

UNIFIED FACILITIES CRITERIA (UFC)

OPERATION AND MAINTENANCE: INSPECTION, TESTING, AND MAINTENANCE OF FIRE PROTECTION SYSTEMS



UNIFIED FACILITIES CRITERIA (UFC)
OPERATION AND MAINTENANCE:
INSPECTION, TESTING, AND MAINTENANCE
OF
FIRE PROTECTION SYSTEMS

Any copyrighted material included in this UFC is identified at its point of use.
Use of the copyrighted material apart from this UFC must have the permission of the
copyright holder.

U.S. ARMY CORPS OF ENGINEERS

NAVAL FACILITIES ENGINEERING COMMAND

AIR FORCE CIVIL ENGINEER SUPPORT AGENCY (Preparing Activity)

Record of Changes (changes are indicated by \1\ ... /1/)

Change No.	Date	Location

This UFC supersedes UFC 3-600-02, dated 1 January 2001.

FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DOD Field Activities in accordance with [USD \(AT&L\) Memorandum](#) dated 29 May 2002. UFC will be used for all DOD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the more stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

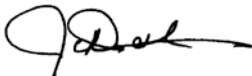
UFC are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Air Force Center for Engineering and the Environment (AFCEE) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DOD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: [Criteria Change Request \(CCR\)](#). The form is also accessible from the Internet site listed below.

UFC are effective upon issuance and are distributed only in electronic media from the following source:

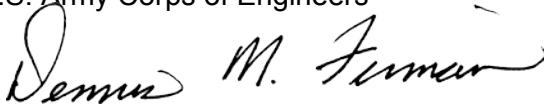
- Whole Building Design Guide web site <http://dod.wbdg.org/>.

Hard copies of UFC printed from electronic media should be checked against the current electronic version prior to use to ensure that they are current.

AUTHORIZED BY:




JAMES C. DALTON, P.E.
Chief, Engineering and Construction
U.S. Army Corps of Engineers



DENNIS FIRMAN, P.E.
Director of the Air Force Center for Engineering
and the Environment
Department of the Air Force



JOSEPH E. GOTT, P.E.
Chief Engineer
Naval Facilities Engineering Command



MICHAEL McANDREW
Director, Facility Investment and
Management
Office of the Deputy Under Secretary of Defense
(Installations and Environment)

UNIFIED FACILITIES CRITERIA (UFC) REVISION SUMMARY SHEET

Document: UFC 3-601-02, *Operation and Maintenance: Inspection, Testing, and Maintenance of Fire Protection Systems*

Superseding: This UFC supersedes UFC 3-600-02, dated January 2001, and all subsequent changes.

Description of Changes: This update to UFC 3-600-02 clarifies many of the requirements in the January 2001 version, updates references, and further coordinates the Services' requirements. This version of the UFC:

- Revises the term "waivers" to "exemptions" in accordance with MIL-STD-3007, *Standard Practice for Unified Facilities Criteria and Unified Facilities Guide Specifications*.
- Updates offices of responsibility.
- Provides guidance on employee workplace notification.
- Provides guidance on work prioritization.
- Provides guidance on false, mistaken, or accidental fire alarm activations.
- Provides additional guidance on inspection of Halon systems to reduce accidental leakage of Halon to the atmosphere.
- Incorporates criteria for inspection, testing, and maintenance (ITM) of emergency lighting systems.
- Incorporates criteria for ITM of egress marking systems.
- Incorporates criteria for ITM of fire and smoke opening protection devices.
- Incorporates criteria for ITM of cross-connection prevention devices.
- Adds new warnings and cautions based on post-event investigations and studies.

Reasons for Changes: This UFC was revised:

- To reflect organizational changes to the alignment of the responsible offices.
- To bring the guidance into compliance with Occupational Safety and Health Administration (OSHA) requirements for employee workplace notification and to provide specific direction on how to comply with the general OSHA requirements.
- To provide guidance on previously unaddressed fire protection systems and features.
- To incorporate lessons learned from post-event investigations and studies.

Impact: This document provides and expands guidance to address field application issues. This revision:

- Reduces maintenance requirements by using performance-based, reliability-centered maintenance frequencies rather than prescriptive-based frequencies.
- Consolidates maintenance frequency requirements from multiple sources into a single source document while continuing to rely on consensus standards and industry references for the technical task execution details.
- Has no anticipated impacts on maintenance costs.
- Will increase the level of urgency assigned to the repair or correction of impaired fire safety features as required by public law.
- Will improve employee awareness of potential safety issues in the work place.
- Unifies requirements. All the requirements in this document are unified between the Services and DOD agencies.

CONTENTS

CHAPTER 1 INTRODUCTION.....	1
1-1 BACKGROUND	1
1-2 PURPOSE AND SCOPE.....	1
1-3 APPLICABILITY	1
1-4 AUTHORITY	2
1-5 REFERENCES.....	2
1-6 OBJECTIVE	2
1-7 CRITERIA	2
1-7.1 Systems and Applications Not Covered.....	2
1-7.2 Conflicts	3
1-7.3 Exemptions	3
1-7.4 Authority Having Jurisdiction (AHJ).....	3
1-8 PERSONNEL QUALIFICATIONS	4
1-8.1 ITM Tasks	4
1-8.2 Other Inspections.....	5
1-9 RECORDS	5
1-10 SYSTEM IMPAIRMENT OR OUT-OF-SERVICE WARNING.....	5
1-11 REPAIR OR CORRECTION OF IMPAIRMENTS TO SYSTEM OR FEATURE PERFORMANCE.....	5
1-12 SYSTEM IMPAIRMENTS AND REPAIRS AND CORRECTIONS REPORTING.....	7
CHAPTER 2 FACILITY SYSTEMS	9
2-1 RCM METHODOLOGY.....	9
2-1.1 Features Requiring Maintenance	9
2-1.2 Unrequired Features	9
2-2 ITM TASK DESCRIPTIONS AND FREQUENCIES	9
2-2.1 Task Descriptions	9
2-2.1.1 Supervised Components.....	9
2-2.1.2 Event-Driven Tests.....	10
2-2.1.3 Excluded National Fire Code Tasks	10
2-2.1.4 Non-ITM Activities	10

2-2.1.5	Medical Facilities	10
2-2.1.6	Fire Extinguishers	10
2-2.2	Fire Detection and Alarm Systems	10
2-2.3	Wet Pipe Automatic Sprinkler Systems	13
2-2.4	Dry Pipe Automatic Sprinkler Systems	14
2-2.5	Deluge Sprinkler Systems	17
2-2.6	Pre-Action Automatic Sprinkler Systems	19
2-2.7	Water Spray Systems	21
2-2.8	Water Mist Systems	24
2-2.9	Foam and Foam-Water Systems	25
2-2.10	Standpipe Systems	32
2-2.11	Hydrants and Monitors	32
2-2.12	Fire Pumps	34
2-2.13	Water Supply Tanks	36
2-2.14	Dry Chemical Systems	37
2-2.15	Wet Chemical Systems	38
2-2.16	Halon Systems	40
2-2.17	Clean Agent Systems	42
2-2.18	Carbon Dioxide Systems	44
2-2.19	Emergency Lighting Systems	45
2-2.20	Egress Marking Systems	46
2-2.21	Fire and Smoke Barrier Opening Protection	49
2-2.22	Backflow Prevention Devices	50
CHAPTER 3 MILITARY FAMILY HOUSING SYSTEMS		51
3-1	SCOPE	51
3-1.1	Residential Smoke Detectors	51
3-1.2	Residential Sprinkler Systems	51
3-2	ITM TASK DESCRIPTIONS	51
GLOSSARY		53
APPENDIX A REFERENCES		55

FIGURES

<u>Figure</u>	<u>Title</u>	
Figure 1-1.	System Out-of-Service or Impaired Sign	8
Figure 2-1.	Liquid Level Measuring System	42
Figure 2-2.	Typical Emergency Lighting Systems	46
Figure 2-3.	Typical Egress Marking Units.....	48
Figure 2-4.	Typical Combination Egress Marking and Emergency Light Units.....	48

TABLES

<u>Table</u>	<u>Title</u>	
Table 2-1.	Fire Detection and Alarm System ITM Tasks	11
Table 2-1.	Fire Detection and Alarm System ITM Tasks (Continued)	12
Table 2-2.	Wet Pipe Sprinkler Systems ITM Tasks	13
Table 2-2.	Wet Pipe Sprinkler Systems ITM Tasks (Continued)	14
Table 2-3.	Dry Pipe Automatic Sprinkler Systems ITM Tasks	15
Table 2-4.	Deluge Sprinkler Systems ITM Tasks	17
Table 2-4.	Deluge Sprinkler Systems ITM Tasks (Continued).....	18
Table 2-5.	Pre-Action Automatic Sprinkler Systems ITM Tasks	19
Table 2-5.	Pre-Action Automatic Sprinkler Systems ITM Tasks (Continued)	20
Table 2-5.	Pre-Action Automatic Sprinkler Systems ITM Tasks (Continued)	21
Table 2-6.	Water Spray Systems ITM Tasks.....	22
Table 2-6.	Water Spray Systems ITM Tasks (Continued)	23
Table 2-7.	Water Mist Systems ITM Tasks.....	24
Table 2-7.	Water Mist Systems ITM Tasks (Continued)	25
Table 2-8.	Low-Expansion Foam Systems for Flammable Liquid Tanks ITM Tasks	25
Table 2-9.	Foam Spray and Sprinkler Systems ITM Tasks	27
Table 2-9.	Foam Spray and Sprinkler Systems ITM Tasks (Continued).....	28
Table 2-10.	Foam Monitors Nozzle Systems ITM Tasks	28
Table 2-10.	Foam Monitors Nozzle Systems ITM Tasks (Continued)	29
Table 2-11.	Grate Nozzle Foam Systems ITM Tasks.....	30
Table 2-12.	High-Expansion Foam Systems ITM Tasks	31

Table 2-13. Standpipe Systems ITM Tasks.....	32
Table 2-14. Hydrants ITM Tasks	33
Table 2-15. Yard Hydrant Monitors and Hose Houses ITM Tasks	34
Table 2-16. Fire Pumps ITM Tasks	34
Table 2-16. Fire Pumps ITM Tasks (Continued)	35
Table 2-17. Water Supply Tanks ITM Tasks	36
Table 2-17. Water Supply Tanks ITM Tasks (Continued).....	37
Table 2-18. Dry Chemical Systems ITM Tasks	37
Table 2-18. Dry Chemical Systems ITM Tasks (Continued).....	38
Table 2-19. Wet Chemical Systems ITM Tasks	38
Table 2-19. Wet Chemical Systems ITM Tasks (Continued).....	39
Table 2-20. Halon Systems ITM Tasks	40
Table 2-20. Halon Systems ITM Tasks (Continued).....	41
Table 2-21. Clean Agent Systems ITM Tasks	42
Table 2-21. Clean Agent Systems ITM Tasks (Continued)	43
Table 2-22. Carbon Dioxide Systems ITM Tasks	44
Table 2-23. Emergency Lighting Systems ITM Tasks	45
Table 2-24. Egress Marking Systems ITM Tasks	47
Table 2-25. Fire and Smoke Barrier Opening Protection ITM Tasks.....	49
Table 2-25. Fire and Smoke Barrier Opening Protection ITM Tasks (Continued)	50
Table 2-26. Backflow Prevention Devices ITM Tasks	50
Table 3-1. MFH Residential Smoke Detectors ITM Tasks.....	52
Table 3-2. MFH Residential Sprinkler Systems ITM Tasks	52

CHAPTER 1

INTRODUCTION

1-1 BACKGROUND

This Unified Facilities Criteria (UFC) has been developed from an evaluation of Department of Defense (DOD) facilities, from surveys of maintenance methods, and from selection of the best practices of the DOD, other government agencies, and the private sector. This UFC is based on recognized reliability-centered maintenance (RCM) concepts and reliability-centered risk management. It was prepared using model building maintenance codes, National Fire Protection Association (NFPA®) National Fire Codes®, industrial standards, and other recognized standards to the maximum extent feasible. Personnel safety and continuity of mission were primary considerations.

1-2 PURPOSE AND SCOPE

This UFC provides requirements for inspection, testing, and maintenance (ITM) of engineered fire protection features in DOD facilities. Do not deviate from these criteria without prior approval of the component office of responsibility in paragraph 1-7.4.

Do not use this UFC for acceptance or commissioning of fire protection systems.

1-3 APPLICABILITY

1-3.1 The criteria in this UFC apply to DOD facilities located on or outside of DOD installations, whether acquired by appropriated or non-appropriated funds, or third party financed and constructed. Facilities include all temporary or permanent structures and their contents, including waterfront facilities, outside storage, and shore protection for ships and aircraft, as well as mobile and stationary equipment.

1-3.2 The criteria in this UFC apply to DOD leased and maintained facilities outside of DOD installations, whether acquired by appropriated or non-appropriated funds, or third party financed and constructed, when the DOD or a DOD contractor maintains the facility.

1-3.3 When maintained by the leaser, DOD-leased facilities located outside of DOD installations, whether acquired by appropriated or non-appropriated funds, or third party financed and constructed, shall be maintained in accordance with the requirements of the local (off-installation) authority having jurisdiction (AHJ) or in the absence of such requirements, this UFC.

1-3.4 Government owned, contractor operated facilities (GOCO) shall follow these criteria unless alternative ITM requirements and frequencies are specifically included in the contract documents.

1-4 **AUTHORITY**

1-4.1 This UFC implements these public laws, which are available at <http://www.gpoaccess.gov/uscode/>:

- *Title 10 United States Code (USC) Section 1794, Military Child Care*
- *Title 15 United States Code (USC) Section 2227, Fire Safety Systems in Federally Assisted Buildings (Fire Administration Authorization Act)*
- *Title 15 United States Code (USC) Section 272, Utilization of Consensus Technical Standards by Federal Agencies*
- *Title 29 United States Code (USC) Section 1910, Subpart L, Fire Protection*
- *Title 29 United States Code (USC) Section 1960, Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters*

1-4.2 15 USC § 272 identifies the necessary consensus technical standards required to implement policy objectives and activities within the area of fire protection engineering for the DOD. Compliance with criteria issued in accordance with this UFC does not constitute an exception to the public laws. Fire protection criteria must conform to the requirements of this UFC and the NFPA National Fire Codes, except as modified by this UFC and specifically referenced by this UFC. Additional criteria include portions of the Factory Mutual (FM) Global Property Loss Prevention Data Sheets (FM Global Data Sheets), as specifically referenced by this UFC.

1-5 **REFERENCES**

Appendix A contains a list of references used in this UFC.

1-6 **OBJECTIVE**

ITM tasks in this UFC represent the minimum required to achieve a 99 percent overall system reliability in response to an actual fire event.

1-7 **CRITERIA**

Use the task frequencies in this UFC in lieu of the frequencies in the National Fire Codes except as indicated in paragraph 1-7.1.

1-7.1 **Systems and Applications Not Covered**

When a specific system or application is not addressed by this UFC, follow national building codes, recognized industry standards, and standard engineering practices. In the absence of such technical information, contact the DOD component AHJ (paragraph 1-7.4). Fire department operations, staffing, and equipment are not addressed in this UFC.

1-7.2 Conflicts

If a conflict exists between this UFC and any other DOD document, referenced code, standard, or publication, this UFC takes precedence. Individual DOD components (paragraph 1-7.4) may issue technical guidance, which takes precedence.

1-7.3 Exemptions

Criteria exemptions may be approved by the AHJ where an alternative ITM action providing equivalent fire protection and life safety exists and is also approved. Requests must include justification, hazard analysis, cost comparison, criteria applied, and other pertinent data. Lack of funds or cost savings do not justify an exemption. Exemptions may be granted only for specific requests and will not extend to cases with similar circumstances.

1-7.4 Authority Having Jurisdiction (AHJ)

For this UFC, the AHJ is the component office of responsibility:

- U.S. Army: Headquarters U.S. Army Corps of Engineers (HQ USACE/CECW-CE)
- U.S. Navy: Naval Facilities Engineering Command, Headquarters Chief Engineer Organization (NAVFACENGCOM HQ-CHE)
- U.S. Marine Corps: HQMC Code LFF-1
- U.S. Air Force: Headquarters Air Force Civil Engineer Support Agency Operations and Programs Support Division (HQ AFCESA/CEO)
- Defense Logistics Agency (DLA) Chief, Security Operations (DES-SO)
- National Geospatial-Intelligence Agency, Installation Operations Office (NGA/SIO)
- National Reconnaissance Office (NRO), Management Services and Operations/Environmental Safety Office (MS&O/ESO)
- Washington Headquarters Service (WHS), Office of the Pentagon Fire Marshal (OPFM)
- All other DOD components: Director, Installations Requirements and Management, Office of the Deputy Under Secretary of Defense (Installations) via the DOD Fire Protection Engineering Working Group (FPEWG)

Note: The FPEWG is comprised of the AHJ from each Service or agency. Each member of the FPEWG is a fire protection engineer (GS-804, Fire Protection Engineer, individual qualification standard).

1-8 PERSONNEL QUALIFICATIONS

1-8.1 ITM Tasks

ITM tasks shall be performed by craftspersons trained or qualified in the maintenance and repair of the specific fire protection system or subsystem.

1-8.1.1 “Trained or qualified” personnel shall perform ITM and repair tasks only on the systems for which these personnel have been specifically qualified. Trained or qualified personnel may supervise other less qualified personnel in the execution of the tasks covered in this UFC. At no time shall apprentice-level craftspersons be allowed to execute the ITM tasks in this UFC without a qualified supervisor on site. Trained or qualified personnel shall perform ITM and repair tasks only within the scope of their specific qualification. Generally accepted qualifications include:

1-8.1.1.1 Craftspersons completing the Fire Suppression Systems Maintenance course (J3AZR3E451 01FA, <https://webm.sheppard.af.mil/sirs/default.html>) at the Technical Training Center, Sheppard Air Force Base, Texas. The 82 Training Wing, 782 Training Group, 366 Training Squadron provides engineer craftsman skills training for all DOD branches and has both Army and Navy detachments assigned to the squadron (366trs.cc@sheppard.af.mil).

1-8.1.1.2 Craftspersons completing the Fire Alarm Systems Maintenance course (J3AZR3E051 012, <https://webm.sheppard.af.mil/sirs/default.html>). The Fire Alarm Systems Maintenance course is no longer offered as part of the advanced training program (last offered October 04).

1-8.1.1.3 Craftspersons with other recognized journeyman or craftsman-level qualifications for fire protection systems, such as National Institute for Certification in Engineering Technologies (NICET) (Level III certification in Fire Alarm Systems, Inspection and Testing of Water-Based Systems, or Special Hazard Suppression Systems), or formalized labor organization-based journeyman training, or similar programs.

1-8.1.1.4 Craftspersons holding a valid, current qualification or license from any state (or local jurisdiction if delegated authority by the state). Local jurisdictions and other organizations may require varying levels of continuing education to maintain recognized journeyman or craftsman-level qualifications.

1-8.1.2 Installation or base operating support (BOS) contractor personnel must meet the state (in which the installation is located) (or local, if delegated authority by the state) qualification and licensing requirements. Where some form of licensing, certification, or approval is required, it shall be current in accordance with the state or local requirements, as applicable. All ITM and repair tasks will be accomplished under the supervision of a licensed craftsperson.

1-8.1.3 Other contractors performing ITM and repair tasks must meet the state (in which the installation is located, or local, if delegated authority by the state) qualification and licensing requirements. Where some form of licensing, certification, or approval is required, it shall be current in accordance with the state or local requirements, as applicable. The contractor must have at least one licensed supervisory employee present on the installation when contractor personnel are executing ITM and repair tasks.

1-8.1.4 General or equipment-specific qualification/endorsement provided by an equipment manufacturer for the manufacturer's equipment.

1-8.1.5 Overseas locations should contact their command fire protection engineering office for guidance on local qualification requirements.

1-8.2 Other Inspections

This UFC also lists inspection tasks that should be performed during other regularly scheduled facility inspections or evaluations. Fire prevention personnel, safety personnel, maintenance craftpersons, or other individuals could perform these inspection tasks.

1-9 RECORDS

Each installation will maintain a permanent record of completed ITM tasks in accordance with each agency's program for reoccurring facility maintenance record keeping. Records may be hard copy or electronic. Where no agency-wide programs exist, records must be developed locally. Records will be maintained for every facility and will include, as a minimum, each ITM task, date scheduled, date completed, and craftsperson completing the task.

1-10 SYSTEM IMPAIRMENT OR OUT-OF-SERVICE WARNING

Building occupants, users, and the public shall be notified whenever any of the systems specified in Chapter 2 are either out of service or impaired to a degree that presents an increased risk to any occupants (Occupational Safety and Health Administration [OSHA] general industry standards contained in Title 29, Code of Federal Regulations [CFR], Parts 1960.26(c)(3) and 1910.160(b)(2)). The sign shown in Figure 1-1 shall be posted by the facility owner, manager, or custodian at all principal public and employee entrances to the building. The sign shall be 7 inches high by 10 inches wide in an American National Standards Institute (ANSI) Z535.2-2007 compliant format using safety orange background color, black type and graphic, and Arial font (ANSI Z535.1-2006). Signs complying with this format may be ordered from many commercial safety sign manufacturers on a wide variety of materials. Computer software is commercially available to print this and other safety signs on color printers.

1-11 REPAIR OR CORRECTION OF IMPAIRMENTS TO SYSTEM OR FEATURE PERFORMANCE

1-11.1 Impairments affecting the performance of installed fire protection features shall be corrected immediately when identified using the highest priority in the appropriate work identification and management system. These processes meet the

OSHA general industry standards requirements for repair or correction of impairments (29 CFR Part 1910.160(b)(2) and 160(b)(6)).

In addition, 10 USC § 1794 requires that deficiencies within military child care activities that are not corrected within 90 days must have an approved waiver from the Service Secretary, without which the activity shall be closed. Waivers must be approved prior to the conclusion of the 90-day period to prevent closure of the activity.

1-11.2 The maintenance activity must notify the local fire authority and the facility or area user when impairments cannot be corrected immediately when identified. The maintenance activity must also advise the facility or area user of the need to post the signs specified in paragraph 1-10. The fire authority shall advise and consult with the facility or area user to determine the immediate measures that must be taken to ensure personnel safety and mission continuity.

1-11.3 When the impairment will exist for more than 72 hours, the local maintenance activity, the local fire authority, the local safety authority, and the facility or area user shall jointly develop written compensatory measures to ensure personnel safety and, to the maximum degree possible, mission continuity. Normally the facility user is the lead to coordinate the compensatory measures package. The jointly developed package must also identify the remaining mission risk exposure. In the absence of compensatory measures, the facility shall be evacuated or operations stopped. Implementation of compensatory measures shall not reduce the priority of the correction of the impairment.

The need for mitigating measures is typically determined on a case-by-case basis. This considers the building, occupancy type, nature and duration of impairment, building occupancy level during the impairment period, active work being conducted on the fire protection features during the impairment, condition of other fire protection systems and features (e.g., sprinklers, structural compartmentation), and hazards and assets at risk.

Appropriate mitigating measures could range from simple occupant notification to increased fire safety checks or inspections by user or installation fire and safety personnel to full-time fire watch; i.e., measures could range from minor operational changes to completely ceasing operations. Determining factors vary from testing-related impairments and maintenance activities during normal business through extensive impairments to high-value, high-hazard situations.

1-11.3.1 The maintenance activity must inform installation and operational commanders of new impairments not corrected within 72 hours, of the jointly developed compensatory measures being recommended, and of the remaining mission risk exposure.

1-11.3.2 Commanders may require evacuation of the workplace until impairments are corrected (OSHA general industry standard: 29 CFR Part 1910 Subpart L App A).

1-11.3.3 Commanders may also limit operations and have an emergency action plan that specifies evacuation actions (OSHA general industry standard: 29 CFR Part 1910 Subpart L App A).

1-11.3.4 A fire watch is a dedicated function: the individual(s) assigned fire watch responsibilities as mitigating or compensatory measures would not be expected to have other duties beyond fire safety, occupational safety, or security. Normally, dedicated fire safety, occupational safety, or security personnel may be assigned to conduct mitigating or compensatory fire watch activities as part of their normal functions.

1-12 **SYSTEM IMPAIRMENTS AND REPAIRS AND CORRECTIONS REPORTING**

The maintenance activity must regularly inform installation and operational commanders, not less than twice a year, of the system impairments, compensatory measures in place, projected correction completions, and corrections completed since the last report.

Figure 1-1. System Out-of-Service or Impaired Sign



CHAPTER 2

FACILITY SYSTEMS

2-1 RCM METHODOLOGY

The objective of ITM for fixed fire protection systems is to assure that the systems will function on demand. RCM analysis identifies any defects responsible for system malfunction and how they can be detected and corrected before a fire. A byproduct of RCM analysis is a list of ITM tasks and how often they must be accomplished (frequencies) to achieve a desired reliability (0.99 for this UFC; see paragraph 1-6). The methodology used to develop the ITM tasks in this UFC is summarized in AFCESA/CES Technical Report 01-10, "Risk Based Reliability Centered Maintenance of DOD Fire Protection Systems." The model used in the report assumed a system demand of one event in fifty (1/50) years and a task effectiveness (ITM done right) of 99 percent. This RCM analysis emphasized task effectiveness ("Is it the right thing to do and is it done right?") and timeliness ("Is it done before a demand?"). The resulting list of tasks and frequencies, therefore, considered frequency and probabilities of demands and failures.

2-1.1 Features Requiring Maintenance

All fire protection features installed in DOD facilities must be maintained in accordance with this UFC. Features that have been disabled in place pending removal are not considered installed.

2-1.2 Unrequired Features

A critical component of any reliability-centered maintenance program is ensuring that the components being maintained are required to be present. Fire protection features not specifically required by UFC 3-600-01 shall be removed to minimize the maintenance workload burden. Unrequired features can be abandoned in place pending final removal if all public interface devices are removed.

2-2 ITM TASK DESCRIPTIONS AND FREQUENCIES

Note: Military family housing (MFH) systems are addressed in Chapter 3.

2-2.1 Task Descriptions

The ITM tasks in tables 2-1 through 2-26 and 3-1 and 3-2 were selected to ensure that the fire protection system would function on demand. Technical tasks must be performed according to the manufacturer's instructions.

2-2.1.1 Supervised Components

Supervision of components increases the likelihood that conditions or faults will be detected without an inspection activity. In these cases, the ITM task is to respond to the alarm and to test the supervisor device (e.g., valve tamper switch) periodically. Accordingly, the tables reflect the improved fault or condition detection by specifying less frequent inspections. Different frequencies are recommended for monitored and for unmonitored fire alarm control equipment. A monitored system is a system that transmits trouble alarms to a supervisory station.

2-2.1.2 **Event-Driven Tests**

Some tests should be event driven. For example, a main drain test is intended to verify the open condition of a control valve to a sprinkler or water spray system, and needs to be done only when the control valve has been operated for maintenance or testing.

2-2.1.3 **Excluded National Fire Code Tasks**

Some tasks recommended in the National Fire Codes are not included in these frequency tables. The detailed analysis documented in AFCESA/CES Technical Report 01-10 excluded tasks that did not contribute to the overall system operational reliability and did not need to be performed. These deleted tasks do not improve the operability of the systems because: (1) the faults they detect are not significant; (2) the faults are detected by other tasks or means; or (3) the faults will be self-evident (“fix it when it breaks”) and do not significantly impair the system. The deleted tasks are not required to be accomplished and shall not be included in reoccurring maintenance programs.

2-2.1.4 **Non-ITM Activities**

Inspection activities listed at the end of each ITM table are not part of the ITM program but are part of building overall inspection and are listed for information only. They were not included in the model used to develop the 99 percent reliability requirements; however, they should be incorporated into each DOD component activity's fire prevention, safety, facility condition, and related inspection or evaluation program.

2-2.1.5 **Medical Facilities**

For medical facilities that require Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) accreditation, follow the tasks frequencies indicated in the related NFPA codes and standards.

2-2.1.6 **Fire Extinguishers**

Fire extinguisher and fire extinguisher cabinet maintenance are not addressed in this UFC.

2-2.2 **Fire Detection and Alarm Systems**

The type and frequency of ITM tasks for fire detection and alarm systems depend on whether the system is monitored or not. Guidance on the tasks in Table 2-1 is contained in the “Inspection, Testing, and Maintenance” section of NFPA Standard 72 (NFPA 72). Residential smoke detectors are addressed in Chapter 3 of this UFC.

WARNING

Fire alarm systems with more than two abnormal conditions (trouble conditions) are outside their minimum tested or listed operating parameters and may not meet their performance requirement for receipt or transmission of subsequent alarm or additional trouble conditions.

WARNING

Any fire alarm system with more than three unexplained activations (fire indication conditions) in a 6-month period is experiencing a system instability that should be evaluated by a technician or engineer, and appropriate corrective measures should be implemented immediately.

CAUTION

Alarm systems in a TROUBLE condition should be able to transmit an ALARM condition while in trouble; however, because this is not considered to be a normal or acceptable alarm system status, immediate maintenance action is indicated.

NOTE

Any fire alarm system with more than three explained activations (fire indications) resulting from non-fire events being mistaken for actual fires should be evaluated by a technician or engineer to determine if corrective actions are necessary.

Table 2-1. Fire Detection and Alarm System ITM Tasks

Frequency	Component	Tasks
Monthly	1. Control Panels and Annunciator Equipment (unmonitored only)	1. Inspect panel condition (connections, fuses, light-emitting diodes [LED]).
Annual	1. Control Panel and Annunciator Equipment (monitored)	1. Test to verify proper receipt of alarm, supervisory, and trouble signals (inputs) and operation of notification appliances and auxiliary functions (outputs). 2. Verify that all lamps and LEDs are illuminated. 3. Load test backup batteries (when provided).
	2. Initiating Devices: a. Manual Fire Alarm Stations	1. Verify station is accessible (visual).
	b. Radiant Energy Detectors (Optical Detectors)	1. Test to verify alarm initiation and receipt. 2. Verify no facility change that affects performance.
	c. Gas Detectors	1. Test to verify alarm initiation and receipt. 2. Verify no facility change that affects performance.
	3. Notification Appliances and Voice Communication (telephone, speakers, horns, and strobe lights)	1. Test to verify operability.
	4. Digital Alarm Transmitters and Receivers	1. Test to verify operability.

Table 2-1. Fire Detection and Alarm System ITM Tasks (Continued)

Frequency	Component	Tasks
2 Years	1. Initiating Devices: a. Manual Fire Alarm Stations	1. Operate to verify alarm receipt.
	b. Heat Detectors (restorable) (Remove devices not required by UFC 3-600-01.)	1. Test with a heat source to verify alarm initiating and receipt. 2. Verify no facility change that affects performance.
	c. Smoke Detectors (single-station detectors, system detectors, and air sampling detectors) (Remove devices not required by UFC 3-600-01 or other directives.)	1. Test with manufacturer-approved smoke simulant to verify smoke entry and alarm initiation and receipt. 2. Verify no facility change that affects performance.
	d. Supervisory Devices (low air pressure, temperature, water level)	1. Test to verify initiation and receipt of supervisory alarm.
5 Years	1. Smoke Detectors (Remove devices not required by UFC 3-600-01.)	1. Test detector sensitivity to ensure that the detector has remained within its listed and marked sensitivity range (or 4 percent obscuration light gray smoke, if not marked).
As Part of Building Inspection	Entire System	1. Visually check: a. Detectors unblocked and uncovered. b. Panels secured and indicator lamps functional. c. Notification appliances in place. d. Manual stations in place and unobstructed. 2. Exercise evacuation notification appliances for audibility, clarity, and visibility.

2-2.3 **Wet Pipe Automatic Sprinkler Systems**

Technical guidance on the tasks in Table 2-2 is contained in NFPA 25. Residential sprinklers are addressed in Chapter 3.

CAUTION

Main drain static or residual test pressures that vary more than 10 percent from the previous test readings or the original acceptance readings require immediate evaluation to determine the cause.

WARNING

Main drain static or residual test pressures that vary more than 20 percent from the previous test readings or the original acceptance readings indicate an emergency situation. Immediate distribution system flow testing (paragraph 2-2.11) is indicated. Immediately conduct main drain tests on all adjacent sprinkler systems to determine the extent to which the sprinkler systems are compromised.

Table 2-2. Wet Pipe Sprinkler Systems ITM Tasks

Frequency	Component	Tasks
Monthly	1. Control Valves (without seal, lock, or electric supervision)	1. Verify valve position.
Annual	1. Control Valves (sealed, locked, or electrically supervised)	1. Verify valve position.
	2. Waterflow Alarm Devices	1. Operate to verify initiation and receipt of alarm. 2. Verify alarm test valve alignment and tamper switch (if sealed or electrically supervised).
	3. Alarm Valve and Trim	1. Visually check the exterior of valves, gauges, trim alignment. 2. Verify valve pressure and legibility of the hydraulic nameplate.
	4. Main Drain	1. Conduct a main drain test to verify supply (valve position). 2. Document static and residual pressure readings on a 3- by 5-inch (3x5) tag and secure it to the system pressure gauge. 3. Compare results with results from previous main drain tests and original acceptance test. 4. Verify that the results are within acceptable limits or identify corrective measures.

Table 2-2. Wet Pipe Sprinkler Systems ITM Tasks (Continued)

Frequency	Component	Tasks
Annual (Continued)	5. Fire Department Connection	1. Verify accessibility and condition. 2. If caps are removed or missing, check for obstructions.
2 Years	1. Control Valves	1. Operate valve through entire travel to verify function. 2. Lubricate valves and stems to ensure operability.
5 Years	1. Alarm Valve	1. Clean and inspect internally to verify condition.
	2. Anti-freeze Loops	1. Confirm correct solution mixture.
10 Years	1. Gauges	1. Recalibrate or replace gauges.
20 Years	1. Fast Response Sprinklers and Extra High Temperature Sprinklers	1. Test sample sprinklers to verify response characteristics.
50 Years	1. Standard Sprinklers	1. Replace or test a sample of sprinklers to verify response characteristics.
Following System Modification or Repair	1. Main Drain (following maintenance or repair action requiring the water supply to be shut off)	1. Conduct main drain test to verify supply (valve position).
As Part of Building Inspection	Entire System	Visually check: 1. Pipe hangers. 2. Sprinklers for obstruction. 3. Piping for leaks. 4. Riser condition.

2-2.4 Dry Pipe Automatic Sprinkler Systems

Technical guidance for these tasks is contained in NFPA 25.

CAUTION

Main drain static or residual test pressures that vary more than 10 percent from the previous test readings or the original acceptance readings require immediate evaluation to determine the cause.

WARNING

Main drain static or residual test pressures that vary more than 20 percent from the previous test readings or the original acceptance readings indicate an emergency situation. Immediate distribution system flow testing (paragraph 2-2.11) is indicated. Immediately conduct main drain tests on all adjacent sprinkler systems to determine the extent to which the sprinkler systems are compromised.

Table 2-3. Dry Pipe Automatic Sprinkler Systems ITM Tasks

Frequency	Component	Tasks
Monthly	1. Control Valves (without seal, lock, or electric supervision)	1. Verify valve position.
Annual	1. Control Valves (sealed, locked, or electrically supervised)	1. Verify valve position.
	2. Waterflow Alarm Devices	1. Operate to verify initiation and receipt of alarm. 2. Verify alarm test valve alignment and tamper switch (if sealed or electrically supervised).
	3. Dry Pipe Alarm Valve and Trim	1. Visually inspect the exterior of valves, gauges, trim alignment. 2. Verify valve pressure and legibility of the hydraulic nameplate.
	4. Main Drain	1. Conduct main drain test to verify supply (valve position). 2. Document static and residual pressure readings on a 3x5 tag and secure it to the system pressure gauge. 3. Compare results with results from previous main drain tests and original acceptance test. 4. Verify that the results are within acceptable limits or identify corrective measures.
	5. Fire Department Connection	1. Verify accessibility and condition. 2. If caps are removed or missing, check for obstructions.
	6. Dry Pipe Alarm Valve Enclosure Heating	1. Verify operability at the beginning of the heating season (annually for constant cold areas).
	7. Low Temperature Alarm	1. Verify initiation and receipt of alarm at the beginning of the heating season.

Table 2-3. Dry Pipe Automatic Sprinkler Systems ITM Tasks (Continued)

Frequency	Component	Tasks
Annual (Continued)	8. Low Point Drains	1. Drain all low points to remove condensation prior to the cold season.
2 Years	1. Control Valves	1. Operate valve through entire travel to verify function. 2. Lubricate valve stem.
	2. Dry Pipe Alarm Valves	1. Trip valve to verify operability. 2. Inspect internal condition before resetting, and clean valve seat. 3. Check priming water level (before and after trip test).
	3. Quick-Opening Devices	1. Test to verify operability.
	4. Low Air Pressure Alarm	1. Test to verify initiation and receipt of supervisory alarm.
	5. Automatic Air Pressure Maintenance Devices	1. Inspect to verify proper operation.
5 Years	1. Strainers	1. Inspect internally and clean to verify condition.
10 Years	1. Gauges	1. Recalibrate or replace gauges.
20 Years	1. Fast Response Sprinklers and Extra High Temperature Sprinklers	1. Test sample sprinklers to verify response characteristics.
50 Years	1. Standard Sprinkler	1. Replace or test a sample of sprinklers to verify response characteristics.
Following System Modification or Repair	1. Main Drain (following maintenance or repair action requiring the water supply to be shut off)	1. Conduct main drain test to verify supply (valve position). 2. Document static and residual pressure readings on a 3x5 tag and secure it to the system pressure gauge.
As Part of Building Inspection	Entire System	Visually check: 1. Pipe hangers. 2. Heads for obstruction. 3. Piping for leaks. 4. Riser condition. 5. Sprinkler spares.

2-2.5 **Deluge Sprinkler Systems**

Detection devices for actuation are addressed in paragraph 2-2.2. Technical guidance on the tasks is contained in NFPA 25 and NFPA 15.

CAUTION

Main drain static or residual test pressures that vary more than 10 percent from the previous test readings or the original acceptance readings require immediate evaluation to determine the cause.

WARNING

Main drain static or residual test pressures that vary more than 20 percent from the previous test readings or the original acceptance readings indicate an emergency situation. Immediate distribution system flow testing (paragraph 2-2.11) is indicated. Immediately conduct main drain tests on all adjacent sprinkler systems to determine the extent to which the sprinkler systems are compromised.

Table 2-4. Deluge Sprinkler Systems ITM Tasks

Frequency	Component	Tasks
Monthly	1. Control Valves (without seal, lock, or electric supervision)	1. Verify valve position.
Annual	1. Control Valves (sealed, locked, or electrically supervised)	1. Verify valve position.
	2. Waterflow Alarm Devices	1. Operate to verify initiation and receipt of alarm. 2. Verify alarm test valve alignment and tamper switch (if sealed or electrically supervised).
	3. Deluge Alarm Valve and Trim	1. Inspect the exterior of valves, gauges, trim alignment. 2. Verify valve pressure and legibility of the hydraulic nameplate.
	4. Main Drain	1. Conduct a main drain test to verify supply (valve position). 2. Document static and residual pressure readings on a 3x5 tag and secure it to the system pressure gauge. 3. Compare results with results from previous main drain tests and original acceptance test. 4. Verify that the results are within acceptable limits or identify corrective measures.

Table 2-4. Deluge Sprinkler Systems ITM Tasks (Continued)

Frequency	Component	Tasks
Annual (Continued)	5. Fire Department Connection	<ol style="list-style-type: none"> 1. Verify accessibility and condition. 2. If caps are removed or missing, check for obstructions.
	6. Valve and Riser Heated Enclosure (if provided)	<ol style="list-style-type: none"> 1. Verify operability at the beginning of the heating season.
	7. Low Temperature Alarm	<ol style="list-style-type: none"> 1. Verify initiation and receipt of alarm at the beginning of the heating season.
2 Years	1. Control Valves	<ol style="list-style-type: none"> 1. Operate valve through entire travel to verify function. 2. Lubricate valve stem.
	2. Deluge Valve	<ol style="list-style-type: none"> 1. Trip to verify operability. 2. Verify that manual actuators are operable. 3. Inspect the internal condition and clean valve seat before resetting.
	3. Low Point Drains	<ol style="list-style-type: none"> 1. Drain all low points after deluge valve test and before cold weather.
5 Years	1. Strainers	<ol style="list-style-type: none"> 1. Inspect internally and clean to verify condition.
10 Years	1. Gauges	<ol style="list-style-type: none"> 1. Recalibrate or replace.
	2. Deluge Valve	<ol style="list-style-type: none"> 1. Conduct full flow test.
Following System Modification or Repair	1. Main Drain (following maintenance or repair action requiring the water supply to be shut off)	<ol style="list-style-type: none"> 1. Conduct main drain test to verify supply (valve position). 2. Document static and residual pressure readings on a 3x5 tag and secure it to the system pressure gauge.
As Part of Building Inspection	Entire System	<ol style="list-style-type: none"> 1. Visually check: <ol style="list-style-type: none"> a. Pipe hangers. b. Sprinklers for obstruction. c. Piping for leaks. d. Riser condition. e. Sprinkler spares. 2. Ensure: <ol style="list-style-type: none"> a. Detectors unblocked/uncovered. b. Panels secured and indicator lamps functional. c. Notification appliances in place. d. Manual stations in place and unobstructed.

2-2.6 **Pre-Action Automatic Sprinkler Systems**

Detection devices for actuation are addressed in paragraph 2-2.2. Technical guidance on the tasks is contained in NFPA 25.

CAUTION

Main drain static or residual test pressures that vary more than 10 percent from the previous test readings or the original acceptance readings require immediate evaluation to determine the cause.

WARNING

Main drain static or residual test pressures that vary more than 20 percent from the previous test readings or the original acceptance readings indicate an emergency situation. Immediate distribution system flow testing (paragraph 2-2.11) is indicated. Immediately conduct main drain tests on all adjacent sprinkler systems to determine the extent to which the sprinkler systems are compromised.

Table 2-5. Pre-Action Automatic Sprinkler Systems ITM Tasks

Frequency	Component	Tasks
Monthly	1. Control Valves (without seal, lock, or electric supervision)	1. Verify valve position.
Annual	1. Control Valves (sealed, locked, or electrically supervised)	1. Verify valve position.
	2. Waterflow Alarm Devices	1. Operate to verify initiation and receipt of alarm. 2. Verify alarm test valve alignment and tamper switch (if sealed or electrically supervised).
	3. Pre-Action Valve and Trim	1. Inspect the exterior of valves, gauges, trim alignment. 2. Verify valve pressure and legibility of the hydraulic nameplate.
	4. Main Drain	1. Conduct a main drain test to verify supply (valve position). 2. Document static and residual pressure readings on a 3x5 tag and secure it to the system pressure gauge. 3. Compare results with results from previous main drain tests and original acceptance test. 4. Verify that the results are within acceptable limits or identify corrective measures.

Table 2-5. Pre-Action Automatic Sprinkler Systems ITM Tasks (Continued)

Frequency	Component	Tasks
Annual (Continued)	5. Fire Department Connection	<ol style="list-style-type: none"> 1. Verify accessibility and condition. 2. If caps are removed or missing, check for obstructions.
	6. Valve and Riser Heated Enclosure (if provided)	<ol style="list-style-type: none"> 1. Verify operability at beginning of heating season.
	7. Low Temperature Alarm	<ol style="list-style-type: none"> 1. Verify initiation and receipt of alarm at the beginning of the heating season.
2 Years	1. Control Valves	<ol style="list-style-type: none"> 1. Operate valve through entire travel to verify function. 2. Lubricate valve stem.
	2. Pre-Action Valve	<ol style="list-style-type: none"> 1. Trip to verify proper operation. 2. Verify manual actuators (if provided). 3. Inspect internal condition and clean valve seat before resetting.
	3. Low Point Drains	<ol style="list-style-type: none"> 1. Drain all low points after pre-action valve trip test and before cold weather (if unheated area).
	4. Air Supply (if present)	<ol style="list-style-type: none"> 1. Test the automatic air pressure maintenance device. 2. Test the low air supply alarm.
5 Years	1. Strainers	<ol style="list-style-type: none"> 1. Clean and inspect the interior to verify condition.
10 Years	1. Gauges	<ol style="list-style-type: none"> 1. Recalibrate or replace gauges.
20 Years	1. Fast-Response Sprinklers and Extra High Temperature Sprinklers	<ol style="list-style-type: none"> 1. Test a sample of sprinklers to verify response characteristics.
50 Years	1. Closed-Head Sprinklers	<ol style="list-style-type: none"> 1. Replace or test sample closed-head sprinklers to verify response characteristics.

Table 2-5. Pre-Action Automatic Sprinkler Systems ITM Tasks (Continued)

Frequency	Component	Tasks
Following System Modification or Repair	1. Main Drain (following maintenance or repair action requiring the water supply to be shut off)	<ol style="list-style-type: none"> 1. Conduct main drain test to verify supply (valve position). 2. Document static and residual pressure readings on a 3x5 tag and secure it to the system pressure gauge.
As Part of Building Inspection	Entire System	<ol style="list-style-type: none"> 1. Visually check: <ol style="list-style-type: none"> a. Pipe hangers. b. Sprinklers for obstruction. c. Piping for leaks. d. Riser condition. e. Sprinkler spares. 2. Ensure: <ol style="list-style-type: none"> a. Manual stations in place and unobstructed. b. Detectors unblocked/uncovered. c. Panels secured and indicator lamps functional. d. Notification appliances in place.

2-2.7 Water Spray Systems

Detection devices for actuation are addressed in paragraph 2-2.2. Technical guidance on these tasks is contained in NFPA 25.

CAUTION

Main drain static or residual test pressures that vary more than 10 percent from the previous test readings or the original acceptance readings require immediate evaluation to determine the cause.

WARNING

Main drain static or residual test pressures that vary more than 20 percent from the previous test readings or the original acceptance readings indicate an emergency situation. Immediate distribution system flow testing (paragraph 2-2.11) is indicated. Immediately conduct main drain tests on all adjacent sprinkler systems to determine the extent to which the sprinkler systems are compromised.

Table 2-6. Water Spray Systems ITM Tasks

Frequency	Component	Tasks
Monthly	1. Control Valves (without seal, lock, or electric supervision)	1. Verify valve position.
Annual	1. Control Valves (sealed, locked, or electrically supervised)	1. Verify valve position.
	2. Waterflow Alarm Devices	1. Operate to verify initiation and receipt of alarm. 2. Verify alarm test valve alignment and tamper switch (if sealed or electrically supervised).
	3. Pre-Action Valve and Trim	1. Inspect the exterior of valves, gauges, trim alignment. 2. Verify valve pressure and legibility of the hydraulic nameplate.
	4. Main Drain	1. Conduct a main drain test to verify supply (valve position). 2. Document static and residual pressure readings on a 3x5 tag and secure it to the system pressure gauge. 3. Compare results with results from previous main drain tests and original acceptance test. 4. Verify that the results are within acceptable limits or identify corrective measures.
	5. Fire Department Connection	1. Verify accessibility and condition. 2. If caps are removed or missing, check for obstructions.
	6. Valve and Riser Enclosure Heater	1. Verify operability at the beginning of the heating season.
	7. Low Temperature Alarm	1. Verify initiation and receipt of alarm at the beginning of the heating season.
2 Years	1. Control Valves	1. Operate valve through entire travel to verify function. 2. Lubricate valve stem.
	2. Water Spray Valve	1. Trip to verify operability. 2. Verify manual actuators (if provided). 3. Verify spray pattern. (If experience shows nozzles are not moved, this can be extended to 10 years or after modifications.) 4. Inspect interior of valve and clean valve seat before resetting.

Table 2-6. Water Spray Systems ITM Tasks (Continued)

Frequency	Component	Tasks
2 Years (Continued)	3. Low Point Drains	1. Drain all low points after pre-action valve trip test and before cold weather.
5 Years	1. Strainers	1. Clean and inspect interior to verify condition.
10 Years	1. Gauges	1. Recalibrate or replace.
20 Years	1. Fast-Response Sprinklers and Extra High Temperature Sprinklers	1. Test sample heads to verify response characteristics.
50 Years	1. Standard Sprinklers	1. Replace or test a sample of sprinklers to verify response characteristics.
Following System Modification or Repair	1. Main Drain (following maintenance or repair action requiring the water supply to be shut off)	1. Conduct main drain test to verify supply (valve position). 2. Document static and residual pressure readings on a 3x5 tag and secure it to the system pressure gauge.
As Part of Building Inspection	Entire System	1. Visually check: a. Pipe hangers. b. Sprinklers for obstruction. c. Piping for leaks. d. Riser condition. e. Sprinkler spares. 2. Ensure: a. Manual stations in place and unobstructed. b. Detectors unblocked/uncovered. c. Panels secured and indicator lamps functional. d. Notification appliances in place.

2-2.8 Water Mist Systems

Detection devices for actuation are addressed in paragraph 2-2.2. Technical guidance on the tasks is contained in NFPA 750.

Table 2-7. Water Mist Systems ITM Tasks

Frequency	Component	Task
Weekly	1. Water Tanks (without electric remote supervision of water level)	1. Check water level.
	2. Air Compressor/ Receiver/Cylinders (without electric remote supervision of air pressure)	1. Check air pressure.
Semi-Annual	1. Pumps	1. Complete churn test to ensure operability.
	2. Air Compressors	1. Start to ensure operability.
	3. System Operating Components	1. Inspect to verify valve alignment and that valve is free of damage.
Annual	1. Water Tanks (remote electrically supervised and monitored)	1. Check water level detection device and supervisory controls.
	2. Air Compressors/ Receivers/Cylinders (electric remote supervision of air pressure)	1. Check air pressure and supervisory pressure switch.
	3. Waterflow Alarm	1. Operate to verify initiation and receipt of alarm.
	4. Pumps	1. Conduct full flow functional test.
	5. Pressure Relief Devices	1. Manually operate to ensure operability.
	6. Manual Actuators	1. Verify operability.
	7. Control Valve (sectional water supply valve)	1. Verify operability and position.
5 Years	1. Pressure Cylinders (normally at atmospheric pressure)	1. Pressurize to verify operability.
	2. System	1. Conduct flow test.
	3. Water	1. Verify water quality when refilling.
	4. Water Tanks	1. Inspect tanks for structural integrity prior to refilling.
	5. Nozzle Sampling	1. Test a sample of nozzles to verify response characteristics.

Table 2-7. Water Mist Systems ITM Tasks (Continued)

Frequency	Component	Task
5-12 Years	1. Storage Vessels	1. Conduct hydrostatic test for pressure cylinders in accordance with OSHA and U.S. Department of Transportation (DOT) standards.
As Part of Building Inspection	Entire System	1. Visually check: <ol style="list-style-type: none"> a. Pipe hangers. b. Nozzles for obstruction. c. Piping for leaks. d. Riser condition. e. Nozzle spares. 2. Ensure: <ol style="list-style-type: none"> a. Detectors unblocked/uncovered. b. Panels secured and indicator lamps functional. c. Notification appliances in place. d. Manual stations in place and unobstructed.

2-2.9 Foam and Foam-Water Systems

Table 2-8 addresses low-expansion foam systems for flammable liquid tanks as covered in NFPA 11. Table 2-9 addresses low-expansion foam spray and sprinkler systems, including aqueous film-forming foam (AFFF) as covered in NFPA 16. Table 2-10 addresses low-expansion foam monitor nozzle systems for multiple applications as covered in NFPA 11. Table 2-11 addresses low-expansion grate nozzle foam systems for aircraft hangar applications as covered in NFPA 11. Table 2-12 addresses high-expansion foam systems as covered in NFPA 11.

Table 2-8. Low-Expansion Foam Systems for Flammable Liquid Tanks ITM Tasks

Frequency	Component	Tasks
Annual	1. Foam Concentrate	1. Inspect for quality and evidence of sludge or deterioration. 2. Take sample and test in accordance with manufacturer's instructions.
	2. Foam Pumps/Proportioners	1. Test to verify operability and proper proportioning. 2. Flush pumps after operation.

Table 2-8. Low-Expansion Foam Systems for Flammable Liquid Tanks ITM Tasks (Continued)

Frequency	Component	Tasks
Annual (Continued)	3. System Actuators	1. Verify all manual and automatic actuation functions.
	4. Foam Concentrate Strainers	1. Inspect and clean if necessary.
	5. Distribution/Discharge	1. Ensure that discharge devices are free of damage. 2. Inspect pipe and hanger to verify support and pitch.
2 Years	1. Foam Pumps/Proportioners	1. Test to verify operability and proper proportioning. 2. Flush pumps after operation.
	2. Control Valves	1. Operate valve through entire travel to verify function. 2. Lubricate valve stem.
5 Years	1. Distribution Piping (including underground)	1. Spot-check piping interior for evidence of deterioration.
	2. Strainers (water supply)	1. Inspect and clean if necessary.
Following System Modification or Repair	1. Main Drain (following maintenance or repair action requiring the water supply to be shut off)	1. Conduct main drain test to verify supply (valve position).
As Part of Building Inspection	Entire System	1. Visually check: a. Pipe hangers. b. Generators for obstruction (air intake or foam discharge). c. Generator nozzles for obstruction and generator screens for damage. d. Piping for leaks. e. Riser condition. 2. Ensure: a. Panels secured and indicator lamps functional. b. Notification appliances in place. c. Manual stations in place and unobstructed.

Table 2-9. Foam Spray and Sprinkler Systems ITM Tasks

Frequency	Component	Tasks
Monthly	1. Control Valves (without seal, lock, or electric supervision)	1. Verify valve in open (proper) position.
Semi-Annual	1. Foam Concentrate	1. Verify adequate supply.
	2. Foam Proportioning System	1. Test pump to ensure operability. 2. Inspect proportioning system for proper valve alignment and system condition.
Annual	1. Control Valves (sealed, locked, or electrically supervised)	1. Verify valve in proper position.
	2. Foam Concentrate	1. Take sample and test in accordance with manufacturer's instructions.
	3. Foam Concentrate Strainers	1. Inspect exterior to ensure that blow down valve is closed.
2 Years	1. Control Valve	1. Operate valve through entire travel to verify function. 2. Lubricate stem.
	2. Foam Proportioning System	1. Conduct full flow test to ensure proper system function. 2. Verify proper concentration.
	3. Actuators	1. Verify operability of manual and automatic actuators.
	4. Distribution System	1. Verify nozzle (sprinkler) coverage during flow test. 2. Inspect piping hangers, sprinklers, and nozzles for condition and location.
	5. Foam Concentrate Strainers	1. Inspect and clean after flow test.
5 Years	1. Balancing Valve	1. Flush to prevent concentrate buildup on diaphragm.
	2. Strainers (water supply)	1. Inspect and clean if necessary.
10 Years	1. Foam Concentrate Tank	1. Drain, flush, and perform internal inspection for corrosion. If pressure vessel, perform hydrostatic test.

Table 2-9. Foam Spray and Sprinkler Systems ITM Tasks (Continued)

Frequency	Component	Tasks
Following System Modification or Repair	1. Main Drain (following maintenance or repair action requiring the water supply to be shut off)	1. Conduct main drain test to verify supply (valve position).
As Part of Building Inspection	Entire System	1. Visually check: <ol style="list-style-type: none"> a. Pipe hangers. b. Sprinklers/nozzles for obstruction. c. Piping for leaks. d. Riser condition. 2. Ensure: <ol style="list-style-type: none"> a. Detectors unblocked/uncovered. b. Panels secured and indicator lamps functional. c. Notification appliances in place. d. Manual stations in place and unobstructed. 3. Check sprinkler spares.

Table 2-10. Foam Monitors Nozzle Systems ITM Tasks

Frequency	Component	Tasks
Monthly	1. Control Valves (without lock or electric supervision)	1. Verify valve in open (proper) position.
Semi-Annual	1. Foam Concentrate	1. Verify adequate supply.
	2. Foam Proportioning System	1. Test pump to ensure operability. 2. Inspect proportioning system for proper valve alignment and system condition.
Annual	1. Control Valves (locked or electrically supervised)	1. Verify valve in proper position.
	2. Foam Concentrate	1. Take sample and test in accordance with manufacturer's instructions.
	3. Foam Concentrate Strainers	1. Inspect exterior to ensure that blow down valve is closed.

Table 2-10. Foam Monitors Nozzle Systems ITM Tasks (Continued)

Frequency	Component	Tasks
Annual (Continued)	4. Nozzle and Nozzle Driver	<ol style="list-style-type: none"> 1. Lubricate in accordance with manufacturer's direction. 2. Ensure that nozzle elevation set not to apply foam on aircraft surfaces.
2 Years	1. Control Valve	<ol style="list-style-type: none"> 1. Operate valve through entire travel to verify function. 2. Lubricate stem.
	2. Foam Proportioning System	<ol style="list-style-type: none"> 1. Conduct full flow test to ensure proper system function. 2. Verify proper concentration.
	3. Actuators	<ol style="list-style-type: none"> 1. Verify operability of manual and automatic actuators.
	4. Distribution System	<ol style="list-style-type: none"> 1. Verify nozzle coverage during flow test. 2. Inspect piping hangers, sprinklers, and nozzles for condition and location.
	5. Foam Concentrate Strainers	<ol style="list-style-type: none"> 1. Inspect and clean after flow test.
5 Years	1. Balancing Valve	<ol style="list-style-type: none"> 1. Flush to prevent concentrate buildup on diaphragm.
	2. Strainers (water supply)	<ol style="list-style-type: none"> 1. Inspect and clean if necessary.
10 Years	1. Foam Concentrate Tank	<ol style="list-style-type: none"> 1. Drain, flush, and perform internal inspection for corrosion. If pressure vessel, perform hydrostatic test.
Following System Modification or Repair	1. Main Drain (following maintenance or repair action requiring the water supply to be shut off)	<ol style="list-style-type: none"> 1. Conduct main drain test to verify supply (valve position). 2. Document static and residual pressure readings on a 3x5 tag and secure it to the system pressure gauge.
As Part of Building Inspection	Entire System	<ol style="list-style-type: none"> 1. Visually check: <ol style="list-style-type: none"> a. Pipe hangers. b. Nozzle for obstruction. c. Piping for leaks. d. Riser condition. 2. Ensure: <ol style="list-style-type: none"> a. Detectors unblocked/uncovered. b. Panels secured and indicator lamps functional. c. Notification appliances in place. d. Manual stations in place and unobstructed.

Table 2-11. Grate Nozzle Foam Systems ITM Tasks

Frequency	Component	Tasks
Annual	1. Foam Concentrate	<ol style="list-style-type: none"> 1. Inspect to verify adequate supply. 2. Take sample and test in accordance with manufacturer's instructions.
	2. Foam Nozzles	<ol style="list-style-type: none"> 1. Inspect to verify condition.
2 Years	1. Foam Nozzles	<ol style="list-style-type: none"> 1. Conduct test to verify operability. (Test may be done with water only.)
	2. Actuators	<ol style="list-style-type: none"> 1. Verify that all manual and automatic actuators function.
	3. Foam Proportioning System	<ol style="list-style-type: none"> 1. Conduct full flow test to ensure proper system function. (This may be done through a test connection or through the foam nozzles. Only discharge until full foam flow appears from each nozzle; then end foam injection.) 2. Verify proper concentration.
	4. Control Valve	<ol style="list-style-type: none"> 1. Operate valve through entire travel to verify function. 2. Lubricate stem.
After Activation	1. Strainers	<ol style="list-style-type: none"> 1. Inspect and clean after system actuation or flow test.
Following System Modification or Repair	1. Main Drain (following maintenance or repair action requiring the water supply to be shut off)	<ol style="list-style-type: none"> 1. Conduct main drain test to verify supply (valve position). 2. Document static and residual pressure readings on a 3x5 tag and secure it to the system pressure gauge.
As Part of Building Inspection	Entire System	<ol style="list-style-type: none"> 1. Visually Check: <ol style="list-style-type: none"> a. Pipe hangers and mounts. b. Nozzles for obstruction. c. Piping for leaks. d. Riser condition. 2. Ensure: <ol style="list-style-type: none"> a. Detectors unblocked/uncovered. b. Panels secured and indicator lamps functional. c. Notification appliances in place. d. Manual stations in place and unobstructed.

Table 2-12. High-Expansion Foam Systems ITM Tasks

Frequency	Component	Tasks
Annual	1. Foam Concentrate	1. Inspect to verify adequate supply. 2. Take sample and test in accordance with manufacturer's instructions.
	2. Foam Generator	1. Inspect to verify condition and proper valve alignment.
2 Years	1. Foam Generator	1. Conduct test to verify operability. (Water-powered may be done with water only.)
	2. Actuators	1. Verify that all manual and automatic actuators function.
	3. Foam Proportioning Systems	1. Conduct full flow test to ensure proper system function. (Test may be done through a test connection or through the foam generators. Only discharge until full foam flow appears from each generator; then end foam injection.) 2. Verify proper concentration.
	4. Control Valve	1. Operate valve through entire travel to verify function. 2. Lubricate stem.
After Activation	1. Strainers	1. Inspect and clean after system actuation or flow test.
Following System Modification or Repair	1. Main Drain (following maintenance or repair action requiring the water supply to be shut off)	1. Conduct main drain test to verify supply (valve position). 2. Document static and residual pressure readings on a 3x5 tag and secure it to the system pressure gauge.
As Part of Building Inspection	Entire System	1. Visually check: a. Pipe hangers. b. Generators for obstruction (air intake or foam discharge). c. Generator nozzles for obstruction and generator screens for damage. d. Piping for leaks. e. Riser condition. 2. Ensure: a. Detectors unblocked/uncovered. b. Panels secured and indicator lamps functional. c. Notification appliances in place. d. Manual stations in place and unobstructed.

2-2.10 **Standpipe Systems**

Detection devices for actuation are addressed in paragraph 2-2.2. Technical guidance on the tasks is contained in NFPA 14 and 25.

Table 2-13. Standpipe Systems ITM Tasks

Frequency	Component	Tasks
Semi-Annual	1. Hose Connection and Pressure Reducing Valves	1. Inspect for damage, leaking, missing caps, and obstruction.
2 Years	1. Piping	1. Inspect for damage and pipe supports.
	2. Control Valve	1. Operate valve through entire travel to verify function. 2. Lubricate stem.
5 Years	1. Standpipe	1. Conduct flow test to verify flow capacity and minimum discharge pressure. (Test must confirm only flow/pressure—not duration—of supply). 2. Hydrostatic test to ensure integrity (dry standpipe systems only).
As Part of Building Inspection	Entire System	1. Visually check: a. Pipe hangers. b. Connections for obstruction. c. Piping for leaks. d. Riser condition.

2-2.11 **Hydrants and Monitors**

Technical guidance on the tasks in tables 2-14 and 2-15 is contained in UFC 3-230-02; American Water Works Association (AWWA) Manual 17 (M17) for hydrants and monitors supplied from potable distribution systems; and NFPA 25 for hydrants and monitors supplied by non-potable distribution systems. Flow testing should be accomplished in accordance with AWWA M17, Chapter 6.

CAUTION

Flow tests results that vary more than 10 percent from the previous test readings or the original acceptance readings require immediate evaluation to determine the cause.

WARNING

Flow tests results that vary more than 20 percent from the previous test readings or the original acceptance readings indicate an emergency situation. Immediate distribution system flow testing (paragraph 2-2.11) is indicated. Immediately conduct main drain tests on all adjacent sprinkler systems to determine the extent to which the sprinkler systems are compromised.

Table 2-14. Hydrants ITM Tasks

Frequency	Component	Task
2 Years	<ol style="list-style-type: none"> 1. Hydrants (normally found on public and private potable water distribution systems) 2. Hydrants on dedicated fire protection water distribution systems 3. Hydrants on reuse (gray) water systems are required to be serviced in accordance with this UFC only if specifically installed to meet a fire protection requirement. 	<ol style="list-style-type: none"> 1. Inspect for accessibility, leaks, and worn threads. 2. Lubricate hydrant to ensure ease of operation. 3. With caps on all outlets, operate not less than five full cycles to ensure proper functioning and distribute lubrication. 4. Flush the hydrant not less than 1 minute or until water runs clear, whichever is longer. 5. Verify drainage of barrel (after all operations and before cold weather).
5 Years	<ol style="list-style-type: none"> 1. Underground and Exposed Piping 	<ol style="list-style-type: none"> 1. Conduct flow tests. These should be coordinated with the 2-year ITM tasks whenever possible. (Approximately 20 percent of the installation's hydrants should be tested each year such that at the end of every 5-year cycle, every hydrant has had a flow test conducted and recorded. Test hydrants should be selected such that piping condition/flow capability in each area of the installation is verified.) 2. Document flow test results and provide a copy to the fire and emergency service organization delivering fire suppression services for the installation.
After Flow	<ol style="list-style-type: none"> 1. Strainers 	<ol style="list-style-type: none"> 1. Inspect and clean after each flow.
As Required	<ol style="list-style-type: none"> 1. Hydrants 	<ol style="list-style-type: none"> 1. Apply protective coatings (paint) to prevent corrosion. 2. Identify by hydrant barrel color code the water distribution system to which the hydrant is connected. <ol style="list-style-type: none"> a. Potable water. b. Non-potable fire protection water. c. Non-potable reuse (gray) water. 3. Identify by hydrant bonnet (top) color code the water flow available from the hydrant. [Color codes may be locally determined or may follow AWWA or NFPA recommendations.]

Table 2-15. Yard Hydrant Monitors and Hose Houses ITM Tasks

Frequency	Component	Task
2 Years	1. Yard Monitor Nozzles (normally found on non-potable systems)	<ol style="list-style-type: none"> 1. Inspect for condition. 2. Conduct flow test to verify proper function and range of motion. 3. Lubricate to ensure proper operating conditions.
	2. Hose Houses	<ol style="list-style-type: none"> 1. Inspect for accessibility and physical condition. 2. Verify inventory and equipment condition.
5 Years	1. Underground and Exposed Piping	<ol style="list-style-type: none"> 1. Conduct flow tests. (Approximately 20 percent of the installation's hydrants should be tested each year such that at the end of every 5-year cycle, every hydrant has had a flow test conducted and recorded. Test hydrants should be selected such that piping condition/flow capability in each area of the installation is verified.) 2. Document flow test results.
After Flow	1. Strainers	<ol style="list-style-type: none"> 1. Inspect and clean after each flow.

2-2.12 Fire Pumps

Technical guidance on these tasks is contained in NFPA 20 and NFPA 25. When generators are installed specifically to meet fire protection requirements or generators are used to provide standby power for fire pumps, all the requirements in Table 2-16 related to the engine drives shall be conducted. These requirements shall not supersede requirements for generators serving demands other than fire protection. Generators serving both fire protection and other demands shall conform to the most stringent guidance.

Table 2-16. Fire Pumps ITM Tasks

Frequency	Component	Tasks
Monthly	1. Pump House	<ol style="list-style-type: none"> 1. Inspect for proper condition, ventilation, and heating.
	2. Control Valve and Isolation Valve	<ol style="list-style-type: none"> 1. Verify proper valve position.
	3. Pressure Gauges	<ol style="list-style-type: none"> 1. Check reading and verify gauge operability.

Table 2-16. Fire Pumps ITM Tasks (Continued)

Frequency	Component	Tasks
Monthly (Continued)	4. Controllers	<ol style="list-style-type: none"> 1. Verify that automatic controllers are in the automatic (AUTO) setting. 2. Inspect electric connections. 3. Operate manual and automatic stations.
	5. Batteries	<ol style="list-style-type: none"> 1. Verify proper charge.
	6. Pumps	<ol style="list-style-type: none"> 1. Start and churn to verify operability. (Where equipment permits, allow water to flow back to the source.) [Electric pumps shall operate for 10 minutes and engine-driven pumps shall operate for 30 minutes.] 2. Verify operation of relief valves. 3. Verify full level (for engine-driven pumps). 4. Inspect exhaust system for leaks (for engine-driven pumps). 5. For engine driven pumps, start again using second battery set and churn to verify operability. (Where equipment permits, allow water to flow back to the source.)
2 Years	1. Control Valve	<ol style="list-style-type: none"> 1. Operate and lubricate valves to ensure operability.
	2. Controllers	<ol style="list-style-type: none"> 1. Calibrate pressure switches. 2. Exercise circuit breakers and switches to verify operability. 3. Inspect fuses.
	3. Pumps	<ol style="list-style-type: none"> 1. Check coupling alignment to ensure that the shaft is aligned. 2. Check pump shaft end play. 3. Lubricate bearings. 4. Lubricate couplings. 5. Lubricate right-angle drives.
	4. Fuel (engine-driven pumps)	<ol style="list-style-type: none"> 1. Sample fuel to verify quality.
	5. Relief Valves	<ol style="list-style-type: none"> 1. Calibrate valves.
	6. Emergency Power Supply	<ol style="list-style-type: none"> 1. Test to verify availability and capacity for pump motor.
5 Years	1. Pump	<ol style="list-style-type: none"> 1. Conduct flow test to verify pump output. Test may be through a flow meter returning the water to a storage reservoir or through the test header. Recirculation of water to the suction piping is not permitted. In a multi-pump installation, each pump may be tested separately at not less than 100 percent design capacity for 30 minutes.

2-2.13 Water Supply Tanks

Technical guidance on these tasks is contained in NFPA 22 and NFPA 25.

Table 2-17. Water Supply Tanks ITM Tasks

Frequency	Component	Tasks
Weekly (during freezing weather)	1. Tank Heating System (without electric supervision)	1. Verify water temperature. 2. Verify operability of tank heaters.
Monthly	1. Control Valves (without seals, locks, or electric supervision)	1. Verify proper valve position.
Quarterly	1. Water Level (without remote supervision of water level)	1. Verify proper water level in tank.
Annual	1. Control Valves (sealed, locked, or electrically supervised)	1. Verify proper valve position.
	2. Water Level (with remote electric supervision of water level)	1. Verify proper water level in tank.
	3. Tank Heating System (with remote electric supervision of water temperature)	1. Verify operability of tank heater (prior to cold weather). 2. Test temperature alarms to verify proper operation. (Maintain thermometer in accordance with manufacturer's recommendations.)
	4. Tank	1. Inspect exterior for condition, damage, corrosion, and accessibility. 2. Verify air pressure (for pressure tanks).
	5. Cathodic Protection	1. Inspect to ensure proper operation.
2 Years	1. Control Valves (including drain valves)	1. Operate valve through entire travel to verify function. 2. Lubricate valves to ensure operability.
	2. Water Level Alarms and Level Indicators	1. Test water level alarms to verify operability and set points.
	3. Tank Vent	1. Inspect and clean tank vents.
3 Years	1. Tank (without cathodic protection)	1. Conduct internal tank inspection to determine condition and amount of corrosion.

Table 2-17. Water Supply Tanks ITM Tasks (Continued)

Frequency	Component	Tasks
5 Years	1. Tanks (with cathodic protection)	1. Conduct internal tank inspection to determine condition and amount of corrosion.
	2. Pressure Gauges	1. Calibrate gauges.
	3. Check Valves	1. Inspect interior of valves.
	4. Level Indicator Test	1. Calibrate level indicator.

2-2.14 Dry Chemical Systems

Automatic initiating devices (e.g., heat detectors, smoke detectors) used for system actuation are addressed in paragraph 2-2.2. Manual actuation devices (e.g., fusible links, fusible heads, fusible nozzles) are addressed in Table 2-19. Technical guidance on these tasks is contained in NFPA 17.

NOTE: There is no requirement to replace existing dry chemical systems protecting cooking surfaces, hoods, and ducts. These existing systems that pass the required ITM may continue in service, and these systems may be serviced and repaired as necessary. Existing systems protecting cooking surfaces, hoods, and ducts may not be removed and reinstalled at another location even if the systems met all ITM requirements. All new or replacement systems to protect cooking surfaces, hoods, and ducts must be wet chemical-type systems.

Table 2-18. Dry Chemical Systems ITM Tasks

Frequency	Component	Tasks
Semi-Annual	1. Piping	1. Inspect piping for obstructions and proper support.
	2. Storage Vessels	1. Inspect agent container for condition. 2. Verify storage pressure of propellant.
	3. Agent	1. Verify quantity and quality of agent.
	4. Actuators	1. Inspect manual actuators for accessibility. 2. Inspect detection devices (fusible links or heat detectors) for contamination, and clean. 3. Test actuation system without agent release. (Coordinate with annual replacement of fixed temperature sensing elements.) 4. Verify that interfaces (gas shutoff, power shutoff) operate properly.

Table 2-18. Dry Chemical Systems ITM Tasks (Continued)

Frequency	Component	Tasks
Annual	1. Actuators	1. Replace fixed temperature sensing elements (fusible links/metal alloy type).
5-12 Years	1. Storage Vessels	1. Conduct hydrostatic test for pressure cylinders in accordance with OSHA and DOT standards.
As Part of Building Inspection	Entire System	<ol style="list-style-type: none"> 1. Visually check: <ol style="list-style-type: none"> a. Pipe hangers. b. Nozzles for obstruction. c. Pipe condition. 2. Ensure: <ol style="list-style-type: none"> a. Detectors unblocked/ uncovered. b. Panels secured and indicator lamps functional. c. Notification appliances in place. d. Manual stations in place and unobstructed. e. Nozzle covers (blow-off caps) in place. f. Pressure gauge within operating range.

2-2.15 Wet Chemical Systems

Automatic initiating devices (e.g., heat detectors, smoke detectors) used for system actuation are addressed in paragraph 2-2.2. Manual actuation devices (e.g., fusible links, fusible heads, fusible nozzles) are addressed in Table 2-19. Technical guidance on the tasks is contained in NFPA 17A.

Table 2-19. Wet Chemical Systems ITM Tasks

Frequency	Component	Tasks
Semi-Annual	1. Piping	1. Inspect piping for obstructions and proper support.
	2. Storage Vessels	<ol style="list-style-type: none"> 1. Inspect agent container for condition. 2. Verify the storage pressure of the propellant.
	3. Agent	1. Verify quantity and quality of agent.

Table 2-19. Wet Chemical Systems ITM Tasks (Continued)

Frequency	Component	Tasks
Semi-Annual (Continued)	4. Actuators	<ol style="list-style-type: none"> 1. Inspect manual actuators for accessibility. 2. Inspect detection devices (fusible links or heat detectors) for contamination and clean or replace as necessary. 3. Test actuation system without agent release. (Coordinate with annual replacement of fixed temperature sensing elements) 4. Verify that interfaces (gas shutoff, power shutoff) operate properly.
Annual	1. Actuators	<ol style="list-style-type: none"> 1. Replace fixed temperature sensing elements (fusible metal alloy type).
5-12 Years	1. Storage Vessels	<ol style="list-style-type: none"> 1. Conduct hydrostatic test for pressure cylinders in accordance with OSHA and DOT standards.
As Part of Building Inspection	Entire System	<ol style="list-style-type: none"> 1. Visually check: <ol style="list-style-type: none"> a. Pipe hangers. b. Nozzles for obstruction and proper alignment. c. Riser condition. 2. Ensure: <ol style="list-style-type: none"> a. Detectors unblocked/uncovered. b. Panels secured and indicator lamps functional. c. Notification appliances in place. d. Manual stations in place and unobstructed. e. Nozzle covers (blow-off caps) in place. f. Pressure gauge within operating range.

2-2.16 Halon Systems

Detection devices for actuation are addressed in paragraph 2-2.2. Technical guidance on the tasks is contained in NFPA 12A.

Table 2-20. Halon Systems ITM Tasks

Frequency	Component	Tasks
Annual	1. Piping	1. Inspect piping and nozzles for condition and orientation.
	2. Flexible Hoses	1. Inspect for damage.
	3. Storage Vessels	1. Inspect the exterior of storage containers (tanks, spheres, cylinders).
	4. Agent and Propellant	1. Verify that the quantity of the agent is sufficient. 2. Verify that the pressure of the agent/propellant is sufficient and that the pressure gauge is within operating range.
	5. Actuators	1. Inspect manual actuators for accessibility. 2. Test actuation without agent release.
	6. Auxiliary Equipment	1. Test to verify that interfaces (equipment shutdown, dampers, and door closures) operate properly and are activated by the system actuation.
	7. Valves	1. Verify that valves are in proper alignment.
2 Years	1. Protected Enclosure/Room	1. Inspect the enclosure to verify integrity and ability to maintain agent concentration.
5 Years	1. Cylinders	1. Complete external inspection of non-discharged cylinders to ensure suitability for use.
	2. Flexible Hoses	1. Pressure test hoses to ensure suitability for use.
As Required	1. Agent Cylinders	1. Hydrostatic testing of cylinders is required only when cylinders are to be re-filled/re-charged. Periodic hydrostatic testing is not required.
	2. Protected Enclosure/Room	1. Inspect the enclosure to verify integrity and ability to maintain agent concentration.
	3. After Modification to Compartment/Protected Enclosure	1. If uncertainty exists, follow the enclosure procedures in NFPA 12A.

Table 2-20. Halon Systems ITM Tasks (Continued)

Frequency	Component	Tasks
As Part of Building Inspection	Entire System	<ol style="list-style-type: none"> 1. Visually check: <ol style="list-style-type: none"> a. Pipe hangers. b. Nozzles for obstruction. c. Piping for leaks. d. Riser condition. 2. Ensure: <ol style="list-style-type: none"> a. Detectors unblocked/uncovered. b. Panels secured and indicator lamps functional. c. Notification appliances in place. d. Manual stations in place and unobstructed. e. Nozzle covers in place f. Pressure gauge with operating range.

WARNING

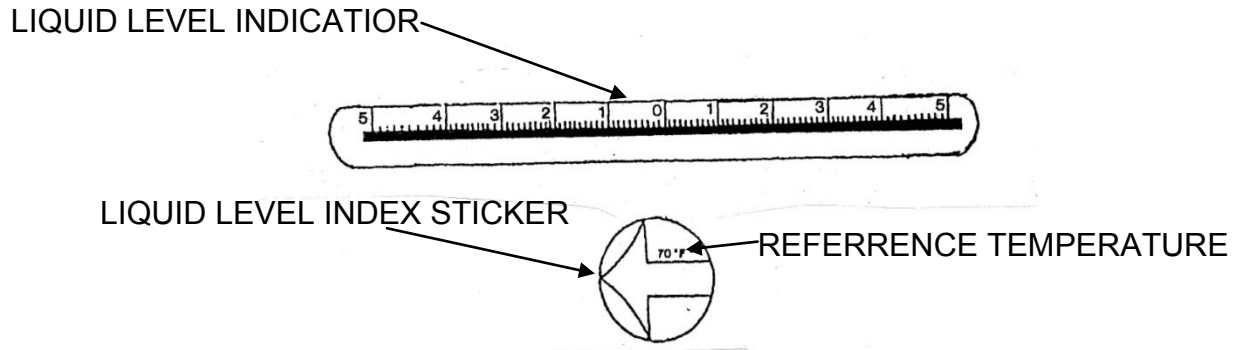
To prevent accidental release of Halon gas to the environment, do not disconnect and weigh cylinders to accomplish the annual agent quantity verification. Disconnecting cylinders to verify agent quantity damages seals and o-rings. Only liquid level methods should be used to determine agent quantity.

CAUTION

Verification of agent quantity will be accomplished by using a liquid level measuring system that does not require disconnecting and individually weighing the Halon cylinders. Since hydrostatic testing of un-discharged cylinders is no longer required, this will minimize the number of times the cylinders will be disconnected and reconnected to the discharge manifold, reducing leaks and unnecessary agent releases. Liquid level indicators and liquid level index stickers (Hammerhead Tower, Inc, 1720 22nd Street, Santa Monica, CA 90404, 310-828-4595, FAX 310-255-0226) or equal will be used. See Figure 2-1.

Figure 2-1. Liquid Level Measuring System

PART NUMBER	DESCRIPTION	PACKAGE QUANTITY
30000	Liquid Level Indicators	16 each
3000010	Liquid Level Index Stickers	8 each



2-2.17 Clean Agent Systems

Detection devices for actuation are addressed in paragraph 2-2.2. Technical guidance on the tasks is contained in NFPA 2001.

Table 2-21. Clean Agent Systems ITM Tasks

Frequency	Component	Tasks
Annual	1. Piping	1. Inspect piping and nozzles for condition and orientation.
	2. Flexible Hoses	1. Inspect for damage.
	3. Storage Vessels	1. Inspect the exterior of storage containers (tanks, spheres, cylinders).
	4. Agent and Propellant	1. Verify adequate quantity of agent. 2. Verify adequate pressure of agent/propellant and pressure gauge within operating range.
	5. Actuators	1. Inspect manual actuators for accessibility. 2. Test actuation without agent release.

Table 2-21. Clean Agent Systems ITM Tasks (Continued)

Frequency	Component	Tasks
Annual (Continued)	6. Auxiliary Equipment	1. Test to verify that interfaces (equipment shutdown, dampers, and door closures) operate properly and are activated by the system actuation.
	7. Valves	1. Verify that the valves are in proper alignment.
2 Years	1. Protected Enclosure or Room	1. Inspect the enclosure to verify integrity and ability to maintain agent concentration.
5 Years	1. Cylinders	1. Perform complete external inspection of non-discharged cylinders to ensure suitability for use.
	2. Flexible Hoses	1. Pressure test hoses to ensure suitability for use.
As Required	1. Protected Enclosure/Room	1. Inspect the enclosure to verify integrity and ability to maintain agent concentration.
	2. After Modification to Compartment/Protected Enclosure	1. If uncertainty exists, follow the enclosure procedures in NFPA 2001.
As Part of Building Inspection	Entire System	<ol style="list-style-type: none"> 1. Visually check: <ol style="list-style-type: none"> a. Pipe hangers. b. Nozzle for obstruction. c. Piping for leaks. d. Riser condition. 2. Ensure: <ol style="list-style-type: none"> a. Detectors unblocked/uncovered. b. Panels secured and indicator lamps functional. c. Notification appliances in place. d. Manual stations in place and unobstructed. e. Nozzle covers in place. f. Pressure gauge within operating range.

WARNING

To prevent accidental release of extinguishing agents to the environment, do not disconnect and weigh cylinders to accomplish the annual agent quantity verification. Disconnecting cylinders to verify agent quantity damages seals and o-rings. Only liquid level methods should be used to determine agent quantity.

2-2.18 Carbon Dioxide Systems

Detection devices for actuation are addressed in paragraph 2-2.2. Technical guidance on the tasks is contained in NFPA 12.

Table 2-22. Carbon Dioxide Systems ITM Tasks

Frequency	Component	Tasks
Semi-Annual	1. Liquid Level (low pressure carbon dioxide [CO ₂])	1. Verify adequate liquid level with tank level gauge.
Annual	1. Piping and Nozzles	1. Inspect piping for condition and proper support. 2. Check nozzles for obstruction and alignment.
	2. Flexible Hoses	1. Inspect for damage.
	3. Low Pressure Tanks	1. Check level and pressure gauges. 2. Verify valve alignment.
	4. High Pressure Cylinders	1. Inspect for condition and securing.
	5. Actuation System	1. Exercise control panel function, including zone valve operation. 2. Inspect manual actuators for accessibility. 3. Check times and time delay (pre-discharge).
	6. Auxiliary Equipment	1. Test to verify that interfaces (shutdown, door closers, and dampers) operate properly and are activated by the control panel.
2 Years	1. High Pressure Cylinders	1. Verify CO ₂ quantity by weighing cylinders.
As Required	1. Protected Enclosure/Room	1. Inspect the enclosure to verify integrity and ability to maintain agent concentration.
	2. After Modification to Compartment/Protected Enclosure	1. If uncertainty exists, follow the enclosure procedures in NFPA 2001.
As Part of Building Inspection	Entire System	1. Visually check: a. Pipe hangers. b. Nozzles for obstruction. c. Piping for leaks. d. Riser condition. 2. Ensure: a. Detectors unblocked/uncovered. b. Panels secured and indicator lamps functional. c. Notification appliances in place. d. Manual stations in place and unobstructed. e. Nozzle covers in place.

2-2.19 Emergency Lighting Systems

Emergency lighting systems include individual battery-powered lighting units, central battery-powered units, and standby generator-powered lighting systems. Technical guidance on the task is located in NFPA 101, NFPA 110, and NFPA 111. Figure 2-2 shows typical systems.

Table 2-23. Emergency Lighting Systems ITM Tasks

Frequency	Component	Tasks
Annual	1. Individual Battery-Powered Lighting Units	1. Activate for not less than 90 minutes to verify battery voltage and capacity.
	2. Central Battery-Powered Lighting Systems	1. Activate for not less than 90 minutes to verify battery voltage and capacity.
	3. Emergency Generator-Powered Lighting Systems	1. During regularly scheduled generator and transfer switch maintenance, visually check operation of each emergency generator-powered fixture.
5 to 10 years	Individual Fixtures' Replaceable Batteries or Unitized Fixtures	1. Replace battery or complete unitized fixture in accordance with manufacturer's estimated service life.

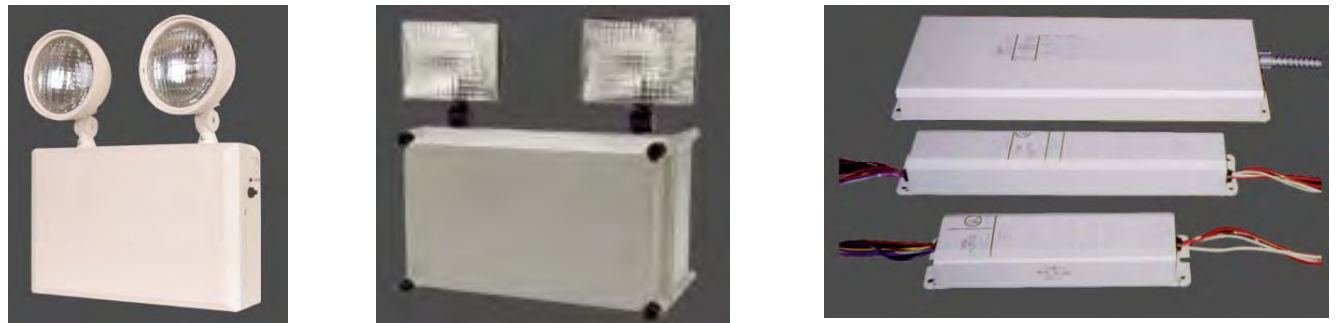
CAUTION

Battery-powered emergency lights generally require from 1 to 7 days to initially charge or to re-charge following a 90-minute discharge or activation.

Figure 2-2. Typical Emergency Lighting Systems



Typical Emergency Light Units with a 5-year Manufacturer's Estimated Service Life Battery



Typical Emergency Light Units and Florescent Fixture Ballasts with a 10-year Manufacturer's Estimated Service Life Battery



Typical Central Emergency Power Sources with a 10-year Manufacturer's Estimated Service Life Battery

2-2.20 Egress Marking Systems

Egress lighting systems include individual battery-powered lighting units, central battery-powered units, and standby generator-powered lighting systems. Figures 2-3 and 2-4 show typical units.

Table 2-24. Egress Marking Systems ITM Tasks

Frequency	Component	Tasks
Annual	1. Externally Illuminated and Un-illuminated Marking	<ol style="list-style-type: none"> 1. Inspect fixture condition and mounting. 2. Ensure that emergency light source, if required, is functional.
	2. Photoluminescent Marking	<ol style="list-style-type: none"> 1. Inspect sign condition and mounting. 2. Inspect charging light source and mounting. 3. Ensure that charging light source is functional (un-switched 5 foot-candles fluorescent or greater). Note: Charging light must be on at all times the building is occupied.
	3. Internally Illuminated Marking	<ol style="list-style-type: none"> 1. Inspect fixture condition and mounting. 2. Ensure that the bulb or light source is functional. 3. For electroluminescent marking, ensure that the power source is operational.
	4. Internally Illuminated Marking with Standby Battery Backup	<ol style="list-style-type: none"> 1. Inspect fixture condition and mounting. 2. Ensure that the bulb or light source is functional. 3. Activate on battery power for not less than 90 minutes to verify battery voltage and capacity.
	5. Internally Illuminated Marking with Emergency Generator Backup	<ol style="list-style-type: none"> 1. Inspect fixture condition and mounting 2. Ensure that the bulb or light source is functional. 3. During regularly scheduled generator and transfer switch maintenance, visually check the operation of each emergency generator-powered fixture.
5 to 10 years	1. Internally Illuminated Marking with Standby Battery Backup	<ol style="list-style-type: none"> 1. Replace battery or fixture if battery is not replaceable (unitized fixture) in accordance with manufacturer's estimated service life.

CAUTION

Battery-powered emergency egress marking generally requires from 1 to 7 days to initially charge or to re-charge following a 90-minute discharge or activation.

NOTE: All new and replaced internally illuminated egress markings must be ENERGY STAR® compliant.

Figure 2-3. Typical Egress Marking Units



Typical Energy Star Egress Marking Units with a 10-year Manufacturer's Estimated Service Life Battery

Figure 2-4. Typical Combination Egress Marking and Emergency Light Units



Typical Combination Egress Marking and Emergency Light Units with a 5-year Manufacturer's Estimated Service Life Battery (not Energy Star compliant)

NOTE: LED egress marking devices without battery backup are normally considered to have a 25-year estimated service life. (Consult the manufacturer's technical materials for specific guidance.)

2-2.21 Fire and Smoke Barrier Opening Protection

Detection devices for actuation are addressed in paragraph 2-2.2. Technical guidance on the tasks is contained in NFPA 80.

Table 2-25. Fire and Smoke Barrier Opening Protection ITM Tasks

Frequency	Component	Tasks
Annual (Electric hold-open devices are tested as part of the alarm systems in Table 2-1.)	1. Hinged Fire Doors	1. Test magnetic hold-open devices for release on activation of fire alarm. 2. Inspect closers for proper operation.
	2. Sliding Doors	1. Test magnetic hold-open devices for release on activation of fire alarm. 2. Ensure that weights have a free and unobstructed path of travel.
	3. Rolling or Sliding Fire Shutters	1. Test magnetic hold-open and other mechanical latches for release on activation of fire alarm. 2. Operate the shutter through its entire travel.
1 Year after Construction and Every 6 Years Thereafter	1. Fire and Smoke Dampers	1. Test electric (magnetic) hold-open and other mechanical latches for release on activation of fire alarm. 2. Inspect travel path for anything that may obstruct or interfere with free operation.
As Part of Building Inspection	1. Hinged Fire Doors	1. Inspect door condition, gaskets, and mounting hardware. Ensure proper lubrication. 2. Inspect fusible links, if present, for paint or other accumulations that slow thermal response.
	2. Sliding Doors	1. Inspect door condition and mounting hardware. Ensure proper lubrication. 2. Inspect fusible links, if present, for paint or other accumulations that slow thermal response. 3. Inspect travel path for anything that may obstruct or interfere with free operation.

Table 2-25. Fire and Smoke Barrier Opening Protection ITM Tasks (Continued)

Frequency	Component	Tasks
As Part of Building Inspection (Continued)	3. Rolling or Sliding Fire Shutters	<ol style="list-style-type: none"> 1. Inspect door condition and mounting hardware. Ensure proper lubrication. 2. Inspect fusible links, if present, for paint or other accumulations that slow thermal response. 3. Inspect travel path for anything that may obstruct or interfere with free operation.
	4. Fire and Smoke Dampers	<ol style="list-style-type: none"> 1. Inspect fixture condition and mounting. 2. Inspect fusible links, if present, for paint or other accumulations that slow thermal response.
	5. Installed Fire Stopping, Listed Sleeves, Penetrations, Seal Bags, and Other Fire Stopping Material	<ol style="list-style-type: none"> 1. Inspect fire-resistive barriers for new or other unprotected penetrations of rated walls, floors, or ceilings.

2-2.22 Backflow Prevention Devices

Technical guidance on the tasks in Table 2-26 is contained in UFC 3-230-02 and AWWA Manual 14 (M14). Backflow prevention and cross-connection devices are normally considered part of the water distribution system; however, their maintenance and full operation is critical to the function of fire suppression systems supplied by the potable distribution system. UFC 3-230-02 requires each installation to have a backflow prevention and cross-connection maintenance program. All backflow prevention devices are required to have a test connection downstream of the backflow device capable of the fire protection system's maximum fire flow demand. Reduced pressure backflow prevention devices have a specific approved friction loss operating range; full flow testing is required to demonstrate that the device is operating within the manufacturer's listed friction loss curves.

Table 2-26. Backflow Prevention Devices ITM Tasks

Frequency	Component	Tasks
2 years	1. Reduced Pressure Backflow Prevention Devices Serving Fire Protection Systems	<ol style="list-style-type: none"> 1. Conduct full flow test to ensure that flow and pressure meet or exceed system demand.
5 years	1. Double-Check Backflow Prevention Devices Serving Fire Protection Systems	<ol style="list-style-type: none"> 1. Conduct full flow test to ensure that flow meets or exceeds system demand.

CHAPTER 3

MILITARY FAMILY HOUSING SYSTEMS

3-1 SCOPE

The maintenance concepts for MFH fire protection systems are based on the management and controls unique to the MFH program. In the civilian sector, an owner or tenant makes a personal choice to occupy a dwelling unit and is responsible for its maintenance and repair and any associated fire protection devices. In MFH, occupants are assigned housing units, and the housing management activity is responsible for the maintenance and repair of units and associated fire protection devices. All MFH occupants are required to attend a briefing on their responsibilities as MFH occupants prior to occupying a MFH dwelling. These briefings include the occupant's responsibilities for conducting tests and cleaning installed fire protection features. On average, MFH maintenance teams conduct change of occupancy maintenance every 1 to 2 years; therefore, scheduled maintenance performed by the housing management activity is centered on this change of occupancy.

3-1.1 Residential Smoke Detectors

MFH units are required to have hard-wired, interconnected smoke detectors. Each installation develops programs to train occupants in the testing and maintenance actions for the installed smoke detector. Actions required as part of change of occupancy maintenance by the housing management activity are listed in Table 3-1.

3-1.2 Residential Sprinkler Systems

Some MFH units are also provided with sprinkler systems.

3-1.2.1 Residential sprinkler systems in multi-family buildings up to four stories are normally constructed in accordance with NFPA 13R. These systems are maintained in accordance with the tables in Chapter 2 of this UFC. Building occupants are not expected to conduct system tests or maintenance actions.

3-1.2.2 Residential sprinkler systems in multi-family buildings over four stories are normally constructed in accordance with NFPA 13. These systems are maintained in accordance with the tables in Chapter 2 of this UFC. Building occupants are not expected to conduct system tests or maintenance actions.

3-1.2.3 Residential sprinkler systems in one- and two-family dwellings and townhouse-style units are normally constructed in accordance with NFPA 13D. Installations develop their own programs to train occupants in the testing and maintenance actions required. Actions required as part of change of occupancy maintenance by the housing management activity are listed in Table 3-2.

3-2 ITM TASK DESCRIPTIONS

The ITM tasks in tables 3-1 and 3-2 should be part of the housing maintenance conducted between occupancies.

Caution

Battery-powered detectors are not permitted, and when found, must be replaced with interconnected hardwired detectors on change of occupancy.

Table 3-1. MFH Residential Smoke Detectors ITM Tasks

Frequency	Component	Tasks
Change of Occupancy	1. Smoke Detector (hardwired single-station and multi-station detectors)	<ol style="list-style-type: none"> 1. Activate each detector with an approved smoke simulant. 2. Remove cover and inspect for grease buildup; replace and relocate detector with evidence of grease buildup in the detector. 3. Vacuum detector and replace cover. 4. Activate each detector with the installed test button. 5. Replace any detector failing to activate on either the smoke simulant or the test button.
	2. Backup Battery (if present)	<ol style="list-style-type: none"> 1. Replace battery.
10 Years	1. Smoke Detectors (hardwired single-station and multi-station detectors)	<ol style="list-style-type: none"> 1. Replace detectors. If replacing existing detectors without an interconnection feature, replacement detectors must include interconnection between all smoke detectors in the dwelling unit.

Table 3-2. MFH Residential Sprinkler Systems ITM Tasks

Frequency	Component	Tasks
Change of Occupancy	1. Sprinklers	<ol style="list-style-type: none"> 1. Inspect all sprinklers. 2. Clean or replace sprinklers as necessary. Sprinklers that have been painted must be replaced: cleaning is not permitted. 3. Inspect ceilings or wall at head for signs of leakage or water stains.
	2. Valves	<ol style="list-style-type: none"> 1. Inspect all valves to ensure that they are open and sealed.
	3. Waterflow and Alarm Devices	<ol style="list-style-type: none"> 1. Test to verify operability.
20 Years	1. Fast-Response Sprinkler Heads	<ol style="list-style-type: none"> 1. Test a sample of sprinklers or replace all sprinklers.

GLOSSARY

AFFF—aqueous film-forming foam

AHJ—authority having jurisdiction

ANSI—American National Standards Institute

AWWA—American Water Works Association

BOS—base operating support

CFR—Code of Federal Regulations

CO₂—carbon dioxide

DES-SO—Chief, Security Operations (Defense Logistics Agency)

DLA—Defense Logistics Agency

DLSC-BIS—Defense Logistics Support Command Installation Support Team

DOD—Department of Defense

DOT—U.S. Department of Transportation

FM—Factory Mutual

FPEWG—Fire Protection Engineering Working Group

GOCO—government owned, contractor operated

HQ AFCESA/CEO—Headquarters Air Force Civil Engineer Support Agency, Operations and Programs Support Division (previously AFCESA/CES)

HQ DLA-D—Defense Logistics Agency Director

HQMC—U.S. Marine Corps

HQ USACE/CECW-CE—Headquarters U.S. Army Corps of Engineers

ITM—inspection, testing, and maintenance

JCAHO—Joint Commission on the Accreditation of Healthcare Organizations

LED—light-emitting diode

MFH—military family housing

MS&O/ESO—Management Services and Operations, Environmental Safety Office

NAVFACENGCOM HQ-CHE—Naval Facilities Engineering Command, Headquarters Chief Engineer Organization

NFPA—National Fire Protection Association

NGA/SIO—National Geospatial-Intelligence Agency, Installation Operations Office

NICET—National Institute for Certification in Engineering Technologies

NRO—National Reconnaissance Office
OSHA—Occupational Safety and Health Administration
RCM—reliability-centered maintenance
UFC—Unified Facilities Criteria
U.S.—United States
USC—United States Code

APPENDIX A

REFERENCES

- AFCESA/CES Technical Report 01-10, "Risk Based Reliability Centered Maintenance of DOD Fire Protection Systems," January 1999, <http://stinet.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA392898>.
- ANSI Z535.1-2006, *American National Standard for Safety Colors*, American National Standards Institute, <http://webstore.ansi.org/default.aspx>.
- ANSI Z535.2-2007, *American National Standard for Environmental and Facility Safety Signs*, American National Standards Institute, <http://webstore.ansi.org/default.aspx>.
- AWWA M14, *Recommended Practice for Backflow Prevention and Cross-Connection Control*, 2004, American Water Works Association, <http://www.awwa.org/Bookstore/>.
- AWWA M17, *Installation, Field Testing, and Maintenance of Fire Hydrants*, 2006, American Water Works Association, <http://www.awwa.org/Bookstore/>.
- CFR Title 29, Part 1960.26(c)(3), *Conduct of Inspections*, http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=11277.
- CFR Title 29, Part 1910.160(b)(2), *Fixed Extinguishing Systems, General*, http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9814&p_table=STANDARDS.
- CFR Title 29, Part 1910 Subpart L App A, *Fire Protection*, http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10124.
- MIL-STD-3007F, *Standard Practice for Unified Facilities Criteria and Unified Facilities Guide Specifications*, 13 December 2006, U.S. Department of Defense, <http://www.wbdg.org/ccb/>.
- NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2005, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2008, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 2009, National Fire Protection Association, <http://www.nfpa.org/>.

- NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2010, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, 2010, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, 2010, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 14, *Standard for the Installation of Standpipes and Hose Systems*, 2007, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 2007, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2007, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2009, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 2009, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2010, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 22, *Standard for Water Tanks for Private Fire Protection*, 2008, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2008, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 72, *National Fire Alarm Code®*, 2010, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, 2010, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 101, *Life Safety Code®*, 2009, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 110, *Standard for Emergency and Standby Power Systems*, 2010, National Fire Protection Association, <http://www.nfpa.org/>.

- NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, 2010, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2006, National Fire Protection Association, <http://www.nfpa.org/>.
- NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2008, National Fire Protection Association, <http://www.nfpa.org/>.
- UFC 3-230-02, *Operation and Maintenance: Water Supply Systems*, 10 July 2001, Naval Facilities Engineering Command, http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4.
- UFC 3-600-01, *Fire Protection Engineering for Facilities*, 26 September 2006, Naval Facilities Engineering Command, http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4.
- USC Title 10, Section 1794, *Military Child Care*, 2 January 2006, <http://uscode.house.gov/search/criteria.shtml>.
- USC Title 15, Section 2227, *Fire Safety Systems in Federally Assisted Buildings* (Fire Administration Authorization Act), 2 January 2006, <http://uscode.house.gov/search/criteria.shtml>.
- USC Title 15, Section 272, *Utilization of Consensus Technical Standards by Federal Agencies*, 2 January 2006, <http://uscode.house.gov/search/criteria.shtml>.