

Northbrook, Illinois • (708) 272-8800
 Melville, New York • (516) 271-6200
 Santa Clara, California • (408) 985-2400
 Research Triangle Park,
 North Carolina • (919) 549-1400



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.

A not-for-profit organization
 dedicated to public safety and
 committed to quality service.

AVA Documents
 Document Sharing Hub

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

-2-

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.

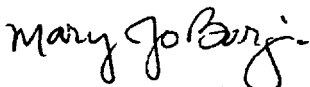
UL NORTHBROOK, IL OFFICE
333 Pfingsten Road
Northbrook, IL 60062-2096
Telephone: 708-272-8800
Fax: 708-509-6244
Larry Shudak – Control Equipment
Extension: 42791

UL SANTA CLARA, CA OFFICE
1655 Scott Blvd.
Santa Clara, CA 95050-4169
Telephone: 408-985-2400
Fax: 408-296-3256
Bill Barry – Control Equipment
Extension: 32084

Lou Chavez – Initiating Devices
Extension: 43238

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

UNDERWRITERS LABORATORIES INC.



MARY JO BORJA (Ext. 42281)
Associate Project Engineer
Standards Department

REVIEWED BY:



PAUL PATTY (Ext. 42752)
Associate Managing Engineer
Engineering Services 417A

SR:AM

38BUL.B01



Documents

Document Sharing Hub

APPENDIX A

PROPOSED PRODUCT CATEGORIES



Documents

Document Sharing Hub

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, NPFA 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, NPFA 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 (FSVW).

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 (FSVW).

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

November 23, 1994

Revision pages for

Standard for

Manually Actuated Signaling Boxes for Use With Fire-Protective Signaling Systems

UL 38, Sixth Edition

Attached to this transmittal notice is a revision of the sixth edition of UL 38.

A CHANGE ON A PAGE DATED NOVEMBER 23, 1994 IS INDICATED BY A SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEM, PRECEDED AND FOLLOWED BY AN ASTERISK.

THESE NEW AND REVISED REQUIREMENTS ARE NOW IN EFFECT.

The new and revised requirements are substantially in accordance with UL's bulletin on this subject dated June 27, 1994. The bulletin is now obsolete and may be discarded.

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 38-1993.

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	January 27, 1994 (Reprinted November 23, 1994)
2, 3	November 23, 1994
4	January 27, 1994
5	November 23, 1994
6 – 9	January 27, 1994
10	November 23, 1994
11 – 30	January 27, 1994
31	January 28, 1994
32	January 27, 1994
33	November 23, 1994
34	January 27, 1994
35, 36	November 23, 1994
37, 38	January 27, 1994
39	November 23, 1994
40, A1	January 27, 1994

JANUARY 27, 1994
(Title Page Reprinted: November 23, 1994)



1

UL 38

Standard for

**Manually Actuated Signaling Boxes for Use
With Fire-Protective Signaling Systems**

First Edition – June, 1964
Second Edition – December, 1969
Third Edition – March, 1974
Fourth Edition – July, 1981
Fifth Edition – June, 1987

Sixth Edition

January 27, 1994

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated January 27, 1994. 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 A154.1-1969, September 3, 1969
Approved as ANSI SE3.12-1975, April 30, 1975
Approved as ANSI/UL 38-1981, April 3, 1981
Approved as ANSI/UL 38-1986, November 12, 1986
Approved as ANSI/UL 38-1993, October 11, 1993

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 1-55989-515-2

COPYRIGHT © 1974, 1994 UNDERWRITERS LABORATORIES INC.

CONTENTS**FOREWORD****INTRODUCTION**

1 Scope	5
2 General	5

CONSTRUCTION

3 Enclosures	6
4 Electric Shock	9
5 Corrosion Protection	10
6 Field Wiring System Connection	10
7 Internal Wiring	12
8 Bonding for Grounding	14
9 Components	15
10 Spacings	18
11 Servicing Protection	20
12 Outdoor Use Signaling Boxes	20

PERFORMANCE

13 General	21
14 Normal Operation Test	21
15 Circuit Emergency Operation	24
16 Overcurrent and Undercurrent Operation Test	24
17 Overload and Endurance Test	25
18 Jarring Test	26
19 Drop Test	27
20 Temperature Test	27
21 Electric Shock Current Test	30
22 Corrosion Tests	33
23 Transient Test	35
24 Dielectric Voltage-Withstand Test	35
25 Abnormal Operation Test	36
26 Burnout Test	36
27 Impact Test for Enclosures	37
28 Polymeric Materials Tests	37
29 Outdoor Use Signaling Box Tests	37

MANUFACTURING AND PRODUCTION TESTS

30 Production-Line Dielectric Voltage-Withstand Test	38
--	----

MARKING

31 General	39
32 Installation Wiring Diagram	40

APPENDIX A

Standards for Components	A1
--------------------------	----

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 manually actuated signaling boxes for fire-protective signaling systems intended for permanent installation and used in ordinary locations in accordance with the National Electrical Code, NFPA 70, and the National Fire Alarm Code, NFPA 72.

1.1 revised November 23, 1994

1.2 A manually actuated signaling box is an assembly of a mechanism having electrical contacts designed to transmit a signal when an integral part is operated manually. The signaling contacts are intended to be connected to circuits of fire-protective signaling systems. The types of boxes covered by these requirements are noncoded boxes and coded boxes, including fire-alarm boxes, fire and watch boxes, watch boxes, and watchman's stations for suppressed-signal tour combinations.

1.2 revised November 23, 1994

1.3 A manually actuated box having a pre-wound signaling mechanism and equipped with a tripping electromagnet to permit automatic actuation by separate detectors, and similar combination devices, will be judged with regard to compliance with the applicable requirements for both manually actuated signaling boxes and electrically actuated transmitters.

1.4 A manually actuated signaling box shall be constructed for use with system-control units, electrically actuated transmitters, or similar units that will permit its application in compliance with applicable Standards of the National Fire Protection Association.

1.5 These requirements do not cover electrically actuated transmitters.

1.5 revised November 23, 1994

1.6 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific provisions of this standard cannot be judged to comply with this Standard. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

1.6 revised November 23, 1994

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 for 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.

2.3 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.

CONSTRUCTION

3 Enclosures

3.1 General

3.1.1 Electrical parts of a signaling box shall be located or enclosed so as to provide protection against contact with uninsulated live parts.

3.1.2 Operating parts, such as contacts, gear mechanisms, and similar devices, shall be protected against mechanical damage and fouling by dust or other material that may impair their intended operation.

3.1.3 Provision shall be made for mounting a signaling box in position. Bolts, screws, or other parts used for mounting a signaling box shall be independent of those used for securing component parts of the assembly.

3.1.4 An opening for a winding shaft or similar part shall not be larger than is necessary (with sufficient clearance) for the intended operation of the signaling box.

3.1.5 Except as noted in 3.1.6, a signaling box intended for either flush or surface mounting in a back box shall be provided with a back box that has provision for the connection of metal-clad cable or conduit. A back box without provision for the connection of metal-clad cable or conduit may be used if:

- a) Definite instructions are furnished with the box indicating the sections of the unit that are intended to be drilled in the field for the connection of raceways, or
- b) The unit is intended for mounting on an outlet box.

3.3.6 A knockout shall be provided with a flat surrounding surface intended 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 indicated in Spacings, Section 10.

3.4 Nonmetallic enclosures

3.4.1 An enclosure or parts of an enclosure of nonmetallic material shall have the mechanical strength and durability and be formed so that operating parts will be protected against damage. The mechanical strength of the enclosure shall be at least equivalent to a sheet metal enclosure of the minimum thickness specified in Table 3.2. See Impact Test for Enclosures, Section 27, and Polymeric Materials Test, Section 28.

3.4.2 Among the factors to be taken into consideration when determining the acceptability of a nonmetallic enclosure or parts are:

- a) The mechanical strength;
- b) Resistance to impact;
- c) Moisture absorptive properties;
- d) Combustibility and resistance to ignition from electrical sources;
- e) Dielectric strength, insulation resistance, and resistance to arc tracking; and
- f) Resistance to distortion and creeping at temperatures to which the material may be subjected under conditions of normal or abnormal usage.

All these factors are to be considered with regard to aging.

3.4.3 The continuity of the grounding system shall not rely on the dimensional integrity of the nonmetallic material.

4 Electric Shock

4.1 Any part that is exposed only during operator servicing shall not present the risk of electric shock. See Electric Shock Current Test, Section 21.

4.2 Each terminal provided for the connection of an external antenna shall be conductively connected to the supply circuit grounded conductor. The conductive shall have a maximum resistance of 5.2 megohms, a minimum wattage rating of 1/2 watt, and shall be effective with the power switch in either the on or off position.

Exception: The conductive connection need not be provided if:

- a) *Such a connection is established in the event of electrical breakdown of the antenna isolating means,*
- b) *The breakdown does not result in a risk of electric shock, and*
- c) *In a construction using an isolating power transformer, the resistance of the conductive connection between the supply circuit and chassis does not exceed 5.2 megohms.*

4.3 The maximum value of 5.2 megohms specified in 4.2 is to include the maximum tolerance of the resistor value used; that is, a resistor rated 4.2 megohms with 20 percent tolerance or a resistor rated 4.7 megohms with a 10 percent tolerance may be used. A component comprised of a capacitor with a built-in shunt resistor that complies with the requirements for antenna isolating capacitors may be rated a minimum of 1/4 watt.

4.4 *Deleted November 23, 1994*

5 Corrosion Protection

5.1 An iron or steel part, other than a bearing or similar part for which such protection is impracticable, shall be protected against corrosion by enameling, galvanizing, sherardizing, plating, or other equivalent means. Parts such as washers, screws, bolts, and the like shall be protected against corrosion, if corrosion of such unprotected parts is likely to result in a risk of fire, electric shock, or unintentional contact with moving parts that can cause injury to persons.

Exception No. 1: Deleted

Exception No. 2: Parts made of stainless steel, polished or treated, if necessary, do not require additional protection against corrosion.

5.1 revised November 23, 1994

5.2 The requirement of 5.1 applies to all enclosures of sheet steel or cast iron, and to all springs and other parts upon which intended mechanical operation may depend. Bearing surfaces shall be of materials and construction that reduce the likelihood of binding due to corrosion.

6 Field Wiring System Connection

6.1 General

6.1.1 A wiring terminal or lead shall be used for the connection of conductors of at least the size required by the National Electrical Code, ANSI/NFPA 70-1993, corresponding to the electrical rating of the unit.

6.1.2 Duplicate terminals or leads, or equivalent means to achieve electrical supervision, shall be provided for each incoming and outgoing alarm-initiating-circuit connection. A common terminal may be used for connection of both incoming and outgoing wires, provided that the construction of the terminal does not permit an uninsulated section of a single conductor to be looped around the terminal and serve as two separate connections, thereby precluding supervision of the connection in the event that the wire becomes dislodged from under the terminal. A notched clamping plate under a single securing screw, in each notch of which separate conductors of an initiating circuit are intended to be inserted, may be used, but this arrangement shall be supplemented by additional marking in the wiring area or on the installation wiring diagram specifying the intended connections to the terminals.

6.2 Field wiring compartment

6.2.1 The field wiring compartment to which connections are to be made shall provide sufficient space to complete all wiring connections specified by the installation wiring diagram.

6.2.2 Protection for internal components in the wiring area and wire insulation from sharp edges shall be provided by insulating or metal barriers having smooth, rounded edges or by the word "CAUTION" and the following or equivalent instructions located in the wiring area: "When Making Installation, Route Field Wiring Away From Sharp Projections, Corners and Internal Components."

Table 21.3
Electric shock – stored energy

Potential in volts, across capacitance prior to discharge	Maximum capacitance in microfarads
1000	0.868
900	1.02
800	1.22
700	1.50
600	1.90
500	2.52
400	3.55
380	3.86
360	4.22
340	4.64
320	5.13
300	5.71
280	6.40
260	7.24
240	8.27
220	9.56
200	11.2
180	13.4
160	16.3
140	20.5
120	26.6
100	36.5
90	43.8
80	53.8
70	68.0
60	89.4
50	124.00
45	150.00
42.4	169.00

21.9 Current measurements are to be made with any operating control, or adjustable control that is subject to user operation:

- a) In all operating positions and
- b) Either with or without a separable connector or similar component in place.

These measurements are to be made with controls placed in the position that causes maximum current flow.

21.9 revised November 23, 1994

22 Corrosion Tests

22.1 General

22.1.1 A signaling box shall operate in the intended manner after being subjected to the corrosive atmosphere tests described in 22.1.2 – 22.3.3.5.

22.1.2 Two samples of the device are to be subjected to each test gas atmosphere. The samples are to be suspended vertically in a rectangular chamber of glass provided with a glass cover having openings for gas inlet and outlet for a test period of 10 days.

22.2 Indoor use signaling boxes

22.2.1 Hydrogen sulfide

22.2.1.1 Hydrogen sulfide is to be supplied to the test chamber from a commercial cylinder containing the gas under pressure. An amount of hydrogen sulfide equal to 0.1 percent of the volume of the test chamber is to be introduced into the chamber each working day. A small amount of water is to be maintained at the bottom of the chamber. The chamber is to be at room temperature throughout the test period.

22.2.2 Carbon dioxide – sulfur dioxide

22.2.2.1 Sulfur dioxide and carbon dioxide are to be supplied to the test chamber from commercial cylinders containing these gases under pressure. Amounts of sulfur dioxide equal to 0.5 percent of the test chamber volume and carbon dioxide equal to 1 percent of the chamber volume are to be introduced into the chamber each working day. A small amount of water is to be maintained at the bottom of the chamber. The chamber is to be at room temperature throughout the test period.

22.3 Outdoor use signaling boxes

22.3.1 Hydrogen sulfide

22.3.1.1 Hydrogen sulfide is to be supplied to the test chamber from a commercial cylinder containing the gas under pressure. An amount of hydrogen sulfide equal to 1 percent of the volume of the test chamber is to be introduced into the chamber each working day. A small amount of water is to be maintained at the bottom of the chamber. The chamber is to be at room temperature throughout the test period.

22.3.2 Carbon dioxide – sulfur dioxide

22.3.2.1 Sulfur dioxide and carbon dioxide are to be supplied to the test chamber from commercial cylinders containing these gases under pressure. An amount of sulfur dioxide equal to 1 percent of the volume of the test chamber, and an equal volume of carbon dioxide are to be introduced into the chamber each working day. A small amount of water is to be maintained at the bottom of the chamber. The chamber is to be at room temperature throughout the test period.

22.3.3 Salt spray

22.3.3.1 The apparatus for salt spray (fog) testing is to consist of a fog chamber, the inside of which measures 48 by 30 by 36 inches (122 by 76 by 91 cm), a salt solution reservoir, a supply of suitably conditioned compressed air, one dispersion tower constructed in accordance with the Method of Salt Spray (Fog) Testing, ASTM B117-90, specimen supports, provision for heating the chamber, and necessary means of control.

22.3.3.2 The dispersion tower for producing the salt fog is to be located in the center of the chamber and is to be supplied with humidified air at a pressure of 17 – 19 psig (117 – 131 kPa) so that the salt solution is aspirated as a fine mist or fog into the interior of the chamber.

22.3.3.3 The salt solution is to consist of 20 percent by weight of common salt (sodium chloride), in distilled water, the pH value of the collected solution being between 6.5 and 7.2 with a specific gravity of 1.126 to 1.157 at 95°F (35°C). The temperature of the chamber is to be maintained at 95 ± 2°F (35 ± 1°C) throughout the test period.

22.3.3.4 The device is to be suspended vertically in the fog chamber for 240 hours.

22.3.3.5 Drops of solution that accumulate on the ceiling or cover of the chamber are to be diverted from dropping on the specimens. Drops of solution that fall from the specimens are not to be recirculated, but are to be removed by a drain located at the bottom of the apparatus.

23 Transient Test

23.1 A manual station using electronic components that are likely to be affected by transients shall operate for its intended signaling performance after being subjected to 60 supply line transients. The transients are to be applied with the unit connected as intended in service and then the unit is to be operated to determine signaling performance. Two samples are to be subjected to the test.

23.2 For this test, each input/output circuit is to be subjected to a minimum of four different transient waveforms having peak voltage levels in the range of 100 to 2400 volts, as delivered into a 200 ohm load. A fifth transient voltage waveform may be applied based on the design of the product. A transient waveform at 2400 volts is to have a pulse rise time of 100 volts per microsecond, a pulse duration of approximately 80 microseconds, and an energy level of approximately 1.2 joules. Other applied transients shall have peak voltages representative of the entire range of 100 to 2400 volts, with pulse durations from 80 to 1100 microseconds, and energy levels not less than 0.03 joule or greater than 1.2 joules. The transient pulses are to be coupled directly onto the input/output circuit conductors of the equipment under test.

23.2 revised November 23, 1994

23.3 The manual station is to be subjected to 60 transient pulses induced at the rate of six pulses per minute as follows:

- a) Twenty pulses (two at each transient voltage level specified in 23.2) between each input/output circuit lead or terminal and earth ground, consisting of ten pulses of one polarity, and ten of the opposite polarity (total of 40 pulses); and
- b) Twenty pulses (two at each transient voltage level specified in 23.2) between any two input/output circuit leads or terminals consisting of ten pulses of one polarity and ten pulses of the opposite polarity.

24 Dielectric Voltage-Withstand Test

24.1 A signaling box and related accessories shall withstand for 1 minute, without breakdown, the application of an essentially sinusoidal ac potential of a frequency within the range of 40 – 70 hertz, or a dc potential, between live parts and the enclosure, between live parts and exposed dead metal parts, and between live parts of circuits operating at different potentials or frequencies. The test potential is to be (also, see 24.3):

- a) For a unit rated 30 volts ac rms (42.4 volts dc or ac peak) or less – 500 volts (707 volts, if a dc potential is used).
- b) For a unit rated between 31 and 250 volts ac rms – 1000 volts (1414 volts, if a dc potential is used).

- c) For a unit rated more than 250 volts ac rms – 1000 volts plus twice the rated voltage (1414 volts plus 2.828 times the rated ac rms voltage, if a dc potential is used).

24.2 Exposed dead metal parts referred to in 24.1 are noncurrent-carrying metal parts that are likely to become energized and that are accessible from outside of the enclosure of a signaling box during normal operation with the door of the enclosure closed.

24.3 For the application of a potential in accordance with 24.1, the voltage is to be the applicable value specified in (a), (b), or (c) of 24.1, based on the highest voltage of the circuits under test instead of the rated voltage of the unit. Electrical connections between the circuits are to be disconnected before the test potential is applied.

24.4 If an autotransformer is in the circuit, the primary of the transformer is to be disconnected and an ac test potential in accordance with 24.1(c) is to be applied directly to all wiring involving more than 250 volts.

24.5 If the charging current through a capacitor or capacitor type filter connected across the line, or from line to earth ground, is sufficient to prevent maintenance of the specified ac test potential, the capacitor or filter is to be tested using a dc test potential in accordance with 24.1.

24.6 The test potential may be obtained from any convenient source having sufficient capacity to maintain the specified voltage. The output voltage of the test apparatus is to be monitored. Starting at zero, the potential is to be increased at a rate of approximately 200 volts per minute until the required test value is reached and is to be held at that value for 1 minute.

24.7 A printed wiring assembly or other electronic circuit component that would be damaged by the application of, or would short-circuit, the test potential, is to be removed, disconnected, or otherwise rendered inoperative before the test. A representative subassembly may be tested instead of an entire unit. Rectifier diodes in the power supply may be individually shunted before the test to avoid destroying them in the case of a malfunction elsewhere in the secondary circuits.

25 Abnormal Operation Test

25.1 A signaling box operating in any condition of intended operation shall not increase the risk of fire or electric shock when abnormal fault conditions are introduced.

25.2 A signaling box is to be operated under the most severe abnormal conditions likely to be encountered in service and while connected to a source of supply as described in 25.3. Emission of flame or molten metal, or any other manifestation of a risk of fire is considered a failure.

25.3 With regard to installation-wiring circuit-fault conditions, the fault conditions are to be maintained continuously until constant temperatures are attained, or until burnout occurs, if the fault does not result in the operation of an overload protective device.

26 Burnout Test

26.1 A continuous-duty resistor shall not be burned out nor shall its operation be impaired by continuously carrying the full anticipated current at any setting. A resistor intended for intermittent use shall be able to carry its rated current on any step for as long a time as permitted by the character of the apparatus that it controls.

26.2 If a mercury-tube switch is used in such a manner that a fault (either a short-circuit or a ground) will cause it to carry current in excess of its maximum rated load, the switch shall withstand without introducing a risk of fire, a short-circuit as described in 26.3 – 26.5.

30.5 The test equipment is to include a visible indication of application of the test potential and an audible or visible indication, or both, of breakdown. In the event of breakdown, manual reset of an external switch is required, or an automatic reject of the product under test is to result. Other arrangements may be considered and accepted if determined to achieve the results contemplated.

30.6 If the charging current through a capacitor or capacitor type filter connected across the line, or from line to earth ground, is sufficient to prevent maintenance of the specified ac test potential, the unit is to be tested using a dc test potential in accordance with 30.1.

MARKING

31 General

31.1 A signaling box shall be permanently marked with the following information which shall be visible after installation. Unless otherwise indicated, the information shall appear directly on the unit or on a separate installation wiring diagram referenced in the marking.

- a) Name or identifying symbol of the manufacturer or private labeler.
- b) Model number or equivalent and serial number.
- c) Electrical rating, in volts, amperes, or watts, and frequency for each circuit. This information may appear on the installation wiring diagram.
- d) Signaling service for which the box is intended, such as fire, watch, supervisory, or the like.
- e) Simple and readily understood operating instructions if the signaling box is intended for fire-alarm service.
- f) Correct mounting position if the signaling box is intended to be mounted in a definite position. This information may appear on the installation wiring diagram.
- g) Reference to an installation wiring diagram, if not attached to the signaling box, by drawing number and issue number or date.

31.2 The marking of the model designation and the electrical rating is not required to be located on the outside of an enclosure, provided that it is visible by opening a door or removing a cover after installation. A marking of the electrical rating that is not visible with the cover removed is acceptable only if the installation wiring need not be disconnected to read the marking. See 6.2.2 for additional marking.

31.2 revised November 23, 1994

31.3 The marking to indicate the kind of signaling service and method of operation for alarm signals shall be conspicuous and shall be in raised or depressed letters or the equivalent that will not be obliterated by one coat of paint applied to the outer surfaces of the box.

31.4 If a manufacturer produces signaling boxes at more than one factory, each such assembly shall have a distinctive marking to identify it as the product of a particular factory.

31.5 A product intended for outdoor use shall be marked "For Outdoor Use," "For Indoor or Outdoor Use," or the equivalent.