



Inspection and Testing of Water-Based Systems

Standard Model/Computer-Based Testing

Level III Content Outline

The candidate for NICET certification at Level III in the Inspection and Testing of Water-Based Systems should have the knowledge and experience to:

Without supervision, perform and supervise inspections and tests of all water-based fire protection systems other than foam-water, water-mist, and ultra-high-speed water spray systems, particularly those that require, for safety and accuracy, knowledge of system operation, materials, interfaces, specialized fire protection functions, and/or hydraulic effects of high or changing pressures.

There are two exams listed at Level III; both, plus the two listed at Level I and the three listed at Level II are required for certification at Level III.

Note: For each exam, the skills and knowledge listed under each task are suggestive of those involved in that task, but are not intended to constitute an exhaustive listing.

Test # 10022: Level III Inspections and Responsibilities

3.1 Inspection

(Questions related to these tasks makeup 79-83% of the exam)

3.1.1 Inspect deluge and preaction systems for damage or any conditions that might limit proper functioning.

Knowledge:

Function and appearance of the major components that are unique to deluge and/or preaction systems
Functions and components of different types of activation systems
NFPA 25: 3.5.2, 3.6.4.2, 3.6.4.4, 13.4.3.1

Skills:

Use NFPA 25: 13.4.3.1 and Table 13.1 to determine inspection frequencies.
Verify that the scope of an inspection job can be fulfilled in conformance with NFPA 25: 13.4.3.1.
Visually inspect the components that are unique to deluge and/or preaction systems (including air maintenance device, closed sprinklers, and inspector's test connection) for damage or conditions that could limit or threaten the functionality of the system.
Inspect the condition of any associated non-electrical detection devices.

3.1.2 Visually inspect water-spray systems for proper alignment of nozzles and for damage or any conditions that might limit proper functioning.

Knowledge:

Function and appearance of the components of water spray nozzles and pipe supports

Function and appearance of the major parts of each type of pneumatic or hydraulic detection system
NFPA 25: 3.6.5, 10.2.5, Table 10.1

Skills:

Use NFPA 25: Table 10.1 to determine inspection frequencies.
Verify that the scope of an inspection job can be fulfilled in conformance with NFPA 25: 10.2.5.
Identify target hazard being protected.
Verify proper alignment of the nozzles.
Inspect spray nozzles and pipe supports for externally visible damage or deficiencies that limit or threaten the functionality of the water spray system.
Inspect pneumatic and hydraulic detectors (pilot line detectors) for damage or conditions that could limit or threaten their functionality.

3.1.3 Perform an external inspection of a water storage tank and its support structure for evidence of damage, corrosion, reduced support, or other possible deficiencies.

Knowledge:

NFPA 25: 9.2 and Table 9.1

Skills:

Use NFPA 25: 9.2 and Table 9.1 to determine inspection frequencies for tank system components.
Inspect the outside of the tank and its external components for evidence of damage, corrosion, or other possible deficiencies.
Inspect external insulation and protective coatings for evidence of damage, corrosion, reduced support, or other possible deficiencies.



Inspect the support structure of the tank for evidence of damage, corrosion, reduced support, or other possible deficiencies.

Inspect the immediate environment of the tank for possible hazards to the proper functioning of the tank.

Record and report any deficiencies.

3.1.4 Perform an internal inspection of a tank, heating system, and anti-vortex plate for evidence of corrosion, silt build-up, leaks, and other possible deficiencies.

Knowledge:

NFPA 25: 9.2.6

Skills:

Use NFPA 25: 9.2.6 to determine inspection frequencies. Identify any tank deficiencies, including waste materials, debris, aquatic growth and life, silt build-up, cracks in floor or walls, poor condition of lining or coating, obstruction or blockage of vortex plate or pump inlet, etc.

Verify functioning of automatic fill valves.

3.1.5 Inspect systems protecting freezers and cold storage areas for evidence of ice blockages.

Knowledge:

NFPA 25: 5.2.4.4, 14.3, and Figure A.5.2.4.4

Skills:

Use NFPA 25: 5.2.4.4, 14.3 to determine inspection frequencies. Read and interpret gauge readings on air lines in dry pipe and preaction sprinkler systems. Inspect lines entering refrigerated areas for ice blockage and evidence of damage to pipes or fittings. Use alternative methods for investigating possible ice blockages.

3.1.6 Identify special systems, including foam, water mist, and ultra high-speed water spray.

Knowledge:

NFPA 25: 11.2

Functions and visual appearances of the components unique to a foam system

Functions and visual appearances of the components unique to a water mist system

Functions and visual appearances of the components unique to an ultra high-speed water spray system

Skills:

Use NFPA 25: Tables 10.1, 11.1, and 12.2.2 to determine inspection frequencies.

Identify the presence of a foam, water mist, or ultra-high-speed water spray system.

3.3 Documentation

(Questions related to these tasks makeup 11-15% of the exam)

3.3.1 Prepare formal reports for work under the scope of Level III.

Knowledge:

NFPA 25: 4.4

Role of the inspector/tester in determining the status of a water-based fire protection system

Skills:

Determine which information must be included in reports. Identify which party or parties should receive the final report.

Complete reports on Level III inspection and testing activities, results, and observations.

3.5 Work Management

(Questions related to these tasks makeup 4-8% of the exam)

3.5.2 Supervise inspection and testing personnel and jobs.

Knowledge:

NFPA 25

Knowledge and skills required for inspection and testing tasks

Potential consequences of poor performance of various inspection and testing tasks

Knowledge and skills that can lead to the most accurate inspection and testing results, and those that can prevent injury, damage, or unnecessary expense
NICET Practice Analysis (Content Outlines) for Inspection and Testing of Water-Based Systems

Skills:

Evaluate the capabilities of inspection and testing personnel.

Identify gaps between the knowledge and skills possessed by personnel and those required for competent performance.

Select individuals for, and assign them to, particular tasks.

Provide the correct degree of supervision to assure correct performance of assigned inspection and testing tasks.

Provide training appropriate to the skill level of individuals.

Promote awareness of safety hazards on a job site and appropriate protections.

Promote awareness of potential damage or workplace disruption from inspection and testing activities and possible corrective measures.

Ensure that inspectors have the necessary tools and information to properly carry out their parts of the job.

Monitor the completion of required inspections/tests, the correct collection of data and observations, the job schedule, and returning of the system to service.

**Test # 10023: Level III Advanced Testing****3.2 Testing**

(Questions related to these tasks makeup 85-89% of the exam)

3.2.1 Perform a flow test on a fire pump to determine its pressure and flow characteristics, and whether further investigation is indicated.**Knowledge:**

NFPA 25: 8.3.3 and 8.3.5

Purpose, parts, and operation of a pitot gauge

Purpose, parts, and operation of a multimeter

Terminology and units of measure applied to pumps and pump rotation, to water pressure and flow, and to electrical potential and current

Affinity laws

Skills:

Use NFPA 25: 8.3.3 and Table 8.1 to determine testing frequencies.

Convert velocity pressure to flow.

Identify alarm and AHJ contacts for notification of test.

Survey surrounding area for potential discharge damage issues prior to testing

Locate the points to conduct test procedures.

Conduct a fire pump flow test.

Use a pitot gauge to measure velocity pressure.

Plot test data on a graph.

Interpret the test results and data plots.

Determine the pump's rated conditions.

Use a multimeter to measure volts and amps

Use a tachometer to measure rotation.

Apply affinity laws to flow/pressure test results based on observed RPM.

Identify any damage to the pump system equipment, and any conditions or problems encountered during testing that could limit or threaten the pump system's functionality and recommend further investigation if warranted.

Record and report test results.

3.2.2 Perform a trip test on a deluge system.**Knowledge:**

NFPA 25: 13.4.3.2.2 through 13.4.3.2.7,

Differences between deluge and preaction systems

Trip test procedures

Skills:

Identify alarm and AHJ contacts for notification of test-related signals.

Locate points for test procedures.

Take steps to prevent property damage or injury resulting from test procedures.

Conduct a trip test on a deluge system.

Observe, identify, and record the discharge patterns of spray nozzles.

Apply pass/fail criteria specified in NFPA 25 13.4.3.2.2.3, 13.4.3.2.6.3, and A13.4.3.2.2.1, to test results.

3.2.3 Perform preaction system tests, including priming water test, partial and full flow trip tests, and detection system interface tests.**Knowledge:**

NFPA 25: 13.4.3.2 and related Annex sections

Appearances and functions of preaction valves, trim, and detection system components

Function and appearance of the components of a preaction system

Skills:

Identify alarm and AHJ contacts for notification of test-related signals.

Conduct a trip test on a preaction system protecting a freezer.

Conduct a test of the detection system to verify interface with preaction valve.

Use NFPA 25: 13.4.4.2.2 – 13.4.4.2.2.3, and Table 13.1 to determine testing frequencies and scheduling considerations for full-flow trip testing.

Use NFPA 25: 13.4.3.2.1 to determine testing frequencies for priming water tests. Obtain, read, and interpret manufacturer's documentation for specific valves.

Identify specific valves, their trim, and their functions.

Locate points in the system used in the test procedures.

Conduct a partial flow trip test.

Conduct a full flow trip test; determine whether a change in the water delivery time has occurred.

Perform a priming water test on a preaction systems equipped with supervisory air.

Record and report observations and test results, including any deficiencies.

3.2.4 Perform an operational test on a water spray fixed system and determine whether further investigation is indicated.**Knowledge:**

NFPA 25: 10.3

Skills:

Use NFPA 25: Table 10.1 to determine testing frequencies.

Identify alarm and AHJ contacts for notification of test-related signals.

Research and identify appropriate test criteria.

Verify that test protocols (including the contractor's pre-test documentation) are in conformance with NFPA 25: 10.3.

Conduct an operational test of a water spray fixed system. Replace discharge nozzles with pressure gages as needed.

Verify that the nozzle discharge pattern is correct.



Record and report test results and any deficiencies identified.

3.2.5 Test tank heating system, low temperature alarms, high temperature limit switch, and high and low water-level alarms to verify proper signal transmission and reception.

Knowledge:

NFPA 25: 9.3

Skills:

Use NFPA 25: 9.3 and Table 9.1 to determine testing frequencies and scheduling considerations.

Test supervisory devices per manufacturer instructions.

Test low temperature alarms and high temperature limit switches for accuracy and for reliability of signal transmission and reception.

Test water level alarms for accuracy and for reliability of signal transmission and reception.

Test water level indicators (per NFPA 25: A.9.3.1 for mercury gauges) for accuracy and freedom of movement.

Record and report test results and observations, including any deficiencies.

3.2.6 Perform a hydrostatic test on a standpipe system.

Knowledge:

NFPA 25: 6.3.2

NFPA 13: 24.2.1

Purpose and procedures for a standpipe system hydrostatic test

Potential hazards associated with hydrostatic testing

Tools required for test procedures

Skills:

Use NFPA 25: 6.3.2.1 and Table 6.1 to determine testing frequencies and scheduling considerations.

Locate points and sections in the standpipe system for use in the test procedure.

Follow procedures to mitigate potential hazards.

Use a test pump.

Measure hydrostatic pressure with a pressure gauge.

Conduct a standpipe system hydrostatic test at the pressure specified in NFPA 25: 6.3.2.1.

Record and report test results and any observed deficiencies.

3.2.7 Perform a full flow test on a standpipe system to verify that the water supply still provides the design pressure at the desired flow.

Knowledge:

Types of standpipe systems and their full flow testing requirements

Standpipe system full flow test procedures

Appearances and functions of standpipe system components that will be used in testing

Potential hazards of testing procedures

Potential for property damage from testing procedures

Tools necessary to conduct the test

Skills:

Use NFPA 25: 6.3.1 and Table 6.1 to determine testing frequencies and scheduling considerations.

Locate the pressure and flow criteria at the time of installation.

Obtain manufacturer's documentation for pressure reducing or restricting hose valves.

Locate points in the system used in the test procedures.

Take steps to prevent property damage or personal injury resulting from the test procedures.

Conduct a full flow test consistent with NFPA 25: 6.3.1.

Record and report test results and any observed deficiencies.

3.2.8 Test pressure reducing and relief valves for proper operation.

Knowledge:

NFPA 25: 13.5, 3.3.24, 3.3.25, 3.5.1, 3.5.4, and 3.5.5

Appearances and functions of various types of pressure reducing and relief valves and their trim, including pressure regulating devices, pressure restricting devices, pressure control valves, pressure reducing valves, and pressure relief valves

Potential hazards of testing procedures

Potential for property damage from testing procedures

Full and partial flow test procedures

Tools required for the test procedures

Skills:

Use NFPA 25: 13.5 and Table 13.1 to determine testing frequencies and scheduling considerations.

Locate and identify pressure reducing and relief valves and regulating devices.

Locate the pressure and flow criteria at the time of installation.

Verify that pressure reducing and relief valve settings are as required.

Obtain, read, and interpret manufacturer's documentation for specific valves.

Identify specific valves, their trim, and their functions.

Locate points in the system used in the test procedures.

Calculate pressure elevation differences and adjust pressure readings accordingly.

Take steps to prevent property damage or personal injury resulting from the test procedures.

Conduct a partial flow test.

Conduct a full flow test.

Use pressure gauges, pitot tubes, and conversion charts to measure pressure and flow.

Record and report observations and test results, including any deficiencies.



3.2.9 Perform functional tests of hydrants and monitor nozzles.

Knowledge:

Different types of water distribution systems and other water sources in the local community
Characteristics of public and private water supply systems
NFPA 25: 7.3.2
Test procedures for monitor nozzles mounted on hydrants and elsewhere
Tools required for the test procedure
Proper procedures for opening and closing hydrants
Potential impacts of water discharge

Skills:

Use NFPA 25: Table 7.1 to determine testing frequencies.
Verify that each hydrant is within the scope of the testing contract.
Plan for and mitigate impacts from water discharge.
Properly use tools required for the test procedures.
Conduct a hydrant test to verify functionality.
Test monitor nozzles per NFPA 25, 7.3.3.2.
Record and report test results and any deficiencies.

3.2.10 Perform a flow test to verify that the condition of underground piping has not deteriorated.

Knowledge:

NFPA 25: 7.3.1
Appearances and functions of the components of fire hydrants
Tools and procedures for operating a fire hydrant
Alternate methods of achieving flow from underground piping
Tools (e.g. pitot gauge, hydrant wrench, pressure gauge with hydrant thread cap and tap, ruler) necessary to conduct the test
Full flow test procedures
Velocity pressure (psi) to flow (gpm) conversion
NFPA 291: Chapter 4
General types of hydrant outlets and their coefficients of discharge (as described in NFPA 291: Figure 4.7.1)

Skills:

Use NFPA 25: Table 7.1 to determine testing frequencies.
Determine the age of the piping to be tested, and locate any previous flow test results.
Locate points where test procedures are to be conducted.
Determine hydrant coefficients.
Use a Pitot gauge to measure velocity pressure.
Take steps to prevent property damage or injury resulting from the test procedures.
Conduct a flow test of underground piping.
Plot test results.
Determine whether test results suggest that deterioration in the condition of the piping has occurred.

Record and report test results and any observed deficiencies.

3.2.11 Perform a forward flow test on a backflow prevention device.

Knowledge:

NFPA 25: 13.6.2
Appearances and functions of the components of a backflow prevention device
Procedures for a forward flow test

Skills:

Use NFPA 25: 13.6.2 and Table 13.1 to determine testing frequencies and scheduling considerations.
Determine the required flow rate based on system demand.
Locate the points at which test procedures will be conducted.
Survey surrounding area for potential discharge damage issues prior to testing.
Conduct a forward flow test consistent with NFPA 25: 13.6.2.
Record and report test results and any observed deficiencies.

3.4 Safety

(Questions related to these tasks makeup 2-6% of the exam)

3.4.1 Follow safe practices for Level III inspections and tests.

Knowledge:

NFPA 70E
Hazards associated with various types of pressurized or energized equipment

Skills:

Take steps to prevent property damage or personal injury resulting from the performance of Level III test procedures, particularly where those involve pressurized water or gas, or energized circuits.

3.5 Work Management

(Questions related to these tasks makeup 7-11% of the exam)

3.5.1 Identify specialized equipment required for Level III tests.

Knowledge:

Names and appearances of tools and specialized equipment used in Level III tests
Specific tools and specialized equipment required for specific Level III tests

Skills:

Identify specialized equipment required for specific Level III tests.