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Subjects 2225 (698, 886, 1203, 1569, 1813)
 (In reply, refer to Subject 2225)

333 Pfingsten Road
 Northbrook, IL 60062
 June 25, 1996

TO: Casualty Council of Underwriters Laboratories Inc.,
 Electrical Council of Underwriters Laboratories Inc.,
 Subscribers to UL's Standards Service and Listees for
 Metal-Clad Cable and Cable Sealing Fittings for Hazardous (Classified)
 Locations;
 Explosion - Proof and Dust - Ignition - Proof Electrical Equipment for Use in
 Hazardous (Classified) Locations;
 Industrial Control Equipment for Use in Hazardous (Classified) Locations;
 Metal - Clad Cables; and
 Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations

SUBJECT: Extension of the Comment Due Date for the Proposed First Edition of the Standard for
 Metal-Clad Cables and Cable Sealing Fittings for Use in Hazardous (Classified)
 Locations, UL 2225;

SUMMARY OF TOPICS

This bulletin extends the comment due date for the Subject 2225 Bulletin dated May 10, 1996
 from June 7, 1996 to July 12, 1996.

The original comment due date for UL's Subject 2225 Bulletin dated May 10, 1996, was June 7, 1996.
 Due to requests from industry, the comment due date has been extended to July 12, 1996.

Please provide the following concerning the Subject 2225 Bulletin dated May 10, 1996:

1. Your comments concerning the proposed revisions; and
2. Your comments concerning the proposed effective date, should the proposals be adopted.

Comments should be sent to the attention of Alan McGrath at the Northbrook office of UL, 333 Pfingsten
 Road, Northbrook, Illinois 60062-2096. Please reference all correspondence to Subject 2225.

UNDERWRITERS LABORATORIES INC.

Alan McGrath

ALAN McGRATH (Ext. 43038)
 Project Engineer
 Standards Department

REVIEWED BY:

Don Ankele

DON ANKELE (Ext. 42965)
 Staff Engineer
 Hazardous Locations
 Engineering Services - 418B

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Subjects 2225 (698, 886, 1203, 1569, 1813)
 (In reply, refer to Subject 2225)

333 Pfingsten Road
 Northbrook, IL 60062
 June 14, 1996

TO: Casualty Council of Underwriters Laboratories Inc.,
 Electrical Council of Underwriters Laboratories Inc.,
 Subscribers to UL's Standards Service and Listees for
 Metal-Clad Cable and Cable Sealing Fittings for Hazardous (Classified)
 Locations;
 Explosion - Proof and Dust - Ignition - Proof Electrical Equipment for Use in
 Hazardous (Classified) Locations;
 Industrial Control Equipment for Use in Hazardous (Classified) Locations;
 Metal - Clad Cables; and
 Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations

SUBJECT: Announcement of UL's Acceptance of Submittals for Metal-Clad Cables and Cable
 Sealing Fittings for Division 1 Hazardous (Classified) Locations, and Announcement of
 the First Listing of Metal-Clad Cable Sealing Fittings for Division 1 Hazardous (Classified)
 Locations

SUMMARY OF TOPICS

UL announces that it is now accepting submittals for metal-clad cables and cable sealing fittings for hazardous (classified) locations.

UL announces it is now accepting submittals for metal-clad cables and cable sealing fittings for use in hazardous (classified) locations. These products will be investigated in accordance with the first edition of the Standard for Metal - Clad Cable and Cable Sealing Fittings for Use in Hazardous (Classified) Locations, UL 2225 expected to be published on July 31, 1996. The first Listing of metal-clad cable sealing fittings for Division 1 Hazardous (Classified) Locations has recently been issued.

UL 2225 covers metal-clad cable for use in hazardous (classified) locations, Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F and G and Class III; Class I, Zone 1, Groups IIA, IIB, IIB plus Hydrogen, and IIC in accordance with the National Electrical Code, NFPA 70.

UL 2225 also covers explosion-proof and dust-ignition-proof cable sealing fittings for use in Hazardous (Classified) Locations, Class I, Division 1 and 2, Groups A, B, C, and D; Class II, Division 1 and 2, Groups E, F, and G; Class III, and Class I, Zones 1 and 2, Groups IIA, IIB, IIB plus Hydrogen, and IIC in accordance with the National Electrical Code, NFPA 70.

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UL 2225 also covers explosion-proof and dust-ignition-proof cable sealing fittings intended for use on mobile offshore oil rigs and drilling platforms. Investigations of these fittings include an evaluation for conformity to the installation and use provisions of Title 46 Code of Federal Regulations Sub-part 111.105 and Subpart 111.60 of the United States Coast Guard Electrical Engineering Regulations, Subchapter J (Parts 110 to 113 inclusive) as applied by the authority having jurisdiction.

UL 2225 also applies to metal-clad cables and cable sealing fittings for hazardous locations under the following atmospheric conditions:

- a) A minimum ambient temperature of minus 50°C (minus 58°F),
- b) An oxygen concentration of not greater than 21 percent by volume, and
- c) A nominal barometric pressure of one atmosphere.

UL 2225 was developed because metal-clad cable can now be installed in Division 1 hazardous (classified) locations in accordance with the 1996 National Electrical Code (NEC). Sections 501-4(a) Exception No. 2, 502-4(a) Exception, and 505-15(3)(b) and (c) of the 1996 NEC requires that the metal-clad cable be investigated to, and comply with, a nationally recognized testing laboratory standard before the product can be installed.

The proposed requirements in UL 2225 were developed from UL's engineering experience, previous investigations of metal-clad cables and Division 2 cable sealing fittings, and from the following UL standards:

The Standard for Fittings for Conduit and Outlet Boxes, UL 514B;
 The Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations, UL 886;
 The Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations, UL 1203; and
 The Standard for Metal-Clad Cables, UL 1569.

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

NORTHBROOK OFFICE:

Mr. Don Ankele
 847-272-8800 (Ext. 42965)
 Engineering Services 418B
 333 Pfingsten Road
 Northbrook IL, 60062

MELVILLE OFFICE:

Mr. Tom Guida
 516-271-6200 (Ext. 22228)
 Engineering Services 216S
 1285 Walt Whitman Road
 Melville, NY 11747

UNDERWRITERS LABORATORIES INC.

Alan McGrath

ALAN McGRATH (Ext. 43038)
 Project Engineer
 Standards Department

SR:JTM

REVIEWED BY:

Don Ankele/am

DON ANKELE (Ext. 42965)
 Staff Engineer
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Subjects 2225 (698, 886, 1203, 1569, 1813)
 (In reply, refer to Subject 2225)

333 Pfingsten Road
 Northbrook, IL 60062
 May 10, 1996

TO: Casualty Council of Underwriters Laboratories Inc.,
 Electrical Council of Underwriters Laboratories Inc.,
 Subscribers to UL's Standards Service and Listees for
 Metal-Clad Cable and Cable Sealing Fittings for Hazardous (Classified)
 Locations;
 Explosion - Proof and Dust - Ignition - Proof Electrical Equipment for Use in
 Hazardous (Classified) Locations;
 Industrial Control Equipment for Use in Hazardous (Classified) Locations;
 Metal - Clad Cables; and
 Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations

SUBJECT: Request for Comments on Proposed Requirements for the Proposed First Edition of the
 Standard for Metal-Clad Cables and Cable Sealing Fittings for Hazardous (Classified)
 Locations, UL 2225; PROPOSED EFFECTIVE DATE

SUMMARY OF TOPICS

This bulletin proposes the following:

The minimum time requirement for the accelerated aging test contained in the proposed first edition of UL 2225 would be deleted.

COMMENTS DUE: JUNE 7, 1996

This bulletin supplements the Subject 2225 bulletin dated April 19, 1996.

Attached for your review and comment are proposed requirements for UL 2225. Questions regarding interpretation of requirements should be directed to the responsible UL Staff. Please see Appendix A of this bulletin regarding designated responsibility for the subject product categories.

Please note that proposed requirements are of a tentative and early nature and are for review and comment only. Current requirements are to be used to judge a product until these requirements are published in final form.

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PROPOSED EFFECTIVE DATE

The proposed requirement will not necessitate a review or additional testing of currently Listed products. Therefore, UL proposes that the new requirement becomes effective upon publication.

RATIONALE

In UL's Subject 2225 Bulletin dated April 19, 1996, UL proposed that the accelerated aging test be conducted for a length of time of at least 30 days as determined by the equation contained in 28.3.3.1. However, after further review, UL has determined that there could be instances where the accelerated aging could be conducted in less than 30 days. Therefore, as shown below, UL is proposing to delete the 30 day minimum requirement.

IMPACT

The proposed revision, if adopted, would not require a review, retest, or modifications to currently Listed products.

PROPOSAL

28.3.3 Accelerated aging tests

28.3.3.1 Three separate enclosure samples are to be conditioned in an oven at a temperature (T_2) and for a length of time (D) determined in accordance with the following ~~but not less than 30 days:~~

$$D = \frac{18262.5}{2^{\Delta T/10}}$$

$$T_2 = T_1 + \frac{\Delta T}{10} \left(\frac{\ln \frac{18262.5}{D}}{\ln 2} \right)$$

in which:

D is the test time in days ~~(30 days minimum)~~.

T_1 is the maximum temperature in °C obtained on the enclosure in a temperature test under normal operating conditions.

T_2 is the test oven temperature in °C.

ΔT is T_2 minus T_1 .

Either the test time in days (D) or the test temperature (T_2) is to be selected by the manufacturer.

28.3.3.1 revised (date of publication)

REQUEST FOR COMMENTS ON PROPOSALS

Please provide the following:

1. Your comments concerning the proposed requirement; and
2. Your comments concerning the proposed effective date, should the proposals be adopted.

Written comments should be sent to the attention of Alan McGrath at UL's Northbrook office, 333 Pfingsten Road, Northbrook, IL 60062-2096. Please reference all correspondence to Subject 2225.

All comments should be sent by June 7, 1996.

Unless specifically requested to do so, UL will not acknowledge comments indicating concurrence with these proposals.

UNDERWRITERS LABORATORIES INC.

Alan McGrath

ALAN McGRATH (Ext. 43038)
Project Engineer
Standards Department

SR:JTM

REVIEWED BY:

Don Ankele

DON ANKELE (Ext. 42965)
Staff Engineer
Engineering Services 418B

APPENDIX A

DESIGNATED RESPONSIBILITY FOR UL PRODUCT CATEGORIES

CYMX, CABLE SEALING FITTINGS FOR USE IN HAZARDOUS LOCATIONS
 EBNV, CONDUIT FITTINGS FOR USE IN HAZARDOUS LOCATIONS
 EBNV2, CONDUIT FITTINGS FOR USE IN HAZARDOUS LOCATIONS
 FTRQ, HAZARDOUS LOCATIONS EQUIPMENT – ENCLOSURES
 POWX, MINERAL INSULATED CABLE FITTINGS
 QAZV, OUTLET BOX ACCESSORIES
 QBCR, HAZARDOUS LOCATIONS EQUIPMENT – OUTLET BOXES
 QBCR2, HAZARDOUS LOCATIONS EQUIPMENT – OUTLET BOXES
 PJAX, METAL-CLAD CABLES
 FDLW, DRILLING EQUIPMENT – MARINE SHIPBOARD CABLE SEALING
 FITTINGS
 DAZV, HAZARDOUS LOCATIONS EQUIPMENT – CENTRIFUGES
 DMRR, HAZARDOUS LOCATIONS EQUIPMENT – CLEANING MACHINES
 FTRV, ENCLOSURES FOR USE IN HAZARDOUS LOCATIONS
 FDKX, DRILLING EQUIPMENT, DRILLING INSTRUMENTATION FOR USE IN
 HAZARDOUS LOCATIONS
 FTRX, ENCLOSURE ACCESSORIES
 QDIY, HAZARDOUS LOCATIONS EQUIPMENT – PAINTING EQUIPMENT
 QFIW, HAZARDOUS LOCATIONS EQUIPMENT – PANELBOARDS
 QNHV, HAZARDOUS LOCATIONS EQUIPMENT – PLUMBING ACCESSORIES
 SAOX, HAZARDOUS LOCATIONS EQUIPMENT – REELS – CORDS
 TVLE2, SEALING COMPOUNDS FOR USE IN HAZARDOUS LOCATIONS
 VCSV, HAZARDOUS LOCATIONS EQUIPMENT – SOUND RECORDING AND
 REPRODUCING EQUIPMENT
 VXDY, HAZARDOUS LOCATIONS EQUIPMENT – STATIC NEUTRALIZING
 EQUIPMENT
 WYMV, HAZARDOUS LOCATIONS EQUIPMENT – TELEMETERING EQUIPMENT
 WZAT, HAZARDOUS LOCATIONS EQUIPMENT – TELEPHONES
 XIAZ, HAZARDOUS LOCATIONS EQUIPMENT – TIME INDICATING AND
 RECORDING EQUIPMENT
 ZBRX, HAZARDOUS LOCATIONS EQUIPMENT – VIBRATORS
 ZCFV, HAZARDOUS LOCATIONS EQUIPMENT – VISCOMETERS
 ZRBZ, HAZARDOUS LOCATIONS EQUIPMENT – X-RAY EQUIPMENT
 ZRBZ2, HAZARDOUS LOCATIONS EQUIPMENT – X-RAY EQUIPMENT
 ACCESSORIES
 NNNY, INDUSTRIAL CONTROL EQUIPMENT – CONTROL PANEL AND
 ASSEMBLIES
 NNRL, INDUSTRIAL CONTROL EQUIPMENT – CONTROL ASSEMBLY COVERS
 NOIV, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 AUXILIARY DEVICES
 NOPU2, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 AUXILIARY DEVICES
 NOTH, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 COMBINATION MOTOR

NOWT, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 FLOAT-AND PRESSURE
 NOWT2, INDUSTRIAL CONTROL EQUIPMENT – CONTROLLERS –
 COMPONENT
 NPKR, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 MAGNETIC MOTOR
 NPKR2, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 MAGNETIC MOTOR
 NPXZ, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 MANUAL MOTOR
 NPXZ2, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 MANUAL MOTOR
 NQLZ, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 MISCELLANEOUS MOTOR
 NRBX, INDUSTRIAL CONTROL EQUIPMENT RELATING TO HAZARDOUS
 LOCATIONS
 NRDZ, INDUSTRIAL CONTROL EQUIPMENT RELATING TO HAZARDOUS
 LOCATIONS – AUXILIARY DEVICES
 NRFQ, INDUSTRIAL CONTROL EQUIPMENT RELATING TO HAZARDOUS
 LOCATIONS – MAGNETIC MOTOR CONTROLLERS

The individuals shown in the following tables are involved with the investigation of products covered under the subject categories. The Primary Designated Engineer (**shown in UPPERCASE letters**) coordinates the establishment and uniform interpretation of UL requirements applicable to the product categories. The Designated Engineers (**shown in lowercase letters**) work with the Primary Designated Engineer to interpret requirements and maintain standards.

Should you have questions regarding the interpretation of the requirements proposed in this bulletin or any adopted requirements that affect your product, you are encouraged to contact the individual at the office to which you normally submit your products.

The Industry Advisory Conference Chairman for the subject categories is Lee Hewitt at UL's Northbrook office. The IAC Chairman oversees the significant interpretations made by the Primary Designated Engineer and arbitrates any differences regarding interpretation of UL requirements.

CCN	Office/Subsidiary	Responsible Engineer	Extension
CYMX, TVLE2, FTRV, FTRQ, FDLW, FTRX	Northbrook	D. ANKELE	42965

CCN	Office/Subsidiary	Responsible Engineer	Extension
POWX, EBNV, EBNV2 QAZV, QBCR, QBCR2	Northbrook	T. DIGANCI	42844

CCN	Office/Subsidiary	Responsible Engineer	Extension
PJAZ	Melville	T. GUIDA	22228
	Northbrook	K. Conner	42330
	Santa Clara	A. Flandez	32816

CCN	Office/Subsidiary	Responsible Engineer	Extension
NNNY, NNRL, NOIV, NOPU2, NOTH, NOWT, NOWT2, NPKR, NPKR2, NPXZ, NPXZ2, NQLX, NRBX, NRDZ, NRFQ, QNHV	Northbrook	E. BRIESCH	43174

CCN	Office/Subsidiary	Responsible Engineer	Extension
DAZV, DMRR, QDIY, QFIW, ZRBZ, VXDY, ZRBZ2,	Northbrook	P. KELLY	42326

CCN	Office/Subsidiary	Responsible Engineer	Extension
DMRR	Northbrook	J. WODZINSKI	42840

CCN	Office/Subsidiary	Responsible Engineer	Extension
SAOX, VCSV	Northbrook	J. ZIMMER	42969

CCN	Office/Subsidiary	Responsible Engineer	Extension
WYMV, FDKX	Northbrook	D. MAHER	42930

CCN	Office/Subsidiary	Responsible Engineer	Extension
WZAT	Northbrook	S. RIRIE	43623

CCN	Office/Subsidiary	Responsible Engineer	Extension
ZCFV, ZBRX	Northbrook	R. FILIP	42841

CCN	Office/Subsidiary	Responsible Engineer	Extension
XIAZ	Northbrook	K. MCMANAMA	42469

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Subjects 2225 (698, 886, 1203, 1569, 1813)
 (In reply, refer to Subject 2225)

333 Pfingsten Road
 Northbrook, IL 60062
 April 19, 1996

TO: Casualty Council of Underwriters Laboratories Inc.,
 Electrical Council of Underwriters Laboratories Inc.,
 Subscribers to UL's Standards Service and Listees for
 Metal-Clad Cable and Cable Sealing Fittings for Hazardous (Classified)
 Locations;
 Explosion - Proof and Dust - Ignition - Proof Electrical Equipment for Use in
 Hazardous (Classified) Locations;
 Industrial Control Equipment for Use in Hazardous (Classified) Locations;
 Metal - Clad Cables; and
 Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations

SUBJECT: Request for Comments on Proposed Requirements for the Proposed First Edition of the
 Standard for Metal-Clad Cables and Cable Sealing Fittings for Hazardous (Classified)
 Locations, UL 2225, PROPOSED EFFECTIVE DATE

SUMMARY OF TOPICS

This bulletin proposes the following:

The First Edition of the Standard for Metal-Clad Cables and Cable-Sealing Fittings for Hazardous (Classified) Locations, UL 2225, would be published.

COMMENTS DUE: MAY 17, 1996

This bulletin supersedes the Subject 2225 bulletin dated November 10, 1995.

Attached as Appendix A for your review and comment are proposed requirements for UL 2225. Questions regarding interpretation of requirements should be directed to the responsible UL Staff. Please see Appendix B of this bulletin regarding designated responsibility for the subject product categories.

Please note that proposed requirements are of a tentative and early nature and are for review and comment only. Current requirements are to be used to judge a product until these requirements are published in final form.

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PROPOSED EFFECTIVE DATE

These proposed requirements will not necessitate a review or additional testing of currently Listed products. Therefore, UL proposes that the new requirements become effective upon publication.

RATIONALE

On November 10, 1995 UL issued a Subject 2225 bulletin which contained the first draft of the proposed Standard for Metal-Clad Cables and Cable-Sealing Fittings for Hazardous (Classified) Locations, UL 2225. The rationale for proposing the standard was essentially as follows:

Metal - Clad Cable can now be installed in Division 1 hazardous (classified) locations in accordance with the 1996 National Electrical Code. Articles 501-4(a) Exception No. 2, 502-4(a) Exception, and 505-15(3)(b) and (c) of the 1996 NEC requires that the metal-clad cable be investigated to, and comply with, a nationally recognized testing laboratory standard before the product can be installed. Therefore, UL has developed the proposed first edition of the Standard for Metal - Clad Cable and Cable Sealing Fittings for Hazardous (Classified) Locations, UL 2225.

The proposed requirements in UL 2225 were developed from UL's engineering experience, previous investigations of Division 2 cable sealing fittings, and from the following UL standards:

The Standard for Fittings for Conduit and Outlet Boxes, UL 514B;
 The Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations, UL 886;
 The Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations, UL 1203; and
 The Standard for Metal-Clad Cables, UL 1569.

UL has now responded to all comments received on the first draft. The second draft of the proposed first edition of UL 2225 is contained in Appendix A. For your convenience in review, proposed additions to the first draft are shown underlined, proposed deletions are shown ~~lined out~~, and extensively revised paragraphs are also shown underlined.

IMPACT

A new category will be established to cover Metal - Clad Cables that comply with this new standard. Cable sealing fittings complying with this new standard will be covered under the existing product categories of CYMX, cable sealing fittings for hazardous locations, and FDLW, marine shipboard cable sealing fittings for hazardous locations.

UL proposes that this new standard become effective upon publication.

REQUEST FOR COMMENTS ON PROPOSALS

Please provide the following:

1. Your comments concerning the proposed requirements; and
2. Your comments concerning the proposed effective date, should the proposals be adopted.

Written comments should be sent to the attention of Alan McGrath at UL's Northbrook office, 333 Pfingsten Road, Northbrook, IL 60062-2096. Please reference all correspondence to Subject 2225.

Subjects 2225 (698, 886, 1203, 1569, 1813)

-3-

April 1996

All comments should be sent by May 17, 1996.

Unless specifically requested to do so, UL will not acknowledge comments indicating concurrence with these proposals.

UNDERWRITERS LABORATORIES INC.

Alan McGrath

ALAN McGRATH (Ext. 43038)
Project Engineer
Standards Department

SR:JTM

REVIEWED BY:

Don Ankele

DON ANKELE (Ext. 42965)
Staff Engineer
Engineering Services 418B

PROPOSED REQUIREMENTS ARE OF A TENTATIVE AND EARLY NATURE AND ARE FOR REVIEW AND COMMENT ONLY. CURRENT REQUIREMENTS ARE TO BE USED TO JUDGE A PRODUCT UNTIL THESE REQUIREMENTS ARE PUBLISHED IN FINAL FORM.

APPENDIX A

PROPOSED FIRST EDITION OF THE STANDARD FOR METAL - CLAD CABLE AND CABLE SEALING FITTINGS FOR HAZARDOUS (CLASSIFIED) LOCATIONS, UL 2225

For your convenience in review, proposed additions to the first draft contained in UL's Subject 2225 Bulletin dated November 10, 1995 are shown underlined, proposed deletions are shown ~~lined out~~, and extensively revised paragraphs are also shown underlined.

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1 Scope

1.1 These requirements cover metal-clad cable for Use in hazardous (classified) locations, Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F and G and Class III; Class I, Zones 1 and 2, Groups IIA, IIB, IIB plus Hydrogen, and IIC in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements also cover explosion-proof and dust ignition-proof cable sealing fittings for use in hazardous (classified) locations, Class I, Division 1 and 2, Groups A, B, C, and D; Class II, Division 1 and 2, Groups E, F, and G; Class III, and Class I, Zones 1 and 2, Groups IIA, IIB, IIB plus Hydrogen, and IIC in accordance with the National Electrical Code, NFPA 70.

1.3 These requirements also cover explosion-proof and dust ignition-proof cable sealing fittings intended for use on mobile offshore oil rigs and drilling platforms. Investigations of these fittings include an evaluation for conformity to the installation and use provisions of Title 46 Code of Federal Regulations Sub-part 111.105 and Subpart 111.60 of the United States Coast Guard Electrical Engineering Regulations, Subchapter J (Title 46 Code of Federal Regulations, Parts 110 to 113 inclusive) as applied by the authority having jurisdiction.

~~1.4 Metal-clad cable shall also comply with all of the requirements in the Standard for Metal-Clad Cables, UL 1569.~~

~~1.5 Explosion-proof and dust ignition-proof cable sealing fittings shall also comply with the requirements in the Standard for Fittings for Conduit and Outlet Boxes, UL 514B.~~

1.6 These requirements apply to metal-clad cables and cable sealing fittings for hazardous locations under the following atmospheric conditions:

- a) A minimum ambient temperature of minus 50°C (minus 58°F),
- b) An oxygen concentration of not greater than 21 percent by volume, and
- c) A nominal barometric pressure of one atmosphere.

1.7 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 explosion, 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 requirements or 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.

2 General

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.

2.2 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 Definitions

3.1 The following definitions apply in this Standard.

3.1.1 EXPLOSION-PROOF CABLE SEALING FITTING – A device or combination of devices intended to provide a means of entry of a cable into a hazardous location explosion-proof enclosure and which also provides strain relief and provides required sealing characteristics, either by an integral means or when combined with a separate sealing fitting.

3.1.2 DUST-IGNITION-PROOF CABLE SEALING FITTING – A cable sealing fitting capable of meeting the requirements for dust-ignition-proof construction and performance as given in the Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations, UL 886.

3.1.3 SEALING CHARACTERISTICS – Those characteristics necessary to minimize the migration of gases through the seal and to prevent the propagation of flame from enclosures required to be explosion-proof, and/or exclude hazardous dusts or readily ignitable fibers from an enclosure required to be dust ignition-proof.

PART I – METAL-CLAD CABLES

CONSTRUCTION

4 General

4.1 Metal-clad cables for use in Division 1, and Zones 1 and 2 hazardous locations shall comply with all applicable construction requirements for metal-clad cables in the Standard for Metal-Clad Cables, UL 1569.

4.2 Metal-clad cables for use in Division 1 and Zone 1 hazardous locations shall also have the following constructional features:

- a) A gas/vapor tight continuous corrugated aluminum sheath,
- b) An overall jacket of polymeric material, and
- c) Separate grounding conductors in accordance with Section 250-95 of the 1996 NEC.

4.3 The sheath, jacket and grounding conductors required by 4.2 shall also comply with all applicable construction requirements in the Standard for Metal-Clad Cables, UL 1569.

4.4 Metal-clad cables with optical-fiber members shall be subjected to special investigation.

PERFORMANCE

5 General

5.1 ~~Except as indicated otherwise in Sections 6 – 8,~~ Metal-clad cables for use in Division 1, and Zones 1 and 2 hazardous locations shall comply with the all applicable performance requirements for metal-clad cables in the Standard for Metal-Clad Cables, UL 1569 and also in Sections 6 - 8A of this standard.

5.2 The sheath, jacket and grounding conductors required by 4.2 shall also comply with any applicable performance requirements in the Standard for Metal-Clad Cables, UL 1569, and also in Sections 6 - 8A of this standard.

6 Impact Test – Low Temperature

6.1 The non-metallic components of at least eight specimens of finished cable shall not crack when the non-metallic components of ten specimens of finished cable are tested. The test is to consist of an impact of a 3 lb (1.36 kg) mass falling through a distance of 3 ft (0.91 m) at a temperature of $-25 \pm 1^{\circ}\text{C}$ ($-13 \pm 1.8^{\circ}\text{F}$), or at the minimum ambient rated and marked on the cable, if rated lower than -25°C (-13°F).

6.2 The 10 specimens are to be placed in an environmental chamber and maintained at the required temperature for a period of 4 hours. Immediately following this conditioning, each of the 10 specimens are to be placed on a solid supporting surface and then subjected to the impact specified in 6.1 by means of a steel head. This steel head is to have an overall diameter of 28.5 mm (1.1 in.) and is to have a flat striking surface that is 25 mm (1 in) in diameter with slightly rounded edges. Flat cable is to be placed such that the major cross-sectional axis is parallel with the supporting surface.

7 Mechanical Damage – Impact

7.1 An impact test shall be conducted using the requirements, including sample selection, specified for the Impact Test, Section 21, in the Standard for Metal-Clad Cables, UL 1569. However, the weight of the falling mass shall be 25 lbs (11.34 kg) through a distance of 1 ft (0.31 m) instead of 10 lbs (4.54 kg) through a distance of 1.5 ft. (0.46 m) for the tests with the No. 14 AWG conductors.

8 Crushing Test

8.1 A crushing test shall be conducted using the requirements, including sample selection, specified for the Crushing Test - All Cable, Section 22, in the Standard for Metal-Clad Cables, UL 1569. However, the crushing force is to be 1500 lbf (6670 N) instead of 1000 lbf (4448 N) for the test with the No. 14 AWG conductors.

8A Flame Test

8A.1 The flame test shall be performed in accordance with the FT4/IEEE 1202 Type of Flame Exposure test found in the Standard for Fire-Propagation and Smoke-Release Test for Cables, UL 1685.

9 Explosion Test

~~9.1 These requirements are applicable only to metal-clad cables for Class I Hazardous Locations with one or more subassemblies, where the integrity of each subassembly is to be maintained in passage through the cable-sealing fitting used with the cable, for example shielded signal cables.~~

~~9.2 Explosion flame propagation tests shall be performed on samples of the cable under consideration using the gas mixtures and test method specified in the appropriate group in the Explosion Tests, Section 23. The cable shall be fitted to a 1 cubic foot (0.028 cubic meter) test enclosure using a suitable explosion-proof cable-sealing fitting, installed in accordance with the manufacturer's instructions. No attempt shall be made during the fitting installation to seal individual conductors within a subassembly. The length of the cable protruding from the cable-sealing fitting shall be 5.5 ft (1.8 m). No attempt shall be made to seal the outer end of the cable, or the ends of each subassembly protruding into the test enclosure. Each subassembly shall protrude through the gland into the test enclosure with the shield, jacket or other covering intact for a length of $5.9 \pm .4$ inch (150 ± 10 mm). For each test the test gas mixture shall be introduced into the test chamber and the pressure shall be increased to 3 psi (20.7 kPa) for a period of 10 min, or until the concentration of the gas exiting the cable reaches the test gas concentration. An envelope surrounding the outer end of the cable under test shall be filled with the same test gas mixture. The gas mixture in the 1 cubic foot test~~

~~enclosure shall then be ignited by means of a spark plug. There shall be no ignition of the gas in the envelope surrounding the outer end of the cable as a result of these tests.~~

MARKING

10 General

10.1 Metal-clad cables for use in Division 1 and Zone 1 hazardous locations shall comply with all applicable marking requirements for metal-clad cables in the Standard for Metal-Clad Cables, UL 1569.

10.2 Cables complying with the requirements of this standard shall also be surface marked "HL". The marking "HL" indicates the suitability of the cable for use in Division 1 and Zone 1 hazardous locations. The manner in which this marking is applied shall comply with the applicable requirements in UL 1569.

~~10.3 The size of the marking specified in 10.2 shall be in accordance with the Marking Section of the Standard for Metal-Clad Cables, UL 1569.~~

PART II – CABLE SEALING FITTINGS

CONSTRUCTION

11 General

11.1 Cable sealing fittings shall comply with the construction requirements in all the Standard for Fittings for Conduit and Outlet Boxes, UL 514B, and with all the construction requirements in the Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations, UL 886.

11.2 Design tolerances of the cable sealing fitting shall be considered in determining compliance with 11.1 of this standard checked for compliance with the manufacturing drawings supplied by the manufacturer.

11.3 The width of all joint surfaces or the length of path through or across any joint surface or opening in the cable sealing fitting, including threadless joints and threaded joints, shall be dimensionally measured for compliance with the appropriate requirements contained in 15.1 or in Section 6 and 15.4 in the Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations, UL 886, for the specific hazardous locations for which the sealing fitting is intended.

11.4 All joint surfaces shall have the gap between joint surfaces examined by means of a appropriate measuring tools. The gap between the joint surfaces shall not exceed the dimensions specified in 15.1 or in Section 6 in the Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations, UL 886 for the specific hazardous locations for which the cable sealing fitting is intended.

11.5 Cable sealing fittings intended to seal metal-clad cables with optical-fiber members shall be subjected to special investigation.

12 Enclosure Types

12.1 A cable sealing fitting that complies with the applicable requirements of this standard: ~~may be marked Type 7 and 9.~~

a) For use in Class I, Groups A, B, C, or D locations may be marked with the enclosure designation Type 7, or

b) For use in Class II, Groups E, F, or G locations may be marked with the enclosure designation Type 9.

Exception: A cable sealing fitting marked for use only in Zone 1 or Zone 2.

12.2 A cable sealing fitting that is intended for use in environmental conditions that has a marked enclosure type designation, shall also comply with the applicable requirements for each enclosure type, as specified in the Standard for Enclosures For Electrical Equipment, UL 50; for example, Type 3, 4X, or 6.

12.3 A cable sealing fitting marked Type 3, 3R, 3S, 4, 4X, 6, or 6P enclosure may also be marked "Raintight" if no water enters the enclosure. Compliance with these requirements shall be determined by the applicable tests in the Standard for Enclosures for Electrical Equipment, UL 50.

13 Material

13.1 A cable sealing fitting shall be made of ferrous materials, copper, brass, bronze, or aluminum or its alloys containing not less than 80 percent aluminum. A metal such as zinc or magnesium, or their alloys, is not acceptable.

13.2 Copper shall not be used for a cable sealing fitting for use in Class I, Group A or IIC locations.

13.3 Nonmetallic material shall be subjected to the ~~Solvent Vapor~~ Non-metallic Enclosure Materials Test in Section 28.

14 Bonding Continuity

14.1 Cable sealing fitting intended for use with multiconductor metal-clad cables shall be constructed in a manner such that connection between the metallic covering of the cable and the cable connector will comply with the requirements of the Standard for Fittings for Conduit and Outlet Boxes, UL 514B.

15 Joints

15.1 ~~15.4~~ For Groups A, B, C and D; IIA, IIB, and IIC, a flamepath having a cylindrical cross-section shall have a length of not less than 1 inch (25.4 mm). The diametrical clearance (difference in diameters) shall not be greater than 0.0033 inch (0.083 mm). The diametrical clearance of a path longer than 1-1/4 inch (31.8 mm) shall not be more than 0.0045 inch (0.114 mm). For flamepath lengths greater than 1 inch (25.4 mm) but less than 1-1/4 inch (38.1 mm) the clearance shall be as given in UL 886, Table 6.1.

15.2 ~~15.3~~ Non-threaded metal-to-metal joints are permitted for Class I, Group A or IIC Cable sealing fitting, provided

a) The joint complies with Class I, Group B requirements for joint dimensions as stated in UL 886; Section 6; and

b) The assembly complies with the Class I, Group A or IIC explosion flame propagation test requirements in 23.9 - 23.13.

15.3 ~~15.4~~ All other explosion-proof joints in cable sealing fittings shall comply with the requirements in Joints, Section 6, in the Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations, UL 886.

15.4 ~~15.2~~ A cable sealing fitting shall be so constructed that positive mechanical retention is provided, independent of any ground clamp or strain relief, to prevent movement of any part that could then result in a reduction of any internal flame path or an increase of any internal gap prevents external movement of the cable shall not affect the joint and gap requirements. Non-metallic parts shall not be relied upon to secure parts forming a flame path.

15.5 In determining compliance with 15.4, non-metallic parts shall not be relied upon to secure parts forming a flame path.

16 Supply Connections

16.1 A cable sealing fitting shall be provided with at least five full threads. A cable sealing fitting shall be provided with male threads conforming to the requirements for conduit threads or other wiring methods in accordance with Article 501 in the National Electrical Code, NFPA 70-1993, and shall gauge ± 1 turn. A shoulder on the cable sealing fitting shall not bottom before 5 full threads are engaged when installed in a test plate having a female thread form of the same type thread tapped to ± 5 turns on the thread form gauge.

17 Seal

17.1 A seal shall be provided between the end of the connector intended for the connection of the cable and the end of the connector intended for connection to the explosion-proof equipment as indicated in 17.2 and 17.3.

17.2 A sealing compound or a cement used for the seal shall:

- a) Not be less than 5/8 inch (16.9 mm) deep,
- b) Neither soften nor crack under the service conditions,
- c) Ensure a tight seal and to retain the compound in place, and
- d) Not be affected adversely by the hazardous vapors in which it is intended to be used.
- e) Seal each individual conductor or subassembly and the metal jacket of the cable.

17.3 The sealing compound shall neither flow nor creep at the operating temperature of the device. A sealing compound of the softening type shall have a softening point of not less than 93°C (200°F) as determined by the Standard Test Method for Softening Point by Ring-and-Ball Apparatus, ASTM E28-92. Polymeric sealing compounds shall be subjected to the Solvent Vapor Tests found in Tests on Sealing Compounds, Section 29.

18 Protection Against Corrosion

18.1 All ferrous-metal parts other than stainless steel shall be protected against corrosion, except at joint surfaces and conduit threads, for example, by zinc or cadmium coating, plating, enameling, painting, varnishing, or lacquering. Joint surfaces and conduit threads may be electroplated.

Exception: As an alternative for a cable sealing fitting of ferrous metal other than stainless steel, the Rust-Resistance Test, Section 33, in the Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations, UL 886, may be conducted.

19 Materials Applied to Joint Surfaces

19.1 A corrosion inhibiting grease such as petrolatum or soap-thickened mineral oils may be applied to the metal joint surfaces before assembly.

19.2 The grease shall be of a type that does not:

- a) Harden because of aging,
- b) Contain an evaporating solvent, and
- c) Cause corrosion of the joint surfaces.

19.3 Paint or a sealing material shall not be applied to the contacting surfaces of a joint.

Exception: A threaded joint surface or a threaded opening for conduit may be provided with a metallic paint or other noninsulating coating if the joint surface or opening with the paint or coating applied:

- a) For Class I locations, prevents the passage of flame, hot particles, or sparks capable of igniting the surrounding atmosphere during the explosion tests. See 16.9 under Explosion Tests, Section 16, in the Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations, UL 886.*
- b) For Class I and Class II locations, complies with the requirements in 22.2.1 of UL 886.*

PERFORMANCE

20 General

20.1 Cable sealing fittings for use in Division 1 and Zone 1 hazardous locations shall comply with all the performance requirements in the Standard for Fittings for Conduit and Outlet Boxes, UL 514B.

21 Torque

21.1 A cable sealing fitting is to be assembled with the intended cable and the cable sealing fitting shall be screwed into a mating tapped hole the depth of which is greater than the length of thread on the cable sealing fitting and which is tapped square to the surface.

21.2 The cable sealing fitting is to be tightened with a manually operated torque wrench to the torque values as determined by the formula specified in 21.3, the wrench being applied first to the main body of the connector, then to each successive component.

21.3 The torque value is to be determined by Table 21.1, ~~the formula $T = 1.76D$ where~~

~~T = torque in newton-meters~~

~~D = distance in millimeters between flats of a hexagonal body or compression nut or diameter in millimeters of the cable gland body or compression nut.~~

Table 21.1
Tightening torque for conduit hubs

Conduit hub trade size		Tightening torque	
Inches	(mm O.D.)	Pound-inches	(Nm)
1/2 - 3/4	(21.3 - 26.7)	800	(90)
1 - 1-1/2	(33.4 - 48.3)	1000	(113)
2 and larger	(60.3 and larger)	1600	(181)

21.4 The assembled cable sealing fitting shall withstand the torque test without breakage. At the completion of the test, the cable sealing fitting shall be dismantled and examined and shall show no visible evidence of damage to the cable sealing fitting components, nor shall there be breakage of the cable outer covering.

22 Resistance to Impact Test (Division 1 Cable Sealing Fittings Only)

22.1 Division 1 Cable Sealing Fittings shall not result in a risk of fire or explosion by cracking, breaking or having loosened parts when subjected to the impact as specified in 22.2 – 22.10.

22.2 The cable sealing fitting is to be subjected to the effect of a 7 N impact from a mass of 2.2 lbs (1 kg) falling vertically from a height of 2.1 ft (0.7 m). The weight shall be fitted with an impact head of hardened steel in the form of a hemisphere of 1 inch (25 mm) diameter.

22.3 Two samples of each trade size of cable sealing fitting, considered to be the weakest, are to be impacted at two separate places of each sample.

22.4 The points of impact are to be at the location furthest from the supply connection threads.

22.5 The cable sealing fitting sample is to be mounted on a steel base so that the direction of the impact is normal to the surface being tested. The base shall have a mass of at least 44 lbs (20 kg) or be rigidly fixed or inserted into the floor. Figures 22.1 and 22.2 give an example of a suitable test rig.

22.6 The cable sealing fitting is to be tested with the cable fitted.

22.7 For impact purposes, the cable sealing fitting is fixed on a rigidly mounted steel plate or secured as specified by the manufacturer of the cable sealing fitting.

22.8 The torque applied in fixing the cable sealing fitting is to be as given in Section 21.

22.9 The samples are to be impacted in an ambient temperature of $68 \pm 9^{\circ}\text{F}$ ($20 \pm 5^{\circ}\text{C}$).

22.10 Following the impact, the samples shall be subjected to a visual examination to determine compliance with the requirement that there shall be no cracking, breaking or loosening of parts (see 22.1 of this standard). Should it not be possible to visually make this determination, then the samples shall comply with the Explosion Test, Section 23, and the Hydrostatic Pressure Test, Section 24, of this standard.

Figure 22.1
Example of fixture for resistance to impact test

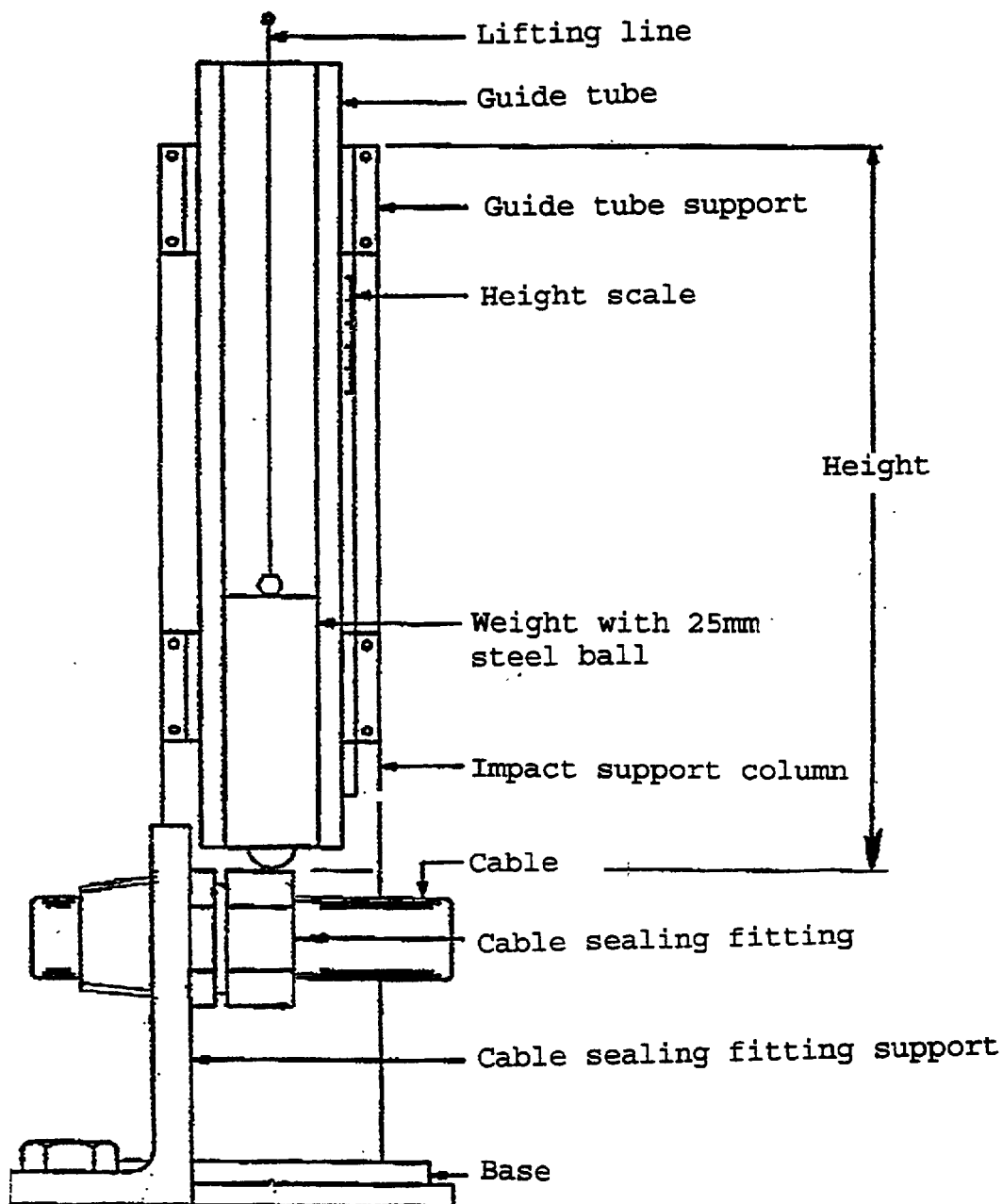
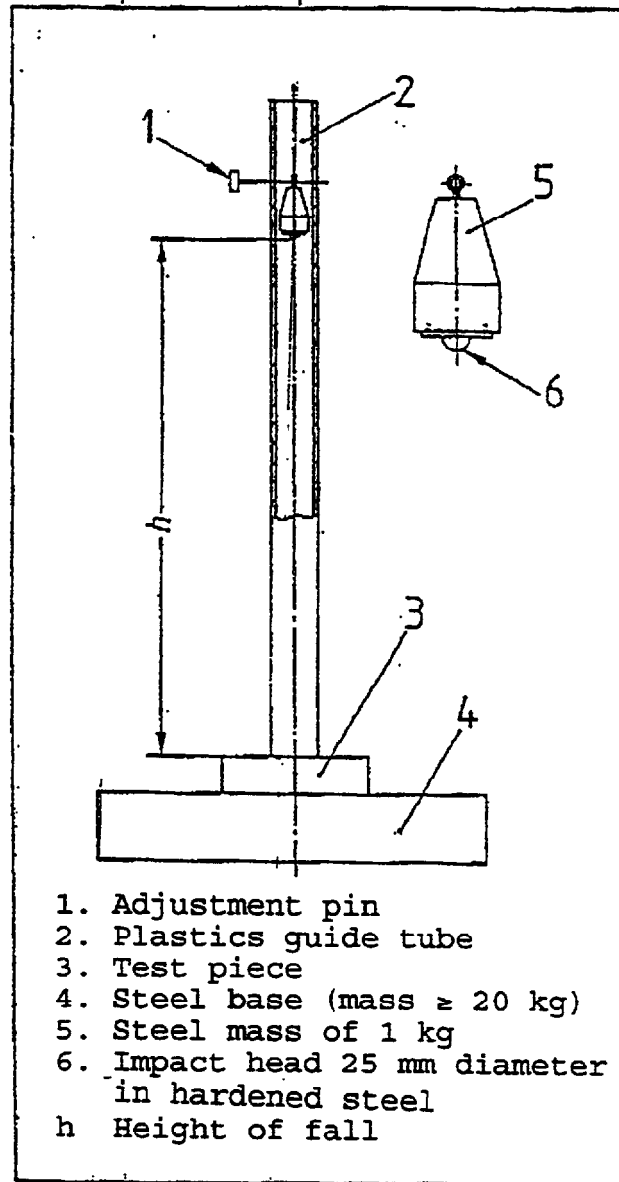


Figure 22.2
Typical Arrangement for Impact Test



23 Explosion Tests

23.1 The requirements in 23.2 – 23.13 shall be applied to all cable sealing fittings. All gaskets shall be removed for this test.

23.2 Cable sealing fittings for use in Class I locations shall be subjected to a series of tests in the presence of specific gas- or vapor-air mixtures over the range of flammable or explosive concentrations to determine the maximum explosion-pressure effects of the gas- or vapor-air mixture over the test range specified in Table 23.1 and the maximum propagation effects of the gas- or vapor-air mixture as specified in Tables 23.2 and 23.3.

Exception: Cable sealing fittings not exceeding 4 in. trade size and not using labyrinth or polymeric-to-polymeric joint constructions need not be subjected to explosion tests if the fitting complies with either (a) or (b) below in addition to being subjected to a hydrostatic pressure strength test in accordance with Exception No. 3 to 24.1 of this standard::

- a) The fitting is for use in Group C, Group D, or Groups C and D or Group IIA, IIB, or IIA and IIB locations; or
- b) The fitting is for use in Group A, Group B, or Groups A and B, or Group IIC, IIB plus Hydrogen, locations and all joints are of the tapered, threaded type, with taper of 3/4 inch per foot (60 mm/m); and
- c) ~~The fitting is subjected to a hydrostatic pressure strength test in accordance with Exception No. 3 to 24.1.~~

Table 23.1
Gas-air mixtures for maximum pressure tests

Class I group	Gas	Test range percent in air	Minimum number of tests
A, IIC	Acetylene	5 – 20	10
B, IIB plus Hydrogen, IIC	Hydrogen	15 – 35	10
C, IIB	Ethylene	4 – 9	10
D, IIA	Propane	3 – 7	10

Table 23.2
Gas-air mixtures for flame propagation tests with factors applied to joints

Class I group	Explosive test mixture	Minimum number of tests
A, IIC	Acetylene, 7.5% $\pm$ 1%	5
B, IIB plus Hydrogen, IIC	Hydrogen, 27% $\pm$ 1%	5
C, IIB	Ethylene 6.5% $\pm$ 0.5%	5
D, IIA	Propane, 4.2% $\pm$ 0.1%	5

Table 23.3
Gas-air mixtures for flame propagation tests with without factors applied to the mixtures joints

Class I group	Explosive test mixture	Minimum number of tests
A, IIC	Acetylene – 10.0 $\pm$ 1%	5
B, IIB plus Hydrogen, IIC	Oxygen – 6.7% $\pm$ 1%	
	Hydrogen – 40.0% $\pm$ 1%	5
C, IIB	Oxygen – 9.5% $\pm$ 1%	
	Hydrogen – 37% $\pm$ 1%	5
D, IIA	Hydrogen – 55% $\pm$ 1%	5

23.3 During the explosion tests, the cable sealing fitting shall prevent the passage of sparks or flame to the surrounding atmosphere which are capable of igniting the surrounding atmosphere.

23.4 Tests are to be conducted with cables assembled to the fittings.

23.5 Short lengths of cable having end fittings assembled in accordance with the manufacturer's instructions are to be connected to a sample enclosure representative of explosion-proof equipment. The representative test enclosure is to have a free internal volume of 1800 – 2100 cubic inches (29.5 – 34.4 dm) or (1 cubic foot). Representative samples of the cable assemblies under investigation are to be installed in the enclosure. For cable sealing fittings for Class I, Division 1 or Class I, Zone 1 locations, the inlet of the enclosure is to be provided with 5, 10, and 15 feet (1.5, 3.0, and 4.6 m) of 1-1/2 inch trade-size (48.3 mm outside diameter) conduit. For Class I, Division 2 or Class I, Zone 2, the lengths of conduit are to be omitted.

23.6 For the explosion tests, the cable sealing fitting and the representative test enclosure is to be installed in a test chamber that has inlet and outlet connections to the lines carrying the explosive mixture. The representative test enclosure is to be tapped with threaded holes for connection to the inlet or outlet lines carrying the explosive mixture, attachment of explosion-pressure recording device, and insertion of a spark plug for ignition. The length of conduit attached to the representative test enclosure is to be used for inlet or outlet connection to the line carrying the explosive mixture. For cable sealing fittings for Class I, Division 1 or Class I, Zone 1 locations, a spark plug is to be located in the length of conduit approximately 4 inches (102 mm) from the outer end of the conduit. For Class I, Division 2 or Class I, Zone 2 the spark is to be initiated within the representative test enclosure. The explosive

mixture is to be prepared by auxiliary equipment capable of maintaining predetermined concentrations of the mixture.

23.7 The explosive mixture is to be allowed to flow into the test assembly and into the surrounding test chamber until all of the original air has been displaced. Samples are to be taken for analyses from the line carrying the explosive mixture. The mixture within the test assembly is then to be ignited by the spark plug.

23.8 If a cable sealing fitting is intended to be provided with a metallic paint or other noninsulating coating on a threaded joint surface or on threaded supply connections, the explosion tests are also to be conducted on a sample provided with such coating. See 19.3(a).

23.9 A cable sealing fitting for Class I, Groups A and B, IIC plus Hydrogen, or IIC locations, that has flat, cylindrical, or rabbet-type joints is to be tested with test factors applied by having the metal-to-metal joints reduced to 75 percent of the total joint width to be used and with the joints shimmed to give a clearance of 50 percent greater than the clearance to be used. A fitting that has threaded joints not tapered 3/4 inch per foot, is to be tested with a threaded engagement of 75 percent of the total number of engaging threads to be used. The lateral clearance at a threaded joint is to be the maximum obtainable in production fittings, including maximum manufacturing tolerances.

23.10 A device with a labyrinth joint is to be tested with the joint reduced to 75 percent of the total joint width and the joint clearance increased by 50 percent.

23.11 A threaded polymeric-to-polymeric joint is to be tested with a thread engagement of 75 percent of the total number of engaging threads to be used.

23.12 Products having other polymeric joints shall be subjected to the test program outlined in Non-metallic Materials Qualified by Material Tests, Section 28.

23.13 All joints having production within 80 to 100% of product maximum clearance and 80—100% of production minimum length may alternatively be tested with test factors applied to the test gas mixtures by using the gas-air mixtures given for the gas group in Table 23.3.

24 Hydrostatic Pressure Tests

24.1 A cable sealing fitting shall withstand for 1 minute, without rupture or permanent distortion, a hydrostatic test pressure on the end of the seal of four times the maximum internal explosion pressure developed during the explosion tests.

Exception No. 1: The hydrostatic pressure test may be omitted if calculations indicate an acceptable factor of safety based on the maximum internal explosion pressure. The safety factor shall be five for all calculations.

Exception No.2: If excess leakage occurs, resulting in the inability of the test apparatus to maintain the required pressure in a test of a 2 inch (60.3 mm outside diameter) or larger trade size cable sealing fitting with wires sealed in the fitting, a fitting with a seal but without wires may be used.

Exception No. 3: For a cable sealing fitting as described in 24.2 that is not subjected to explosion tests, the hydrostatic test pressure is to be as specified in Table 24.1.

Table 24.1
Hydrostatic pressures for cable fitting seals

Class I area classification	Required hydrostatic pressure (psig)			
	Group A	Group B or IIC	Group C or IIB	Group D or IIA
Division 1 or Zone 1	2,000	2,000	1,200	600
Division 2 or Zone 2	500	500	500	500

24.2 The hydrostatic pressure test on the seal in a fitting is to be conducted on a seal prepared at room temperature, and immediately following the specified minimum cure time on a seal prepared at the minimum temperature specified by the manufacturer in the installation instructions supplied with the fitting or with the sealing compound.

24.3 The hydrostatic pressure is to be applied at the rate of approximately 100 – 600 psig (690 – 4137 kPa) per minute until the required internal pressure is reached. Gaskets or other means may be employed if necessary to prevent leakage of water during application of pressure.

25 Dust Penetration Test

25.1 A cable sealing fitting for Class II locations shall be exposed to a circulating dust-air atmosphere to determine that the enclosure is dusttight. During this test there shall be no entrance of the dust into the box or the fitting.

Exception: A cable sealing fitting need not be exposed to the circulating dust-air atmosphere if all joints:

- a) Are of the threaded type, or
- b) Are ungasketed and comply with the requirements in 6.1.1, 6.2.1.4 – 6.2.4.4, and 15.1 in the Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations, UL 886.
- c) Are ungasketed and comply with 15.4.

25.2 For the dust penetration test, cable sealing fittings assembled as described in 23.5 shall be used in the test, except that the lengths of Inlet conduit shall be omitted.

25.3 The box or the fitting is to be installed in a test chamber to permit free circulation of dust-air mixtures around the device. The test chamber is to be provided with a cover and with dust-air inlet and outlet connections. The fitting in the representative test enclosure is to be exposed to the dust-air atmosphere that is to be produced by auxiliary apparatus and introduced into the test chamber. The test is to be continued for at least 30 hours while the box or the fitting is continuously exposed to the circulating dust-air atmosphere.

25.4 Grain dust consisting of wheat or corn dust, or both, that has passed through a U.S.A. Standard 150 micron (100 mesh) wire cloth is to be used for the dust-air atmosphere if the box or the fitting is for use in Class II, Group F, Group G, or Groups F and G locations.

25.5 Magnesium dust, all of which has passed through a U.S.A. Standard 250 micron (60 mesh) wire cloth, 66 percent of which has passed through 150 micron (100 mesh) wire cloth, and 22 percent of which has passed through a 75 micron (200 mesh) wire cloth is to be used for the dust-air atmosphere if the box or the fitting is for use in Class II, Group E, Groups E and F, or Groups E, F, and G locations.

25.6 The wire cloth is to conform to the dimensional requirements of the Standard Specification for Wire-Cloth Sieves for Testing Purposes, ASTM E11-8795.

26 Leakage of Sealing Fittings Test

26.1 A cable sealing fitting having wires sealed with compound specified for use with the fitting shall not permit the passage of more than 0.007 cubic foot (0.2 L) of air per hour at a pressure of 6 inches (152 mm) of water.

26.2 The test is to be conducted on seals prepared at room temperature and on seals prepared at the minimum temperature specified by the manufacturer in the installation instructions supplied with the fitting or with the sealing compound.

26.3 Regarding the number and size of wires that are to be sealed in each sealing fitting, consideration shall be given to the maximum number of conductors for use in each trade size cable sealing fitting and the maximum available number of conductors for use in each trade size cable sealing fitting shall be used.

~~Exception: Other numbers and sizes of wires may be used if they represent the conductor fill range of wires specified in the instructions provided with the fitting.~~

27 High Humidity Tests

27.1 These requirements apply to ~~cement-based~~ sealing compounds.

27.2 Sample cable sealing fittings, conditioned as described in 27.3, shall be subjected to Hydrostatic Pressure Tests, Section 24, and Leakage of Sealing Fittings Test, Section 26.

27.3 Cable sealing fittings prepared in accordance with 23.2 are to be subjected to the following environmental conditioning:

- a) 60 days at 60°C (140°F) and a relative humidity of 95 – 100 percent.
- b) 60 days at 20°C (68°F) and relative humidity of 95 – 100 percent with a 1 inch (25.4 mm) column of water maintained on the top of the seal.

28 Non-metallic Materials ~~Qualified by Material Tests~~

28.1 General

28.1.1 Non-metallic materials shall comply with either 28.2 or 28.3 and shall comply with 28.4.

28.2 Chemical compatibility by material samples

28.2.1 Sample preparation

28.2.1.1 39 samples with like dimensions shall be prepared. The dimensions of these samples are to be at least 5 by 1/2 by 1/8 inch (127 by 12.7 by 3.2 mm).

28.2.1.2 The initial linear dimension(s) of each sample shall be measured.

28.2.1.3 The initial hardness of each sample shall be measured.

28.2.1.4 The initial weight of each sample shall be measured.

28.2.2 Solvent vapor exposure tests

28.2.2.1 For each of the following test chemicals, a set of three samples shall be exposed to a 100% saturated vapor in air of the chemical at 68°F to 77°F (20°C to 25°C) for a period of 7 days.

Acetic Acid (Glacial)
Acetone
Ammonium Hydroxide (20% by weight)
ASTM reference fuel C
Diethyl Ether
Ethyl Acetate
Ethylene Dichloride
Furfural
n-Hexane
Methyl Ethyl Ketone
Methanol
2-Nitropropane
Toluene

Exception: The manufacturer may mark specific chemical atmospheres in which the product is to be used and test for those chemical exposures only.

28.2.3 Sample evaluation

28.2.3.1 The linear dimension(s) of each sample shall be measured within one hour after removal from the solvent vapor. The dimensional changes shall not indicate shrinkage of more than 1% of the initial value.

28.2.3.2 The hardness of each sample shall be measured within one hour after removal from the solvent. The hardness change shall not exceed 10% of the initial value.

28.2.3.3 The weight of each sample shall be measured within one hour after removal from the solvent vapor. The weight loss shall not exceed 1% of the initial value.

28.2.4 Accelerated aging tests ~~Additional Tests~~

28.2.4.1 A set of three complete enclosure samples shall be subjected to the following tests:

- a) Accelerated aging per 28.3.3, and
- b) Flamepath erosion test per 28.3.4.2.

28.3 Chemical compatability by complete end product tests

~~Non-metallic materials qualified by complete end product tests~~

28.3.1 Sample Preparation

28.3.1.1 Sixteen (16) complete samples are required.

28.3.2 Solvent vapor exposure tests

28.3.2.1 For each of the following test chemicals, one enclosure shall be exposed to a 100% saturated vapor in air of the chemical at 68°F to 77°F (20°C to 25°C) for a period of 7 days.

Acetic Acid (Glacial)
Acetone
Ammonium Hydroxide (20% by weight)
ASTM reference fuel C
Diethyl Ether
Ethyl Acetate
Ethylene Dichloride
Furfural
n-Hexane
Methyl ethyl ketone
Methanol
2-Nitropropane
Toluene

Exception: The manufacturer may mark specific chemical atmospheres in which the product is to be used and test for those chemical exposures only.

28.3.3 Accelerated aging tests

28.3.3.1 Three ~~separate enclosure complete end product~~ samples are to be conditioned in an oven at a temperature (T_2) and for a length of time (D) determined in accordance with the following but not less than 30 days:

$$D = \frac{18262.5}{2^{\Delta T/10}}$$

$$T_2 = T_1 \frac{\Delta T}{10} \left(\frac{\ln \frac{18262.5}{D}}{\ln 2} \right)$$

in which:

D is the test time in days (30 days minimum).

T_1 is the maximum temperature in °C obtained on the enclosure in a temperature test under normal operating conditions.

T_2 is the test oven temperature in °C.

ΔT is T_2 minus T_1 .

Either the test time in days (D) or the test temperature (T_2) is to be selected by the manufacturer.

28.3.4 Sample Evaluation

28.3.4.1 The three end-product samples subjected to the accelerated aging test of 28.3.4.1 and each of the samples subjected to the solvent vapor exposure tests shall be individually subjected to the Hydrostatic Pressure Test, Section 23, based on the test pressure obtained during the explosion pressure tests conducted as described in Explosion Tests, Section 22.

28.3.4.2 Samples subjected to the solvent vapor exposure test of 28.3.4.2 or Accelerated Aging Test of 23.1, shall exhibit no visual erosion of any flamepath when subjected to 100 additional flame propagation tests according to the test method of 23.2 to 23.13.

28.4 ~~Surface resistivity~~ Test for Accumulation of Static Electricity

28.4.1 General

28.4.1.1 A nonmetallic external part with an area greater than 15.5 in² (100 cm²) shall comply with either the requirements in 28.4.2 or 28.4.3 of this standard.

28.4.2 Method A

28.4.2.1 Any non-metallic surface with area greater than 15.5 in² (100 cm²) shall have a surface resistivity of 1 GΩ or less at 73.4°F (23°C) and 50% relative humidity as defined by the material specifications or be determined by the test in 28.4.2.

28.4.2.2 The resistance shall be tested on the enclosure or on parts of the enclosure. Two parallel electrodes 0.04 inch (1 mm) in width, 4 inches (100 mm) in length, 0.4 inch (10 mm) apart shall be centered on a 6 X 2.4 inch (150 mm X 60 mm) sample. The sample shall be cleaned with distilled water, then with isopropyl alcohol, then once more with distilled water before being dried. Untouched by bare hands, it shall be conditioned for 24 hours at 23°C and 50% relative humidity. The test shall be carried out under the same conditions. A direct voltage of 500 ± 10 Vdc shall be applied for one minute. The resistance is the quotient of the direct voltage applied at the electrodes to the total current flowing between them when the direct voltage has been applied for one minute.

28.4.3 Method B

28.4.3.1 A nonmetallic external part with an area greater than 15.5 in² (100 cm²) shall comply with the requirements in 28.4.3.2 - 28.4.3.5.

28.4.3.2 No sparks shall be observed when a grounded metal sphere is brought into gradual contact with the nonmetallic part, mounted as intended, after it has been electrostatically charged.

28.4.3.3 Three samples of the part are to be conditioned for at least 48 hours at a relative humidity of 25 ± 10 percent.

28.4.3.4 Immediately after removal from the low-humidity chamber, the samples are to be supported by means of insulators in a room having a relative humidity not more than 35 percent and having all sources of light, other than electrical sparks, eliminated. An electrostatic charge is to be sprayed on nonconductive parts of the product using a Van de Graaf generator limited to 5000 volts.

28.4.3.5 A 3/8-inch (9.5-mm) diameter grounded metal sphere is to be brought into gradual contact with the nonconductive area of the sample.

29 Tests on Sealing Compounds

29.1 A sealing compound used in Class I equipment shall be subjected to the tests described in 29.2 – 29.7 to determine its resistance to chemicals.

29.2 The resistance to crushing of the sealing compound is to be determined on as-received specimens and specimens exposed to chemical vapors. The crushing force after exposure is to be at least 85 percent of the value determined using as-received samples. In addition, changes in dimensions and weight after exposure are to be determined. Shrinkage or loss of weight of more than 1 percent or an increase in weight or swelling that changes the intended properties of the sealing compound is not acceptable. See 29.8.

29.3 Cylindrical specimens 1/2 inch (12.7 mm) in diameter and 3/4 inch (19.1 mm) long are to be used for the tests. At least 81 specimens are required – six for each chemical and three for as-received tests. The samples shall be of uniform size and shape, having both ends perpendicular to the side of the cylinder.

29.4 The specimens are to be exposed for 168 hours (7 days) to saturated vapors in air of the chemicals specified in 28.2.2.

29.5 During and after the exposure, the specimens are to be observed for discoloration, swelling, crazing, cracking, leaching, or dissolving.

29.6 After the exposure, three specimens from each chemical exposure are to be weighed and measured immediately after removal from the chemical vapor.

29.7 The other three exposed specimens and the as-received specimens are to be placed between two parallel plates and crushed with a compression-testing machine having a crosshead speed of 0.1 inch (2.54 mm) per minute. The load is to be applied perpendicular to the axis of the cylindrical specimens and the compressive force required to crack and break the specimens is to be recorded.

29.8 As an alternative, tests to determine resistance of the sealing compound to chemicals may be conducted on a complete sample that incorporates the sealing compound as intended in the final assembly, but without cable or conductors. These tests are to consist of explosion and hydrostatic pressure tests in accordance with Sections 23 and 24 on the complete sample after the sample has been exposed to the chemicals specified in 28.3.2. There shall be no flame propagation, rupture, cracking, breakage, or other damage to the sealing compound.

MARKING

30 Details

30.1 Cable sealing fitting shall be marked with the following:

- a) The manufacturer's or private labeler's name, trademark, or other descriptive marking by which the organization responsible for the product may be identified.
- b) A descriptive catalog or designation number to specifically identify the product.
- c) Designation of the hazardous location in which the product is intended to be used. Depending on the location, this may include the Class, Group, Division, Zone and Temperature Code.

30.2 In addition to, or as an alternative to, the marking in 30.1(c), cable sealing fittings that have been investigated and found to comply with the requirements for Class I, Group D locations may additionally or alternatively marked Class I, Zone 1, Group IIA.

30.3 In addition to, or as an alternative to, the marking in 30.1(c), cable sealing fittings that have been investigated and found to comply with the requirements for Class I, Group C locations may additionally or alternatively marked Class I, Zone 1, Group IIB.

30.4 In addition to, or as an alternative to, the marking in 30.1(c), cable sealing fittings that have been investigated and found to comply with the requirements for Class I, Group B locations may additionally or alternatively marked Class I, Zone 1, Group IIB plus Hydrogen.

30.5 In addition to, or as an alternative to, the marking in 30.1(c), cable sealing fittings that have been investigated and found to comply with the requirements for Class I, Group A locations may additionally or alternatively marked Class I, Zone 1, Group IIC.

30.6 For Division 1 or Division 2, designation of the hazardous location Group need not be marked on a fitting if the size or design of the fitting is such that there is insufficient space for this marking, and:

- a) The designations of both the hazardous location class and group appear on the smallest package in which the fitting is shipped, and
- b) The fitting is suitable for all hazardous location groups in the Division 1 or Division 2 hazardous location class marked on the fitting.

30.7 Except as noted, all markings shall be on a metal plate or plates permanently attached to the cable sealing fitting, or shall be embossed, stamped, cast, or molded in the fitting where it will be readily visible after installation.

30.8 A nonmetallic pressure-sensitive label may be used if an investigation indicates that such marking means is permanent and suitable for the purpose. The investigation will include exposure to the various chemical reagents likely to be encountered in use.

Exception: Labels used in Division 2 or Zone 2.

30.9 A cable sealing fitting shall be provided with the necessary installation instructions detailing proper cable size selection and type of sealing compound to be used. This information may be marked on the box or fitting or it may be part of the installation instructions packed with each box or fitting.

30.10 Each fitting or each package of sealing compound shall be provided with instructions containing the following information:

- a) Preparation of dams, if required.
- b) Instructions for mixing the compound. For cement-based compounds, the instructions shall include proportions of compound to water by weight or volume. The proportions by weight or volume need not be indicated if the compound and water are prepacked as a unit.
- c) Filling or assembly instructions.

d) A statement including the following:

- 1) Specific temperature below which the seal should not be poured.
- 2) Period of time the fitting must be at, or above, the given temperature in order that the seal will set properly.
- 3) ~~Maximum number of conductors.~~

APPENDIX B

DESIGNATED RESPONSIBILITY FOR UL PRODUCT CATEGORIES

CYMX, CABLE SEALING FITTINGS FOR USE IN HAZARDOUS LOCATIONS
 EBNV, CONDUIT FITTINGS FOR USE IN HAZARDOUS LOCATIONS
 EBNV2, CONDUIT FITTINGS FOR USE IN HAZARDOUS LOCATIONS
 FTRQ, HAZARDOUS LOCATIONS EQUIPMENT – ENCLOSURES
 POWX, MINERAL INSULATED CABLE FITTINGS
 QAZV, OUTLET BOX ACCESSORIES
 QBCR, HAZARDOUS LOCATIONS EQUIPMENT – OUTLET BOXES
 QBCR2, HAZARDOUS LOCATIONS EQUIPMENT – OUTLET BOXES
 PJAX, METAL-CLAD CABLES
 FDLW, DRILLING EQUIPMENT – MARINE SHIPBOARD CABLE SEALING
 FITTINGS
 DAZV, HAZARDOUS LOCATIONS EQUIPMENT – CENTRIFUGES
 DMRR, HAZARDOUS LOCATIONS EQUIPMENT – CLEANING MACHINES
 FTRV, ENCLOSURES FOR USE IN HAZARDOUS LOCATIONS
 FDKX, DRILLING EQUIPMENT, DRILLING INSTRUMENTATION FOR USE IN
 HAZARDOUS LOCATIONS
 FTRX, ENCLOSURE ACCESSORIES
 QDIY, HAZARDOUS LOCATIONS EQUIPMENT – PAINTING EQUIPMENT
 QFIW, HAZARDOUS LOCATIONS EQUIPMENT – PANELBOARDS
 QNHV, HAZARDOUS LOCATIONS EQUIPMENT – PLUMBING ACCESSORIES
 SAOX, HAZARDOUS LOCATIONS EQUIPMENT – REELS – CORDS
 TVLE2, SEALING COMPOUNDS FOR USE IN HAZARDOUS LOCATIONS
 VCSV, HAZARDOUS LOCATIONS EQUIPMENT – SOUND RECORDING AND
 REPRODUCING EQUIPMENT
 VXDY, HAZARDOUS LOCATIONS EQUIPMENT – STATIC NEUTRALIZING
 EQUIPMENT
 WYMV, HAZARDOUS LOCATIONS EQUIPMENT – TELEMETERING EQUIPMENT
 WZAT, HAZARDOUS LOCATIONS EQUIPMENT – TELEPHONES
 XIAZ, HAZARDOUS LOCATIONS EQUIPMENT – TIME INDICATING AND
 RECORDING EQUIPMENT
 ZBRX, HAZARDOUS LOCATIONS EQUIPMENT – VIBRATORS
 ZCFV, HAZARDOUS LOCATIONS EQUIPMENT – VISCOMETERS
 ZRBZ, HAZARDOUS LOCATIONS EQUIPMENT – X-RAY EQUIPMENT
 ZRBZ2, HAZARDOUS LOCATIONS EQUIPMENT – X-RAY EQUIPMENT
 ACCESSORIES
 NNNY, INDUSTRIAL CONTROL EQUIPMENT – CONTROL PANEL AND
 ASSEMBLIES
 NNRL, INDUSTRIAL CONTROL EQUIPMENT – CONTROL ASSEMBLY COVERS
 NOIV, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 AUXILIARY DEVICES
 NOPU2, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 AUXILIARY DEVICES
 NOTH, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 COMBINATION MOTOR

NOWT, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 FLOAT-AND PRESSURE
 NOWT2, INDUSTRIAL CONTROL EQUIPMENT – CONTROLLERS –
 COMPONENT
 NPKR, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 MAGNETIC MOTOR
 NPKR2, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 MAGNETIC MOTOR
 NPXZ, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 MANUAL MOTOR
 NPXZ2, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 MANUAL MOTOR
 NQLZ, INDUSTRIAL CONTROL EQUIPMENT – MOTOR CONTROLLERS –
 MISCELLANEOUS MOTOR
 NRBX, INDUSTRIAL CONTROL EQUIPMENT RELATING TO HAZARDOUS
 LOCATIONS
 NRDZ, INDUSTRIAL CONTROL EQUIPMENT RELATING TO HAZARDOUS
 LOCATIONS – AUXILIARY DEVICES
 NRFQ, INDUSTRIAL CONTROL EQUIPMENT RELATING TO HAZARDOUS
 LOCATIONS – MAGNETIC MOTOR CONTROLLERS

The individuals shown in the following tables are involved with the investigation of products covered under the subject categories. The Primary Designated Engineer (**shown in UPPERCASE letters**) coordinates the establishment and uniform interpretation of UL requirements applicable to the product categories. The Designated Engineers (**shown in lowercase letters**) work with the Primary Designated Engineer to interpret requirements and maintain standards.

Should you have questions regarding the interpretation of the requirements proposed in this bulletin or any adopted requirements that affect your product, you are encouraged to contact the individual at the office to which you normally submit your products.

The Industry Advisory Conference Chairman for the subject categories is Lee Hewitt at UL's Northbrook office. The IAC Chairman oversees the significant interpretations made by the Primary Designated Engineer and arbitrates any differences regarding interpretation of UL requirements.

CCN	Office/Subsidiary	Responsible Engineer	Extension
CYMX, TVLE2, FTRV, FTRQ, FDLW, FTRX	Northbrook	D. ANKELE	42965

CCN	Office/Subsidiary	Responsible Engineer	Extension
POWX, EBNV, EBNV2 QAZV, QBCR, QBCR2	Northbrook	T. DIGANCI	42844

CCN	Office/Subsidiary	Responsible Engineer	Extension
PJAZ	Melville	T. GUIDA	22228
	Northbrook	K. Conner	42330
	Santa Clara	A. Flandez	32816

CCN	Office/Subsidiary	Responsible Engineer	Extension
NNNY, NNRL, NOIV, NOPU2, NOTH, NOWT, NOWT2, NPKR, NPKR2, NPXZ, NPXZ2, NQLX, NRBX, NRDZ, NRFQ, QNHV	Northbrook	E. BRIESCH	43174

CCN	Office/Subsidiary	Responsible Engineer	Extension
DAZV, DMRR, QDIY, QFIW, ZRBZ, VXDY, ZRBZ2,	Northbrook	P. KELLY	42326

CCN	Office/Subsidiary	Responsible Engineer	Extension
DMRR	Northbrook	J. WODZINSKI	42840

CCN	Office/Subsidiary	Responsible Engineer	Extension
SAOX, VCSV	Northbrook	J. ZIMMER	42969

CCN	Office/Subsidiary	Responsible Engineer	Extension
WYMV, FDKX	Northbrook	D. MAHER	42930

CCN	Office/Subsidiary	Responsible Engineer	Extension
WZAT	Northbrook	S. RIRIE	43623

CCN	Office/Subsidiary	Responsible Engineer	Extension
ZCFV, ZBRX	Northbrook	R. FILIP	42841

CCN	Office/Subsidiary	Responsible Engineer	Extension
XIAZ	Northbrook	K. MCMANAMA	42469

GR
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A not-for-profit organization dedicated to public safety
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July 22, 1996

Revision pages for

Standard for

Metal-Clad Cables

UL 1569, Second Edition

Attached to this distribution notice is a revision of the Second edition of UL 1569.

A CHANGE ON A PAGE DATED JULY 22, 1996 IS INDICATED BY A SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEM, PRECEDED AND FOLLOWED BY AN ASTERISK.

THE NEW AND REVISED REQUIREMENTS IN THIS STANDARD ARE NOW IN EFFECT EXCEPT FOR THOSE PARAGRAPHS, SECTIONS, TABLES, FIGURES, AND OTHER ELEMENTS OF THE STANDARD HAVING FUTURE EFFECTIVE DATES AS INDICATED IN THE NOTE FOLLOWING THE AFFECTED ITEM. TO RETAIN THE REQUIREMENTS IN EFFECT UNTIL THESE FUTURE EFFECTIVE DATES, DO NOT DISCARD THE PAGES REPLACED BY THOSE HAVING FUTURE EFFECTIVE DATES UNTIL THOSE DATES.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this standard unless the applicant specifically requests that the product be judged under the current requirements. However, should the applicant elect this option, it should be noted that compliance with all the requirements in this standard will be required as a condition of continued Listing and Follow-Up Services after the effective date and understanding of this should be signified in writing.

The revised requirements are substantially in accordance with UL's Bulletin on this subject dated May 15, 1996. The bulletin is now obsolete and may be discarded.

As indicated on the title page (page 1), this UL Standard for Safety has been approved by the Department of Defense.

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:

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2	May 30, 1995
3	May 13, 1996
4	May 30, 1995
5	July 16, 1996

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66	April 5, 1996
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71 – 89	May 30, 1995
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91 – 148	May 30, 1995

MAY 30, 1995

(Title Page Reprinted: July 22, 1996)

1

UL 1569

Standard for

Metal-Clad Cables

First Edition – July, 1983

Second Edition

May 30, 1995

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

The Department of Defense (DoD) has adopted UL 1569 on July 23, 1983. The publication of revised pages or a new edition of this standard will not invalidate the DoD adoption.

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.

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6.1.3 A copper conductor shall not be smaller than No. 18 AWG and shall not be larger than 2000 kcmil. An aluminum or copper-clad aluminum conductor shall not be smaller than No. 12 AWG and shall not be larger than 2000 kcmil.

6.1.4 Each No. 6 AWG – 2000 kcmil conductor shall be stranded. Soft-annealed copper conductors in the No. 6 – 4/0 AWG sizes may employ the 19-wire combination round-wire unilay stranding described in UL 83 or UL 44. Any size of uncoated or coated copper conductor employing stranding other than combination unilay stranding may be compressed-stranded. Any size of a stranded aluminum conductor may be compressed-stranded. The No. 12 AWG – 1000 kcmil sizes of aluminum conductor and the No. 2 – 4/0 AWG sizes of uncoated copper conductor may be compact-stranded. A compact-stranded aluminum conductor shall have all layers with the same direction of lay (left-hand unidirectional). A compact-stranded copper conductor may be left-hand unidirectional or may have the direction of lay reversed in adjacent layers (concentric-lay-stranded with the outer layer left-handed). A compact-stranded conductor shall not be segmented. A finished compact-stranded conductor shall not be larger in overall diameter than indicated in Column C or D of Table 20.2 of UL 1581, and shall not be smaller than indicated in column A or B of Table 20.2 of UL 1581. The length of lay of the strands in the outer layer of a No. 1 AWG – 1000 kcmil compact-stranded conductor shall be 8 – 16 times the overall diameter of that layer. The length of lay of the strands in the outer layer of a No. 12 – 2 AWG compact-stranded conductor shall be 8.0 – 17.5 times the overall diameter of that layer.

6.1.4 revised May 13, 1996

6.1.5 A finished compressed-stranded ASTM Class B, C, or D conductor shall not be larger in overall diameter than indicated in column R or S of Table 6.2 and shall not be smaller in overall diameter than indicated in column P or Q of Table 6.2.

6.1.6 Any joint in a conductor shall comply with 47.1 or the applicable Standard indicated in 7.2.1, except that a splice is acceptable in a No. 18 – 10 AWG stranded conductor as a whole if the splice (butt splice) is made by machine brazing or welding such that the resulting solid section of the stranded conductor is not longer than 1/2 inch or 13 mm, the splice does not increase the diameter of the conductor, there are no sharp points, and the distance between splices in a single conductor does not average less than 3000 ft or 915 m in any reel length of that single insulated conductor. A butt splice shall be made only before insulating. All finished, insulated stranded conductors containing a butt splice shall not be marked as an NEC type but the following are acceptable:

- a) POLARITY IDENTIFICATION – Color coding and/or surface printing of hash marks, numbers, color names, or the like.
- b) RATINGS ON NON-NEC CONDUCTORS – Surface marking of the 34.1(c)(1) temperature and dry/wet ratings from Table 9.1.

6.1.6 revised July 22, 1996

6.1.7 Cable having interlocked armor shall contain one copper, aluminum, or copper-clad aluminum grounding conductor that is in one location or in several sections (see 6.1.10) and is not smaller than indicated under the heading "Grounding Conductor" in Table 6.3 (90°C or 194°F circuit conductors) or in Table 6.4 (75°C or 167°F circuit conductors). One or more additional copper, aluminum, or copper-clad aluminum grounding conductors may be provided. Each additional grounding conductor shall not be sectioned and shall not be smaller than indicated in Table 6.3 or 6.4 as applicable. If only one grounding conductor is provided, it may be bare or it may be insulated in accordance with 35.1. If more than one grounding conductor is provided, one grounding conductor (the required conductor) may be bare or insulated and every other grounding conductor shall be insulated in accordance with 35.2 or 35.3, as applicable. See 6.1.12.

6.1.8 Cable having corrugated- or smooth-sheath armor with a resistance greater than indicated in one of the last four columns of Table 6.3 (90°C or 194°F circuit conductors) or in Table 6.4 (75°C or 167°F circuit conductors) shall contain one copper, aluminum, or copper-clad aluminum grounding conductor that is in one location or in several sections (see 6.1.10) and is of a size such that the measured resistance (see 6.1.11) of the grounding conductor in parallel with the armor is not higher than indicated in one of the last four columns of Table 6.3 or 6.4 as applicable. One or more additional copper, aluminum, or copper-clad aluminum grounding conductors may be provided. Each additional grounding conductor shall not be sectioned and shall not be smaller than indicated in Table 6.3 or 6.4 as applicable. If only one grounding conductor is provided, it may be bare or it may be insulated in accordance with 35.1. If more than one grounding conductor is provided, one grounding conductor (the required conductor) may be bare or insulated and every other grounding conductor shall be insulated in accordance with 35.2 or 35.3, as applicable. See 6.1.12.

Table 6.1
Diameters over round compact-stranded aluminum conductors

Table 6.1 deleted May 13, 1996

Table 11.12
Physical properties of NBR/PVC jacket under or over armor
on cable containing Type USE (single-conductor), RHW,
THWN, or RH conductors and/or conductors insulated
per Tables 47.3 – 47.5 and 47.7

Condition of specimens at time of measurement	Maximum acceptable set in recovery test (1-inch or 25-mm bench marks stretched to 3 inches or 75 mm)	Minimum acceptable	
		ultimate elongation (1-inch or 25-mm bench marks)	tensile strength
Unaged	31 percent (5/16 inch or 7.8 mm)	300 percent (3 inches or 75 mm)	1500 lbf/in ² or 10.3 MN/m ² or 1034 N/cm ² or 1.05 kgf/mm ²
Aged in an oxygen bomb for 96 h at 70.0 ± 1.0°C (158.0 ± 1.8°F) and a gauge pressure of 300 ± 10 lbf/in ² or 2.07 ± 0.07 MN/m ² or 207 ± 7 N/cm ² or 0.211 ± 0.007 kgf/mm ²	Not measured	65 percent of the result with unaged specimens if the sum of tensile and elongation percentages is at least 140. Otherwise, 70 percent of the result with unaged specimens	
Aged in a full-draft circulating-air oven for 168 h at 70.0 ± 1.0°C (158.0 ± 1.8°F)	Not measured	70 percent of the result with unaged specimens	
Aged in oil for 18 h at 121.0 ± 1.0°C (249.8 ± 1.8°F)	Not measured	60 percent of the result with unaged specimens	

Table 11.12 revised January 5, 1996

Table 11.13
Physical properties of oil-resistant PVC,
CP, CPE, neoprene, XL or NBR/PVC jacket under
or over armor on any cable

Condition of specimens at time of measurement	Minimum acceptable ultimate elongation (1-inch or 25-mm bench marks)	Minimum acceptable tensile strength
75°C (167°F) oil-resistant jacket: Aged in oil for 60 d at 75.0 ± 1.0°C (167.0 ± 1.8°F)	65 percent of the result with unaged specimens	
60°C (140°F) oil-resistant jacket: Aged in oil for 96 h at 100.0 ± 1.0°C (212.0 ± 1.8°F)	50 percent of the result with unaged specimens	

Table 11.13 title revised July 22, 1996

Table 11.14
Thicknesses of PVC, CP, CPE, neoprene, XL or NBR/PVC
jacket under or over the armor

Calculated diameter or length of minor axis under the Jacket		Minimum acceptable average thickness of the jacket		Minimum acceptable thickness at any point of the jacket	
Inch	mm	Inch	mm	Inch	mm
0 – 0.425	0 – 10.80	40	1.02	28	0.71
over 0.425 but not over 1.500	over 10.80 but not over 38.10	50	1.27	35	0.89
over 1.500 but not over 2.250	over 38.10 but not over 57.15	60	1.52	42	1.07
over 2.250 but not over 3.000	over 57.15 but not over 76.20	75	1.90	52	1.32
over 3.000	over 76.20	85	2.16	60	1.52

Table 11.14 title revised July 22, 1996