarantee certification.**

- NICET certification is only awarded to persons performing engineering **technician** level work. This must be documented in the examinee's Work History in the application.
- A preponderance of the work experience must be acquired while residing in the United States and its territories, employing U.S. standards and work practices.
- A significant proportion of the relevant work experience must be recent.
- The work history write-up must be complete, detailed, and specific. It must describe your specific job duties, responsibilities, work tasks, specific tests you perform, materials tested, assignments over the years, job title/position changes, and any other pertinent information. Lack of detail will delay certification.

Technician Recommendation Form

A valid Technician Recommendation form MUST be on file to award certification at Level III. It is valid for one year from the date shown next to the recommender's signature.

This form is available on the Website. It must be completed by a person who is familiar with the examinee's technical capabilities and background.

Technician Profile

Inspection and Testing of Water-Based Systems

	Level I	Level II	Level III
Education	No formal education requirement. Certification at Level II and higher assumes prior educational experiences (college, self-study, workshops, etc.) that develop equivalent knowledge necessary for graduation from a fire protection engineering technology (or closely related) associate degree program.		
Minimum Work Experience	None to very limited work experience in fire protection or related activities	A minimum two years, of which at least 6 months must be recent employment involving water-based fire protection system field inspection and testing, and the balance (18 months) made up of prior experience in fire protection activities in a directly related capacity	Level II certification experience plus three years during which water-based fire protection systems inspection and testing is the primary activity; at least 1 year of the inspection and testing experience must have been acquired within the 3-year period just prior to this level's certification award date.
Level of Responsibility	Under direct supervision	Under general supervision	Under little or no daily supervision. May supervise others
Typical Activities	Assists in the inspection and/or testing of fire protection systems	Conducts routine inspection and testing of water-based fire protection systems	Conducts comprehensive inspection and testing of water-based fire protection systems
Typical Job Titles	Inspector Trainee	Inspector	Senior Inspector

Crossover Work Elements

"Crossover" work elements are identified as identical or nearly identical in topic coverage and test questions to work elements in other selected fields/subfields. Almost all the certification programs have "generic" crossover work elements covering communication skills, mathematics, physical science and other basic areas of knowledge. Once a crossover work element is passed on an examination, it does not normally have to be taken again on any other examinations. Crossover credit for the passed elements will be assigned to an examinee's record as follows:

- **First Time Testing in New Subfield:** When you test work elements in a new subfield (at least one element), any crossover credit from previously-tested subfields will automatically be assigned to the new subfield. At the same time, any crossover credit from the new subfield will automatically be assigned to previously-tested subfields. This assignment of crossover credit will occur every time a new subfield is tested.

- **Additional Testing in Previously-Tested Subfield:** When you test new work elements or retest failed work elements from a previously-tested subfield, any crossover credit from the newly-passed work elements will automatically be assigned to all previously-tested subfields.

- No crossover credit will be assigned to a subfield until you **test at least one work element** from that subfield.

- Crossover credit will not be assigned to or from work elements if the certification is in Delinquent or Expired Status.

- The 120-day waiting period policy which applies to failed work elements also applies to all work elements that have crossover credit to that work element (see Policy #20).

- The following documents are available. Use the Personal Records Order Form on the Website.

    - **Personal Crossover Evaluation** lists your "potential" crossover credit to a designated **untested s**ubfield.

    - **Crossover Listing** lists all current crossovers between two specified subfields. You may order up to three listings at no charge.

    - **Official Personal Transcript** lists all work elements presently credited to the examinee's testing record (including those passed on an exam and those achieved through crossover) for a designated subfield.

WARNING

Revisions to certification programs can occasionally eliminate previous crossovers relationships or create new ones. Thus, crossover credit shown on the "Personal Crossover Evaluation" and on any "Crossover Listing" cannot be assumed to be permanent.

The Personal Crossover Evaluation is a "potential" list. Only when a new subfield is tested and the crossover credit is posted to the test record does it become permanent. The Official Personal Transcript shows the crossover credit actually awarded.

Testing

The NICET written examinations are designed by the individual who has performed the work elements associated with the program. Preparation for this examination should be minimal.

The exam is open-book; therefore, standards, references, and/or textbooks are permitted (and encouraged) at the test site. When appropriate, the work element description specifies the applicable standards or procedures.

When work elements are keyed directly to specific industry-wide standards, the standard will be identified by a normally used notation at the end of the work element description.

When a specific publication is used as an authoritative source, the title will be listed at the end of the work element. Refer to the "Selected General References" in this manual.

Training

NICET does not endorse, certify, or accredit training programs. The Institute does, however, provide information on the certification procedures and objectives so that training courses can be developed specifically to help persons planning to take a NICET certification exam.

Expiration of Certificate

The first certificate(s) awarded will have an expiration date of three years from the date of award. The certificate(s) will expire at the end of that three-year period unless renewed through recertification. A certificate that is not renewed at the end of three-year period will expire. A consequence of the certificate going into Expired Status will be deletion of all records, including test history.

Upgrading the certificate or adding a certificate in a different technical area does not change your 3-year expiration date.

Recertification Policy

All certificants should read Policy #30, "Continuing Professional Development." At the end of each 3-year period, all certificants must demonstrate that they have accumulated sufficient Continuing Professional Development (CPD) points within the certification area(s) held to renew the certificate(s) for another 3 years. Once renewed, the certificate is valid for an additional three-year period. The recertification fee must be paid when submitting the recertification application form.

Work Element Listing

Inspection and Testing of Water-Based Systems

Level I - General Work Elements

(Work at Level I Is Performed Under Direct Supervision)

Core Work Elements (See Note 1)

ID No. Work Element Title and Description

41001 INSPECTION PROCEDURES
Assist in the inspection and testing of water-based fire protection systems. Record observations and data. (NFPA 13, NFPA 25)

41002 NFPA STANDARD DEFINITIONS
Understand NFPA standard definitions, including "authority having jurisdiction", "approved", "inspect", "listed", "maintenance", "shall", "should", "test", etc. as they apply to water-based fire protection systems. ("Definition" and "Scope" sections of NFPA standards)

41003 BASIC COMPONENTS
Based on manufacturer's literature and fire protection texts, understand operation and use of sprinklers, dry/alarm/deluge valves, and other related devices. Know the purpose of product approval and testing standards organizations such as ASTM, FM, UL, and ULC.

41004 BASIC METRIC UNITS AND CONVERSIONS
Perform conversions to and from basic metric (SI) units. (IEEE/ASTM SI 10)

41005 SYSTEM APPURTENANCES
Recognize correct piping arrangements pertaining to water supply connections, fire department connections, water supply test pipes, gauges, valves, inspector's test connection, drains, etc. (NFPA 13)

41006 ROLE OF THE INSPECTOR
To inspect, test, report and document any and all system abnormalities. To instruct the owner's representative on conducting inspection and testing procedures. (NFPA 25)

41007 ON-SITE INSPECTION AND TESTING PREPARATION
Know the proper tools for inspection and testing of water-based systems. Know the frequency and methodology for inspection and testing. Know what forms and documents the owner or his or her representative must be given upon completion of the inspection and testing.

41008 GENERAL SYSTEM TERMINOLOGY
Comprehend the general and special terms used in the water-based extinguishing systems vocabulary. Understand the specific meaning of terms frequently used in the inspection and testing of water-based systems. (NFPA 13, NFPA 14, NFPA 20, Detection, Treatment and Prevention of Microbiologically Influenced Corrosion in Water-Based Fire Protection Systems)

41009 INSPECTOR'S SAFETY CONCERNS
Recognize hazardous materials and environments. Know and use appropriate safety precautions. (OSHA 29 CFR, Parts 1910 and 1926)

Non-Core Work Elements

41010 BASIC MATHEMATICS
Solve mathematical problems requiring simple addition, subtraction, multiplication, and division. Round to the correct number of significant figures, calculate percentages, read graphs, and use simple geometric definitions and formulas. (See general mathematics textbooks.)

41011 BASIC PHYSICAL SCIENCE
Apply terms, definitions, and concepts from mechanics, electricity, heat, and chemistry. (Solutions may involve simple formulas found in basic physics textbooks, but will not involve algebraic manipulations or trigonometry)

Note 1: All General work elements are categorized as either Core or Non-Core. Read the chart on page 4 and the Personal Tally Worksheet on page 14 carefully to see when the Core elements are mandatory for certification.

41012 BASIC COMMUNICATION SKILLS
Use proper punctuation, vocabulary, spelling, and sentence structure. Follow written instructions. (basic grammar references)

41013 FIRE PROTECTION DESIGN SYMBOLS
Recognize standard design symbols common to the fire protection industry. (NFPA 13, NFPA 170)

41014 PLANS AND SPECIFICATIONS
Understand general and special architectural and mechanical specifications. Understand architectural, mechanical, electrical, and structural site plans and specifications to determine dimensions, types of materials, elevations, locations, and other information. Calculate area, lengths, spacings, beam sizes, volumes, etc. from dimensions and other data in the plans and specifications. (NFPA 13, general construction texts and references)

41015 STANDPIPE AND HOSE SYSTEM COMPONENTS
Recognize the characteristics of standpipe and hose system components, including their purpose, function, and operation. Understand basic system terminology. (NFPA 13, NFPA 14)

41016 CLASSIFICATION OF OCCUPANCIES
Recognize hazard classification and occupancy classification concepts as defined in NFPA standards. (NFPA 13)

41017 FIELD IDENTIFICATION OF SPRINKLERS
Recognize the temperature rating, orifice size, and orientation of sprinklers. Identify the various types of sprinklers available. Determine if decorative sprinklers were factory coated to meet their listing and/or approval. (NFPA 13, NFPA 25, UL Fire Protection Equipment Directory)

41018 AUTHORITIES HAVING JURISDICTION
Recognize the role of state and local health authorities, fire departments, and insurance companies. Know the requirements for reporting system conditions. (NFPA 25)

Level I - Special Work Elements

42001 CONTRACTS AND FORMS
Recognize the role of contracts and forms in determining the scope of work to be performed. Understand the inspector's scope of responsibility. Understand the owner's responsibility.

42002 FOAM-WATER SYSTEM COMPONENTS
Recognize the characteristics of deluge foam-water sprinkler and foam-water spray system components, including their purpose, function, and operation. Understand basic system terminology. (NFPA 13, NFPA 16)

42003 FIRE PROTECTION WATER TANKS
Recognize the characteristics of water tanks for fire protection, including their purpose, function, and operation. Understand basic system terminology. (NFPA 22)

42004 PRIVATE FIRE SERVICE MAIN SYSTEM COMPONENTS
Recognize the characteristics of private fire service mains and their appurtenances, including their purpose, function, and operation. Understand basic system terminology. (NFPA 13, NFPA 24)

42005 NON-WATER-BASED FIRE PROTECTION SYSTEMS
Recognize the various types of non water-based fire suppression systems, understand their basic operating characteristics, and be familiar with their hazard to life safety. Understand basic system terminology utilized in the industry. (NFPA 10, NFPA 11, NFPA 11A, NFPA 12, NFPA 12A, NFPA 17, NFPA 17A, NFPA 2001, Principles of Fire Protection, Fire Protection Handbook)

42006 BASIC PRINCIPALS OF COMBUSTION
Understand basic fire behavior. (NFPA 17, Fire Suppression and Detection Systems, Fire Protection Handbook)

42007 FIRST AID PROCEDURES
Understand the basic rules and procedures of first aid. (See general handbooks on first aid.)

42008 WATER-SPRAY FIXED-SYSTEM COMPONENTS
Recognize the characteristics of water-spray fixed-system components, including their purpose, function, and operation. Understand basic system terminology. (NFPA 13, NFPA 15)

42009 FIRE PUMPS
Recognize the characteristics of fire pumps, including their purpose, function, and operation. Understand basic system terminology. (NFPA 20, Fire Protection Handbook, Fire Protection Hydraulics and Water Supply Analysis)

Level II - General Work Elements

Core Work Elements

43001 SPRINKLER OBSTRUCTION, POSITION, AND CONDITION
Verify proper location and position of sprinklers with respect to obstructions, heat sources, and other special building features. Understand installation requirements for special sprinkler types (extended coverage, large-drop, ESFR), and know the minimum/maximum allowable distances permitted by codes and standards in effect presently and/or at the time of original installation. Report on condition of sprinkler heads. Report observations. (NFPA 13)

43002 WET PIPE SYSTEMS
Verify proper installation of wet pipe systems. Report observations. (NFPA 13)

43003 DRY PIPE SYSTEMS
Verify proper installation of dry pipe systems. Report observations. (NFPA 13)

43004 TESTING OF GENERAL SYSTEM COMPONENTS
Understand the test requirements for water-based fire suppression system testing. Understand what must be tested as well as the frequency and methodology. (NFPA 25)

43005 GENERAL PURPOSE VALVES INSPECTION
Inspect and test general purpose valves such as OS&Y valves, post indicator valves, roadway box valves, check valves, butterfly valves, detector check valves, relief valves, hydrants, and preaction valves. Record observations and data. Report findings. (NFPA 13, NFPA 25)

43006 WATER SUPPLY REQUIREMENTS
Verify that the water supply type, location and arrangement satisfies system requirements. Report observations. (NFPA 13, NFPA 24)

43007 INSPECTION OF GENERAL SYSTEM COMPONENTS
Understand inspection requirements for water-based fire suppression systems, recognize typical fire sprinkler system components. (NFPA 13)

43008 IMPAIRMENT PROCEDURE
Recognize the conditions for temporary impairment of water-based fire protection systems and the appropriate notification and tagging procedures. (NFPA 25)

43009 INSPECTION PREPARATION
Plan the inspection and testing of water-based fire protection systems. Understand the tools necessary for inspection and testing. Understand proper notification protocol. (NFPA 25)

Non-core Work Elements

43010 INTERMEDIATE MATHEMATICS
Perform mathematical calculations utilizing basic algebra (fundamental laws, algebraic expressions), geometry, and the trigonometric functions of triangles. (See basic textbooks on algebra and trigonometry.)

43011 STANDPIPE AND HOSE SYSTEMS INSPECTION AND TESTING
Verify that the standpipe and hose systems being inspected conform to the requirements of NFPA and other standards in effect presently and/or at the time of original installation. Report observations. (NFPA 13, NFPA 14, NFPA 25)

43012 NO-FLOW TRIP TESTS
Perform no-flow trip tests on dry, pre-action, and deluge systems. Record data and report findings. (NFPA 25)

43013 STORAGE OCCUPANCIES AND COMMODITY CLASSIFICATION
Recognize storage configurations, classification of commodities, and the use of ESFR sprinklers. (NFPA 230)

43014 CENTRIFUGAL FIRE PUMP INSPECTION
Verify that the centrifugal fire pumps and jockey pumps being inspected conform to the requirements of NFPA and other standards in effect presently and/or at the time of original installation. Report observations. (NFPA 20, NFPA 25, Fire Protection Hydraulics and Water Supply Analysis)

43015 LOCAL ALARM DEVICES INSPECTION
Inspect and test local alarm devices. Record observations and data. (NFPA 25)

43016 SUPERVISORY ALARM DEVICES INSPECTION
Inspect and test supervisory alarm devices. Record observations and data. (NFPA 25, NFPA 72)

43017 COMPONENT/MATERIAL LIMITATIONS
Understand pressure, temperature, and other limitations placed on system components and materials by NFPA. (NFPA 13, NFPA 14, NFPA 20, NFPA 22, NFPA 24, nationally recognized standards issued by organizations such as ASTM, FM, UL, ULC, and manufacturers' data sheets)

Level II - Special Work Elements

44001 RESIDENTIAL SYSTEMS INSPECTION
Verify proper installation of residential sprinklers for one- and two-family dwellings, multi-story buildings, and manufactured homes. Report observations. (NFPA 13, NFPA 13D, NFPA 13R)

44002 DIESEL-DRIVE FIRE PUMPS AND CONTROLLERS INSPECTION
Verify proper installation of diesel-drive pumps, jockey pumps, and their controllers. Record observations and data. Report findings. (NFPA 20, NFPA 25)

44003 ELECTRIC-DRIVE FIRE PUMPS AND CONTROLLERS INSPECTION
Verify proper installation of electric-drive pumps, jockey pumps, and their controllers. Record observations and data. Report findings. (NFPA 20, NFPA 25, NFPA 70)

44004 ATMOSPHERIC TANKS INSPECTION AND TESTING
Verify piping arrangements and placement of atmospheric "covered" tanks (elevated, surface, and embankment supported), including operating condition of accessories. Report observations. (NFPA 22, NFPA 25)

44005 PRESSURE TANKS INSPECTION AND TESTING Verify piping arrangements and placement of pressure tanks, including operating condition of accessories. Report observations. (NFPA 22, NFPA 25)

44006 WATER-BASED FIRE PROTECTION SYSTEM FIELD SKETCHING
Draw free-hand sketches to describe hazards which might need special protection or require system modifications.

44007 FIRE PROTECTION SYSTEM SPECIAL VALVES INSPECTION
Inspect and test fire protection system special valves such as pressure reducing valves (system/hose), altitude valves, deluge-type valves, and solenoid valves. Record observations and data. Report findings. (NFPA 25)

44008 FOAM-WATER SYSTEMS INSPECTION
Verify that the deluge foam-water and foam-water spray systems being inspected conform to the requirements of NFPA and other standards in effect presently and/or at the time of original installation. Report observations. (NFPA 13, NFPA 16, NFPA 25)

44009 GENERAL STORAGE SYSTEMS INSPECTION
Verify that general storage systems being inspected conform to the requirements of NFPA and other standards in effect presently and/or at the time of original installation. Report observations. (NFPA 230)

44010 PIPE JOINING TECHNIQUES
Verify that pipe joints conform to NFPA Standard (13) and other nationally recognized standards issued by organizations such as ASTM, FM UL, and ULC. Report observations. (NFPA 13)

44011 PRIVATE SERVICE MAINS INSPECTION
Verify that the private service mains and their appurtenances being inspected conform to the requirements of NFPA and other standards in effect presently and/or at the time of original installation. Report observations. (NFPA 13, NFPA 24, NFPA 25)

44012 PREACTION AND DELUGE SYSTEMS INSPECTION
Verify proper installation. Report observations. (NFPA 13, NFPA 25)

44013 FULL FLOW TESTS OF DRY-PIPE SYSTEMS
Perform full flow trip test of dry-pipe valve(s), including reset of system to operational condition. Record data and report findings. (NFPA 25)

44014 WATER SPRAY FIXED SYSTEMS INSPECTION
Verify that the water spray fixed systems being inspected conform to the requirements of NFPA and other standards in effect presently and/or at the time of original installation. Report observations. (NFPA 13, NFPA 14, NFPA 15, NFPA 25)

44015 INSPECTION HYDRAULICS
Apply the basic principles of hydraulics to the inspection and testing of water-based fire suppression systems. Assess and/or calculate the effect of flow, elevation, and pipe size on the system pressure and liquid velocity. Perform basic calculations involving force, pressure, and area. (Fire Protection Hydraulics and Water Supply Analysis)

Level III - General Work Elements

Core Work Elements

45001 WATER FLOW TESTS
Conduct flow tests of public and/or private water supplies. Complete flow test summary sheet and prepare water supply graphs. (NFPA 13, NFPA 12, NFPA 25, SFPE Handbook of Fire Protection Engineering, Fire Protection Hydraulics and Water Supply Analysis)

45002 FIRE PUMP FLOW TEST
Conduct a fire pump flow test. Record data, evaluate results, and report findings. (NFPA 20, NFPA 25, Fire Protection Hydraulics and Water Supply Analysis)

45003 STANDPIPE FLOW TESTS
Conduct a standpipe flow test. Record data, evaluate results, and report findings. (NFPA 14, NFPA 25)

Non-core Work Elements

45005 OBSTRUCTION INVESTIGATIONS
Identify the conditions warranting an obstruction investigation. Conduct a complete obstruction investigation. Record observations data. Report findings. (NFPA 25)

45006 OSHA AND OTHER INDUSTRY SPECIFIC SAFETY REGULATIONS
Follow standard safety practices in performing job tasks. Recognize and call attention to improper safety practices at the work site. (29 CFR, Parts 1910 and 1926)

45007 TESTING OF FIRE PUMP RELATED EQUIPMENT
Test fire pump related equipment such as controllers, automatic transfer switches, and emergency or stand-by power supplies. Record data, evaluate results, and report findings. (NFPA 20, NFPA 25, NFPA 110)

45008 BUSINESS COMMUNICATIONS
Use the rules of syntax and style to write clear sentences and paragraphs in preparing routine correspondence and reports. Follow standard business communications procedures. (See basic grammar and writing handbooks.)

Level III - Special Work Elements

46001 EXPOSURE PROTECTION SYSTEMS INSPECTION
Verify that exposure protection systems comply with applicable standards (placement & density). Report observations. (NFPA 13, NFPA 80A)

46002 SEISMIC BRACING
Verify the need for and the presence of proper seismic bracing. Report observations. (NFPA 13, NFPA 25)

46003 BACKFLOW PROTECTION
Recognize the various types of backflow protection devices. Understand inspection and testing requirements of state and local health authorities. (NFPA 13, AWWA M14)

46005 WATER SPRAY SYSTEMS FLOW TEST
Conduct flow test of water spray systems. Assure proper coverage by all nozzles and operation of detection system and valves. Record observations data. Report findings. (NFPA 15, NFPA 25)

46007 CONTRACT COST ESTIMATES AND SPECIFICATIONS
Assist in preparing cost estimates and specifications for inspection, testing, and maintenance contracts.

46008 ANTIFREEZE SYSTEMS INSPECTION AND TESTING
Verify proper installation of antifreeze systems. Report observations. Locate and interpret any existing regulations for antifreeze systems issued by water supply authorities and/or state and local health authorities. Identify anti-freeze solutions acceptable for use with potable and non-potable water supplies. Calculate the existing solution and by volume percentage and system capacity limits. Record observations and data. Report findings. (NFPA 13, NFPA 25)

46009 TIME MANAGEMENT AND SCHEDULING
Develop inspection and test schedules utilizing road maps, known traffic conditions, and time management principles.

46010 TESTING OF PREACTION AND DELUGE SYSTEMS
Test preaction and deluge systems. Record data, evaluate results, and report findings. (NFPA 13, NFPA 25)

Personal Tally Sheet

Inspection and Testing of Water-Based Systems

- Put a check mark next to the appropriate work element number when you receive a passing score on your Examination Score Report.
- Put a "C" next to the appropriate work element number if you have crossover credit from another field/subfield. Read page 7 in this manual concerning crossover credit.
- Refer to the chart on page 4 to determine whether you have passed an exam requirement.

Level I General	**Level I Special**	**Level II General**	**Level II Special**	**Level III General**	**Level III Special**
___41001 *	___42001	___43001 *	___44001	___45001 *	___46001
___41002 *	___42002	___43002 *	___44002	___45002 *	___46002
___41003 *	___42003	___43003 *	___44003	___45003 *	___46003
___41004 *	___42004	___43004 *	___44004	___45005	___46005
___41005 *	___42005	___43005 *	___44005	___45006	___46007
___41006 *	___42006	___43006 *	___44006	___45007	___46008
___41007 *	___42007	___43007 *	___44007	___45008	___46009
___41008 *	___42008	___43008 *	___44008		___46010
___41009 *	___42009	___43009 *	___44009		
___41010		___43010	___44010		
___41011		___43011	___44011		
___41012		___43012	___44012		
___41013		___43013	___44013		
___41014		___43014	___44014		
___41015		___43015	___44015		
___41016		___43016			
___41017		___43017			
___41018					

*** = Core Work Element**

Relevant Standards

The following organizations issue standards appropriate to this certification program. The standards below are specifically referenced in the work element listing. On NICET's web site is a table, "Fire Standards Referenced in NICET Exams," that lists the edition year of the NFPA standard used in writing the test questions. Examinees are strongly recommended to bring the indicated standard editions to the test center.

National Fire Protection Association (NFPA)

NFPA 10	Portable Fire Extinguishers
NFPA 11	Foam Extinguishing Systems
NFPA 11A	Medium and High Expansion Foam Systems
NFPA 12	Carbon Dioxide Systems
NFPA 12A	Halon 1301 Systems
NFPA 13	Installation of Sprinkler Systems
NFPA 13D	Dwelling Sprinkler Systems
NFPA 13R	Residential Occupancies up to and Including Four Stories in Height
NFPA 14	Standpipe and Hose Systems
NFPA 15	Water Spray Fixed Systems for Fire Protection
NFPA 16	Deluge Foam-Water Sprinkler and Foam-Water Spray Systems
NFPA 17	Dry Chemical Extinguishing Systems
NFPA 17A	Wet Chemical Extinguishing Systems
NFPA 20	Centrifugal Fire Pumps
NFPA 22	Water Tanks for Private Fire Protection
NFPA 24	Private Fire Service Mains and Their Appurtenances
NFPA 25	Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
NFPA 70	National Electrical Code
NFPA 72	Protective Signaling Systems
NFPA 80A	Protection of Buildings from Exterior Fire Exposures
NFPA 110	Emergency Power Supplies
NFPA 170	Fire Safety Symbols
NFPA 230	Fire Protection of Storage
NFPA 2001	Fire Extinguishing Systems, Clean Agent

American Society for Testing and Materials (ASTM)

IEEE/ASTM SI 10	Use of the International System of Units (SI): The Modern Metric System

American Water Works Association (AWWA)

M14	Backflow Prevention and Cross Connection Control

Selected General References

Annual Book of ASTM Standards. American Society for Testing and Materials. Philadelphia, PA.

Brock, Pat D. Fire Protection Hydraulics and Water Supply Analysis, 2nd Edition. Oklahoma State University Fire Protection Publications, Stillwater, OK.

Bryan, John L. Fire Suppression and Detection Systems, 2nd Edition. MacMillan Publishing Co., Inc. New York, NY.

Detection, Treatment and Prevention of Microbiologically Influenced Corrosion in Water-Based Fire Protection Systems. NFSA Publication.

Fire Alarm Signaling Systems (FASS-94). National Fire Protection Association. Quincy, MA.

Fire Protection Handbook. National Fire Protection Association. Quincy, MA.

Gagnon, Robert M. Design of Water-Based Fire Protection Systems. Delmar Publishers. Albany, NY. 1997.

Guide for Sprinkler Plan Review. National Fire Sprinkler Association, Inc. Patterson, NY.

OSHA Safety & Health Standards C29 CFR 29 CFR, Parts 1910 and 1926.

The SFPE Handbook of Fire Protection Engineering, National Fire Protection Association. Quincy, MA.

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES
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EXAMINATION SCORE REPORT

SAMPLE

Exam No. 99999
Examinee: JOHN DOE

Test Date: 11/17/99
Report Date: 12/27/99

INSPECTION AND TESTING OF WATER-BASED SYSTEMS

Work Element Number and Title		Score (%)	Pass/Fail
3041001	Inspection Procedures	75.00	P
3041002	NFPA Standard Definitions	80.00	P
3041006	The Role of the Inspector	35.00	F*
3042002	Foam Water System Components	35.00	F**
3043008	Impairment Procedure	65.00	P
3043017	Component/Material Limitations	80.00	P
3044003	Electric-Drive Fire Pumps and Controllers Inspection	20.00	F**
3044006	Water-Based System Field Sketching	90.00	P
3045007	Testing of Fire Pump Related Equipment	90.00	P

*** This failed work element cannot be retested prior to 120 days after the test date shown on this score report.**
**** This is your second failure for this work element. It cannot be retested prior to 120 days after the test date shown on this score report.**

JOHN DOE
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