

MAINTENANCE AND TESTING OF FIRE SPRINKLER SYSTEMS

Introduction

When properly installed and maintained, automatic fire sprinkler systems have proven to be **the** most effective means for protecting life and property against fire. In recognition of their excellent track record in controlling the spread of fire, both state codes and national standards offer fire sprinklers as a cost-effective alternative to meeting many of their base code requirements.

A lot is riding, therefore, on a sprinkler system's ability to operate and function properly. So much so, in fact, that state law prohibits the occupancy of any portion of a building until the required suppression system has been tested and approved [see MSFC(07), Sec. 901.5.1]. Further, MSFC(07), Sec. 901.6 requires that such systems be maintained in an operative condition at all times and be repaired or replaced when defective.

In order to meet both federal certification requirements and state licensure requirements, automatic fire sprinkler systems are required to be inspected, tested and maintained in accordance with NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*. For federal certification, NFPA 101(00), Sec. 2.1.1 references the 1998 edition of NFPA 25. For state licensure, MSFC(07), Sec. 901.6.1, as amended, and Table 901.6.1 reference the 2002 edition of the standard. While the provisions in this edition of the standard applicable to fire sprinkler systems are very similar to those found in the 1998 edition, you'll find that the 2002 edition contains more restrictive testing requirements for dry sprinklers and sprinklers subjected to harsh environments.

Application:

It must be noted that this document is intended to serve as a quick-reference guide only and is **not** intended to be all-inclusive. It covers most, but not all, of the inspection, testing and maintenance requirements applicable to fire sprinkler systems. Some facilities may have additional equipment not covered in this guide. It is important, therefore, that the user have access to, and become familiar with all the requirements found in, NFPA 25. The standard can be ordered from NFPA at 1-800-344-3555 or www.nfpacatalog.org. [Note: For new installations, the installing contractor is required to provide a copy of NFPA 25 for the property owner.]

System types

The requirements contained in NFPA 25 are based on the type of sprinkler system installed. The two types most commonly found in healthcare occupancies are wet pipe and dry pipe sprinkler systems. Some buildings contain both types of systems – a wet pipe system in heated areas and a dry-pipe system in unheated areas. Simply put, a *wet pipe sprinkler system* is a piping system containing water so arranged that water discharges immediately from sprinklers activated by heat from a fire. A *dry pipe sprinkler system* is a piping system containing air or nitrogen under pressure so arranged that upon activation of a sprinkler, the water pressure opens a valve allowing water to flow into the pipe and out the opened sprinkler.

Definitions

In order to follow the requirements of the standard, it's important to have a good understanding of what's meant by "inspection", "testing" and "maintenance". Those terms are defined in NFPA 25(98), Sec. 1-5 as follows [see also NFPA 25(02), Sec. 3.3]:

- *Inspection*. A visual examination of a system or portion thereof to verify that it appears to be in operating condition and is free of physical damage.

- *Testing.* A procedure used to determine the status of a system as intended by conducting periodic physical checks such as waterflow tests, fire pump tests, alarm tests, and trip tests of dry-pipe valves. These tests follow up on the original acceptance test at intervals specified in the appropriate chapter of NFPA 25.
- *Maintenance.* Work performed to keep equipment operable or to make repairs.

Personnel qualifications

It is the facility's responsibility to ensure that only properly trained and competent persons perform inspections, testing and maintenance on its fire sprinkler system. NFPA 25 simply states, "These tasks shall be performed by personnel who have developed competence through training and experience." [see NFPA 25(98), Sec. 1-4.2 or NFPA 25(02), Sec. 4.1.2.3].

The State of Minnesota, however, has more restrictive requirements that apply to persons who perform work on fire sprinkler systems. Such persons must meet certain license and certification requirements [see MN Statutes, Chapter 299M and MN Rules, Chapter 7512]. What this means is that, unless they meet these requirements, facility personnel are limited to performing inspection and some basic testing activities only. The amount of testing that can be performed will depend on the level of training received. One of the best sources for such training would be the fire sprinkler company that performs the facility's annual service. Evidence of any training received will need to be maintained in each employee's personnel file.

System history

A number of requirements applied to a healthcare facility's fire protection systems are based on the age and date of installation of those systems. Without an accurate written history of the fire protection system(s) in your facility, it can be difficult to prove to a state or federal life safety surveyor that those systems are being maintained in accordance with applicable state and federal standards. This can result in fire/life safety deficiencies being cited. Turnover of administrative and/or maintenance personnel only serves to compound the problem. One of the best ways to deal with this is to create and maintain an historical log on your system(s).

As with just about anything, the hardest part of creating an historical log is getting started – after that, it's a matter of keeping it up-to-date. Basic questions that need to be answered include:

- When was the system initially installed? Who installed it?
- Were any additions, modifications or repairs made to the system? When? Who did the work?

It's important to note that certain changes made to your building could necessitate modifications to your fire protection system. Things to watch for include: construction or removal of walls and installation of such things as drop-in ceilings, new suspended light fixtures, tracks for lift systems and new cubicle curtains.

A sample historical log has been developed for your use. The log can be used "as is" or serve as a guide that you can use to create your own log. A completed log is provided to serve as an example of how the log is expected to be filled out.

[Click Here for Sample Fire Sprinkler System Historical Log](#)

Applicable standards

1. Specific requirements relating to the inspection, testing and maintenance of fire sprinkler systems can be found in:
 - Chapters 2 and 9 of the 1998 edition of NFPA 25
 - Chapters 5 and 12 of the 2002 edition of NFPA 25
2. Specific requirements relating to the inspection, testing and maintenance of fire pumps can be found in:
 - Chapter 5 of the 1998 edition of NFPA 25
 - Chapter 8 of the 2002 edition of NFPA 25

Specific Requirements

The inspection, testing and maintenance requirements that apply to your building's fire sprinkler system start from the date of initial installation and continue on at specific intervals throughout the life of the system. What follows is a brief synopsis of some of the major requirements you need to be aware of.

New installations

In order to meet both federal certification requirements and state licensure requirements, automatic fire sprinkler systems are required to be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*. NFPA 101(00), Sec. 2.1.1 references the 1999 edition of NFPA 13. MSFC(07), Sec. 901.6.1, as amended, and Table 901.6.1, on the other hand, reference the 2002 edition of the standard. Healthcare facilities are required to comply with the most restrictive requirements of the two standards. For purposes of this guide, however, all code references will be based on the 1999 edition of NFPA 13.

All newly installed fire sprinkler systems are required to meet specific acceptance requirements, such as flushing of fire service mains and testing of both underground and aboveground piping [see NFPA 13(99), Chapter 10; MSFC(07), Sec. 901.5]. These services must be provided by licensed contractors.

Monthly

The following monthly inspections can be performed by facility staff:

1. Visually inspect control valves to ensure that they are:
 - In the normal open position
 - Accessible
 - Properly sealed
 - Locked and/or supervised
 - Free from leaks
 - Provided with appropriate signage identifying the portion of the system they control
2. Visually inspect gauges on wet pipe systems to verify that they are in good condition and that normal water pressure is being maintained.
3. Visually inspect gauges on dry pipe systems to verify that they are in good condition and that normal air and water pressure are being maintained.

Note: Where air pressure is not supervised at a constantly attended location, these gauges need to be inspected on a weekly basis.

Quarterly

1. The following quarterly inspections are in addition to those required monthly and can be performed by facility staff:
 - a. For hydraulically designed sprinkler systems, inspect the hydraulic nameplate to verify that it's securely attached to the sprinkler riser and is legible.

Note: Most newly installed fire sprinkler systems are now hydraulically designed. When in doubt, ask your sprinkler contractor.
 - b. Inspect alarm devices to verify that they are free of physical damage.
 - c. Inspect fire department connections to verify that:
 - They are visible and accessible
 - Couplings or swivels are not damaged and rotate smoothly
 - Plugs or caps are in place and not damaged
 - Gaskets are in place and in good condition
 - Identification signs are in place
 - The check valve is not leaking
 - The automatic drain valve is in place and operating properly
2. With proper training the following quarterly tests can be performed by facility staff:
 - a. Test the waterflow alarm on wet pipe sprinkler systems by opening the inspector's test connection. This simulates the opening of a sprinkler head.

Note: Where freezing weather conditions or other circumstances prohibit the use of the inspector's test connection, the bypass connection is allowed to be used.
 - b. Test the waterflow alarm on dry pipe sprinkler systems *by using the bypass connection.*

Caution: Opening the inspector's test connection can cause the system to trip accidentally, allowing the pipes to fill with water and creating a potential for a serious freeze problem.

Annually

In addition to the monthly and quarterly inspections and tests, NFPA 25 has very detailed and specific inspection, testing and maintenance services that need to be performed on an annual basis. Because of their complexity, and to comply with Minnesota state law, these services must be performed by a licensed sprinkler contractor and would include such things as:

- An inspection of the facility's supply of spare sprinkler heads to ensure that there are a minimum of two sprinklers of each type and temperature rating and that there is a sprinkler wrench for each type of sprinkler.
- A check of all sprinklers, hangers, pipe and fittings
- Testing of the main drain
- Testing of any antifreeze solution used
- Testing and maintenance of valves

Dry pipe sprinkler systems require some additional testing and maintenance. Priming water level, low pressure alarms and quick-opening devices must be tested. An annual trip test is also required.

Long term

1. A full flow trip test is required for dry pipe sprinkler systems every 3 years [see NFPA 25(98), Sec. 9-4.4.2.2.1 or NFPA 25(02), Sec. 12.4.4.2.2.2].
2. Sprinkler system gauges typically have a life expectancy of 10 to 15 years. As a result, these gauges must be replaced every 5 years or tested every 5 years by comparison to a calibrated gauge.

Gauges not accurate to within 3 percent of the full scale must be recalibrated or replaced [see NFPA 25(98), Sec. 2-3.2 or NFPA 25(02), Sec. 5.3.2].

3. System check valves must be inspected internally every 5 years to verify that all components operate properly, move freely and are in good condition [see NFPA 25(98), Sec. 9-4.2.1 or NFPA 25(02), Sec. 12.4.2.1].
4. The 1998 edition of NFPA 25 has specific requirements dealing with testing of sprinkler heads that have been in service for an extended period of time [see NFPA 25(98), Sec. 2-3.1]. These requirements, which emphasize the importance of knowing the history of your facility's fire sprinkler system, would include:
 - a. Sprinklers manufactured prior to 1920 must be replaced.
 - b. Representative samples of solder-type, extra-high temperature sprinklers (i.e. 325°-375° F) that are exposed to semi-continuous or continuous maximum allowable ambient temperature conditions are required to be tested at 5 year intervals. These would be sprinklers you might find, for example, in your boiler room and would have red-colored frame arms.
 - c. Sprinklers manufactured using fast response elements that have been in service for 20 years are required to be tested. Retesting is required at 10-year intervals.

Note: The first residential sprinkler was listed for service in 1981 and the first quick-response sprinkler was listed for service in 1983.
 - d. Sprinklers that have been in service for 50 years must be replaced. An alternative is to submit representative samples from one or more sample areas to a recognized testing laboratory acceptable to the AHJ for testing. Such tests are required to be repeated at 10-year intervals.
 - e. Sprinklers in service for 75 years are required to be replaced or representative samples submitted for testing. Retesting is then required at 5-year intervals.
5. The 2002 edition of NFPA 25 has the following additional testing requirements [see NFPA 25(02), Sec. 5.3.1]:
 - a. Dry sprinklers that have been in service for 10 years must be tested or replaced. They must be retested at 10-year intervals.
 - b. Where sprinklers are subjected to harsh environments, including corrosive atmospheres and corrosive water supplies, the sprinklers must be replaced or representative samples tested every 5 years.

Note: "Harsh environments" have been interpreted to include areas exposed to outside weather (e.g. sprinklers installed under exterior canopies) and cold storage areas (e.g. coolers and freezers).

Fire pumps

1. Fire pumps, where present, are also subject to very specific inspection, testing and maintenance requirements to help ensure that they will function properly when needed. Some of the basics include:
 - a. Fire pumps must be inspected weekly to verify that the pump assembly appears to be in operating condition and is free from physical damage [see NFPA 25(98), Sec. 5-2 or NFPA 25(02), Sec. 8.2 for specific conditions that must be checked].
 - b. Fire pump assemblies must be tested weekly [see NFPA 25(98), Sec. 5-3.2 or NFPA 25(02), Sec. 8.3 for specific observations and adjustments that need to be made while the pump is running].
 - c. An annual test of the fire pump assembly is required. This test must be conducted under minimum, rated and peak flows of the pump [see NFPA 25(98), Sec. 5-3.3 or NFPA 25(02),

Sec. 8.3.3 for specific visual observations, measurements and adjustments that need to be made while the pump is running and flowing water under the specified output condition].

2. NFPA 25 requires that a preventive maintenance program be established on all components of the pump assembly in accordance with manufacturer's recommendations [see NFPA 25(98), Sec. 5-5 or NFPA 25(02), Sec. 8.5].

Note: NFPA 25 provides a helpful table to use in the absence of manufacturer's recommendations for preventive maintenance [see NFPA 25(98), Table 5-5.1 or NFPA 25(02), Table 8.5.3].

Documentation Requirements

Just as important as conducting required inspections, testing and maintenance is documenting the fact that they occurred. Both NFPA 13 and NFPA 25 require that these services be properly recorded. What follows is a brief synopsis of some of the major documentation requirements you need to be aware of.

Initial installation records

As mentioned earlier, MSFC(07), Sec. 901.5.1 makes it unlawful to occupy any portion of a building until the required suppression system has been tested and approved. The AHJ will want proof that all underground and aboveground piping related to the fire sprinkler system has been properly tested, including flushing of underground piping and hydrostatic testing of aboveground piping [see NFPA 13(99), Sec. 10-2]. Proper documentation serves as evidence that this has occurred.

1. Initial records must, at a minimum, include:
 - a. Name of installation contractor
 - b. *Contractor's Material and Test Certificate for Aboveground Piping* [see NFPA 13(99), Figure 10-1(a)]
 - c. *Contractor's Material and Test Certificate for Underground Piping* [see NFPA 13(99), Figure 10-1(b)]
2. In addition, the installing contractor is required to provide you with the following [see NFPA 13(99), Sec. 10-4]:
 - a. All literature and instructions provided by the manufacturer describing proper operation and maintenance of all equipment and devices installed, and
 - b. A copy of NFPA 25 (Be aware that you very likely will **not** receive a copy of the 1998 edition of NFPA 25, but rather the latest edition of the standard adopted by NFPA).
3. The installing contractor is required to identify hydraulically designed systems with a permanently marked weatherproof sign properly secured near the valve controlling the corresponding hydraulically designed area [see NFPA 13(99), Sec. 10-5]. This sign must include the following information:
 - a. Location of the design area(s)
 - b. Discharge densities over the design area(s)
 - c. Required flow and residual pressure demand at the base of the riser
 - d. Occupancy classification or commodity classification and maximum permitted storage height and configuration
 - e. Hose stream demand included in addition to the sprinkler demand

Note: A sample information sign can be found in Appendix A to NFPA 13 [see Figure A-10-5].

Monthly, quarterly, annual and long term records

Sample forms for inspection, testing and maintenance of fire sprinkler systems can be found in Appendix B of the 1998 edition of NFPA 25 or in Annex B of the 2002 edition of NFPA 25. These

forms should be available through your local fire sprinkler contractor. An excellent form developed by the American Fire Sprinkler Association (AFSA) for use on wet pipe systems is also available on the Minnesota Health Care Engineers Association's web site (www.mhcea.org).

Sample reports are also available for dry pipe sprinkler systems and fire pumps as follows (again, these reports should be available through your local fire sprinkler contractor):

- Inspection, testing and maintenance of dry pipe sprinkler systems [see NFPA 25(98), Appendix B, Figure B-5 or NFPA 25(02), Annex B, Figure B.1(e)] – 4-page form based on AFSA Form 94-107A.
- Inspection, testing and maintenance of fire pumps [see NFPA 25(98), Appendix B, Figure B-11 or NFPA 25(02), Annex B, Figure B.1(m)] – 2-page form based on National Sprinkler Association Form 25-20.

Dry pipe system trip tests

1. A tag or card showing the following must be attached to dry pipe system valves [see NFPA 25(98), Sec. 9-4.4.2.5 or NFPA 25(02), Sec. 12.4.4.2.5]:
 - Date dry pipe valve last tripped
 - Name of person and organization conducting the test
2. Separate records of initial air and water pressure, tripping air pressure and dry pipe valve operating condition must be maintained on the premises for comparison with previous test results.

It's important that at least two people in your facility know where your records are kept to increase the likelihood that they can be readily provided if requested during an inspection. MSFC(07), Sec. 901.6.2 requires that these records be maintained on the premises for at least three years and must be copied for the fire code official on request.