

Methods and Frequencies for the Testing, Inspection, and Maintenance of Fire Detection and Alarm Systems

Fire Safety Services, Inc. has organized the following information regarding the testing and maintenance for fire alarm and fire detection systems. The following has been extracted from the 2002 edition of the National Fire Alarm Code, NFPA-72. It is intended as a reference guide only and not a substitute for the actual standard. Please refer to the 2002 edition of NFPA-72 for definitions, details and procedures.

Testing requirements of NFPA-72:

10.4.3 Testing shall be performed in accordance with the schedules in Table 10.4.3, except as modified in other paragraphs of 10.4.3, or more often if required by authority having jurisdiction.

Exception:

Devices or equipment that is inaccessible for safety considerations (e.g., continuous process operations, energized electrical equipment, radiation, and excessive height) shall be tested during scheduled shutdowns if approved by the authority having jurisdiction but shall not be tested at intervals exceeding 18 months.

• **Specific requirements for smoke detector testing from NFPA-72:**

10.4.3.4.1 Two or more detectors shall be tested on each initiating circuit annually.

10.4.3.4.2 Different detectors shall be tested each year, with records kept by the building owner specifying which detectors have been tested.

10.4.3.4.3 Within 5 years, each detector shall have been tested.

** **Smoke detector sensitivity testing requirements of NFPA-72:**

10.4.3.2.1 Sensitivity of smoke detectors and single- and multiple-station smoke alarms (in other than one- and two-family dwellings) shall be checked within 1 year after installation.

10.4.3.2.2 Sensitivity shall be checked every alternate year thereafter unless otherwise permitted by compliance with 10.4.3.2.3.

10.4.3.2.3 After the second required calibration test, if sensitivity tests indicate that the device has remained within its listed and marked sensitivity range (or 4 percent obscuration gray smoke, if not marked); the length of time between calibration tests shall be permitted to be extended to a maximum of 5 years.

10.4.3.2.3.1 If the frequency is extended, records of nuisance alarms and subsequent trends of these alarms shall be maintained.

10.4.3.2.3.2 In zones or in areas where nuisance alarms show any increase over the previous year, calibration tests shall be performed.

Other testing requirements of NFPA-72:

10.4.3.1 If automatic testing is performed at least weekly by a remotely monitored fire alarm control unit specifically listed for the application, the manual testing frequency shall be permitted to be extended to annually. Table 10.4.3 shall apply.

10.4.3.3 Test frequency of interfaced equipment shall be the same as specified by the applicable NFPA standards for the equipment being supervised.

10.4.8 Tests of all circuits extending from the central station shall be made at intervals of not more than 24 hours.

Inspection requirements of NFPA-72:

10.3.1 Visual inspections shall be performed in accordance with the schedules in Table 10.3.1 or more often if required by the authority having jurisdiction.

Exception:

Devices or equipment that are inaccessible for safety considerations shall be inspected during scheduled shutdowns if approved by the authority having jurisdiction. Extended intervals shall not exceed 18 months.

F S²

**FIRE
SAFETY
SERVICES
INC.**

BOSSIER CITY, LA

Component	Initial/ Reacceptance	Monthly	Quarterly	Semiannually	Annually	Table 10.4.2.2 Reference
1. Control Equipment – Building Systems Connected to Supervising Station						1, 7, 16, 17
a) Functions	X	—	—	—	X	—
b) Fuses	X	—	—	—	X	—
c) Interfaced equipment	X	—	—	—	X	—
d) Lamps and LEDs	X	—	—	—	X	—
e) Primary (main) power supply	X	—	—	—	X	—
f) Transponders	X	—	—	—	X	—
2. Control Equipment – Building Systems Not Connected to a Supervising Station	—	—	—	—	—	1
a) Functions	X	—	X	—	—	—
b) Fuses	X	—	X	—	—	—
c) Interfaced equipment	X	—	X	—	—	—
d) Lamps and LEDs	X	—	X	—	—	—
e) Primary (main) power supply	X	—	X	—	—	—
f) Transponders	X	—	X	—	—	—
3. Engine-Driven Generator – Central Station Facilities and Fire Alarm Systems	X	X	—	—	—	—
4. Engine-Driven Generator – Public Fire Alarm Reporting Systems	X (weekly)	—	—	—	—	—
5. Batteries - Central Station Facilities						
a) Lead-acid type	—	—	—	—	—	6b
1) Charger test (replace battery as needed.)	X	—	—	—	X	—
2) Discharge test (30 minutes)	X	X	—	—	—	—
3) Load voltage test	X	X	—	—	—	—
4) Specific gravity	X	—	—	X	—	—
b) Nickel-cadmium type	—	—	—	—	—	6c
1) Charger test (replace battery as needed.)	X	—	X	—	—	—
2) Discharge test (30 minutes)	X	—	—	—	X	—
3) Load voltage test	X	—	—	—	X	—
c) Sealed lead-acid type	X	X	—	—	—	6d
1) Charger test (replace battery within 5 years after manufacture or more frequently as needed.)	—	X	X	—	—	—
2) Discharge test (30 minutes)	X	X	—	—	—	—
3) Load voltage test	X	X	—	—	—	—
6. Batteries – Fire Alarm Systems						
a) Lead-acid type	—	—	—	—	—	6b
1) Charger test (replace battery as needed.)	X	—	—	—	X	—
2) Discharge test (30 minutes)	X	—	—	X	—	—
3) Load voltage test	X	—	—	X	—	—
4) Specific gravity	X	—	—	X	—	—
b) Nickel-cadmium type	—	—	—	—	—	6c
1) Charger test (replace battery as needed.)	X	—	—	—	X	—
2) Discharge test (30 minutes)	X	—	—	—	X	—
3) Load voltage test	X	—	—	X	—	—
c) Primary type (dry cell)	—	—	—	—	—	6a
1) Load voltage test	X	X	—	—	—	—
d) Lead-acid type	—	—	—	—	—	6d
1) Charger test (replace battery within 5 years after manufacture or more frequently as needed.)	—	—	—	—	X	—
2) Discharge test (30 minutes)	X	—	—	—	X	—
3) Load voltage test	X	—	—	X	—	—
7. Batteries – Public Fire Alarm Reporting Systems Voltage tests in accordance with Table 10.4.2.2, items 7(1)–(6)	X (daily)	—	—	—	—	—
d) Lead-acid type	—	—	—	—	—	6b
1) Charger test (replace battery as needed.)	X	—	—	—	X	—
2) Discharge test (30 minutes)	X	—	X	—	—	—
3) Load voltage test	X	—	X	—	—	—
4) Specific gravity	X	—	—	X	—	—
e) Nickel-cadmium type	—	—	—	—	—	6c
1) Charger test (replace battery as needed.)	X	—	X	—	X	—
2) Discharge test (30 minutes)	X	—	—	—	X	—
3) Load voltage test	X	—	—	—	—	—
f) Sealed lead-acid type	—	—	—	—	—	6d
4) Charger test (replace battery within 5 years after manufacture or more frequently as needed.)	X	—	—	—	X	—
5) Discharge test (30 minutes)	X	—	—	—	X	—
6) Load voltage test	X	—	X	—	—	—

Component	Initial/ Reacceptance	Monthly	Quarterly	Semiannually	Annually	Table 10.4.2.2 Reference
8. Fiber-Optic Cable Power	X	—	—	—	X	12b
9. Control Unit Trouble Signals	X	—	—	—	X	9
10. Conductors—Metallic	X	—	—	—	—	11
11. Conductors – Nonmetallic	X	—	—	—	—	12
12. Emergency Voice/Alarm Communications Equipment	X	—	—	—	X	18
13. Retransmission Equipment (The requirements of 10.4.7 shall apply.)	X	—	—	—	—	—
14. Remote Enunciators	X	—	—	—	X	10
15. Initiating Devices	—	—	—	—	—	13
a) Duct detectors	X	—	—	—	X	—
b) Electromechanical releasing device	X	—	—	—	X	—
c) Fire extinguishing system(s) or suppression system(s) switches	X	—	—	—	X	—
d) Fire—gas and other detectors	X	—	—	—	X	—
e) Heat detectors (The requirements of 10.4.3.4 shall apply.)	X	—	—	—	X	—
f) Fire alarm boxes	X	—	—	—	X	—
g) Radiant energy fire detectors	X	—	—	X	—	—
h) System smoke detectors – functional	X	—	—	—	X	—
i) Smoke detectors – sensitivity (The requirements of 10.4.3.2 shall apply.)	—	—	—	—	—	—
j) Single- and multiple-station smoke alarms (The requirements for monthly testing in accordance with 10.4.4 shall also apply.)	X	—	—	—	X	—
k) Single- and multiple-station heat alarms	X	—	—	—	X	—
l) Supervisory signal devices (except valve tamper switches)	X	—	X	—	—	—
m) Water flow devices	X	—	—	X	—	—
n) Valve tamper switches	X	—	—	X	—	—
16. Guard's Tour Equipment	X	—	—	—	X	—
17. Interface Equipment	X	—	—	—	X	19
18. Special Hazard Equipment	N	—	—	—	X	15
19. Alarm Notification Appliances	—	—	—	—	—	14
a) Audible devices	X	—	—	—	X	—
b) Audible textual notification appliances	X	—	—	—	X	—
c) Visible devices	X	—	—	—	X	—
20. Off-Premises Transmission Equipment	X	—	X	—	—	—
21. Supervising Station Fire Alarm Systems – Transmitters	—	—	—	—	—	16
a) DACT	X	—	—	—	X	—
b) DART	X	—	—	—	X	—
c) McCulloh	X	—	—	—	X	—
d) RAT	X	—	—	—	X	—
22. Special Procedures	X	—	—	—	X	21
23. Supervising Station Fire Alarm Systems – Receivers	—	—	—	—	—	17
a) DACR	X	X	—	—	—	—
b) DARR	X	X	—	—	—	—
c) McCulloh systems	X	X	—	—	—	—
d) Two-way RF multiplex	X	X	—	—	—	—
e) RASSR	X	X	—	—	—	—
f) RARSR	X	X	—	—	—	—
g) Private microwave	X	X	—	—	—	—

Device	Method
1 Control Equipment	
a) Functions	At a minimum, control equipment shall be tested to verify correct receipt of alarm, supervisory, and trouble signals (inputs), operation of evacuation signals and auxiliary functions (outputs), circuit supervision including detection of open circuits and ground faults, and power supply supervision for detection of loss of ac power and disconnection of secondary batteries.
b) Fuses	The rating and supervision shall be verified.
c) Interfaced equipment	Integrity of single or multiple circuits providing interface between two or more control panels shall be verified. Interfaced equipment connections shall be tested by operating or simulating operation of the equipment being supervised. Signals required to be transmitted shall be verified at the control panel.
d) Lamps and LEDs	Lamps and LEDs shall be illuminated.
e) Primary (main) power supply	All secondary (standby) power shall be disconnected and tested under maximum load, including all alarm appliances requiring simultaneous operation. All secondary (standby) power shall be reconnected at end of test. For redundant power supplies, each shall be tested separately.
2 Engine Driven Generator	If an engine-driven generator dedicated to the fire alarm system is used as a required power source, operation of the generator shall be verified in accordance with NFPA 110, <i>Standard for Emergency and Standby Power Systems</i> , by the building owner.
3 Secondary (Standby) Power Supply	All primary (main) power supplies shall be disconnected and the occurrence of required trouble indication for loss of primary power shall be verified. The system's standby and alarm current demand shall be measured or verified and, using manufacturer's data, the ability of batteries to meet standby and alarm requirements shall be verified. General alarm systems shall be operated for a minimum of 5 minutes and emergency voice communications systems for a minimum of 15 minutes. Primary (main) power supply shall be reconnected at end of test.
4 Uninterrupted Power Supply (UPS)	If a UPS system dedicated to the fire alarm system is used as a required power source, operation of the UPS system shall be verified by the building owner in accordance with NFPA 111, <i>Standard on Stored Electrical Energy Emergency and Standby Power Systems</i> .
5 Batteries — General Tests	Prior to conducting any battery testing, the person conducting the test shall ensure that all system software stored in volatile memory is protected from loss.
a) Visual inspection	Batteries shall be inspected for corrosion or leakage. Tightness of connections shall be checked and ensured. If necessary, battery terminals or connections shall be cleaned and coated. Electrolyte level in lead-acid batteries shall be visually inspected.
b) Battery replacement	Batteries shall be replaced in accordance with the recommendations of the alarm equipment manufacturer or when the recharged battery voltage or current falls below the manufacturer's recommendations
c) Charger test	Operation of battery charger shall be checked in accordance with charger test for the specific type of battery.
d) Discharge test	With the battery charger disconnected, the batteries shall be load tested following the manufacturer's recommendations. The voltage level shall not fall below the levels specified. <i>Exception: An artificial load equal to the full fire alarm load connected to the battery shall be permitted to be used in conducting this test.</i>
e) Load voltage test	With the battery charger disconnected, the terminal voltage shall be measured while supplying the maximum load required by its application. The voltage level shall not fall below the levels specified for the specific type of battery. If the voltage falls below the level specified, corrective action shall be taken and the batteries shall be retested. <i>Exception: An artificial load equal to the full fire alarm load connected to the battery shall be permitted to be used in conducting this test.</i>

Device	Method
6 Battery Tests (Specific Types)	
a) Primary battery load voltage test	The maximum load for a No. 6 primary battery shall not be more than 2 amps per cell. An individual (1.5-volt) cell shall be replaced when a load of 1 ohm reduces the voltage below 1 volt. A 6-volt assembly shall be replaced when a load of 4 ohms reduces the voltage below 4 volts.
b) Lead-acid type	
1. Charger test	With the batteries fully charged and connected to the charger, the voltage at the batteries shall be measured with a voltmeter. The voltage shall be 2.30 vdc per cell ± 0.02 volts at 25°C (77°F) or as specified by the equipment manufacturer.
2. Load voltage test	Under load, the battery shall not fall below 2.05 volts per cell.
3. Specific gravity	The specific gravity of the liquid in the pilot cell or all of the cells shall be measured as required. The specific gravity shall be within the range specified by the manufacturer. Although the specified specific gravity varies from manufacturer to manufacturer, a range of 1.205—1.220 is typical for regular lead-acid batteries, while 1.240—1.260 is typical for high-performance batteries. A hydrometer that shows only a pass or fail condition of the battery and does not indicate the specific gravity shall not be used, because such a reading does not give a true indication of the battery condition.
c) Nickel-cadmium type	
1. Charger test ¹	With the batteries fully charged and connected to the charger, an ampere meter shall be placed in series with the battery under charge. The charging current shall be in accordance with the manufacturer's recommendations for the type of battery used. In the absence of specific information, 1/30 to 1/25 of the battery rating shall be used.
2. Load voltage test	Under load, the float voltage for the entire battery shall be 1.42 volts per cell, nominal. If possible, cells shall be measured individually.
d) Sealed lead-acid type	
1. Charger test	With the batteries fully charged and connected to the charger, the voltage across the batteries shall be measured with a voltmeter. The voltage shall be 2.30 vdc per cell ± 0.02 volts at 25°C (77°F) or as specified by the equipment manufacturer.
2. Load voltage test	Under load, the battery shall perform in accordance with the battery manufacturer's specifications.
7 Public Reporting System Tests	
In addition to the tests and inspection required above, the following requirements shall apply.	
Manual tests of the power supply for public reporting circuits shall be made and recorded at least once during each 24-hour period. Such tests shall include following:	
<ol style="list-style-type: none"> 1) Current strength of each circuit. Changes in current of any circuit exceeding 10 percent shall be investigated immediately. 2) Voltage across terminals of each circuit inside of terminals of protective devices. Changes in voltage of any circuit exceeding 10 percent shall be Investigated immediately. 3) Voltage between ground and circuits². If this test shows a reading in excess of 50 percent of that shown in the test specified in (2), the trouble shall be immediately located and cleared. Readings in excess of 25 percent shall be given early attention. These readings shall be taken with a calibrated voltmeter of not more than 100-ohms resistance per volt. Systems in which each circuit supplied by an independent current source (Forms 3 and 4) require tests between ground and each side of each circuit. Common current source systems (Form 2) require voltage tests between ground and each terminal of each battery and other current source. 4) Ground current reading shall be permitted in lieu of (3). If this method testing is used, all grounds showing a current reading in excess of 5 percent the supplied line current shall be given immediate attention. 5) Voltage across terminals of common battery, on switchboard side of fuses. 6) Voltage between common battery terminals and ground. Abnormal ground readings shall be investigated immediately. 	
Tests specified in (5) and (6) shall apply only to those systems using a common battery. If more than one common battery is used, each common battery shall be tested.	

Device	Method
8 Transient Suppressors	Lightning protection equipment shall be inspected and maintained per the manufacturer's specifications. Additional inspections shall be required after any lightning strikes. Equipment located in moderate to severe areas outlined in NFPA 780, <i>Standard for the Installation of Lightning Protection Systems</i> , Appendix H, shall be inspected semiannually and after any lightning strikes.
9 Control Unit Trouble Signals	<p data-bbox="191 369 1398 420">a) Audible and visual Operation of panel trouble signals shall be verified as well as ring-back feature for systems using a trouble-silencing switch that requires resetting.</p> <p data-bbox="191 449 1455 520">b) Disconnect switches If control unit has disconnect or isolating switches, performance of intended function of each switch shall be verified and receipt of trouble signal when a supervised function is disconnected shall also be verified.</p> <p data-bbox="191 550 1435 600">c) Ground-fault monitoring circuit If the system has a ground detection feature, the occurrence of ground-fault indication shall be verified whenever any installation conductor is grounded.</p> <p data-bbox="191 630 1468 865">d) Transmission of signals to off-premises location An initiating device shall be actuated and receipt of alarm signal at the off-premises location shall be verified. A trouble condition shall be created and receipt of a trouble signal at the off-premises location shall be verified. A supervisory device shall be actuated and receipt of a supervisory signal at the off-premises location shall be verified. If a transmission carrier is capable of operation under a single- or multiple-fault condition, an initiating device shall be activated during such fault condition and receipt of a trouble signal at the off-premises location shall be verified, in addition to the alarm signal.</p>
10 Remote Annunciator	The correct operation and identification of annunciators shall be verified. If provided, the correct operation of annunciator under a fault condition shall be verified.
11 Conductors –Metallic	<p data-bbox="191 1003 1468 1129">a) Stray voltage All installation conductors shall be tested with a volt/ohmmeter to verify that there are no stray (unwanted) voltages between installation conductors or between installation conductors and ground. Unless a different threshold is specified in the system installed equipment manufacturer's specifications, the maximum allowable stray voltage shall not exceed 1 volt ac/dc.</p> <p data-bbox="191 1159 1468 1230">b) Ground faults All installation conductors other than those intentionally and permanently grounded shall be tested for isolation from ground per the installed equipment manufacturer's specifications.</p> <p data-bbox="191 1260 1435 1331">c) Short-circuit faults All installation conductors other than those intentionally connected together shall be tested for conductor-to-conductor isolation per the installed equipment manufacturer's specifications. These same circuits also shall be tested conductor-to-ground.</p> <p data-bbox="191 1360 1468 1474">d) Loop resistance With each initiating and indicating circuit installation conductor pair short-circuited at the far end, the resistance of each circuit shall be measured and recorded. It shall be verified that the loop resistance does not exceed the installed equipment manufacturer's specified limits.</p> <p data-bbox="191 1503 1468 1604">e) Supervision Introduction of a fault in any circuit monitored for integrity shall result in a trouble indication at the control unit. One connection shall be opened at not less than 10 percent of the initiating devices, notification appliances and controlled devices on every initiating device circuit, notification appliance circuit, and signaling line circuit.</p>
12 Conductors –Nonmetallic	<p data-bbox="191 1642 1455 1713">a) Circuit integrity Each initiating device, notification appliance, and signaling line circuit shall be tested to confirm that the installation conductors are monitored for integrity in accordance with the requirements of Chapter 4 and Chapter 6.</p>

Device	Method
b) Fiber optics	The fiber-optic transmission line shall be tested in accordance with the manufacturer's instructions by the use of an optical power meter or by an optical time domain reflectometer used to measure the relative power loss of the line. This relative figure for each fiber-optic line shall be recorded in the fire alarm control panel. If the power level drops 2 percent or more from the value recorded during the initial acceptance test the transmission line, or section thereof, or connectors shall be repaired or replaced by a qualified technician to bring the line back into compliance with the accepted transmission level per the manufacturer's recommendations.
c) Supervision	Introduction of a fault in any supervised circuit shall result in a trouble indication at the control unit. One connection shall be opened at not less than 10 percent of the initiating device notification appliance and signaling line circuit. Each initiating device, notification appliance and signaling line circuit shall be tested for correct indication at the control unit. All circuits shall perform as indicated in Table 6.5, Table 6.6.1 or Table 6.7.

13 Initiating Devices

a) Electromechanical releasing device	
1. Nonrestorable-type link	Correct operation shall be verified by removal of the fusible link and operation of the associated device. Any moving parts shall be lubricated as necessary.
2. Restorable-type link ³	Correct operation shall be verified by removal of the fusible link and operation of the associated device. Any moving parts shall be lubricated as necessary.
b) Fire extinguishing system(s) or suppression system (s) alarm switch	The switch shall be mechanically or electrically operated and receipt of signal by the control panel shall be verified.
c) Fire—gas and other detectors	Fire—gas detectors and other fire detectors shall be tested as prescribed by the manufacturer and as necessary for the application.
d) Heat detectors	
1. Fixed-temperature, rate-of-rise, rate of compensation, restorable line, spot type (excluding pneumatic tube type)	Heat test shall be performed with a heat source per the manufacturer's recommendations for response within 1 minute. A test method shall be used that is recommended by the manufacturer or other method shall be used that will not damage the nonrestorable fixed-temperature element of a combination rate-of-rise/fixed-temperature element detector.
2. Fixed-temperature, nonrestorable line type	Heat test shall not be performed. Functionality shall be tested mechanically and electrically. Loop resistance shall be measured and recorded. Changes from acceptance test shall be investigated.
3. Fixed-temperature, nonrestorable spot type	After 15 years from initial installation, all devices shall be replaced or two detectors per 100 shall be laboratory tested. The two detectors shall be replaced with new devices. If a failure occurs on any of the detectors removed, additional detectors shall be removed and tested to determine either a general problem involving faulty detectors or a localized problem involving one or two defective detectors. If detectors are tested instead of replaced, tests shall be repeated at intervals of 5 years.
4. Nonrestorable (general)	Heat tests shall not be performed. Functionality shall be tested mechanically and electrically.
5. Restorable line type, pneumatic tube only	Heat tests shall be performed (where test chambers are in circuit) or a test with pressure pump shall be conducted.
6. Single- and multiple-station heat alarms	Functional tests shall be conducted according to manufacturer's instructions. Nonrestorable heat detectors shall not be tested with heat.
e) Fire alarm boxes	Manual fire alarm boxes shall be operated per the manufacturer's instructions. Key-operated presignal and general alarm manual fire alarm boxes shall both be tested.
f) Radiant energy fire detectors	Flame detectors and spark/ember detectors shall be tested in accordance with the manufacturer's instructions to determine that each detector is operative. Flame detector and spark/ember detector sensitivity shall be determined using any of the following: <ul style="list-style-type: none"> 1) Calibrated test method 2) Manufacturer's calibrated sensitivity test instrument 3) Listed control unit arranged for the purpose 4) Other approved calibrated sensitivity test method that is directly proportional to the input signal from a fire, consistent with the detector listing or approval.

If designed to be field adjustable, detectors found to be outside of the approved range of sensitivity shall be replaced or adjusted to bring them into the approved range. Flame detector and spark / ember detector sensitivity shall not be determined using a light source that administers an unmeasured quantity of radiation at an undefined distance from the detector.

g) Smoke detectors

- | | |
|--|--|
| 1. System detectors and single-station smoke alarms used in other than one- and two-family dwellings | The detectors shall be tested in place to ensure smoke entry into the sensing chamber and an alarm response. Testing with smoke or listed aerosol approved by the manufacturer shall be permitted as acceptable test methods. Other methods approved by the manufacturer that ensure smoke entry into the sensing chamber shall be permitted. Any of the following tests shall be performed to ensure that each smoke detector is within its listed and marked sensitivity range: <ol style="list-style-type: none"> 1) Calibrated test method 2) Manufacturer's calibrated sensitivity test instrument 3) Listed control equipment arranged for the purpose 4) Smoke detector/control unit arrangement whereby the detector causes a signal at the control unit when its sensitivity is outside its listed sensitivity range 5) Other calibrated sensitivity test method approved by the authority having jurisdiction |
| 2. Single- and multiple-station smoke alarms | Functional tests shall be conducted according to manufacturer's instructions. |
| 3. Air sampling | Per manufacturer's recommended test methods, detector alarm response shall be verified through the end sampling port on each pipe run; airflow through all other ports shall be verified as well. |
| 4. Duct type | Air duct detectors shall be tested or inspected to ensure that the device will sample the air stream. The test shall be made in accordance with the manufacturer's instructions. |
| 5. Projected beam type | The detector shall be tested by introducing smoke, other aerosol, or an optical filter into the beam path. |
| 6. Smoke detector with built-in thermal element | Both portions of the detector shall be operated independently as described for the respective devices. |
| 7. Smoke detectors with control output functions | It shall be verified that the control capability shall remain operable even if all of the initiating devices connected to the same initiating device circuit or signaling line circuit are in an alarm state. |

h) Initiating devices, supervisory

- | | |
|-------------------------------------|--|
| 1. Control valve switch | Valve shall be operated and signal receipt shall be verified to be within the first two revolutions of the hand wheel or within one-fifth of the travel distance, or per the manufacturer's specifications. |
| 2. High- or low-air pressure switch | Switch shall be operated. Receipt of signal obtained where the required pressure is increased or decreased a maximum 70 kPa (10 psi) from the required pressure level shall be verified. |
| 3. Room temperature switch | Switch shall be operated. Receipt of signal to indicate the decrease in room temperature to 4.4°C (40°F) and its restoration to above 4.4°C (40°F) shall be verified. |
| 4. Water level switch | Switch shall be operated. Receipt of signal indicating the water level raised or lowered 76.2 mm (3 in.) from the required level within a pressure tank, or 305 mm (12 in.) from the required level of a nonpressure tank, shall be verified, as shall its restoral to required level. |
| 5. Water temperature switch | Switch shall be operated. Receipt of signal to indicate the decrease in water temperature to 4.4°C (40°F) and its restoration to above 4.4°C (40°F) shall be verified. |

Device	Method
i) Mechanical, electro sonic, or pressure-type water flow device	Water shall be flowed through an inspector's test connection indicating the flow of water equal to that from a single sprinkler of the smallest orifice size installed in the system for wet-pipe systems, or an alarm test bypass connection for dry-pipe, pre-action, or deluge systems in accordance with NFPA 25, <i>Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems</i> .
14 Alarm Notification Appliances	
a) Audible	Sound pressure level shall be measured with sound level meter meeting ANSI S1.4a, <i>Specifications for Sound Level Meters</i> , Type 2 requirements. Levels throughout protected area shall be measured and recorded. The sound level meter shall be set in accordance with ANSI S3.41, <i>American National Standard Audible Evacuation Signal</i> using the time-weighted characteristic F (FAST). Record the maximum output when the audible emergency evacuation signal is on.
b) Audible textural notification appliances (speakers and other appliances to convey voice messages)	Sound pressure level shall be measured with sound level meter meeting ANSI SI .4a, <i>Specifications for Sound Level Meters</i> , Type 2 requirements. Levels throughout protected area shall be measured and recorded. The sound level meter shall be set in accordance with ANSI S3.41, <i>American National Standard Audible Evacuation Signal</i> using the time-weighted characteristic F (FAST). Record the maximum output when the audible emergency evacuation signal is on.
c) Visible	Audible information shall be verified to be distinguishable and understandable. Test shall be performed in accordance with the manufacturer's instructions. Appliance locations shall be verified to be per approved layout and it shall be confirmed that no floor plan changes affect the approved layout. Verify that the candela rating marking agrees with the approved drawings. It shall be confirmed that each appliance flashes.
15 Special Hazard Equipment	
a) Abort switch (IRI type)	Abort switch shall be operated. Correct sequence and operation shall be verified.
b) Abort switch (recycle type)	Abort switch shall be operated. Development of correct matrix with each sensor operated shall be verified.
c) Abort switch (special type)	Abort switch shall be operated. Correct sequence and operation in accordance with authority having jurisdiction shall be verified. Sequencing on as-built drawings or in owner's manual shall be observed.
d) Cross zone detection circuit	One sensor or detector on each zone shall be operated. Occurrence of correct sequence with operation of first zone and then with operation of second zone shall be verified.
e) Matrix-type circuit	All sensors in system shall be operated. Development of correct matrix with each sensor operated shall be verified.
f) Release solenoid circuit	Solenoid shall be used with equal current requirements. Operation of solenoid shall be verified.
g) Squibb release circuit	AGI flashbulb or other test light approved by the manufacturer shall be used. Operation of flashbulb or light shall be verified.
h) Verified, sequential, or counting zone circuit	Required sensors at a minimum of four locations in circuit shall be operated. Correct sequence with both the first and second detector in alarm shall be verified.
i) All above devices or circuits or combinations thereof	Supervision of circuits shall be verified by creating an open circuit.
16 Supervising Station Fire Alarm Systems –Transmission Equipment	
a) All equipment	Test shall be performed on all system functions and features in accordance with the equipment manufacturer's instructions for correct operation in conformance with the applicable sections of Chapter 8. Initiating device shall be actuated. Receipt of the correct initiating device signal at the supervising station within 90 seconds shall be verified. Upon completion of the test, the system shall be restored to its functional operating condition. If test jacks are used, the first and last tests shall be made without the use of the test jack.

Device	Method
b) Digital alarm communicator transmitter (DACT)	<p>Connection of the DACT to two separate means of transmission shall be ensured. <i>Exception: DACTs that are connected to a telephone line (number) that is also supervised for adverse conditions in a derived local channel.</i></p> <p>DACT shall be tested for line seizure capability by initiating a signal while using the primary line for a telephone call. Receipt of the correct signal at the supervising station shall be verified. Completion of the transmission attempt within 90 seconds from going off-hook to on-hook shall be verified.</p> <p>The primary line from the DACT shall be disconnected. Indication of the DACT trouble signal at the premises shall be verified as well as transmission to the supervising station within 4 minutes of detection of the fault.</p> <p>The secondary means of transmission from the DACT shall be disconnected. Indication of the DACT trouble signal at the premises shall be verified as well as transmission to the supervising station within 4 minutes of detection of the fault.</p> <p>The DACT shall be caused to transmit a signal to the DACR while a fault in the primary telephone number is simulated. Utilization of the secondary telephone number by the DACT to complete the transmission to the DACR shall be verified.</p>
c) Digital alarm radio transmitter (DART)	<p>The primary telephone line shall be disconnected. Transmission of a trouble signal to the supervising station by the DART within 4 minutes shall be verified.</p>
d) McCulloh transmitter	<p>Initiating device shall be actuated. Production of not less than three complete rounds of not less than three signal impulses each by the McCulloh transmitter shall be verified. If end-to-end metallic continuity is present and with a balanced circuit, each of the following four transmission channel fault conditions shall be caused in turn, and receipt of correct signals at the supervising station shall be verified:</p> <ol style="list-style-type: none"> 1) Open 2) Ground 3) Wire-to-wire short 4) Open and ground <p>If end-to-end metallic continuity is not present and with a properly balanced circuit, each of the following three transmission channel fault conditions shall be caused in turn, and receipt of correct signals at the supervising station shall be verified:</p> <ol style="list-style-type: none"> 1) Open 2) Ground 3) Wire-to-wire short
e) Radio alarm transmitter (RAT)	<p>A fault between elements of the transmitting equipment shall be caused. Indication of the fault at the protected premises shall be verified or it shall be verified that a trouble signal is transmitted to the supervising station.</p>
17 Supervising Station Fire Alarm Systems – Receiving Equipment	
a) All equipment	<p>Tests shall be performed on all system functions and features in accordance with the equipment manufacturer’s instructions for correct operation in conformance with the applicable sections of Chapter 8.</p> <p>Initiating device shall be actuated. Receipt of the correct initiating device signal at the supervising station within 90 seconds shall be verified. Upon completion of the test, the system shall be restored to its functional operating condition.</p> <p>If test jacks are used, the first and last tests shall be made without the use of the test jack.</p>
b) Digital alarm communicator receiver (DACR)	<p>Each telephone line (number) shall be disconnected in turn from the DACR and audible and visual annunciation of a trouble signal in the supervising station shall be verified. A signal shall be caused to be transmitted on each individual incoming DACR line at least once every 24 hours. Receipt of these signals shall be verified.</p>

Device	Method
c) Digital alarm radio receiver (DARR)	<p>The following conditions of all DARRS on all subsidiary and repeater station receiving equipment shall be caused. Receipt at the supervising station of correct signals for each of the following conditions shall be verified:</p> <ol style="list-style-type: none"> 1) AC power failure of the radio equipment 2) Receiver malfunction 3) Antenna and interconnecting cable failure 4) Indication of automatic switchover of the DARR 5) Data transmission line failure between the DARR and the supervising or subsidiary station
d) McCulloh systems	<p>The current on each circuit at each supervising and subsidiary station under the following conditions shall be tested and recorded:</p> <ol style="list-style-type: none"> 1) During functional operation 2) On each side of the circuit with the receiving equipment conditioned for an open circuit <p>A single break or ground condition shall be caused on each transmission channel. If such a fault prevents the functioning of the circuit, receipt of a trouble signal shall be verified.</p> <p>Each of the following conditions at each of the supervising or subsidiary stations and all repeater station radio transmitting and receiving equipment shall be caused; receipt of correct signals at the supervising station shall be verified:</p> <ol style="list-style-type: none"> 1) RF transmitter in use (radiating) 2) AC power failure supplying the radio equipment 3) RF receiver malfunction 4) Indication of automatic switchover
e) Radio alarm supervising station receiver (RASSR) and radio alarm repeater station receiver (RARSR)	<p>Each of the following conditions at each of the supervising or subsidiary stations and all repeater station radio transmitting and receiving equipment shall be caused; receipt of correct signals at the supervising station shall be verified:</p> <ol style="list-style-type: none"> 1) AC power failure supplying the radio equipment 2) RF receiver malfunction 3) Indication of automatic switchover, if applicable
f) Private microwave radio systems	<p>Each of the following conditions at each of the supervising or subsidiary stations and all repeater station radio transmitting and receiving equipment shall be caused; receipt of correct signals at the supervising station shall be verified:</p> <ol style="list-style-type: none"> 1) RF transmitter in use (radiating) 2) AC power failure supplying the radio equipment 3) RF receiver malfunction 4) Indication of automatic switchover
18 Emergency Communications Equipment	
a) Amplifier/tone generators	Correct switching and operation of backup equipment shall be verified.
b) Call-in signal silence	Function shall be operated and receipt of correct visual and audible signals at control panel shall be verified.
c) Off-hook indicator (ring down)	Phone set shall be installed or phone shall be removed from hook and receipt of signal at control panel shall be verified.
d) Phone jacks	Phone jack shall be visually inspected and communications path through jack shall be initiated.
e) Phone set	Each phone set shall be activated and correct operation shall be verified.
f) System performance	System shall be operated with a minimum of any five handsets simultaneously. Voice quality and clarity shall be verified.
19 Interface Equipment	
Interface equipment connections shall be tested by operating or simulating the equipment being supervised. Signals required to be transmitted shall be verified at the control panel. Test frequency for interface equipment shall be the same as the frequency required by the applicable NFPA standard(s) for the equipment being supervised.	
20 Guard's Tour Equipment	
The device shall be tested in accordance with the manufacturer's specifications.	

Device	Method
21 Special Procedures	
a) Alarm verification	Time delay and alarm response for smoke detector circuits identified as having alarm verification shall be verified.
b) Multiplex systems	Communications between sending and receiving units under both primary and secondary power shall be verified. Communications between sending and receiving units under open circuit and short circuit trouble conditions shall be verified. Communications between sending and receiving units in all directions where multiple communications pathways are provided shall be verified. If redundant central control equipment is provided, switchover and all required functions and operations of secondary control equipment shall be verified. All system functions and features shall be verified in accordance with manufacturer's instructions.
22 Low-Power Radio (Wireless Systems)	The following procedures describe additional acceptance and reacceptance test methods to verify wireless protection system operation:
	<ol style="list-style-type: none"> 1) The manufacturer's manual and the as-built drawings provided by the system supplier shall be used to verify correct operation after the initial testing phase has been performed by the supplier or by the supplier's designated representative. 2) Starting from the functional operating condition, the system shall be initialized in accordance with the manufacturer's manual. A test shall be conducted to verify the alternative path, or paths, by turning off or disconnecting the primary wireless repeater. The alternative communications path shall exist between the wireless control panel and peripheral devices used to establish initiation, indication, control, and annunciation. The system shall be tested for both alarm and trouble conditions. 3) Batteries for all components in the system shall be checked monthly. If the control panel checks all batteries and all components daily, the system shall not require monthly testing of the batteries.

¹Example: 4000 mAh x 1/25= 160 mA charging current at 25°C (77°F).

²The voltmeter sensitivity has been changed from 1000 ohms per volt to 100 ohms per volt so that false ground readings (caused by induced voltages) are minimized.

³Fusible thermal link detectors are commonly used to close fire doors and fire dampers. They are actuated by the presence of external heat, which causes a solder element in the link to fuse, or by an electric thermal device, which, when energized, generates heat within the body of the link, causing the link to fuse and separate.

⁴Methods of verification of voice intelligibility should include, but not be limited to, any one of the following methods:

- 1) Standard subject-based test methods such as described in ANSI S3.2, *Method for Measuring the Intelligibility of Speech Over Communications Systems*
- 2) Methods and instruments that measure certain physical parameters and provide a common intelligibility scale score such as described in IEC 60849, *Sound systems for emergency purposes*

The use of test methods that provide a common intelligibility scale score may be used for existing systems but should not be used to require revisions to systems that were designed prior to the 2002 edition of this Code. Also, refer to Section 1.4.