FM Approvals

CLASS NUMBER 3230

Examination Standard for Smoke Actuated Detectors for Automatic Alarm Signaling

January 2023

Foreword

This standard is intended to verify that the products and services described will meet stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of this standard is to present the criteria for examination of various types of products and services.

Examination in accordance with this standard shall demonstrate compliance and verify that quality control in manufacturing shall ensure a consistent and reliable product.

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1 INTRODUCTION

1.1 PURPOSE

1.1.1 This standard states testing and certification requirements for smoke actuated detectors for automatic alarm signaling.

1.1.2 Testing and certification criteria may include performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a surveillance program.

1.2 SCOPE

1.2.1 This standard applies to any spot type smoke and beam type detector intended to be employed in indoor locations in accordance with the National Fire Alarm Code, NFPA 72, and ANSI/UL 268.

1.2.2 This standard applies to any duct type smoke detector intended to be employed in indoor locations in accordance with the National Fire Alarm Code, NFPA 72, and ANSI/UL 268A.

1.2.3 This standard applies to any aspirating type smoke detector intended to be employed in indoor locations in accordance with the National Fire Alarm Code, NFPA 72.

1.2.4 This standard specifically does not apply to video based smoke detector systems.

1.3 BASIS FOR REQUIREMENTS

1.3.1 The requirements of this standard are based on experience, research and testing, and/or the standards of other organizations. The advice of manufacturers, users, trade associations, jurisdictions and/or loss control specialists was also considered.

1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of smoke actuated detectors for automatic alarm signaling for the purpose of obtaining certification. Smoke actuated detectors for automatic alarm signaling having characteristics not anticipated by this standard may be certified if performance equal, or superior, to that required by this standard is demonstrated.

1.4 BASIS FOR CERTIFICATION

Certification is based upon satisfactory evaluation of the product and the manufacturer in the following major areas:

1.4.1 Examination and tests on production samples shall be performed to evaluate:

- the performance of the product as specified by the manufacturer and required for certification;
- the durability and reliability of the product.

1.4.2 An examination of the manufacturing facilities and audit of quality control procedures may be conducted to evaluate the manufacturer's ability to consistently produce the product which is examined and tested, and the marking procedures used to identify the product. Subsequent surveillance may be required by the agency in accordance with the certification scheme to ensure ongoing compliance.

1.5 BASIS FOR CONTINUED CERTIFICATION

The basis for continual certification may include the following based upon the certification scheme and requirements of the certification agency:

- production or availability of the product as currently certified;
- the continued use of acceptable quality assurance procedures;
- satisfactory field experience;
- compliance with the terms stipulated by the certification;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory surveillance audits conducted as part of the certification agency's product follow-up program.

1.6 EFFECTIVE DATE

The effective date of this examination standard mandates that all products tested for certification after the effective date shall satisfy the requirements of this standard.

The effective date of this standard is eighteen (18) months after the publication date of the standard for compliance with all requirements.

1.7 SYSTEM OF UNITS

Units of measurement used in this standard are United States (U.S.) customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement. The converted equivalent value may be approximate. Conversion of U.S. customary units is in accordance with ANSI/IEEE/ASTM SI-10.

1.8 NORMATIVE REFERENCES

The following referenced documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the cited edition applies.

ANSI/IEEE/ASTM SI 10, American National Standard for Metric Practice

ANSI/UL 268, 6th Edition, Standard for Smoke Detectors for Fire Alarm Systems (United States requirements only)

ANSI/UL 268A, 4th Edition, Standard for Smoke Detectors for Duct Application

EN 54-20, Fire Detection and fire alarm systems - Aspirating Smoke Detectors

NFPA 72, National Fire Alarm and Signaling Code

1.9 TERMS AND DEFINITIONS

For purposes of this standard, the following terms apply:

Agency	A certification agency or test agency
Aspirating Type Detector	A type of smoke detector wherein air from the protected space is sampled with a tubing network and transported to the detection chamber with a fan.
Open area/Spot-Type Detector	A device in which the detecting element is concentrated at a particular location for detecting smoke in a space intended to be occupied.
Projected Beam–Type Detector	A type of photoelectric light obscuration smoke detector wherein the beam spans the protected area. Can be tested as a spot type or a duct detector depending on application.
Smoke Detector	A device that detects visible or invisible particles of combustion.
Test Medium	Smoke from a cotton wick or vaporized paraffin oil.

Transport time	A function of the characteristics of the tubing network from the source to the detector. Variations that affect transport time include but are not limited to: aspirating port size and number, tubing size and branches, fan capacity and exhaust port characteristics.

2 GENERAL INFORMATION

2.1 PRODUCT INFORMATION

Smoke detectors are supplied to connect to a fire alarm system through dry contact relays, initiating device circuits or signaling line circuits as defined in NFPA 72. They may be fabricated as a removable detector and a base that is wired to a permanently mounted electrical box. The smoke detectors are usually manufactured from polymeric materials. The detectors may be supplied as spot type, duct type, beam type, or aspirating type. Other designs meeting the criteria of this standard may also be considered for certification. Components peculiar to a particular type of detector must have significant details described in the installation instructions as to how they are to be applied/installed/etc.

2.2 CERTIFICATION APPLICATION REQUIREMENTS

The manufacturer shall provide the following preliminary information with any request for certification consideration:

- a complete list of all models, types, sizes, and options for the products or services being submitted for certification consideration;
- general assembly drawings, complete set of manufacturing drawings, materials list, anticipated marking format, piping and electrical schematics, nameplate format, brochures, sales literature, spec. sheets, installation, operation and maintenance procedures, and
- the number and location of manufacturing facilities.
- all documents shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. All documents shall be provided with English translation.

2.3 REQUIREMENTS FOR SAMPLES FOR EXAMINATION

2.3.1 Following authorization of a certification examination, the manufacturer shall submit samples for examination and testing based on the following:

- Sample requirements to be determined by the certification agency based on the applicable standard for the smoke detector type.

2.3.2 Requirements for samples may vary depending on design features, results of prior or similar testing and results of any foregoing tests.

2.3.3 The manufacturer shall submit samples representative of production. Any decision to use data generated using prototypes is at the discretion of the agency.

2.3.4 It is the manufacturer's responsibility to provide any test fixtures necessary to test their specific design, such as those which may be required to evaluate the strength of a properly glued joint of an aspirating detector piping network.

3 GENERAL REQUIREMENTS

3.1 REVIEW OF DOCUMENTATION

During the initial investigation and prior to physical testing, the manufacturer's specifications and details shall be reviewed to assess the ease and practicality of installation and use. The agency examination results may further define the limits of the final certification.

3.2 PHYSICAL OR STRUCTURAL FEATURES

3.2.1 General

The smoke detector ratings shall be appropriate for the service conditions. As applicable, based on the type of detector and the intended use, the detector will fall into one or more of the following categories and be evaluated to the referenced standards.

3.2.2 Open area / spot type smoke detector

Spot type smoke detectors, of either photocell or ionization type, typically characterized by a detachable head of 'clamshell' design that mounts to a base with two or four wire connections and intended installation location of indoor ceilings, shall meet the construction requirements of ANSI/UL 268.

3.2.3 Duct type smoke detector

Duct type smoke detectors, of either photocell or ionization type, typically characterized by their construction that allows them to be mounted on the outside of a duct and sample the air in the duct, two or four wire connections, and intended installation location, shall meet the construction requirements of ANSI/UL 268A.

3.2.4 Aspirating type detector

Depending on the application, aspirating detectors shall comply with the requirements of either 3.2.2 or 3.2.3 in addition to 3.2.4.

3.2.4.1 Aspirating type smoke detectors, usually based on the photocell principle, typically characterized by their construction requiring the use of a tubing network and a fan to move air sampled from the protected space to the sensing chamber, Class A or Class B detection circuit connection, separate power supply connection and intended installation location.

3.2.4.2 Tubing used for aspirating detectors shall be sturdy and resistant to temperature variation as demonstrated by the ability to resist, as a minimum, 28 pounds (125 N) of compression force and 0.37 foot-pound (0.5 J) impact, over the temperature range of 5 to 140oF (-15 to 60oC).

The compression test shall be conducted as follows: The two samples of tubing shall be arranged within an environmental chamber. Prior to any exposure, the air flow through the tubing shall be measured using an anemometer with a sample detector and noted. A steel plate measuring 10 inches (254 mm) by 4 inches (102 mm) shall be placed across both tubing samples. The plate shall be loaded with additional weights, so that the total load is 56 lbs (28 lbs applied to each tubing sample). The samples shall be conditioned for 3 hours at the lower temperature extreme, and then tested for airflow by inserting the samples back into the airflow measurement arrangement. The samples shall then be placed back into the environmental chamber and subjected to the compressive load. After 3 hours of conditioning at the higher temperature extreme, the airflow test shall be repeated. The test is passed if the airflow measured after each temperature exposure is within ± 20% of the original value.

The impact test shall be conducted as follows: The two samples of tubing shall be arranged within an environmental chamber. Prior to any exposure, the air flow through the tubing shall be measured using an anemometer with a sample detector and noted. The impact to the tubing shall be delivered by dropping a 0.725 lb (329 g) weight, concentrated at a 0.79 inch (20 mm) diameter 6/6 nylon tip from a height of 6 inches (152 mm). The tubing samples shall be allowed to condition at the lower temperature extreme for a period of 3 hours, and

then be subjected to the impact. The samples are then tested for airflow by inserting the samples back into the airflow measurement arrangement. The tubing samples shall be then allowed to condition at the higher temperature extreme for 3 hours, after which the impact shall be delivered. The airflow test shall be repeated. The test is passed if the airflow measured after each impact is within ± 20% of the original value.

3.3 MARKINGS

3.3.1 Marking on the product or, if not possible due to size, on its packaging or label accompanying the product, shall include the following information:

- name and address of the manufacturer or marking traceable to the manufacturer;
- date of manufacture or code traceable to date of manufacture or lot identification;
- model number, size, rating, capacity, etc., as appropriate.
- The agencies certification mark of conformity, if applicable.

When hazard warnings are needed, the markings should be universally recognizable.

3.3.2 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the agency's mark of conformity.

3.3.3 If there is an agency's mark of conformity, it shall be displayed visibly and permanently on the product and/or packaging as appropriate and in accordance with the requirements of the agency. The manufacturer shall exercise control of this mark as specified by the agency and the certification scheme.

3.3.4 All markings shall be legible and durable.

3.4 MANUFACTURER'S INSTALLATION AND OPERATION INSTRUCTIONS

The manufacturer shall provide the user with:

- instructions for the installation, maintenance, and operation of the product;
- facilities for repair of the product and supply replacement parts; and
- services to ensure proper installation, inspection, or maintenance for products of such nature that it would not be reasonable to expect the average user to be able to provide such installation, inspection, or maintenance.

3.5 CALIBRATION

3.5.1 Each piece of equipment used to verify the test parameters shall be calibrated within an interval determined on the basis of stability, purpose, and usage. A copy of the calibration certificate for each piece of test equipment is required. The certificate shall indicate that the calibration was performed against working standards whose calibration is certified and traceable to an acceptable reference standard and certified by an ISO/IEC 17025 accredited calibration laboratory. The test equipment shall be clearly identified by label or sticker showing the last date of the calibration and the next due date. A copy of the service provider's accreditation certificate as an ISO/IEC 17025 accredited calibration laboratory should be available.

3.5.2 When the inspection equipment and/or environment is not suitable for labels or stickers, other methods such as etching of control numbers on the measuring device are allowed, provided documentation is maintained on the calibration status of thus equipment.

4 PERFORMANCE REQUIREMENTS

4.1 NORMAL AMBIENT CONDITIONS

Unless otherwise noted, tests will be conducted under normal atmospheric conditions, temperature 59-95 ºF (15 to 35 °C), humidity 25-70 %RH, air pressure 860-1060 mbar (86-106 kPa)

4.2 OPEN AREA DETECTOR

Open area detectors shall conform to the requirements of ANSI/UL 268 for assembly, safety and performance.

4.3 DUCT DETECTOR

Duct type detectors shall conform to the requirements of ANSI/UL 268A for assembly, safety and performance.

4.4 ASPIRATING DETECTOR

Depending on the application, aspirating detectors shall comply with the requirements of either 4.2 or 4.3 in addition to 4.4.

4.4.1 Airflow

- The detector shall indicate a 20% change in airflow as a trouble condition.
- A reduction in airflow shall be indicated as an obstruction,
- An increase in airflow shall be indicated as a break.
- 200 seconds is allowed to indicate a change in airflow.

4.4.2 Transport time – The detector shall be capable of detecting test medium introduced in the aspirating port with the longest transport time in the tubing network in 120 seconds or less.

4.4.3 Sensitivity – The detector shall be capable of having a single aspirating port function as a spot type smoke detector. When test medium (cotton wick or vaporized paraffin oil) is applied to the single aspirating port, the detector shall alarm at an applied smoke level of at least 0.5%/ft to no more than 4%/ft (1.6 to 12.5 %/m).

A sampling network shall be configured to be no more than 6.5 ft (2 m) in length, with two elbows to facilitate the sampling of smoke from a instrumented smoke chamber (see Figure 1). The sampling holes shall be designed such the last hole at the end of the network (intended to protrude into the smoke chamber) shall have an equivalent sensitivity within the range 0.5 – 4 %/ft obscuration, when the detector is set to its maximum sensitivity, or an alternative sensitivity identified by the manufacturer. Holes elsewhere in the pipe network shall be arranged to provide clean* air dilution to accomplish the intended (manufacturer's claimed) sensitivity at the hole that is aspirating smoke. This dilution ratio shall be provided by the manufacturer so that the sensitivity setting of the detector can be correlated against the measured sensitivity at the end sampling hole.

*It is imperative that provisions are made to ensure that smoke from the detector exhaust or possible leakage from the smoke chamber be prevented from entering the air dilution sampling holes. The detector exhaust shall be piped to an extraction vent.

4.4.3.1 The sensitivity of one detector shall be measured six times. The ratio of largest value to smallest value shall be less than 1.6.

4.4.3.2 The sensitivity shall be confirmed for eight samples. The average of the eight results shall be reported as the sensitivity of the detector.

4.4.3.2.1 The ratio of the maximum value to the sensitivity shall be equal to, or less than, 1.33.

4.4.3.2.2 The ratio of the sensitivity to the minimum value shall be equal to, or less than, 1.5.

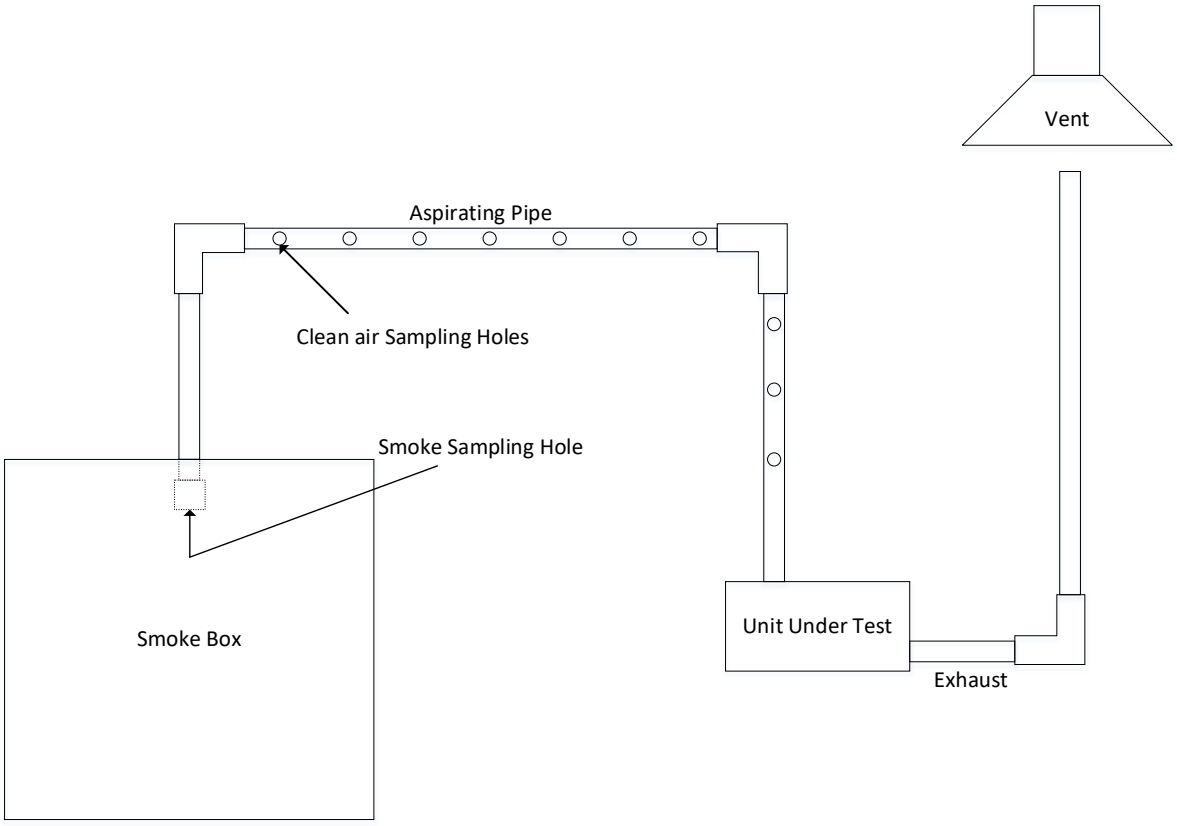


Figure 1 - Aspirating Smoke Detector Sensitivity Test

4.4.4 Voltage variation – One sample of each detector shall be operated over the manufacturer's specified voltage range.

4.4.4.1 The detector's sensitivity will be measured three times each at maximum, minimum and nominal voltage.

4.4.4.2 The ratio of the highest smoke level detected to the lowest smoke level, for all nine readings, detected shall be less than or equal to 1.6.

4.4.5 Humidity testing – The sample detector shall be subjected to an ambient humidity of 93% RH at an ambient temperature of 104°F (40°C) for twenty-four hours with no change in performance as determined by the results of the following tests.

4.4.5.1 The detector's sensitivity shall be confirmed with three measurements in the last hour of the exposure. The pipe sampling network depicted in Figure 1 shall be modified to allow a straight extension pipe to be inserted to extend the network from the smoke box to the environmental chamber. This is depicted in Figure 2. The procedure described in 4.4.3 shall be used.

4.4.5.2 The detectors airflow shall be confirmed in the last hour of the exposure. An anemometer shall be inserted into the pipe network depicted in Figure 2, in between the first sampling hole and the detector. The airflow shall be adjusted down by closing sampling holes and up by replacing the last hole (endcap) with one with a suitably larger hole. The detector shall indicate a trouble within 200 seconds in response to an airflow reduction and increase of 20%.

4.4.5.3 The detector's sensitivity shall be confirmed with three measurements one hour after the exposure. The ratio of largest value to smallest value shall be less than 1.6. The procedure described in 4.4.3 shall be used.

4.4.5.4 The detectors airflow shall be confirmed one hour after the exposure. The procedure described in 4.4.1 shall be used.

4.4.5.5 There shall be no troubles or alarms in the absence of the test medium.

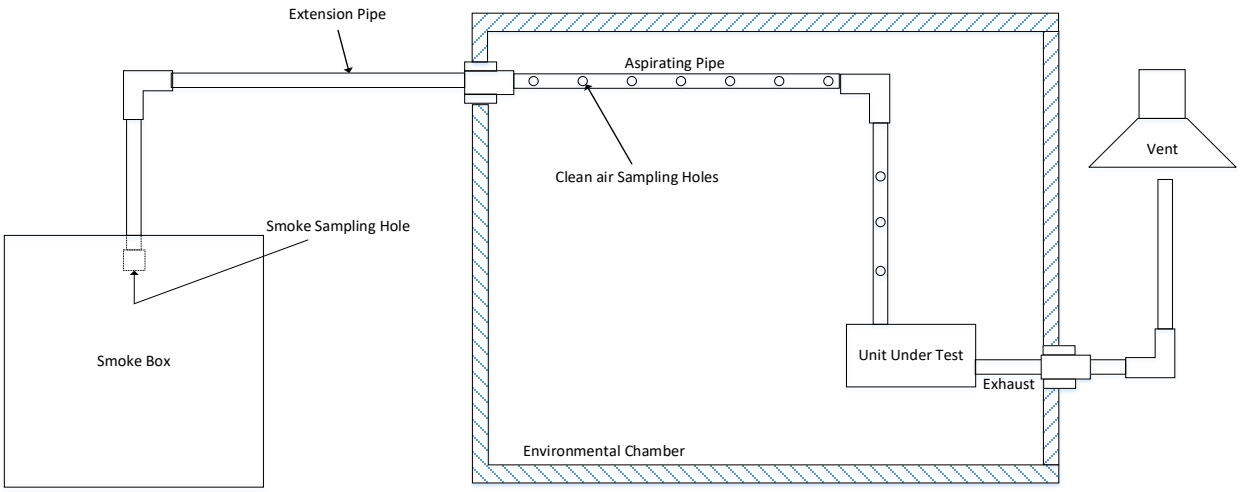


Figure 2- Measuring Sensitivity in the Environmental Chamber

4.4.6 Stability at cold temperature – The sample detector shall be subjected to a 32 °F (0°C) environment for twenty-four hours with no change in performance as determined by the results of the following tests.

The detector's sensitivity shall be confirmed with three measurements in the last hour of the exposure. See 4.4.5.1.

The detectors airflow shall be confirmed in the last hour of the exposure. See 4.4.5.2.

The detector's sensitivity shall be confirmed with three measurements one hour after the exposure. The ratio of largest value to smallest value shall be less than 1.6. The procedure described in 4.4.3 shall be used.

The detectors airflow shall be confirmed one hour after the exposure. The procedure described in 4.4.1 shall be used.

There shall be no troubles or alarms in the absence of the test medium.

4.4.7 Stability at high temperature – The sample detector shall be subjected to a 120°F (49°C), environment for twenty-four hours with no change in performance as determined by the results of the following tests.

4.4.7.1 The detector's sensitivity shall be confirmed with three measurements in the last hour of the exposure. See 4.4.5.1.

4.4.7.2 The detectors airflow shall be confirmed in the last hour of the exposure. See 4.4.5.2.

4.4.7.3 The detector's sensitivity shall be confirmed with three measurements one hour after the exposure. The ratio of largest value to smallest value shall be less than 1.6. The procedure described in 4.4.3 shall be used.

4.4.7.4 The detectors airflow shall be confirmed one hour after the exposure. The procedure described in 4.4.1 shall be used.

4.4.7.5 There shall be no troubles or alarms in the absence of the test medium.

4.4.8 Vibration – A sample detector, mounted in the intended orientation and manner prescribed by the manufacturer shall be subjected to the vibration test. The test shall include a single axis vibration, in the axis of normal mounting. The duration of the test shall be four hours. The vibration shall be a sinusoid on sinusoid with a total displacement of 0.02 in (0.5mm) and a sweep frequency of 10-30-10 at two cycles per minute.

4.4.8.1 The detector's sensitivity shall be confirmed with three measurements after the exposure. The ratio of largest value to smallest value shall be less than 1.6.

4.4.8.2 The detectors airflow shall be confirmed one hour after the exposure.

4.4.8.3 There shall be no troubles or alarms in the absence of the test medium.

4.4.9 Radio frequency transient protection – One sample of each detector shall be tested by exposure to radio frequency transmissions with radiation power levels equivalent to 5 Watts at 12 in. (0.3 m) in the 27 MHz, 150-174 MHz, 450-467 MHz, 850-870MHz, and 900-920 MHz bands. The detectors shall produce no false alarms or trouble signals in the presence of these extraneous transients.

4.4.9.1 The detector's sensitivity shall be confirmed with three measurements after the exposure. The ratio of largest value to smallest value shall be less than 1.6.

4.4.9.2 The detectors airflow shall be confirmed one hour after the exposure.

4.4.9.3 There shall be no troubles or alarms in the absence of the test medium.

4.4.10 Surge transient tests – One sample of each detector shall be tested by connecting the field wiring terminals to a source of five transient waveforms having peak levels of 100; 500; 1,000; 1,500; and 2,400 V, as delivered into a 200 ohm load. The detectors shall produce no false alarms or trouble signals in the presence of these transients.

4.4.10.1 The detector's sensitivity shall be confirmed with three measurements after the exposure. The ratio of largest value to smallest value shall be less than 1.6.

4.4.10.2 The detectors airflow shall be confirmed one hour after the exposure.

4.4.10.3 There shall be no troubles or alarms in the absence of the test medium.

4.4.11 Durability test – Detectors shall demonstrate durability appropriate for the life expectancy of the detector. If the detector is equipped with switching elements such as output relays, the detector shall be cycled through 6,000 on-alarm-reset operations to life test the switching elements. During the test the switching elements shall operate under maximum load.

4.4.11.1 The detector's sensitivity shall be confirmed with three measurements after the exposure. The ratio of largest value to smallest value shall be less than 1.6

4.4.11.2 The detectors airflow shall be confirmed one hour after the exposure.

4.4.11.3 There shall be no troubles or alarms in the absence of the test medium.

4.4.12 Fire tests – A single sample, considered to be representative of the product line, shall be used for the purposes of these tests. To be satisfactory, the test results must comply with the requirements of the referenced standard.

4.4.12.1 For aspirating detectors for open area detection, the standard piping network installed in the smoke room shall be connected to the detector (See Appendix A). The smoke sources and test protocols for these tests are described in ANSI/UL 268.

4.4.12.2 For aspirating detectors for duct detection, the manufacturer's specified piping network installed in the duct tester shall be connected to the detector (See Appendix B). The smoke sources and test protocols for these tests are described in ANSI/UL 268A.

4.4.13 Dielectric Voltage Withstand Test – Detector shall comply with the requirements of ANSI/UL 268 or ANSI/UL 268 A depending on application.

4.5 SMOKE DETECTORS FOR FREEZER APPLICATIONS

4.5.1 Smoke detectors for freezer applications shall conform to the requirements of 3.2, 4.2, 4.3 and 4.4 as applicable to the type of detector for assembly, safety and performance.

4.5.2 Additional requirements for freezer applications, see Appendices C, D, E and F for descriptions of the smoke generation methods.

4.5.2.1 Detector shall respond to smoke generated by a smoldering red oak block before smoke obscuration exceeds 0.6% per foot.

4.5.2.2 Detector shall respond to smoke generated by smoldering polyurethane foam before smoke obscuration exceeds 4.7% per foot.

4.5.2.3 Detector must be capable of supporting class A wiring to the panel.

4.5.2.4 Detector must be capable of proper operation in accordance with section 4.4.4 Voltage Variation, at minimum rated temperature

5 OPERATIONS REQUIREMENTS

5.1 DEMONSTRATED QUALITY CONTROL PROGRAM

5.1.1 A quality assurance program is required to assure that subsequent smoke detector(s) products produced by the manufacturer shall present the same quality and reliability as the specific smoke detector(s) products examined. Design quality, conformance to design, and performance are the areas of primary concern.

- Design quality is determined during the examination and tests and is documented in the certification report.
- Continued conformance to this standard is verified by the certification agency's surveillance program.
- Quality of performance is determined by field performance and by periodic re-examination and testing

5.1.2 The manufacturer shall demonstrate a quality assurance program which specifies controls for at least the following areas:

- Existence of corporate quality assurance guidelines;
- Incoming quality assurance, including testing;
- In process quality assurance, including testing;
- Final inspection and tests;
- Equipment calibration;
- Drawing and change control;
- Packaging and shipping; and
- Handling and disposition of non-conforming materials.

5.1.3 Documentation/Manual

There should be an authoritative collection of procedures and policies. It should provide an accurate description of the quality management system while serving as a permanent reference for implementation and maintenance of that system. The system should require that sufficient records are maintained to demonstrate achievement of the required quality and verify operation of the quality system.

5.1.4 Records

To assure adequate traceability of materials and products, the manufacturer shall maintain a record of all quality assurance tests performed, for a minimum period of two years from the date of manufacture

5.1.5 Drawing and Change Control

- The manufacturer shall establish a system of product configuration control that shall allow no unauthorized changes to the product. Changes to critical documents, identified in the certification report, must be reported to, and authorized by the certification agency prior to implementation for production.
- Records of all revisions to all certified products shall be maintained.

5.2 SURVEILLANCE AUDIT

5.2.1 An audit of the manufacturing facility may be part of the certification agency's surveillance requirements to verify implementation of the quality assurance program. Its purpose is to determine that the manufacturer's equipment, procedures, and quality program are maintained to ensure a uniform product consistent with that which was tested and certified.

5.2.2 Certified products or services shall be produced or provided at, or provided from, location(s) disclosed as part of the certification examination. Manufacture of products bearing a certification mark is not permitted at any other location prior to disclosure to the certification agency.

5.3 MANUFACTURER'S RESPONSIBILITIES

The manufacturer shall notify the certification agency of changes in product construction, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation.

5.4 MANUFACTURING AND PRODUCTION TESTS

Detectors rated at 30 V rms or 60 V dc and above shall be dielectric tested on 100% of production. The power leads and/or relay terminal leads and associated circuitry shall withstand, for one minute with no insulation breakdown, the application of 1000 V ac, 60 Hz, or 1400 V dc with respect to the protective ground lead. Alternatively, test potentials 20% higher may be applied for at least one second.

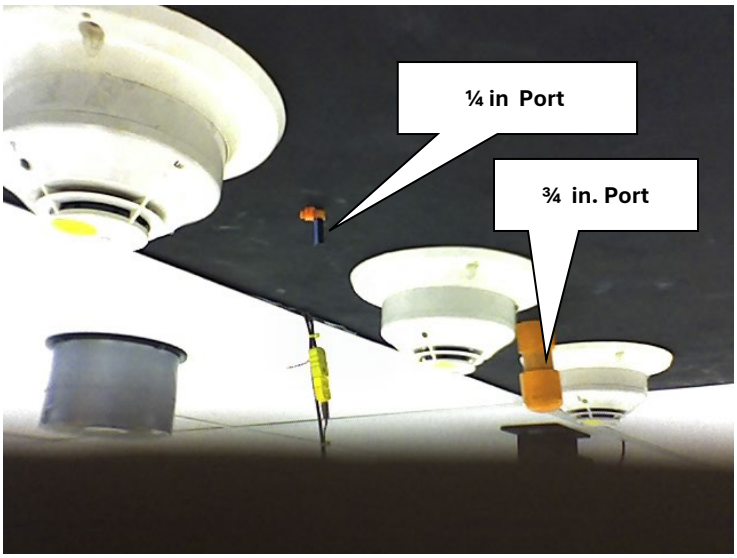
WARNING

The dielectric test required may present a hazard of injury to personnel and/or property and should be performed only under controlled conditions, and by persons knowledgeable of the potential hazards of such.

6 BIBLIOGRAPHY

ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories.

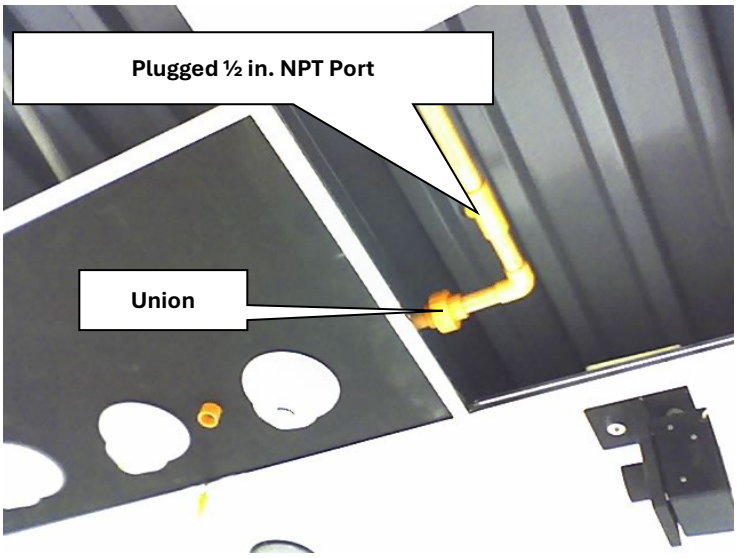
APPENDIX A: SMOKE ROOM ASPIRATING PIPE INSTALLATION



Two aspirating ports have been installed in-between the 3 standard spot detector locations.

- On the left is a small ¼ in. (approximately 5 mm) continuous flexible tube that goes straight to the control room, no T's, L's or anything to dilute the smoke.

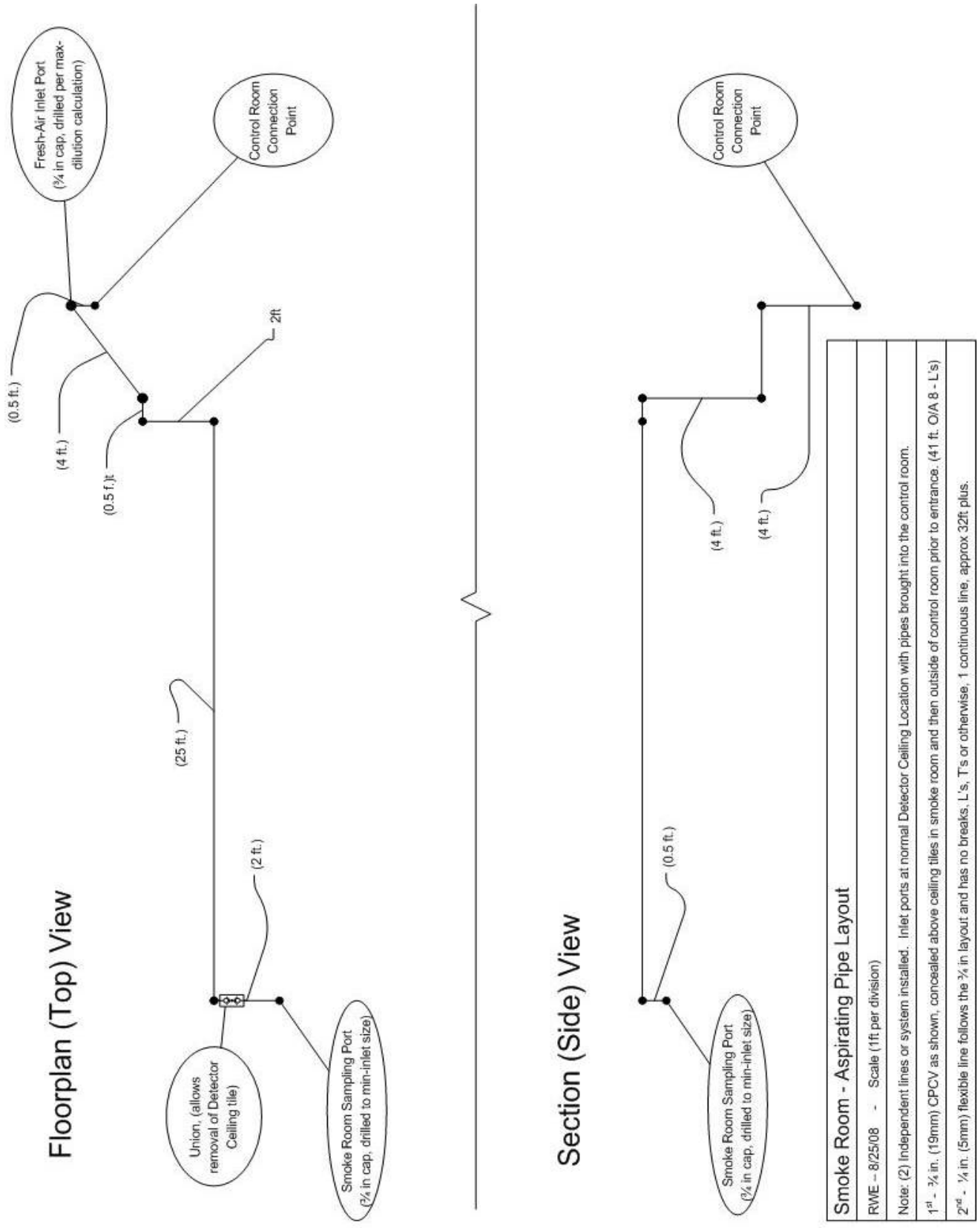
On the right is a ¾ in. (approximately 19 mm) glued hard line. The cap in the room is not glued to be removable and interchangeable for different sampling port sizes.



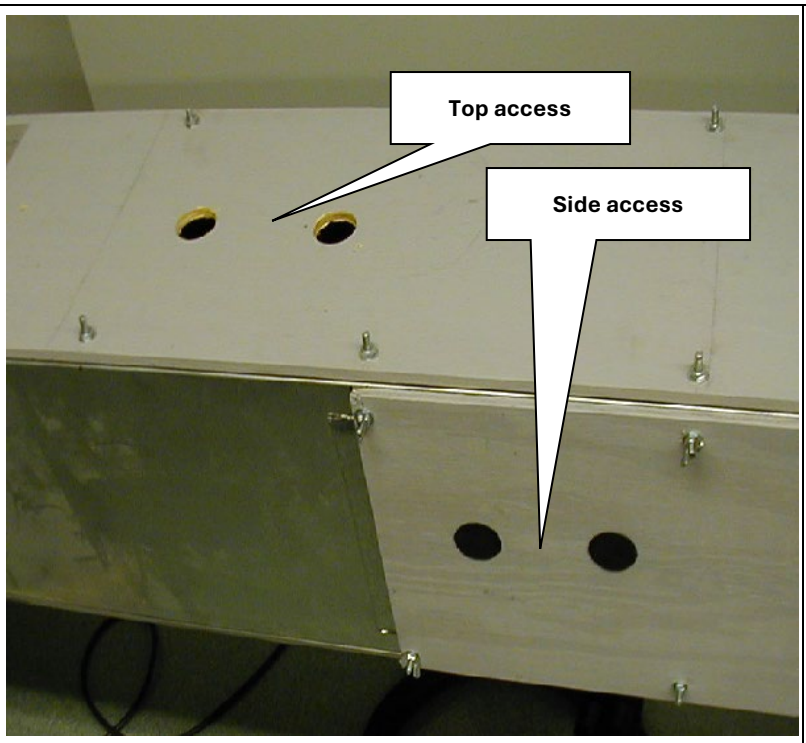
Above the tiles, you can see a union that allows removal of the detector mounting tile, if needed. Also a T with a ½ in. NPT thread (plugged) but available for some of the drops available by some aspirating manufacturers.

APPENDIX A: Smoke Room Aspirating Pipe Installation continued

	Essentially a straight run back to the control room wall, then out and down the outside of the room. Overall is around 40 ft with several L's to get to the control room. There is a T outside the smoke and control room with a removable cap. Again, adjustable for worst case dilution vs the 1 sampling port inside the room.


Floorplan (Top) View
Fresh-Air Inlet Port (¾ in cap, drilled per max-dilution calculation)
Control Room Connection Point
(0.5 ft.)
(4 ft.)
(0.5 ft.)
2ft
(25 ft.)
(2 ft.)
Union, (allows removal of Detector Ceiling tile)
Smoke Room Sampling Port (¾ in cap, drilled to min-inlet size)
Section (Side) View
Control Room Connection Point
(0.5 ft.)
(4 ft.)
(4 ft.)
Smoke Room Sampling Port (¾ in cap, drilled to min-inlet size)
Smoke Room - Aspirating Pipe Layout
RWE – 8/25/08 - Scale (1ft per division)
Note: (2) Independent lines or system installed. Inlet ports at normal Detector Ceiling Location with pipes brought into the control room.
1st - ¾ in. (19mm) CPCV as shown, concealed above ceiling tiles in smoke room and then outside of control room prior to entrance. (41 ft. O/A 8 - L's)
2nd - ¼ in. (5mm) flexible line follows the ¾ in layout and has no breaks, L's, T's or otherwise, 1 continuous line, approx 32ft plus.

APPENDIX B: DUCT ASPIRATING PIPE INSTALL



Two locations for the introduction of the aspirating tubing will be tested in conjunction with ANSI/UL 268A.

Sampling tubing will be introduced from the side and the top of the duct as shown at left.

APPENDIX C: POLYURETHANE FOAM SMOKE GENERATION

The following materials and procedures are to be used for the polyurethane smoke test. Dimensions and locations of test apparatus are intended for reference only. These are variable as long as the correct build up rates are achieved.

a. Combustible- soft polyurethane foam (density 0.025 +/-0.002 g/cc) ½"x ½" x 6 1/2" (12.7 mm x 12.7 mm x 165.1 mm).

b. Point of ignition- gas grill type butane lighter, flame to be held to the ½" x ½" end of the polyurethane block until it ignites in a self sustaining flame.

c. Smoke profile- smoke concentration is regulated by the apparatus for aspirating detector sensitivity measurements described in Appendix F.

APPENDIX D: RED OAK SMOKE GENERATION

The following materials and procedures are to be used for the red oak smoke test. Dimensions and locations of test apparatus are intended for reference only. These are variable as long as the correct build up rates are achieved.

a. Combustible- a single block of kiln dried red oak (water content 5-17%) 1" x 1" x1" (25.4 mm x 25.4 mm x 25.4 mm) with a single face in contact with the hotplate, placed on the outer diameter of the plate. Each stick is to be conditioned for not less than 48 hours at 52°C (125°F) in an air-circulating oven. The block weight is to be 7.6 ±1 grams (0.268 ±0.035 oz) following the oven conditioning. The block dimensions are variable as long as the correct smoke build up rates are achieved.

b. The hot plate is to be a 240 volt, 1550 watt hotplate having a steel plate 8-1/2 inches (216 mm) in diameter and 1/4 inch (6.4 mm) thick. The temperature of the hotplate is to be monitored by an iron-constantan No. 30 AWG (0.05mm2) (Type J) thermocouple attached to the edge of the steel plate as described in ANSI/UL 268.

c. Smoke profile- smoke concentration is regulated by the apparatus for aspirating detector sensitivity measurements described in Appendix F.

Photo of inside of smoke generation chamber

APPENDIX E: COTTON WICK SMOKE GENERATION (PARAFIN OIL SMOKE MAY BE SUBSTITUTED)

The following materials and procedures are to be used for the polyurethane smoke test. Dimensions and locations of test apparatus are intended for reference only. These are variable as long as the correct build up rates are achieved.

a. Combustible- UL wick Item # 1115S conditioned in environmental chamber/oven set to 113oF(45oC) for 72 hours, cut to 6" (152.4 mm)

b. Point of ignition- gas grill type butane lighter, flame to be held to the ½" x ½" end of the polyurethane block until it ignites in a self sustaining flame.

c. Smoke profile- smoke concentration is regulated by the ANSI/UL 268 smoke box with a sampling tube in place of the spot detector as shown below:

APPENDIX F: APPARATUS FOR ASPIRATING DETECTOR FOR FREEZER APPLICATIONS SENSITIVITY MEASUREMENTS

The apparatus depicted below is used only for testing sensitivity to smoldering red oak and smoldering polyurethane foam for aspirating detectors intended to be listed for freezer applications. It allows a wide range of adjustment of the smoke concentration and direct measurement of the concentration entering a single aspirating port of the specimen. The dilution factor is controlled by the tubing network provided by the client. In this fashion, it can generate and measure the low smoke concentrations.