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Subjects 38, 217, 228, 268, 268A, 864, 2075

333 Pfingsten Road
 Northbrook, IL 60062
 August 4, 1995

TO: Casualty Council of Underwriters Laboratories Inc.,
 Electrical Council of Underwriters Laboratories Inc.,
 Fire Council of Underwriters Laboratories Inc.,
 Subscribers to UL's Standards Service for Manually Actuated Signaling Boxes For Use
 With Fire Protective Signaling Systems; Control Units For Fire Protective Signaling
 Systems; Single and Multiple Station Smoke Detectors; Door Closers-Holders, With or
 Without Integral Smoke Detectors; Smoke Detectors for Fire Protective Signaling
 Systems; Smoke Detectors for Duct Application; and Gas Detectors and Sensors

SUBJECT: Announcement of UL's Acceptance of Submittals For Emergency Alarm System
 Components and Gas and Vapor Detectors

SUMMARY OF TOPICS

UL announces that it is prepared to receive submittals of the following equipment:

Emergency Alarm Equipment (FSVW)

Emergency Alarm System Control Units (FSZI)

Emergency Alarm System Control Units Accessories (FSYE)

Emergency Alarm Manual Pull Stations (FSXA)

Gas and Vapor Detectors (FTAM)

The above equipment is intended to be interconnected with other detection, activation and notification devices to form emergency alarm systems. These systems are designed to sense the presence of hazardous vapors, liquids or materials, or other emergency conditions. Upon recognition of an alarm condition, the control unit activates suitable output devices and alarm annunciators. Unless specifically described in the Listing of individual units, this equipment has not been investigated for use as part of a fire alarm signaling system or a security system.

These systems are intended for installation in accordance with NFPA 70, and other model codes and standards which regulate the storage, use and handling of hazardous materials.

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Subjects 38, 228, 268, 268A, 864, 2075

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August 4, 1995

Product categories have been established to cover each of the above referenced product categories. Listing of equipment will appear in the Fire Protection Equipment Directory. A description of these categories is included in Appendix A.

Manufacturers who wish to submit products for investigation should contact one of the individuals listed below.

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This Bulletin should be kept with your copy of the Standard.

UNDERWRITERS LABORATORIES INC.

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SR:AM

38BULB01

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APPENDIX A

PROPOSED PRODUCT CATEGORIES

Proposed Product Categories

Main Category

Emergency Alarm Equipment (FSVW)

This category includes equipment which is intended to operate during an emergency condition to (1) alert occupants in the area of emergencies involving unintended presence of gases or vapors in excess of specified concentrations, (2) transmit a signal to a remote location, and/or (3) activate other equipment for remedial action. Unless specifically described in the listing of individual units, this equipment has not been investigated for use as part of a fire alarm signaling system or a security system.

Listing of the following products appear in this section:

Emergency Alarm System Control Units (FSZI)

Emergency Alarm System Accessories (FSYE)

Emergency Alarm Manual Pull Stations (FSXA)

Gas and Vapor Detectors (FTAM)

In addition to evaluation for potential risks of fire and electric shock, the equipment is investigated for reliability of operation, resistance to unwanted operation, and accuracy of critical measurements, as appropriate. This investigation is conducted using the installation wiring diagrams and instruction manuals provided with the equipment as a guide.

This equipment has only been investigated for use in ordinary unclassified locations as defined in the National Electrical Code, NFPA 70. Equipment Listed for use in Classified (Hazardous) Locations is included in the Hazardous Locations Equipment Directory.

Unless otherwise noted, this equipment has only been investigated for use under normal atmospheric conditions. The gases and vapors to which the equipment is intended to respond are indicated on the equipment and the individual Listings.

The equipment is intended to be installed in accordance with the National Electrical Code, NFPA 70 and other nationally recognized codes which regulate the storage, handling and use of the materials present at the installation.

Subcategories

Emergency Alarm System Control Units (FSZI)

Units covered by this category are intended to be connected to suitable detection and/or initiating devices which are designed to sense the presence of hazardous vapors, liquids, or materials, or other emergency conditions. Upon recognition of an alarm condition, the control unit activates suitable output devices and alarm annunciators.

The installation wiring diagrams and instruction manuals provided with these control units, and referenced by drawing number and issue number or revision level in the marking of the particular unit, were used as a guide under which the units were investigated. These documents include information describing the proper installation, operation, maintenance and testing of the control unit, and identify the components, such as sensors and detectors, needed to make a complete system. The installation wiring diagram identifies the electrical supervision provided by the control unit, along with details on the standby power requirements.

A source of standby power is provided so that if primary power is interrupted, the system will continue to operate under normal standby condition for a minimum of 24 hours, followed by operation under full load alarm condition for a minimum of five minutes.

Unless otherwise noted, emergency alarm system wiring has means to be electrically supervised so that a single open or single ground on any field installed wiring which prevents required operation of the system will be indicated by an audible trouble signal.

For additional information see Emergency Alarm Equipment (FSVW).

The basic standard used to investigate these products is UL 864 "Control Units for Fire-Protective Signaling Systems."

Each control unit is identified by a model designation or equivalent, and this designation is marked on the product.

The Listing Mark of Underwriters Laboratories Inc. on the product is the only method provided by UL to identify products manufactured under its Listing and Follow-Up service. The Listing Mark for these products includes the name and/or symbol of Underwriters Laboratories Inc. (as illustrated in the Introduction of this Directory) together with the word "LISTED", a control number, and the following product name as appropriate: "Emergency Signaling Control Unit," "Emergency Signaling Control Unit Subassembly," "Emergency Signaling Control Unit Enclosure," or "Emergency Signaling Control Unit Enclosure Part."

Emergency Alarm System Accessories (FSYE)

Products covered under this category are intended for connection to an Emergency Alarm System Control Unit to form an emergency alarm system. They may be required system products or provide supplementary annunciation of alarm and trouble conditions, activate remote equipment, or provide some other system function as indicated by the installation wiring diagram applying to its application.

For additional information see Emergency Alarm Equipment (FSVW).

The basic standard used to investigate these products is UL 864 "Control Units for Fire-Protective Signaling Systems."

Each accessory is identified by a model designation or equivalent, and this designation is marked on the product. The manufacturer is required to label 100% of all production for those model designations shown in the individual listings.

The Listing Mark of Underwriters Laboratories Inc. on the product is the only method provided by UL to identify products manufactured under its Listing and Follow-Up service. The Listing Mark for these products includes the name and/or symbol of Underwriters Laboratories Inc. (as illustrated in the Introduction of this Directory) together with the word "LISTED," a control number, and the following product name: "Emergency Signaling Equipment Accessory," "Emergency Signaling Equipment Accessory Subassembly," "Emergency Signaling Equipment Accessory Enclosure," or "Emergency Signaling Equipment Accessory Enclosure Part."

Emergency Alarm Manual Pull Stations (FSXA)

Products covered under this category are intended to be manually activated by trained personnel in the event of any emergency condition, other than a potential fire condition, to signal the existence of an emergency condition to an emergency alarm system control unit.

These units are marked "Emergency" or "Emergency Alarm" and do not include a "Fire" or "Fire Alarm" marking.

For additional information see Emergency Alarm Equipment (FSWW).

The basic standard used to investigate these devices is UL 38 "Manually Actuated Signaling Boxes for Use with Fire Protection Signaling Systems."

Each product is identified by a model designation or equivalent, and this designation is marked on the product.

The Listing Mark of Underwriters Laboratories Inc. on the product is the only method provided by UL to identify products manufactured under its Listing and Follow-Up service. The Listing Mark for these products includes the name and/or symbol of Underwriters Laboratories Inc. (as illustrated in the Introduction of this Directory) together with the word "LISTED," a control number, and the following product name: "Emergency Alarm Box."

Gas and Vapor Detectors (FTAM)

Units covered under this category are intended to be used to detect the presence of gases and vapors in the area in which they are installed. The gases and vapors that have been investigated for use with these detectors are described in the individual Listings, along with the extent of the areas protected by individual detectors.

This equipment has only been investigated for use in ordinary unclassified locations as defined in the National Electrical Code, NFPA 70. Detectors investigated for use in (1) atmospheres which might contain an ignitable mixture of flammable vapors, (2) atmospheres containing a vapor mixture which might be subject to detonation or explosive deflagration, and (3) Classified (Hazardous) Locations are included in the Hazardous Location Equipment Directory.

The installation wiring diagrams and instruction manuals provided with these detectors were used as a guide under which the units were investigated. These documents include information describing the proper installation, operation, maintenance and testing of the detector.

This category does not cover portable gas detectors intended for use in Classified (Hazardous) Locations. See the Hazardous Location Equipment Directory, category (JTPX), for details on these detectors. Single and multiple station carbon monoxide detectors are covered in the Electrical Appliance and Utilization Equipment Directory, category (CZHF). Gas detectors, residential and recreational vehicles are also covered in the Electrical Appliance and Utilization Equipment Directory, category (JKIS).

For additional information see Emergency Alarm Equipment (FSWW).

Markings – The detectors are marked where clearly visible after installation with the gases with which they were investigated, along with concentration levels at which the units generate an alarm signal. Markings also identify the gas detectors installation wiring diagram by document number, and version number or revision date.

Trip Levels – These detectors have been investigated to ensure that they consistently trip at levels with (+/-) 5% of the gas concentration levels indicated in the individual installation wiring diagrams.

Units used to detect ignitable air-vapor mixtures are capable of activating an alarm signal at 25% of the Lower Explosive Limit (LEL) for the vapors to be detected, or less. Units designed to detect toxic vapors or vapors which present a health hazard to the user are capable of alarm activation at 50% of the Immediately Dangerous for Life and Health (IDLH) level or less, as established in the following documents.

Permissible Exposure Limits (PEL'S) "Federal Register, Code of Federal Regulations 29. CFR, subpart Z". Published 7-1-94 (Annually; every July)

Threshold Limit Values (TLV'S) "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices" Published Annually (1994-1995) by American Conference of Governmental Industrial Hygienist.

Indoor Air Values "Ventilation for Acceptable Indoor Air Quality" "Published 1989, by American Society of Heating and Refrigeration Engineers (A.S.H.R.E.).

Recommendation Exposure Limits (REL's) "Recommendations for Occupation and Safety Health Compendium of Policy Documents and Statements." Published 1-92, Publication No. 92-100 by National Institute of safety Health (N.I.O.S.H.)

System Gas Detectors and Sensors are intended to be connected to an emergency alarm system control unit, which is used to generate a system alarm signal upon sensing an alarm condition from the gas detector. The detectors (Gas Detector) may operate by activating a signal at a given concentration of vapor, or (Gas Sensor) may transmit information defining the concentration level to the control unit, which in turn determines when to generate a system alarm signal. Detectors which transmit concentration level information have only been investigated with compatible control units as shown in individual Listings.

The basic standard used to investigate these devices is the proposed UL 2075 "Gas Detectors and Sensors."

Each unit is identified by a model designation or equivalent, and this designation is marked on the product.

The Listing Mark of Underwriters Laboratories Inc. on the product is the only method provided by UL to identify products manufactured under its Listing and Follow-Up service. The Listing Mark for these products includes the name and/or symbol of Underwriters Laboratories Inc. (as illustrated in the Introduction of this Directory) together with the word "LISTED," a control number, and one of the following product names: "Gas Detector," or "Gas Sensor."

**Underwriters Laboratories Inc.®**A not-for-profit organization dedicated to public safety
and committed to quality service**April 15, 1994****Revision pages for****Standard for****Smoke Detectors for Duct Application****UL 268A, Second Edition**

Attached to this transmittal notice is a reprinted title page for the second edition of UL 268A.

Attention is directed to the note on the title page of this standard outlining the procedure to be followed to retain the approved text of ANSI/UL 268A-1994.

Revised and/or additional pages may be issued from time to time.

With the inclusion of the accompanying material, the standard consists of pages dated as shown in the following checklist:

Page	Date
1	March 31, 1993 (Reprinted April 15, 1994)
2 – 62, SA1 – SA9, SB1 – SB8, A1, B1	March 31, 1993

MARCH 31, 1993

(Title Page Reprinted: April 15, 1994)



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UL 268A**Standard for****Smoke Detectors for Duct Application**

Some requirements specified in this standard were previously covered in the Standard for Combustion Products Type Smoke Detectors for Fire Protective Signaling Systems, UL 167, and Photoelectric Type Smoke Detectors for Fire Protective Signaling Systems, UL 168.

First Edition – May, 1983

Second Edition**March 31, 1993**

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated March 31, 1993. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the ANSI approved text.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Approved as ANSI 268A-1985, March 22, 1985

Approved as ANSI 268A-1994, January 20, 1994

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest published set of revision pages.

ISBN 1-55989-378-8**COPYRIGHT © 1983, 1994 UNDERWRITERS LABORATORIES INC.**

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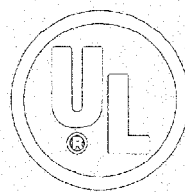
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Smoke Detectors for Duct Application



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Standard



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UL Standards for Safety are developed under a procedure which provides for participation and comment from the affected public as well as industry. The procedure takes into consideration a survey of known existing standards and the needs and opinions of a wide variety of interests concerned with the subject matter of the standard. Thus manufacturers, consumers, individuals associated with consumer-oriented organizations, academicians, government officials, industrial and commercial users, inspection authorities, insurance interests and others provide input to UL in the formulating of UL Standards for Safety, to keep them consonant with social and technological advances.

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March 31, 1993

Standard for

Smoke Detectors for Duct Application

UL 268A, Second Edition

Accompanying this transmittal notice is a copy of the second edition of UL 268A.

THIS EDITION OF THE STANDARD IS NOW IN EFFECT.

Revised and/or additional pages may be issued from time to time.

Subscribers to UL's services in the area covered by this standard will receive these revised and/or additional pages automatically. Others may receive such pages by subscribing to UL's subscription service for revisions. See UL's CATALOG OF STANDARDS FOR SAFETY for a description of the revision subscription service, the cost of the service for this standard, and ordering information.

MARCH 31, 1993

1

UL 268A

Standard for

Smoke Detectors for Duct Application

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First Edition – May 27, 1983

Second Edition

March 31, 1993

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ISBN 1-55989-378-8

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements cover air duct smoke detectors intended for indoor use within or protruding into a duct, or mounted in a housing with sampling tubes extending into or traversing a duct. Air duct smoke detectors are intended to be installed in ducts where the maximum air temperature inside the duct does not exceed 100°F (38°C), in accordance with the Standard for Automatic Fire Detectors, NFPA 72E, and the Standard for the Installation of Air Conditioning and Ventilating Systems, NFPA 90A.

1.2 An air duct smoke detector unit, as covered by these requirements, is intended to detect smoke for the primary purpose of controlling blowers and dampers of air conditioning and ventilating systems to reduce the risk of panic and damage from distribution of smoke and gaseous products. Each unit consists of an assembly of electrical components, including a sensing means to detect smoke (sensing head or projected beam assembly), sampling tubes or equivalent (depending on design), provision for connection to a source of power, and means for generating a signal when smoke is detected. Optional remote control circuits may also be provided. A detector may be powered from a commercial power source, separate power supply, or may be connected to a control unit as part of a fire protection signaling system. Duct detectors are not intended as a substitute for open area protection.

1.3 These requirements cover detectors:

- a) Intended to control air conditioning and ventilating systems,
- b) Intended for control of releasing devices, such as fire and smoke dampers and the like, or
- c) Both (a) and (b).

1.4 These requirements do not cover:

- a) Control units that are covered by the Standard for Control Units for Fire Protective Signaling Systems, UL 864, to which the air duct smoke detectors may be connected.
- b) Single and multiple station smoke detectors covered by the Standard for Single and Multiple Station Smoke Detectors, UL 217.
- c) Smoke detectors intended for open area protection or releasing device service, or both, covered by the Standard for Smoke Detectors for Fire Protective Signaling Systems, UL 268.
- d) Smoke detectors integral with combination door closers and holders, covered by the requirements for door closers, holders, and integral smoke detectors, UL 228.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.1.2 A component need not comply with a specific requirement that:

- a) Involves a feature or characteristic not needed in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

2.1.3 A component shall be used in accordance with its recognized rating established for the intended conditions of use.

2.1.4 Specific components are recognized as being incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions for which they have been recognized.

2.2 Units of measurement

2.2.1 If a value of measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

2.2.2 Unless otherwise indicated, all voltage and current values mentioned in this standard are rms.

2.3 Undated references

2.3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

3 Glossary

3.1 For the purposes of this standard, the following definitions apply.

3.2 COMBINATION SMOKE DETECTOR — A smoke detector that employs more than one smoke detecting means in one unit. In a combination smoke detector either each principle predominates, or contributes in response to at least one of the fire tests described in Fire Tests, Section 36.

3.3 COMPONENT, LIMITED-LIFE — A component that is expected to malfunction and be periodically replaced, and the malfunction of which is supervised if malfunction of the component affects detector operation or sensitivity or both.

3.4 COMPONENT, RELIABLE — A component that is not expected to malfunction or be periodically replaced and therefore is not supervised. A reliable component has a predicated failure rate of 2.5 or less failures per million hours. See Supplement SA.

3.5 PROJECTED BEAM TYPE SMOKE DETECTOR — A device consisting of a separate light source that projects a beam of light across the area to be protected, and a light-sensing receiver. Smoke between the light source and receiver reduces the amount of light reaching the receiver and activates the smoke detector.

3.6 SPOT TYPE SMOKE DETECTOR — A device with the detecting element concentrated at a particular location. A spot type detector is usually employed with a velocity shield or within a duct housing, and serves as the smoke sensing component.

3.7 TROUBLE SIGNAL — A visual or audible signal intended to indicate a fault or trouble condition, such as opening or shorting of a component in the detector or opening or grounding of the connected wiring.

3.8 VOLTAGE CIRCUITS: (For purposes of this standard only)

- a) Low-Voltage Circuit — A circuit involving a potential of not more than 30 volts ac (42.4 volts peak or dc), and supplied from a circuit that is limited to a maximum of 100 volt-amperes.
- b) Line-Voltage Circuit — A circuit having characteristics in excess of those of a low-voltage circuit.

4 Installation and Operating Instructions

4.1 A copy of the schematic wiring diagram, installation drawing and operating instructions, intended to accompany each smoke detector, or equivalent information, are to be used as a guide in the examination and test of the detector. For this purpose, a printed edition is not required.

4.2 The instructions and drawings are to include such directions and information as deemed necessary by the manufacturer for the intended installation, testing, maintenance, operation, and use of the detector. See Installation Wiring Diagram, Section 55, and Technical Bulletin, Section 56.

CONSTRUCTION

5 Enclosure

5.1 General

5.1.1 An electrical part of a product shall be enclosed so as to reduce the risk of contact with uninsulated live parts. A separate enclosure for field-wiring terminals that will be enclosed by a back box is not required.

5.1.2 Enclosures for individual electrical components, outer enclosures, and combinations of the two are to be considered in determining compliance with the requirement in 5.1.1.

5.1.3 An enclosure of an air duct smoke detector assembly shall resist total or partial collapse with the subsequent reduction of spacings, loosening or displacement of parts, and other defects, that alone or in combination may result in a risk of fire, electric shock, or injury to persons, or affect operation.

5.1.4 An enclosure of an air duct smoke detector shall be provided with means for mounting in the intended manner. Any fittings, such as brackets, hangers, or the like, necessary for mounting shall be furnished with the detector. The mounting means shall be accessible without disassembling any operating part of the assembly. The removal of a completely assembled panel, cover, sensing head, or equivalent, to mount the assembly is not considered to be disassembly of any operating part.

5.1.5 With reference to the requirements of 5.1.4, the sensing area unit may be installed remote from the sampling tube assembly, provided that air-tight metal-protected tubing and compatible fittings are employed.

5.2 Cast metal enclosures

5.2.1 The thickness of cast metal used for an enclosure shall be as specified in Table 5.1. Cast metal having a thickness 1/32 inch (0.8 mm) less than that specified in Table 5.1 may be employed if the surface under consideration is curved, ribbed, or otherwise reinforced, or if the shape, size, or both, of the surface is such that the mechanical strength is equivalent to that of material specified in Table 5.1.

5.2.2 If threads for the connection of conduit are tapped all the way through a hole in a metal enclosure wall, there shall not be less than 3-1/2 nor more than five threads in the metal, and the construction shall be such that a standard conduit bushing can be attached.

5.2.3 If threads for the connection of conduit are tapped only part of the way through a hole in an enclosure wall, there shall be a smooth, rounded inlet hole for the conductors that shall afford protection to the conductors equivalent to that provided by a standard conduit bushing.

5.3 Sheet metal enclosures

5.3.1 The thickness of sheet metal for an enclosure shall not be less than that specified in Table 5.2.

Exception: Sheet metal of lesser thickness may be employed if the surface under consideration is curved, ribbed, or otherwise reinforced, or the shape, size, or both, of the surface provides mechanical strength equivalent to that provided by the values of Table 5.2.

5.3.2 Sheet metal shall be not less than 0.032 inch thick (0.81 mm) if of uncoated steel, not less than 0.034 inch (0.86 mm) if of galvanized steel, and not less than 0.045 inch (1.14 mm) if of nonferrous metal at any point where conduit or metal-cable is to be attached.

5.3.3 A ferrous plate or plug closure for an unused conduit opening or other hole in the enclosure having a 1-3/8 inch (34.9 mm) diameter maximum dimension shall have a thickness not less than 0.027 inch (0.69 mm) for steel or 0.032 inch (0.81 mm) for nonferrous metal.

Table 5.1
Cast-metal enclosures

Use, or dimensions of area involved	Minimum thickness, inch (mm)			
	Die-cast metal		Cast metal of other than the die-cast type	
Area of 24 square inches (155 cm ²) or less and having no dimension greater than 6 inches (152 mm)	1/16 ^a	(1.6)	1/8	(3.2)
Area greater than 24 square inches (155 cm ²) or having any dimension greater than 6 inches (152 mm)	3/32	(2.4)	1/8	(3.2)
At a threaded conduit hole	1/4	(6.4)	1/4	(6.4)
At an unthreaded conduit hole	1/8	(3.2)	1/8	(3.2)

^a The area limitation for metal 1/16 inch (1.6 mm) in thickness may be obtained by reinforcing ribs subdividing a larger area.

5.3.4 A closure for a hole larger than 1-3/8 inch (34.9 mm) diameter shall either have a thickness equal to that required for the enclosure of the detector or a standard knockout seal shall be used. Such plates or plugs shall be securely mounted.

5.3.5 A knockout in a sheet metal enclosure shall be secured, and shall be removable without permanent deformation of the enclosure.

5.3.6 A knockout shall be provided with a surrounding surface for seating of a conduit bushing, and shall be located so that installation of a bushing at any knockout likely to be used during installation will not result in spacings between uninsulated live parts and the bushing of less than those required in (Spacings) General, Section 23.

Table 5.2
Sheet metal enclosures

Maximum dimensions of enclosure				Minimum thickness, Inch (mm)							
Length or width		Area		Steel				Brass		Aluminum	
Inch	(mm)	Inch ²	(cm ²)	Zinc-coated		Uncoated					
12	(305)	90	(581)	0.034	(0.86)	0.032	(0.81)	0.0428	(1.09)	0.0438	(1.11)
24	(610)	360	(2322)	0.045	(1.14)	0.042	(1.07)	0.0561	(1.42)	0.0571	(1.45)
48	(1219)	1200	(7742)	0.056	(1.42)	0.053	(1.35)	0.0708	(1.80)	0.0728	(1.85)
60	(1524)	1500	(9678)	0.070	(1.78)	0.067	(1.70)	0.0919	(2.33)	0.0919	(2.33)
Over 60		Over 1500		0.097	(2.46)	0.093	(2.36)	0.1185	(3.01)	0.1195	(3.04)

5.4 Nonmetallic enclosures

5.4.1 An enclosure or parts of an enclosure of nonmetallic material shall have sufficient mechanical strength to comply with Tests of Polymeric Materials, Section 49, and Tests of Elastomeric Materials, Section 50.

5.4.2 Openings in an enclosure for line-voltage circuits, including perforated holes, louvers, and openings protected by means of wire screening, expanded metal, or a perforated cover, shall be of such size or shape and so arranged that a probe, as illustrated in Figure 5.1, cannot be made to contact any line-voltage, uninsulated live electrical parts when inserted through the opening in a straight or articulated position.

5.4.3 An enclosure for a fuse(s) or other overload protective device that is provided with openings shall afford protection against the emission of flame or molten metal.

5.4.4 Openings provided to permit cleaning shall be such that no damage to functional internal components will occur during such cleaning operations.

5.4.5 Perforated sheet metal and sheet metal employed for expanded metal mesh shall be not less than 0.042 inch (1.07 mm) thick if uncoated, and not less than 0.046 inch (1.17 mm) if zinc coated.

Exception: If the indentation of the guard or enclosure will not alter the spacing between uninsulated live parts and grounded metal so as to reduce spacings below the minimum value required, 0.021 inch (0.53 mm) expanded metal mesh or perforated sheet metal [0.024 inch (0.61 mm) if zinc coated] may be employed under the following conditions:

- a) *The exposed area on any one side or surface of the product is not more than 72 square inches (464 cm²) and has no dimension greater than 12 inches (305 mm) or*
- b) *The width of an opening so protected is not greater than 3-1/2 inches (88.9 mm).*

5.4.6 The wires of a screen protecting line-voltage current-carrying parts shall be not smaller than No. 16 AWG (1.3 mm²), and a screen opening shall be not larger than 1/8 square inch (0.81 mm²) in area.

5.5 Covers

5.5.1 An enclosure cover or door of an air duct smoke detector shall be hinged, sliding, pivoted, or similarly attached if:

- a) It provides ready access to circuit protective devices that require renewal, such as fuses or circuit breakers, or
- b) It is necessary to periodically open the cover in connection with the intended operation of the assembly.

For the purpose of this requirement, intended operation is considered to be operation of a switch for testing, connection of equipment to measure air flow through the assembly, or operation of any other component of the assembly that requires such action in connection with its intended performance.

5.5.2 A cover that is intended to be removed only for periodic cleaning of the sensing chamber or replacement of a lamp may be secured by any one of the following equivalent means: positive snap catch, plug-in or twist action, snap tab with two screws, or four screws.

Exception: A ready-access cover or door is not required where the only circuit protective device(s) enclosed is intended to provide protection to portions of internal circuits to prevent excessive circuit damage resulting from a fault. The outside of an assembly employing line-voltage circuits shall be marked with the word "DANGER" and the following or equivalent text: "Risk of Electric Shock. Disconnect Power Prior to Servicing." This marking is not required where only low-voltage circuits are involved.

5.5.3 A hinged cover shall be provided with a latch, screw, or catch to hold it closed. An unhinged cover shall be held in place by screws or the equivalent.

5.6 Glass panels

5.6.1 Glass covering an opening in an enclosure shall be held in place so that it will not be displaced in service and shall provide mechanical protection of the enclosed parts. The thickness of a glass cover shall be not less than that indicated in Table 5.3.

Table 5.3
Thickness of glass covers

Maximum size of opening				Minimum thickness	
Length or width		Area			
Inch	(mm)	Inch ²	(cm ²)	Inch	(mm)
4	(102)	16	(103)	1/16	(1.6)
12	(305)	144	(929)	1/8	(3.2)
Over 12	(305)	Over 144	(929)	a	

^a 1/8 inch (3.2 mm) or more, depending upon the size, shape, and mounting of the glass panel. A glass panel for an opening having an area of more than 144 square inches (929 cm²), or having any dimension greater than 12 inches (305 mm), shall be supported by a continuous groove not less than 3/16 inch (4.8 mm) deep along all four edges of the panel.

5.6.2 A glass panel for an opening having an area of more than 144 square inches (929 cm²), or having any dimension greater than 12 inches (305 mm), shall be supported by a continuous groove not less than 3/16 inch (4.8 mm) deep along all four edges of the panel.

5.6.3 A transparent material other than glass employed as a cover over an opening in an enclosure shall have mechanical strength equivalent to that of glass and not distort or become less transparent at the temperature to which it may be subjected under all anticipated conditions of use.

5.6.4 The transparency of a lens, light filter, or similar part of an air duct smoke detector shall not be affected by service conditions as represented by the tests described in the Performance sections of this standard.

6 Remote Accessories

6.1 General

6.1.1 Unless specifically indicated otherwise, the construction requirements specified for a duct detector shall apply also for any accessories intended to be employed with the detector.

6.2 Sensitivity indicating means

6.2.1 A detector shall be provided with a means for measuring or indicating the nominal sensitivity or sensitivity range of the detector, as described in 6.2.2, or with a sensitivity test feature, as described in 6.2.3, after it has been installed as intended. Removal of a snap-on cover to gain access to the sensitivity control is not acceptable, if high-voltage parts are exposed or can be contacted by the user.

6.2.2 The measuring or indicating means may be: a jack or terminals for connection of a meter, a visual indication such as a change in frequency of a pulsing light which would be visible with the detector installed, a mechanical device as described in 6.2.3, or an equivalent arrangement. The use of an adapter that is connected to metering equipment, and that can be inserted between the base and plug-in head of a detector assembly, is acceptable. A plug-in type detector that may be readily removed and connected to metering equipment is also acceptable.

6.2.3 The test feature may consist of an electrical or mechanical means to simulate a specified level of smoke in the detector sensing chamber. The test feature is to be calibrated to simulate gray smoke having an obscuration of not more than 6 percent per foot [0.027 optical density per foot (OD/ft) (0.088 OD/m)] using gray smoke as measured in the sensitivity test smoke box referenced in 53.1(a)(1).

6.2.4 A detector that incorporates a variable sensitivity control intended to be field adjusted shall have a mechanical stop on the adjusting means at the maximum and minimum settings.

6.3 Radioactive materials

6.3.1 The manufacture, importation, distribution, marking, and disposal of smoke detectors containing radioactive material are subject to the safety requirements of the U. S. Nuclear Regulatory Commission, of local or state radiation control agencies, or of both.

6.3.2 Verification of the compliance of such detectors with the requirements of the regulating agency involved shall be established prior to, or may be established concurrently with, the establishment of compliance with the requirements of this standard.

7 Air Flow Monitoring

7.1 General

7.1.1 To corroborate the operation of the detector during the Fire Tests, Section 36, and to verify intended operation after field installation, a duct detector employing sampling tubes or other arrangement to divert air flow from the duct to a sensing area inside the duct housing shall be provided with a means or instructions for measuring the air flow in the sensing area or for measuring pressure differential between sampling tubes, or equivalent. See 54.7 for marking information required.

7.1.2 The measuring or indicating means may be metering equipment, visual indicators, operation of a mechanical device, or an equivalent arrangement.

7.1.3 The air flow or pressure measurement shall apply through the entire range of air velocities and tube lengths with which the detector is to be employed in service. See Fire Tests, Section 36. To simulate the use of a length of sampling tube longer than 1 foot (0.30 m), the total hole area of the longest tube to be employed in service is to be drilled into the tube under test using the same size holes spaced equal distances apart.

7.2 Alignment and secureness

7.2.1 Sampling tubes shall be provided with positive alignment means, such as a pin/slot arrangement or equivalent, to prevent turning. The use of only a lock washer is not acceptable.

8 Protection Against Corrosion

8.1 Iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means.

Exception: Parts made of stainless steel, polished or treated if necessary, do not require additional protection.

8.2 The requirement of 7.1.1 applies to all enclosures, whether of sheet steel or cast iron, and to all springs and other parts upon which operation may depend. It does not apply to minor parts, such as washers, screws, bolts, and the like, if the corrosion of such unprotected parts would not affect the intended operation of the product.

8.3 Bearing surfaces shall be of materials that are not likely to bind as a result of corrosion.

8.4 Metals shall not be used in combinations that will cause galvanic action to the extent that the intended function of cabinets or enclosures will be affected.

8.5 Hinges and other attachments shall be resistant to corrosion.

8.6 Nonferrous cabinets and enclosures may be employed without corrosion protection.

9 Field-Wiring Connections

9.1 General

9.1.1 An air duct smoke detector shall be provided with wiring terminals or leads for the connection of conductors of at least the size required by the National Electrical Code, ANSI/NFPA 70, corresponding to the electrical rating of the system.

9.1.2 Duplicate terminals or leads, or an equivalent arrangement, shall be provided for connection to the alarm initiating device circuit of a system control unit when specified, one for each incoming and one for each outgoing wire. In addition, terminals intended only for connection to an initiating device circuit of a system control unit shall be marked in accordance with 55.3(e).

9.2 Field wiring compartment

9.2.1 The field wiring compartment area shall be large enough to allow for the completion of all field wiring connections specified by the installation wiring diagram. There shall be space within the compartment to permit the use of a standard conduit bushing on conduit connected to the compartment if a bushing would be required for installation.

9.2.2 An enclosure shall have provision for the connection of metal-clad cable, conduit, or nonmetallic sheathed cable.

Exception: An enclosure without such provision may be acceptable if instructions are provided that indicate the sections of the enclosure that are intended to be drilled in the field for the connection of raceways, or if the assembly is intended for mounting on an outlet box.

9.2.3 An outlet box or compartment in which field wiring connections are to be made shall be located so that the connections may be inspected after the system is installed as intended. The removal of not more than two mounting screws, or an equivalent arrangement, to view the field wiring connections, is considered to comply with this requirement.

9.3 Field wiring terminals

9.3.1 Terminal parts to which field connections are to be made shall consist of binding screws with terminal plates having upturned lugs, or equivalent means, to hold the wires in position.

9.3.2 If a wire-binding screw is employed at a field wiring terminal, the screw shall be not smaller than a No. 6 (3.5 mm diameter). The screw may be plated steel.

9.3.3 A terminal plate tapped for a wire-binding screw shall be of a nonferrous metal not less than 0.030 inch (0.76 mm) thick and shall have not less than two full threads in the metal. See 9.3.5.

9.3.4 A terminal plate may have the metal extruded at the tapped hole for the binding screw so as to provide two full threads. Other constructions may be employed if they provide equivalent security.

9.3.5 If more than one conductor is to be connected to the same terminal, a nonferrous intervening washer shall be provided for each additional conductor.

Exception: If the conductors are separated and secured under a common clamping plate, a separator washer is not required.

9.4 Field wiring leads

9.4.1 Leads provided for field connections shall be not less than 6 inches (152 mm) long, provided with strain relief, and not smaller than No. 18 AWG (0.82 mm²). Rubber or thermoplastic insulation shall be not less than 1/32 inch (0.8 mm) thick, or equivalent.

9.5 Grounding terminals and leads

9.5.1 A line-voltage air duct smoke detector, that:

- a) Is provided with an overall nonmetallic enclosure and cover,
- b) Is intended to be internally serviced, and
- c) Employs internal dead metal parts that can become energized under a fault condition,

shall have an equipment grounding terminal or lead or the equivalent.

9.5.2 An equipment grounding terminal or lead is not required for:

- a) A low-voltage detector,
- b) A line-voltage detector that is provided with an overall nonmetallic enclosure and cover and that:
 - 1) Is not intended to be internally serviced; or
 - 2) Does not employ internal dead metal parts that may be energized under a fault condition and can be contacted during servicing, or dead metal parts that are insulated; or
 - 3) Includes internal dead metal parts that can be contacted during servicing, but employs a two-pole disconnect switch that de-energizes both legs of the supply circuit upon removal of the cover.

9.5.3 The grounding means shall be connected to all exposed dead metal parts that are likely to become energized and all dead metal parts within the enclosure that are exposed to contact during servicing and maintenance. See Bonding for Grounding, Section 11.

9.5.4 The surface of an insulated lead intended solely for the connection of an equipment grounding conductor shall be green, with or without one or more yellow stripes; and no other lead visible to the installer, other than grounding conductors, shall be so identified.

9.5.5 A field wiring terminal intended for connection of an equipment grounding conductor shall be plainly identified, such as by being marked "G," "GR," "Ground," "Grounding," or the equivalent, or by a marking on a wiring diagram provided on the detector. The field wiring terminal shall be located so that it is unlikely to be removed during servicing or installation of the assembly.

9.6 Grounded supply terminals and leads

9.6.1 A field wiring terminal for the connection of the grounded supply conductor of a line-voltage circuit shall be identified by means of a metallic plated coating substantially white in color and shall be readily distinguishable from the other terminals; or identification of the terminal for the connection of the grounded conductor shall be shown in some other manner, such as on an attached wiring diagram.

9.6.2 A field wiring lead provided for connection of the grounded supply conductor of a line-voltage circuit shall be finished to show a white or natural gray color and shall be readily distinguishable from other leads and no other leads visible to the installer, other than grounded conductors, shall be so identified.

9.6.3 A terminal or lead identified for the connection of the grounded supply conductor shall not be electrically connected to a single-pole manual switching device that has an OFF position or to a single-pole nonthermal overcurrent-protective device.

9.7 Isolated (nongrounded) detectors

9.7.1 If an air duct smoke detector is constructed so that the exposed metal enclosure serves as a current-carrying part of the circuit, an insulated (nonmetallic) mounting plate, or a metal mounting plate with insulated bushed holes through which metal mounting screws would be employed, or an equivalent arrangement, shall be provided for installation between the detector current-carrying parts and metal back box.

9.7.2 The arrangement described in 9.7.1 is permitted only on a detector intended for connection to a low-voltage circuit. In addition, the detector shall be marked adjacent to the detector wiring area with the word "CAUTION," and the following or the equivalent text, in letters at least 1/8 inch (3.2 mm) high: "INSTALL ENCLOSURE ISOLATED FROM GROUND ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS AND USING HARDWARE PROVIDED. GROUNDING COULD RESULT IN A FALSE ALARM OR NONOPERATION."

10 Internal Wiring

10.1 General

10.1.1 The internal wiring of an air duct smoke detector shall consist of conductors having insulation rated for the potential and temperatures to which they may be subjected, and shall have the ampacity required for the service.

10.1.2 The wiring shall be routed away from moving parts and sharp projections and held in place with clamps, ties, or the equivalent, unless the wiring is sufficiently rigid to retain a shaped form under all conditions of intended use.

10.1.3 Leads or a cable assembly connected to parts mounted on a hinged cover shall be of sufficient length so that the cover can fully open without applying stress to the leads or their connections. The leads shall be secured, arranged, or both, to prevent abrasion of insulation and jamming between parts of the enclosure.

10.1.4 If the use of a short length of insulated conductor is not feasible, such as a short coil lead or the like, electrical insulating tubing may be employed. The tubing shall not be subjected to sharp bends, tension, compression, or repeated flexing, and shall not contact sharp edges, projections, or corners. The wall thickness of the tubing shall comply with requirements for electrical insulating tubing, except that the wall thickness of polyvinyl chloride tubing of 3/8 inch (9.5 mm) diameter or less shall be not less than 0.017 inch (0.43 mm). For insulating tubing of other types, the wall thickness shall be at least that having mechanical strength, dielectric properties, and heat and moisture resistance characteristics equivalent to polyvinyl chloride tubing having a wall thickness of 0.017 inch.

10.1.5 Internal wiring of circuits operating at different potentials shall be separated by barriers or shall be segregated, unless the conductors of the circuits of lower voltage are provided with insulation equivalent to that required for the highest voltage involved. Segregation of insulated conductors may be accomplished by clamping, routing, or by an equivalent means that maintains separation under all conditions of anticipated use.

10.1.6 Stranded conductors clamped under a wire binding screw or under a similar part shall have the individual strands soldered together or shall be equivalently arranged to provide reliable connections.

10.2 Wireways

10.2.1 Wireways shall be smooth and free from sharp edges, burrs, fins, and moving parts that may cause abrasion of the conductor insulation.