

STANDARD INFORMATION

Amendment 1: All smoke alarms must be compliant with either the 8th edition with revisions dated November 23, 2016, or the 9th edition with revisions dated February 9, 2022, by the effective date stated below. See updated information in blue below.

This SUN supersedes all previous SUNs for UL 217

Standard: UL 217

Standard IDs:

Smoke Alarms [UL 217:2020 Ed.9+R:09Feb2022]

Smoke Alarms [UL 217:2015 Ed.8+R:23Nov2016]

Previous Standard IDs:

Smoke Alarms [UL 217:2020 Ed.9]

Smoke Alarms [UL 217:2015 Ed.8]

Single and Multiple Station Smoke Alarms [UL 217:2006 Ed.6+R:20Nov2012]

EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

Effective Date: Prior to the effective date of **June 30, 2024**, all reports must be certified to the 8th edition with revision dated November 23, 2016, or the 9th edition with revision dated February 2, 2022.

IMPACT, OVERVIEW, AND ACTION REQUIRED

Impact Statement: Per our accreditation, Intertek is required to review reports against the standard revisions to confirm compliance. Once compliance is confirmed, the standard reference in the report is updated to show continued compliance to the technical requirements of the standard. Reports not updated to this version by the effective date above will be withdrawn.

Overview of 8th edition Changes:

- New requirements to assess multi-criteria smoke alarms
- New requirements for firmware updates
- New requirements for interconnected smoke alarms
- New requirement for end-of-life signal
- New requirements for velocity sensitivity
- New flaming polyurethane foam, smouldering polyurethane foam, and cooking nuisance smoke tests
- New surge immunity test



Overview of 9th edition Changes:

- Sensitivity Test Clarifications
- Supervised Battery Clarifications
- Mechanical Push Test for Push-Type Features
- Combination of Requirements for Recreational Vehicles and Boats
- New Firmware Requirements
- Updated Polyurethane Foam and Cooking Nuisance Requirements (including new Go/No Go Flaming PU Test)
- Trouble Signal for Detached Low Frequency or Tactile Accessories
- Revisions for High Voltage Printed Wiring Boards
- Additional Stability Tests for Multi-Criteria Smoke Detectors Employing CO Gas Sensors
- Nuisance Sensor Requirements
- Velocity Revisions
- Manufacturer's Published Instructions
- Smoke Alarm Activation
- Strain Relief/Field Wiring Clarifications
- Fire Test Clarifications
- Paintbrush Marking
- Updated Go/No-Go Field Test (for the smoke sensor)
- Addendum – Minimum Screening Programs in Table C3.1
- Removal of Lamp Interchangeability Requirements

Specific details of new/revised requirements are found in table below.

Current Listings Not Active? – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records. We will do this at no charge as long as Intertek is notified in writing prior to the review of your reports.



STANDARD INFORMATION

CLAUSE	VERDICT	COMMENT
		<i>Additions to existing requirements are <u>underlined</u> and deletions are shown lined-out below.</i>
The following changes reflect the 2015 8th edition changes through 30Oct2016:		
7	Info	<i>Smoke Alarm Reliability Prediction</i> <i>New clause added;</i> A gas sensor or a gas sensing component supervision system of an alarming device shall be provided with the following: a) Reliability data developed using the Military Standardization Handbook, MIL-HDBK 217 or equivalent demonstrating a predicted failure rate of not more than 2.5 failures per million hours operation (see 7.5); or b) Supervision of the predicted failure modes other than for loss of electrical continuity; and c) If the sensor is automatically and periodically tested for its performance response to the target gas (acceptable proxy gas), and results in a trouble signal when the sensor drifts out of specification, then the sensor can be excluded from the reliability calculation.
7.6		<i>New clause added;</i> Documentation of the failure modes resulting from aging for the gas sensor in a multi-criteria alarm or the sensing components and identification of failure modes addressed by the supervision system shall be provided. The manufacturer shall submit a test method to render the sensor unresponsive to the test concentrations as specified by the manufacturer if the documentation submitted for the sensor or the sensing components indicates drift in the less sensitive direction. This method shall be used when conducting the Electrical Supervision Test, Section 41. All predicted failure modes shall result in a trouble signal.
7.7		<i>New clause added;</i> Integral transceiver and related components used for non-supervised, wireless interconnected alarms are required to be included in the reliability prediction.
7.8		<i>New section added;</i> Automatic Drift Compensation for Smoke Sensing
9		This section contains requirements for automatic drift compensation (see standard for details).



CLAUSE	VERDICT	COMMENT
		<i>New section added;</i>
9		Automatic Drift Compensation for Smoke Sensing This section contains requirements for automatic drift compensation (see standard for details).
		<i>New section added;</i>
11		Smoke Sensitivity Indicating Means (optional) This requirement applies to end product installation smoke alarms that are provided with a means for measuring or indicating the nominal sensitivity or a sensitivity range (see standard for details).
12	Info	Maintenance (Field Cleaning) <i>New clause added;</i>
12.1		If recommended by the manufacturer, the smoke alarm shall be cleaned without: a) Degradation of performance when tested in accordance with 85.2, Maintenance (cleaning); and b) Disturbance of field wiring.
13	Info	Alarm Silencing Feature <i>New clause added;</i>
13.4		When single station smoke alarms are configured in a multiple station connection (interconnection of two or more smoke alarms), the smoke alarm that initiates an alarm signal shall be designed to be silenced through a manual operation by physically depressing the alarm silence feature on the initiating alarm.
13.5		As an optional feature, the manufacturer is permitted to include an additional wireless communication remote silencing feature. If included and tested for compliance with the requirements outlined in 13.8, the wireless communication remote silence feature may be activated through a remote device and shall be capable of providing additional instructions for the user to confirm his physical proximity to the initiating smoke alarm. Manufacturers that include a wireless communication remote silencing feature shall include language on their remote device for the user to confirm his physical proximity to the initiating smoke alarm, and that the user verified the presence or absence of smoke/fire at the initiating alarm(s) before silencing the alarm signal using the remote device.
13.6		A multiple-station interconnected smoke alarm that produces an alarm signal (wired, wireless, relay, audible and/or visual) shall be permitted to be silenced by either of the following:



CLAUSE	VERDICT	COMMENT
		<p>a) By activating the alarm silence feature on any multiple station interconnected smoke alarm, provided the smoke alarm that initiated the alarm signal remains in alarm; or</p> <p>b) By physically depressing the alarm silence feature on the initiating smoke alarm(s), as noted in 13.1; or</p> <p>c) By activating the wireless communication remote silencing feature using a remote device.</p> <p>Exception: In the event that the initiating alarm(s) cannot be silenced per the requirements in 13.1, it is permitted that the smoke alarms providing an alarm signal resulting from the multiple-station interconnect, excluding the initiating alarm(s), be silenced but not exceed the limits defined in 13.1.</p> <hr/> <p><i>New clause added;</i></p>
13.7		<p>Upon activation of an alarm signal from a smoke alarm in the multiple-station circuit, or reactivation of the alarm signal from the originating smoke alarm, all alarms in the multiple-station interconnect shall re-initiate their alarm signal.</p> <hr/> <p><i>New clause added;</i></p> <p>Smoke alarms with a wireless communication remote device and employing a remote alarm silence feature shall be tested in accordance with one of the following requirements:</p> <p>a) The remote transmission radio of the smoke alarm shall comply with FCC Part 15.249 and the following frequency and field strength requirements:</p> <ul style="list-style-type: none">1) Frequency range<ul style="list-style-type: none">(i) 2.4 GHz (2.4 GHz – 2.4835 GHz)(ii) 900 MHz (902 – 928 MHz)(iii) 5.8 GHz (5725 – 5875 MHz)2) Field strength<ul style="list-style-type: none">(i) 94 dBuV/m @ 3m <p>or</p> <p>b) The remote transmission radio of the smoke alarm shall comply with FCC Part 15.247 and the following frequency and field strength requirements:</p> <ul style="list-style-type: none">1) Frequency range<ul style="list-style-type: none">(i) 2.4 GHz (2.4 GHz – 2.4835 GHz)(ii) 900 MHz (902 – 928 MHz)(iii) 5.8 GHz (5725 – 5875 MHz)2) Field strength<ul style="list-style-type: none">(i) 30 dBm (1 W) (using antennas with directional gains < 6 dBi) <p>or</p> <p>c) The manufacturer shall provide a defined test procedure, test frequency and field strength in compliance with FCC regulations that demonstrate the open field (line of sight) transmission range of the smoke alarm does not exceed 984 ft (300 m).</p> <hr/>
13.8		



CLAUSE	VERDICT	COMMENT
		<i>New section added;</i>
15		Battery removal indicator This section contains requirements for battery removal (see standard for details).
		<i>New section added;</i>
16		Firmware Update (if provided) This section contains requirements for firmware updates (see standard for details).
	Info	ASSEMBLY
17	Info	General
17.6	Info	Supplementary heat sensor <i>New section added;</i>
17.6.2		The temperature rating of a heat sensor shall not be greater than 60°C (140°F), unless the smoke alarm has been investigated and found appropriate for installation at a higher temperature.
17.6.3		A fixed-temperature heat alarm shall operate within the temperature tolerance range according to its rating as specified in the operating temperature test of the Standard for Single and Multiple Station Heat Alarms, UL 539.
20	Info	Corrosion Protection <i>New clause added;</i>
20.3		Bearing surfaces shall be of such materials that reduce the risk of binding due to corrosion.
21	Info	Field Wiring Connections <i>New section added;</i>
21.3		Field wiring terminals (general) This section contains requirements for field wiring terminals (see standard for details).
		<i>New clause added;</i>
21.4		Special field-wiring terminals (qualified application) This section contains requirements for special field wiring terminals (see standard for details).
		<i>New clause added;</i>
21.6		Grounding terminals and leads



CLAUSE	VERDICT	COMMENT
		This section contains requirements for grounding terminals and leads (see standard for details).
		<i>New clause added;</i>
21.7		Power supply cord This section contains requirements for power supply cords (see standard for details).
23	Info	Internal Wiring
23.1		The internal wiring of a smoke alarm shall be routed away from moving parts and sharp projections and held in place with clamps, string, ties, or the equivalent, unless the wiring is determined to be rigid enough to retain a shaped form. The internal wiring shall consist of conductors having: a) Insulation rated for the potential involved; b) Insulation rated for the temperatures to which they are subjected; and c) The current-carrying capacity for the service.
23.1.2		Leads or a cable assembly connected to parts mounted on a hinged cover shall be of sufficient length to permit the full opening of the cover without applying stress to the leads or their connections. The leads shall be secured or equivalently arranged to prevent abrasion of insulation and jamming between parts of the enclosure. Wire shall be stranded copper.
23.3	Info	Splices
23.3.1		All splices and connections shall be mechanically secured and bonded electrically. Tack soldering of components is permitted where the construction precludes mechanical security only when 5 samples resist a pull-force of 2 lbs (8.9 N) applied for 3 seconds and the connection is subjected to 100 percent inspection and testing with the same pull force by the manufacturer.
23.5	Info	Strain relief
		<i>New clause added;</i>
23.5.1		A strain relief means shall be provided for the field leads, battery leads, and all internally connected wires or cords that are subject to movement in conjunction with the installation, operation, or servicing of a smoke alarm to reduce the risk of any mechanical stress being transmitted to internal connections and terminals. Inward movement of the cord or leads provided with a ring-type cord grip shall not damage internal connections or components or result in a reduction of the electrical spacings required. See the Strain Relief Test, Section 80.
	Info	COMPONENTS
25	Info	General
25.2	Info	Operating components



CLAUSE	VERDICT	COMMENT
		<i>New clause added;</i>
25.2.3		Moving parts shall have sufficient play at bearing surfaces to prevent binding.
		<i>New clause added;</i>
25.2.4		Manually operated parts shall have sufficient strength to withstand the stresses to which they will be subjected in operation.
		<i>New clause added;</i>
25.2.5		An electromagnetic device shall be reliable and ensure positive electrical and mechanical performance under all conditions of normal operation.
27	Info	Electrical Insulating Material
27.4		The thickness of a flat sheet of insulating material, such as phenolic composition employed for panel mounting of parts, shall not be less than 1/16 inch (1.6 mm) thick. Material less than 1/16 inch (1.6 mm) thick shall not be employed unless the panel is supported or reinforced to provide equivalent rigidity. the applicable value indicated in Table 27.1.
Table 27.1		<i>New table added;</i> Thickness of flat sheets of insulating material
28	Info	Lampholders and Lamps
28.1		A smoke-alarm intended to be connected to a commercial alternating current (AC) utility supply, either directly or via a separate power supply as described in 18.1 shall be provided with a steady “power-on” lamp to indicate energization of the unit. Exception: When pulsed, the lamp shall pulse at least once per minute.
		<i>New section added;</i>
29		Photocell Illuminating Lamps and Light Emitting Diodes (LEDs) This section contains requirements for lamps and LED’s (see standard for details).
33	Info	Transformers and Coils
		<i>New clause added;</i>
33.2		A transformer shall meet the requirements of the Standard for Specialty Transformers, UL 506.



CLAUSE	VERDICT	COMMENT
		<i>New clause added;</i>
33.3		<p>The insulation of coil windings of relays, transformers, and other insulation shall resist the absorption of moisture.</p> <p>Exception: An autotransformer shall be used only when the terminal or lead connected to the autotransformer winding that is common to both input and output circuits is identified and the output circuits are located only within the enclosure containing the autotransformer. See 21.6.1 and 21.6.2.</p>
		<i>New section added;</i>
35		<p>Power Supplies</p> <p>This section contains requirements for power supplies (see standard for details).</p>
	Info	PERFORMANCE
37	Info	General
37.1	Info	Test units
37.1.2		<p>The devices employed for testing shall be those specified by the wiring diagram of the smoke alarm. When substitute devices are used, they shall produce functions and load conditions equivalent to those obtained with the smoke alarm in service, including devices intended to be used with the smoke alarm. Smoke alarms intended to be energized by a separate power supply, as described in 35.1.2 shall be tested as a combination, and the applicable requirements of the test also applied to the power supply unit. See Section 87, Power Supply Tests.</p>
		<i>New section added;</i>
37.2		<p>Performance of single sensor components of multi-criteria smoke alarms</p> <p>This section contains requirements for performance of single sensor alarms (see standard for details).</p>
37.4	Info	Test samples and data
37.4.1		<p>The following samples and data are required; the data required in (e) does not have to be in final printed form:</p> <p>d) The monitoring instrument, or reference to a readily available instrument, intended to monitor the sensitivity of each sensor in the multi-criteria smoke alarm.</p> <p>g) Power supplies, if the smoke-alarms are intended to be employed with specific power supply.</p>



CLAUSE	VERDICT	COMMENT
37.5	Info	Component reliability data
37.5.2		<p>The data required by 37.5.1 shall include the following or equivalent information:</p> <ul style="list-style-type: none">d) General description of the smoke alarm manufacturer's quality assurance (QA) program. This data shall include incoming inspection and screening, in-process quality assurance, burn-in data, and testing. This applies to complete and partial assemblies as well as individual components;e) A general description of the circuit operation under standby, alarm, and trouble conditions;f) For smoke alarm employing a reliable LED as the photocell illuminating light source, the data shall be as specified in Section 29, Photocell Illuminating Lamps and Light Emitting Diodes (LEDs);g) General calibration procedure of test instruments employed by the manufacturer in the calibration of a smoke alarm;h) Amount of derating of components under normal standby and alarm conditions;i) Component failure rate data at rated values and derated values.
37.6		<p><i>New section added;</i></p> <p>Accessories</p> <p>This section contains requirements for accessories (see standard for details).</p>
37.7		<p><i>New section added;</i></p> <p>Smoke alarm guards</p> <p>This section contains requirements for smoke alarm guards (see standard for details).</p>
38	Info	Normal Operation Test
38.1	Info	General
38.1.5		<p>A multiple-station smoke alarm shall result in an indication (while in alarm), which will positively identify the actuating unit when installed in a multiple-station mode. When the interconnection wiring is not supervised for opens, shorts, and grounds, no more than 12 smoke alarms or 18 alarms [12 smoke alarms and 6 other (heat, CO, or similar alarms)] shall be specified for interconnection. When the interconnection is supervised, no more than 64 smoke alarms shall be specified for interconnection.</p>
38.1.8		<p>If low power wireless transmission between smoke alarms, is used, it shall be in compliance with the requirements outlined in the Standard for Household Fire Warning System Units, UL 985, section titled "Short Range Radio Frequency Devices." The transmission signal of a smoke alarm with integral or remote transmitter to a compatible receiver shall result in an alarm signal, at the receiver, being locked-in for at least 4 minutes. The test is to be conducted at the maximum distance specified by the manufacturer when tested under free-field conditions with no obstructions between the smoke alarm transmitter and receiver units. Refer to 101.1(m) for instructions to be provided. Lock-in of the receiver is not</p>



CLAUSE	VERDICT	COMMENT
		required when the receiving unit audible alarm signal is energized in time sequence and duration with the smoke alarm.
		<i>New clause added;</i>
38.1.10		Multiple station smoke alarms interconnected with carbon monoxide alarms shall result in the carbon monoxide audible alarm sounding by all interconnected alarms when the carbon monoxide alarms are the actuating units. Smoke alarms may remain silent if they do not produce the CO alarm signal. Refer to the Standard for Single and Multiple Station Carbon Monoxide Alarms, 2034.
		<i>New clause added;</i>
38.1.11		Multiple station smoke alarms interconnected with carbon monoxide alarms shall result in the smoke alarm audible alarm sounding by all interconnected units smoke alarms when the smoke alarms are the actuating units. CO alarms may remain silent if they do not produce the smoke alarm signal.
		<i>New clause added;</i>
38.1.12		Multiple station smoke alarms interconnected with carbon monoxide alarms or combination smoke alarms and carbon monoxide alarms shall result in a smoke alarm audible signal taking precedence when both types of alarms are activated.
		<i>New clause added;</i>
38.1.13		For the multiple station smoke alarm that initiates the smoke alarm signal, the initiating alarm shall be allowed to restore all interconnected units, by operation of the reset button on the actuating unit, to their “Normal Operation” state.
38.2	Info	Standardized alarm signal
38.2.1		A smoke alarm that produces an audible signal which is intended to initiate immediate evacuation from the protected area shall produce the signal in the form of the “three pulse” temporal pattern shown in Figure 38.1. Each ON phase shall last 0.5 second ± 10 percent followed by an OFF phase of 0.5 second ± 10 percent. After the third of these ON phases, there shall be an OFF phase that lasts 1.5 seconds ± 10 percent. Where the intended action is not immediate evacuation, the audible signal shall produce an alert signal distinctive from the “three pulse” temporal system.
38.3	Info	Sensitivity shift criteria
38.3.1		During or immediately after performance tests, the sensitivity of the smoke sensor shall not vary more than ± 1 percent per ft (± 3.3 percent per m) [± 0.0045 optical density per ft (± 0.014 optical density per m)] obscuration from the value recorded prior to the test. For non-multi-criteria smoke alarms the sensitivity limits shall comply with 42.1.1. Manufacturers shall define acceptable sensitivity shift for non-smoke sensors in multi-criteria smoke alarms.



CLAUSE	VERDICT	COMMENT
		<i>New section added;</i>
39		Automatic Drift Compensation for Smoke Sensing This section contains requirements for automatic drift compensation for smoke sensing (see standard for details).
		<i>New section added;</i>
40		Alarm Silenced Test This section contains requirements for the alarm silenced test (see standard for details).
41	Info	Electrical Supervision Test
41.1	Info	General
41.1.2		The wiring extending between smoke alarms wired in a multiple station configuration shall be electrically supervised and capable of operation as a single station type smoke alarm, or multi-criteria smoke alarm, during the following fault condition; open-circuit, short-circuit, or ground, fault conditions on the interconnect circuit. This includes, but is not limited to, short circuit faults between the interconnect conductor(s) and supply conductors if the interconnect circuit is common with the supply circuit. Any fault condition which results in trouble or alarm signal is considered as meeting this requirement. This requirement does not apply to the interconnected wiring of alarms intended to be connected by NFPA 70 Class 1 wiring method.
41.2	Info	Component failure
		<i>New clause added;</i>
41.2.1		Failure of a limited life (non-reliable) electronic component, such as opening or shorting of electrolytic capacitors, shall be indicated by an audible trouble or alarm signal, otherwise a reliable component shall be used. The reliable component shall fall within the reliability prediction described 37.5, Component reliability data.
		<i>New section added;</i>
41.3		Photocell illuminating lamps and light emitting diodes (LEDs) This section contains requirements for lamps and LEDs (see standard for details).
		<i>New section added;</i>
41.9		Multi-criteria smoke alarm with gas sensor This section contains requirements for multi-criteria smoke alarm with gas sensor (see standard for details).



CLAUSE	VERDICT	COMMENT
42	Info	Sensitivity Test
42.1	Info	Smoke sensor (general)
42.1.1		<p>A single criteria smoke alarm, when calibrated to each end of its production window, shall operate within the limits specified in Table 37.1, Visible smoke obscuration limits (gray smoke), or Table 37.2, Measuring ionization chamber (MIC) measurement, when subjected to a smoldering smoke or aerosol buildup condition using the test equipment described in 42.2 – 42.4 and when subjected to a range of air velocities. The manufacturer shall define the gray smoke/aerosol limits for the smoke sensor in a multi-criteria smoke alarm. The smoke generating method used for this test can be smoldering cotton lamp wick, aerosol generator, or punk sticks. Interchangeability between the methods is acceptable (e.g., conformity assessment testing utilizing a different method than the manufacturer) and shall be so documented in product reports and procedures created to document compliance to this standard. When the smoke alarm employs a variable field adjustable sensitivity setting, test measurements shall be made at maximum and minimum smoke alarm settings as specified in Tables 37.1 or 37.2. The sensitivity measurement is to be made with the smoke alarm located in the air stream in the least and most favourable horizontal positions for smoke entry as determined in the Directionality Test, Section 43.</p> <p>New clause added;</p>
42.1.2		<p>When a single criteria smoke alarm evaluated for a special application employs sensitivities outside of the range specified in Tables 37.1 or 37.2, it shall have been evaluated using the sensitivities detailed in the smoke alarm’s instructions; see 101.3.</p> <p>New clause added;</p>
42.1.3		<p>When the manufacturer’s required production control, inspection and test procedures (see Sections 90, General, and 95, Production-Line Dielectric Voltage-Withstand Tests) include testing in accordance with the Sensitivity test, then all product conformity testing shall use the same smoke generating method (e.g. aerosol, cotton lamp wick, punk stick, or equivalent) as specified in the manufacturer’s procedures for the Sensitivity test and all related gray smoke/aerosol testing.</p> <p>New section added;</p>
42.2	Info	<p>Combustibles</p> <p>This section contains requirements for combustibles (see standard for details).</p>
42.4	Info	Test equipment
42.4.1		<p>New clause added;</p> <p>Refer to Appendix B, Typical Sensitivity Smoke Test Chamber Construction, for details on test equipment.</p>



CLAUSE	VERDICT	COMMENT
42.5	Info	Test method New clause added;
42.5.4		Smoldering cotton lamp wick, or equivalent, producing a gray smoke having an equivalent particle size distribution shall be used as the actuating medium. The rate of smoke build-up shall be uniform and within the limits as specified in 42.2, Combustibles, or 42.3, Aerosol generation equipment (alternate method). New section added;
42.7		Smoke sensitivity test feature This section contains requirements for smoke sensitivity test feature (see standard for details). New section added;
42.8		Sensitivity test – gas sensor of a multi-criteria smoke alarm This section contains requirements for the sensitivity test (see standard for details). New section added;
43		Directionality Test This section contains requirements for the directionality test (see standard for details). New section added;
44		Velocity-Sensitivity Test This section contains requirements for the velocity-sensitivity test (see standard for details). New section added;
47		Reduction in Light Output Test This section contains requirements for the reduction in light output test (see standard for details).



CLAUSE	VERDICT	COMMENT
48	Info	Stability Test <p>There shall be no false alarms of a smoke alarm set at the maximum smoke alarm sensitivity setting when two representative samples are subjected to the test specified in (a) – (f). Different smoke alarms may be employed for each test. A test is not required to be conducted when the principle of operation is such that conducting the test has no possible effect. A smoke alarm for which smoke alarm sensitivity is affected by air velocity is to be tested in the position in which a false alarm is most likely to occur.</p>
48.1		<p>c) Ten cycles of temperature variation between 0°C (32°F) and 49°C (120°F).</p> <p>c) Ten cycles of temperature variation between minus 17.8°C (0°F) and plus 66°C (150°F) for extended temperature range; the following formulas shall be applied:</p> <p>1) Low temperature = (TLO - 0°C) - 17.8°C or (TLO - 32°F) - 0°F</p> <p>2) High temperature = (THI - 38°C) + 66°C or (THI - 100°F) + 150°F</p> <p>Where TLO and THI are the respective low and high operating temperatures.</p> <p><i>New clause added;</i></p>
48.2		<p>Two smoke alarms, set at the maximum smoke alarm sensitivity setting, shall be mounted in a position of intended use, energized from a source of supply in accordance with 37.3, Test voltages, and subjected to each of the test conditions in 48.1.</p> <p><i>New clause added;</i></p> <p>For 48.1(b), the smoke alarm is to be transferred from the 20 percent humidity environment to the 90 percent humidity environment as follows:</p>
48.3		<p>a) The smoke alarm is to be first conditioned in the 20 percent humidity environment for at least 1/2-hour.</p> <p>b) The smoke alarm shall be transferred from the 20 percent humidity environment to the 90 percent humidity environment in less than 5 seconds.</p> <p>c) The smoke alarm shall remain powered during each transfer and while in the sample conditioning environment.</p> <p>d) When conducting the transfer of the smoke alarm between conditioning environments, the smoke alarm shall;</p> <p>1) Be placed in an enclosure that was conditioned in the same environment as the smoke alarm, such as a portable cooler,</p> <p>2) The enclosure shall be closed, prior to opening the door of the test environment,</p> <p>3) Then the enclosure containing the smoke alarm shall be transferred between environments.</p> <p>e) Once the enclosure containing the sample is placed in the 90 percent relative humidity conditioning environment:</p>



CLAUSE	VERDICT	COMMENT
		1) The target temperature and humidity within the conditioning environment shall be reached within 3 minutes of placing the enclosure, containing the sample, within the conditioning environment. 2) The enclosure shall be opened after the target temperature and humidity within the conditioning environment have been reached. f) After conditioning the smoke alarm in the 90 percent environment for at least 1/2-hour, the smoke alarm is to be placed in the 20 percent environment, repeating (a) – (f) two additional trials.
		<i>New clause added;</i>
48.4		The transfer method noted within 48.3 (a) – (f) may be conducted using an alternate means provided that the smoke alarm is only exposed to the two conditioning environments as noted in paragraph 48.1(b).
		<i>New clause added;</i>
48.5		For 48.1(c), the time of cycling from one extreme to the other is to be a maximum of 1 hour and a minimum of 5 minutes and not less than 15 minutes at each temperature level. For 48.1(d), the time of change from one pressure to the other is to be 30 seconds. For 48.1 (e) and (f), the smoke alarm is to be positioned in a plane to permit the maximum entry of light into the chamber. Each cycle is to start at one test condition, changing to the other extreme, and returning to the original test condition.
		<i>New section added;</i>
49		Tests – Multi-Criteria Smoke Alarms Incorporating Gas Sensor(s) This section contains requirements for the tests involving gas sensors (see standard for details).
		<i>New section added;</i>
50		Stability Tests for Multi-Criteria Smoke Alarms Incorporating CO Gas Sensor(s) This section contains requirements for the stability test (see standard for details).
51	Info	Fire Tests
51.1	Info	General
		<i>New clause added;</i>
51.1.3		Each smoke alarm subjected to the tests specified in 51.2 – 51.4 shall produce the alarm sound for not less than 5 seconds when installed as intended in service and exposed to three types of controlled test fires. The response time of each smoke alarm shall not be more than 4 minutes for each flaming fire type. Different samples may be used for each flaming fire test.



CLAUSE	VERDICT	COMMENT
51.2	Info	Paper fire The materials and procedures shall be used as follows: b) Receptacle – To be formed of sheet metal seamed together, with no air gap at the seam (open at both ends). Dimensions are as follows: 51.2.2 Thickness: 0.031 in. \pm 0.08 in. (0.40 \pm 2 mm) Diameter: 4 \pm 0.08 in. (101 \pm 2 mm) Height: 12 \pm 0.08 in. (300 \pm 2 mm) Support flange at the bottom 6 \pm 0.08 in. (152 \pm 2 mm). Wire screen of 18 AWG wire, 0.25 in. (6.4 mm) minimum mesh. d) Smoke Profile – The test shall be terminated 4 minutes after ignition. All three samples shall respond prior to the termination of the test. Refer to Figure 51.1. <i>New section added;</i>
51.4		Flaming polyurethane foam test This section contains requirements for the flaming polyurethane foam test (see standard for details).
51.5	Info	Test method <i>New clause added;</i>
51.5.3		A smoke alarm intended for flush mounting is to be mounted flush with the mounting base. The ceiling mounted smoke alarms shall be mounted such that the least favorable position of the Bushaw sample faces the oncoming smoke flow, with the remaining samples rotated 120 and 240 degrees respectively.
51.5.8		All smoke alarm samples shall respond by generating an alarm signal to the test fire for each combustible. The test time is to start at ignition. The smoke obscuration level at each smoke alarm location is to be monitored by a photocell-light-beam assembly, mounted directly on the ceiling, on each side wall, and spaced 5 ft. (1.5 m) apart. Combination and multi-criteria smoke alarms shall be provided with means for monitoring each principle of operation during testing. Each sensor shall contribute in response, either wholly or partially, to at least one of the test fires in section 51 or to the Smoldering Smoke Test, Section 52, unless the sensor is only used to identify nuisance alarm condition.
52	Info	Smoldering Smoke Test
52.1		Each smoke alarm shall operate for continuous (stead or pulsing) produce an alarm sound for not less than 5 seconds when installed as intended in service and exposed to the following controlled smoldering smoke condition.



CLAUSE	VERDICT	COMMENT
		<i>New clause added;</i>
52.2		Each smoke alarm shall produce an alarm when installed as intended in service and exposed to the following controlled smoldering smoke condition.
		<i>New section added;</i>
53		Smoldering Polyurethane Foam Test This section contains requirements for the smoldering polyurethane foam test (see standard for details).
		<i>New section added;</i>
54		Cooking Nuisance Smoke Test This section contains requirements for the cooking nuisance smoke test (see standard for details).
		<i>New section added;</i>
55		Selectivity Test – Multicriteria Smoke Alarms Incorporating Gas Sensor(s) This section contains requirements for the selectivity test (see standard for details).
		<i>New section added;</i>
56		Circuit Measurement Test This section contains requirements for the circuit measurement test (see standard for details).
57	Info	Overvoltage and Undervoltage Tests
57.1	Info	Overvoltage test
57.1.1		A smoke alarm, other than one operating from a main battery power supply, shall operate as intended in the standby condition at maximum and minimum sensitivity settings and perform its intended signaling function, while connected to a supply source of 110 percent of the rated voltage. When a nominal rated voltage value is specified, the overvoltage shall be 110 percent of the rated voltage specified in 37.3, Test voltages. When an operating voltage range is specified, the overvoltage shall be either 110 percent of the high value of the rated voltage range or 110 percent of the rated voltage specified in 37.3, Test voltages, whichever is higher. Three samples are to be subjected to the specified increased voltage in the normal standby condition for at least 16 hours, or until stabilized temperatures have been reached, and then tested for normal signalling operation and sensitivity.
57.1.2		Sensitivity measurements at the increased voltage shall vary not more than specified in 38.3.1. For smoke-alarms intended to be energized from a separate power supply, as described in 35.1, Primary power supply, the overvoltage shall be applied to the input of the power supply.



CLAUSE	VERDICT	COMMENT
		<i>New section added;</i>
58		Temperature Test This section contains requirements for the temperature test (see standard for details).
59	Info	Vibration Test <i>New clause added;</i>
59.2		To determine compliance with 59.1 following vibration as specified in 59.3, smoke sensitivity measurements using gray smoke/aerosol shall be conducted, in accordance with the Sensitivity Test, Section 42, and shall vary not more than specified in 38.3, Sensitivity shift criteria. <i>New section added;</i>
60		Replacement Test, Head and Covers This section contains requirements for the replacement test (see standard for details).
61	Info	Jarring Test <i>New clause added;</i>
61.3		A 3.94 x 3.94 in. ±10 percent (100 by 100 mm ±10 percent) steel plate, 1/8 in. ±10 percent (3.2 mm ±10 percent) thick, shall be rigidly secured to the center of the reverse side of the board. <i>New clause added;</i>
61.5		The test is to be conducted by supporting the smoke alarm in its intended mounting position and conducting the jarring with the smoke alarm in the standby condition and connected to a rated source of supply in accordance with 37.3.1. <i>New section added;</i>
62		Variable Ambient Temperature Tests This section contains requirements for variable ambient temperature tests (see standard for details). <i>New section added;</i>
63		Humidity Test This section contains requirements for the high and low humidity tests (see standard for details).



CLAUSE	VERDICT	COMMENT
64	Info	<i>Corrosion Test</i> <i>New clause added;</i>
64.1		The alarms are to be tested for sensitivity prior to exposure to the corrosive atmospheres. Following the corrosion exposures described in 64.2 and 64.3, the smoke alarms are to be dried in a circulating air oven at a temperature of 40°C (104°F) for at least 24 hours after which the smoke alarms are to be again tested for sensitivity. The sensitivity shall not exceed the limits specified in the Sensitivity Test, Section 42.
64.2		An alarm shall operate as intended after being subjected to the corrosive atmosphere tests described in 64.3 and 64.4. The samples shall be placed in the test chambers that are located in a room having a temperature of 23 ±2 °C (73 ±4°F) and 20 – 50 percent relative humidity. The samples shall be mounted in their intended position of use on a platform 2 in. 1 in. (25.4 mm) above the bottom. The relative humidity inside the chamber during the test is to be 95 93 ±2 percent. The samples are not to be energized during these tests.
64.3		Two samples, one at the maximum and one at the minimum sensitivity setting, are to be exposed to a moist hydrogen sulfide-air mixture as specified in 64.2, in a closed glass chamber for 10 days. The concentration of hydrogen sulphide is to be equivalent of 0.1 percent of the volume of the chamber. A small amount of water (10 m/.0.003 m3 of chamber volume) is to be maintained sulphide by volume in air saturated with water vapor at room temperature is to be 1000 ±50 PPM (parts per million).
64.4		Samples, one at maximum and one at minimum sensitivity setting, are to be exposed to a moist carbon dioxide-sulphur dioxide-air mixture as specified in 64.2 in a closed glass chamber for 10 days. The concentration of carbon dioxide is to be the equivalent of 1.0 percent, and the amount of sulfur dioxide is to be the equivalent of 0.5 percent of the volume of the chamber by volume in air saturated with water vapor at room temperature is to be 10 000 ±500 PPM (parts per million). The concentration of sulphur dioxide by volume in air saturated with water vapor at room temperature is to be 5000 ±250 PPM (parts per million).
66		<i>Transient Tests</i> This section contains requirements for transient tests (see standard for details). <i>New section added;</i>
67		<i>Static Discharge Test</i> This section contains requirements for the static discharge test (see standard for details).



CLAUSE	VERDICT	COMMENT
		<i>New section added;</i>
68		Dust Test This section contains requirements for the dust test (see standard for details). <i>New section added;</i>
69		Overload Tests This section contains requirements for overload tests (see standard for details). <i>New section added;</i>
70		Endurance Test This section contains requirements for the endurance test (see standard for details). <i>New section added;</i>
71		Fire Test – Smoke Alarm with Heat Detection This section contains requirements for the fire test (see standard for details). <i>New section added;</i>
72		Fire Test – Smoke Alarm with Supplementary Heat Detection This section contains requirements for the fire test (see standard for details). <i>New section added;</i>
73		Leakage Current Test This section contains requirements for the leakage current test (see standard for details). <i>New section added;</i>
74		Abnormal Operation Test This section contains requirements for the abnormal operation test (see standard for details). <i>New section added;</i>
76		Locked Rotor Test This section contains requirements for the locked rotor test (see standard for details).



CLAUSE	VERDICT	COMMENT
		<i>New section added;</i>
77		Dielectric Voltage-Withstand Test This section contains requirements for the dielectric voltage-withstand test (see standard for details).
		<i>New section added;</i>
78		Polarity Reversal Test This section contains requirements for the polarity reversal test (see standard for details).
		<i>New section added;</i>
79		Tests on Polymeric Materials This section contains requirements for tests on polymeric materials (see standard for details).
80	Info	Strain Relief Test <i>New section added;</i>
80.3		Strain relief (special field-wiring terminals) This section contains requirements for special field-wire terminals (see standard for details).
		<i>New section added;</i>
80.4		Battery connections This section contains requirements for battery connectors (see standard for details).
		<i>New section added;</i>
82		Survivability Tests This section contains requirements for survivability tests (see standard for details).
		<i>New section added;</i>
84		Audibility Test This section contains requirements for the audibility test (see standard for details).



CLAUSE	VERDICT	COMMENT
		<i>New section added;</i>
85		Field Service Tests (If recommended by the manufacturer) This section contains requirements for field service tests (see standard for details).
86	Info	Conformal Coatings on Printed Wiring Boards
86.1	Info	General <i>New clause added;</i> Conformal coatings are for use only on printed wiring boards where the acceptability of the combination has been investigated for flammability in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, and the dielectric property after environmental, humidity, and thermal conditioning in accordance with the Standard for Polymeric Materials – Industrial Laminates, Filament Wound Tubing, Vulcanized Fibre, and Materials Used in Printed Wiring Boards, UL 746E.
86.1.1		
86.3	Info	High voltage printed wiring boards Three samples of the printed wiring board without electrical components installed, and coated with the conformal coating, shall be subjected to this test. Test leads shall be attached to the printed wiring (prior to the application of the coating) so as to allow for convenient application of the specified test potential. Each sample shall be subjected to a 5,000 volts AC Dielectric Voltage-Withstand Test potential for one minute: a) The test shall be performed between tracks on the printed wiring board;
86.3.2		
		<i>New section added;</i>
87		Power Supply Tests This section contains requirements for power supply tests (see standard for details).
88	Info	Smoke Alarms for Use in Recreational Vehicles (RV)
88.1	Info	General <i>New clause added;</i> A single criteria smoke alarm intended for use in recreational vehicles shall comply with the requirements specified in 89.1 – 89.6, in addition to the requirements specified in Sections 1 – 88 and 91 – 102, inclusive.
88.1.1		
		<i>New section added;</i>
88.2		Marking The following section contains requirements for markings (see standard for details).



CLAUSE	VERDICT	COMMENT
88.3	Info	Variable ambient temperature and humidity test <i>New clause added;</i>
88.3.3		Gas sensitivity measurements, recorded in the environmental chamber, shall not vary more than specified in 42.8, Sensitivity test – gas sensor of a multi-criteria smoke alarm. <i>New clause added;</i>
88.3.5		The tests in 88.3.1 shall be done sequentially on the same two samples and using the same battery samples for all three environments. The tests shall be conducted using each battery model specified in the marking or the installation instructions.
89	Info	Smoke Alarms for Use on Recreational Boats
89.2	Info	Operational tests following conditioning <i>New clause added;</i>
89.2.11		Multi-criteria smoke alarms with gas sensor will conduct the Stability Test for recreational boat approval; the following substitutions are to be made: a) Thirty days in air at $66 \pm 3^{\circ}\text{C}$ ($150 \pm 6^{\circ}\text{F}$). b) At least 72 hours at minus $40 \pm 2^{\circ}\text{C}$ (minus $40 \pm 4^{\circ}\text{F}$). c) Ten days in 93 ± 2 percent humidity at $61 \pm 2^{\circ}\text{C}$ ($142 \pm 4^{\circ}\text{F}$). <i>New clause added;</i>
89.2.12		Smoke sensitivity measurements, recorded in the environmental chamber smoke box, shall not vary more than specified in 38.3, Sensitivity shift criteria. During the sensitivity measurement, the environmental chamber is to be as close as possible to the test conditions specified in 89.2.11, condition (a) to be conducted at 49°C , condition (b) to be conducted at 0°C , and condition (c) to be conducted at 40°C , 93 percent relative humidity, respectively.
89.2.13		Gas sensitivity measurements, recorded in the environmental chamber, shall not vary more than specified in 42.8, Sensitivity test – gas sensor of a multi-criteria smoke alarm. <i>New section added;</i>
89.3		Watertightness Test This section contains requirements for smoke alarms labelled “watertight” (see standard for details). <i>New section added;</i>
89.4		Salt-spray Corrosion Test This section contains requirements for the salt-spray corrosion test (see standard for details).



CLAUSE	VERDICT	COMMENT
		<i>New section added;</i>
89.5		Marking This section contains requirements for markings (see standard for details).
		<i>New section added;</i>
89.6		Operating and installation instructions This section contains requirements for operating and installation instructions (see standard for details).
	Info	MANUFACTURING AND PRODUCTION
90	Info	General
90.1		To verify compliance with the requirements of this section, the manufacturer shall provide the necessary production control, inspection, and tests. The program shall include at least the tests specified in Sections 87 and 88 91 – 96.1 conducted on 100 percent of the production unless otherwise specified.
		<i>New clause added;</i>
90.2		A record of accepted smoke alarms, and the smoke alarm serial number or date code, or equivalent identification is to be maintained.
91	Info	Sensitivity Calibration Tests
		<i>New clause added;</i>
91.2		For multicriteria smoke alarms, the sensitivity of each sensor shall be verified according to the manufacturer’s specification for each sensor following the warm-up period specified by the manufacturer. The limits shall be as specified by the manufacturer. The limits shall be as specified by the manufacturer and verified by Section 42, Sensitivity Test.
		<i>New clause added;</i>
91.4		A warm-up period is not required when the smoke alarm components, except for a photocell illuminating lamp, are operated at not more than 25 percent of the component manufacturer’s power or temperature rating, whichever is appropriate, in the standby condition or when the individual components are burned-in prior to assembly.
		<i>New clause added;</i>
91.5		A warm-up period is required for those smoke alarms or individual components operating at more than 25 percent of rating whose characteristics are variable during initial warm-up, such as solid-state devices, lamp filaments, and resistors, that affect smoke alarm sensitivity.



CLAUSE	VERDICT	COMMENT
92	Info	Smoke Tests <i>New clause added;</i>
92.1		A minimum of two samples from each day's production shall be subjected to a test to determine response from smoke. A smoke test chamber, equivalent to the test compartment described in Appendix B with at least one of the measuring instruments to record the smoke level, shall be employed in conjunction with a smoke generating source, such as a smouldering cotton wick, punk sticks, aerosol generator or equivalent means. <i>New section added;</i>
94		Measurement of In-Service Reliability for Multi-criteria Smoke Alarms with Gas Sensor(s) This section contains requirements for measurements smoke alarms (see standard for details).
97	Info	Battery Quality Assurance <i>New clause added;</i>
97.1		When batteries are employed in a smoke-alarm, the smoke-alarm manufacturer shall conduct a quality assurance programme on the batteries to determine the operational capability. The battery quality assurance may be conducted by the battery manufacturer if each shipment is accompanied by a certificate of compliance verifying the condition on that shipment.
98	Info	Smoke Alarm Shipment
98.1		The battery intended to be employed with the alarm shall be shipped from the factory with the alarm in the same package. To prevent unnecessary drain during shipment and storage, the battery shall not be connected in the alarm. One or both polarities of the battery shall be physically disconnected from the circuitry of the smoke alarm such that no battery capacity is used to provide standby, sleep, or other power to the alarm.
	Info	MARKING
99	Info	General
99.1		A smoke alarm shall be permanently marked with the following information unless specifically indicated that it appears on the installation wiring diagram. The marking shall be in a contrasting color, finish, or equivalent. Unless the letter height is specified, all markings shall be at least 3/64 in. (1.2 mm) high. c) A multi-criteria smoke alarm shall be marked, "Multi-Criteria Smoke Alarm." t) The smoke sensitivity setting for a smoke alarm having a fixed setting. For an alarm which is intended to be adjusted in the field, the range of sensitivity shall be indicated. The marked sensitivity shall be indicated as a percent per ft. obscuration



CLAUSE	VERDICT	COMMENT
		level. The marking shall include a nominal value plus tolerance. For an alarm that is capable of receiving a firmware update, and the sensitivity production range is impacted by the content of the firmware update (such as a new smoke algorithm), a means of indicating the current certified sensitivity or sensitivity range for the current firmware version of the unit shall be provided. x) The smoke alarm shall be marked with the following or equivalent, "Replace after X years". X = Lifetime of the product that identifies when the end-of-life signal will be initiated, but shall not exceed 10 years.
	Info	INSTRUCTIONS
101	Info	General
		Each single and multiple station smoke alarm shall be provided with installation instructions which shall include the following information:
101.1		f) More detailed information on the alarm, end-of-life and trouble signals and an indication where false alarms or trouble signals would be anticipated. The end-of-life information shall include details on how long the unit may be expected to last and shall indicate if the end-of-life is based on the date the unit was manufactured or the date that the user places the unit into service. l) For multiple station alarms, identify the manufacturer and model number of compatible alarms and accessories, such as, but not limited to smoke-alarms, heat alarms, carbon monoxide alarms, signalling devices and/or switching modules.
		<i>New clause added;</i>
		For smoke alarms for use on recreational boats, the smoke alarm installation instructions shall include the following or equivalent:
101.4		a) The smoke alarm is intended to be installed in enclosed accommodation compartments where smoke from undetected fire may accumulate. b) The instructions shall indicate that the devices shall be wired in accordance with Fire Protection Standard for Pleasure and Commercial Motor Craft, NFPA 302, and AC and DC Electrical Systems on Boats, ABYC E-11, and applicable regulations of the United States Coast Guard.
		<i>New clause added;</i>
		For multiple-station interconnected smoke alarms with alarm silencing means, other than physically depressing the silence button, the silencing of the initiating alarm shall describe the following:
101.5		a) An example and information detailing the alarm information as communicated to the user; b) As described in 13.5 all operating instructions shall include detailed information for the user to confirm that he has checked for the presence or absence of smoke at the initiating alarm before activating the silence feature;



CLAUSE	VERDICT	COMMENT
		c) As described in 13.5, all wireless communication remote device notifications shall include a means for the user to confirm that he has checked for the presence or absence of smoke at the initiating alarm before activating the silence feature.
		<i>New section added;</i>
102		Installation Instructions – Wiring Diagram This section contains requirements for the wiring diagram (see standard for details).
		<i>New appendix added;</i>
Appendix B		TYPICAL SENSITIVITY SMOKE TEST CHAMBER CONSTRUCTION This section contains requirements for sensitivity smoke test chamber construction (see standard for details).
		<i>New appendix added;</i>
Appendix D		RELIABILITY PREDICTION AND CRITERIA FOR ACCEPTANCE This section contains requirements for instructions for determining a reliability prediction of electronic components and microelectric circuits (see standard for details).
		<i>New appendix added;</i>
Appendix E		Sample Size Determination for In Service Reliability Testing of Multicriteria Smoke Alarms Consisting of Gas Detection This section contains requirements for sample size determination (see standard for details).
The following changes reflect the 2015 8th edition changes through 23Nov2016:		
51	Info	Fire Tests
51.1	Info	General
		<i>New clause added;</i>
51.1.5		Smoke alarms shall also be subjected to the following tests: a) Flaming polyurethane foam test, 51.4, b) Smoldering polyurethane foam test, section 53, c) Cooking nuisance test, section 54.



CLAUSE	VERDICT	COMMENT
54	Info	Acceptance criteria
54.4	Info	Test procedure
54.4.3	Info	Smoke alarms
		<i>New clause added;</i>
54.4.3.3		Carbon monoxide shall be measured and recorded and shall not exceed the limit specified in 54.4.6.1 when conducting this test. The CO measuring equipment shall either be range selectable by the user or have auto range capability for measuring up to 10 ppm of carbon monoxide. The sample draw for the CO monitor location shall not exceed 0.12 ft ³ /min (3.3 L/min).
		<i>New clause added;</i>
54.4.3.4		The carbon monoxide sampling tube shall be centered between the 2nd and 3rd smoke alarm as illustrated in Figure 54.2. The sample tube shall not be larger than the rated 1/4 in (6.4 mm) O.D. tubing and shall protrude from the ceiling surface 1 ±0.125 in (25.4 ±3.2 mm) into the room from the ceiling surface. Centering of the test samples (alarms) and CO sample tube shall be within ±10% of the specified dimensions illustrated in Figures 54.1 and 54.2.
		<i>New clause added;</i>
54.4.3.5		Beam and MIC placement shall be located in the 10-foot location as noted in Figure 54.1, with the same Beam and MIC placement as specified in Figure 51.7, Fire Test Room, items C, D, E and F.
54.4.6	Info	Smoke profile criteria
		<i>New clause added;</i>
54.2.6.2		For Figure 54.7, CO vs. OBS, the curve of the measured data may fall between the upper and lower limits but shall not exceed the upper limit specified in the figure.
The following changes reflect the 2020 9th edition changes through 02Jan2020.		
16	Info	Firmware Update (if provided)
16.2	Info	Firmware update
		<i>New clause added;</i>
16.2.2		The manufacturer shall provide documentation which details the differences: a) From the original to each subsequent firmware version and b) Between subsequent versions (if applicable).



CLAUSE	VERDICT	COMMENT
16.2.4		<p>Products capable of receiving a firmware update shall be tested and evaluated for the following type of applicable firmware updates when the alarm device or accessory is subjected to the specified operating conditions:</p> <p>a) Authentic Firmware Update:</p> <ol style="list-style-type: none"> 1) Normal standby condition – smoke alarm shall operate as intended after receiving an authentic firmware update. <u>2) Alarm condition – when detecting smoke during a fire event, a firmware update shall not interfere with alarm detection and signaling.</u> 3) Loss of power – <u>smoke alarm shall comply with 16.2.6 or 16.2.7.</u> 4) Firmware transmission (data) interruption – smoke alarm shall comply with 16.2.6 or 16.2.7. <p>b) Duplicate firmware version update:</p> <ol style="list-style-type: none"> 1) Normal standby condition – smoke alarm shall operate as intended after receiving a duplicate firmware update. <p>c) Corrupt firmware update:</p> <ol style="list-style-type: none"> 1) Normal standby condition – <u>smoke alarm shall comply with 16.2.6 or 16.2.7.</u> <p>d) Unsigned manufacturer firmware update:</p> <ol style="list-style-type: none"> 1) Normal standby condition – <u>smoke alarm shall comply with 16.2.6 or 16.2.7.</u>
		<i>New clause added;</i>
16.2.9		<p>Where firmware updates alter the alarm threshold or smoke detection algorithm, the alarm (with firmware updates) shall be tested according to Section 42, Sensitivity Test, Section 50, Fire Tests, and Section 51, Smoldering Smoke Test.</p>
		<i>New clause added;</i>
16.2.10		<p>An alarm with firmware updates shall also be subjected to the Smoldering Polyurethane Foam Tests, 52, and Cooking Nuisance Smoke Test, 53.</p>
	Info	PERFORMANCE
37	Info	General
37.6	Info	Accessories
		<i>New clause added;</i>
37.6.2		<p>The primary power supply of optional accessories shall be either a utility supply (commercial light and power source) or a supervised integral battery or batteries.</p>
37.6.4		<p>Detached accessories utilizing a low frequency sound or actuating tactile appliances for single and multiple units shall provide a low frequency audible trouble signal or visual trouble indication <u>on the portion of the accessory intended to be visible to the user after installation</u> in the event of the following:</p> <p>a) <u>Low energy of the primary battery power source in accordance with 56.2, Battery trouble voltage determination.</u></p>



CLAUSE	VERDICT	COMMENT
		<p>b) Loss of primary power, <u>(not required for accessories utilizing primary batteries as the sole power supply)</u>,</p> <p>c) Low energy of the secondary power source <u>(not required for accessories utilizing primary batteries as the sole power supply)</u>, or</p> <p>d) The accessory unit cannot perform its intended function of enhancing the smoke or heat alarm's primary low frequency audible sound or operate the tactile appliance.</p>
50		Fire Tests
50.1		General
		<i>New clause added;</i>
50.1.6		<p>For smoke alarms incorporating nuisance sensors, the manufacturer shall provide a method or means to simulate the nuisance condition. Tests shall be performed as defined in Section 42 (Sensitivity Test), 50.2 – 50.5 of the fire tests, Section 51 (Smoldering Smoke), Section 52 (Smoldering Polyurethane Foam), and Section 53 (Cooking Nuisance) with the simulated nuisance condition activated.</p>
		<i>New clause added;</i>
50.1.7		<p>Smoke alarms incorporating nuisance sensors shall also be subjected to the tests under normal operating conditions without the nuisance condition present or simulated as specified in 50.1.5.</p>
		<i>New section added;</i>
54		Go/No Go Flaming Polyurethane Foam Test
		<p>This section contains requirements for the go/no go flaming polyurethane foam test. See standard for details.</p>
		<i>New section added;</i>
		Mechanical Push Test for Push-Type Features
61		<p>This test shall be conducted on smoke alarms with a functional feature (i.e., test button, strobe test button, etc.) greater than 12.7 mm (1/2 inch) in diameter that is either elevated or protrudes from the surface of the alarm and that also serves as a method of activating the test feature or other operational feature of the smoke alarm. See standard for details.</p>
67	Info	Transient Tests
67.3	Info	Extraneous transients
67.3.3		<p>To determine compliance with 67.3.1, two single and two sets of multiple station smoke alarms are to be energized from a source of rated voltage and frequency and subjected to transients generated from the following devices located 300 mm (11.8 in) from the alarm, interconnecting wires, or both. The time of application for condition (b) shall be at least 2 minutes. Conditions (c), (d), and (e) are to be</p>



CLAUSE	VERDICT	COMMENT
		<p>applied for 10 cycles, each application of 2 seconds duration, except the last application shall be of a 2-minute duration. Near the end of the last cycle, smoke or other aerosol is to be introduced into the alarm chamber to determine whether the unit is operational with the transient applied.</p> <p>a) Energization and transmission of random voice message of transmitter-receiver units in turn, each having a 5 watt output and operating in the following nominal frequencies:</p> <ol style="list-style-type: none"> 1) 27 megahertz, 2) 150 megahertz, 3) 450 megahertz, 4) 866 megahertz, 5) 910 megahertz, and 6) <u>5.8 gigahertz</u> <p>A total of six energizations in each of two orientations are to be applied from each transmitter receiver; five to consist of 5 seconds on and 5 seconds off, followed by one consisting of a single 15-second energization. For this test, the cellular phones are to be in the same room and on the same plane as the alarm under test. The cellular phones are to be positioned to generate a field strength of 20 volts/meter at the power sensing antenna adjacent to the smoke alarm under test. The test is to be conducted with the antenna tip pointed directly at the smoke alarm, and at a right angle to the first position, centered on the alarm.</p>
80	Info	Strain Relief Test
80.4	Info	Field-wiring leads
		<i>New clause added;</i>
80.4.1		Each lead employed for field connections shall withstand for 1 minute a pull of 44.5 N (10 lbs) without any evidence of damage or transmittal of stress to internal connections. A connector used in the lead assembly shall withstand a pull of 22.2 N (5 lbs) without any evidence of damage, transmittal of stress to internal connections, or separation.
80.5	Info	Battery connections
		<i>New clause added;</i>
80.5.2		Each lead employed in a battery clip lead assembly, shall withstand for 1 minute a pull of 44.5 N (10 lbs) without any evidence of damage or of transmittal of stress to internal connections.
		<i>New section added;</i>
89		Smoke Alarms for Use in Recreational Vehicles (RV) and Boats
		This section contains requirements for RV's and boats. See standard for details.



CLAUSE	VERDICT	COMMENT
		The following changes reflect the 2020 9 th edition changes through 09Feb2022.
42	Info	Sensitivity Test
42.6	Info	Uniformity of operation
		The smoke alarms shall be uniform in operation so that the sensitivity (average of three trials) of any one smoke alarm shall be within 25 percent of the overall average of all twenty-eight smoke alarms tested in 37.4.1 (a), Test samples and data. If a smoke alarm has a variable sensitivity setting, the requirement applies to the end points of the variable range.
		<u>Smoke alarms shall be uniform in operation when conducting the Sensitivity Test, Section 42, as follows:</u>
42.6.1		<u>a) The sensitivity of any one smoke alarm, based on the average of at least three trials, shall be within 25 percent of the overall average when testing at least 12 alarms that are preset (as close to production calibration permits) to the nominal maximum production sensitivity (most sensitive setting); and</u> <u>b) The sensitivity of any one smoke alarm, based on the average of at least three trials, shall be within 25 percent of the overall average when testing at least 12 alarms that are preset (as close to production calibration permits) to the nominal minimum anticipated production sensitivity(least sensitive setting)</u>
		<i>New clause added;</i>
42.6.1A		Combination/multi-criteria smoke alarms shall be provided with a means for monitoring each principle of operation during the Sensitivity Test, Section 42.
		<i>New clause added;</i>
42.6.1B		If a smoke alarm has a variable sensitivity setting, the requirement in 42.6.1 applies to the end points of the variable range.
		<i>New clause added;</i>
42.6.3		For multi-criteria alarms that employ sensors that do not sense smoke, the sensitivity measurements for these sensors shall be within the specified operating range as defined by the manufacturer.