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

333 Pfingsten Road
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 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.

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DATA

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October 6, 1995

Revision pages for

Standard for

Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations

UL 1203, Second Edition

Attached to this transmittal notice is a revision of the Second edition of UL 1203.

A CHANGE ON A PAGE DATED OCTOBER 6, 1995 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 requirements are substantially in accordance with UL's bulletin on this subject dated June 30, 1995. The bulletin is now obsolete and may be discarded.

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	July 27, 1994(Reprinted October 6, 1995)
2	October 6, 1995
3, 4	July 27, 1994
5, 6, 6A	October 6, 1995
7 - 13	July 27, 1994
14	October 6, 1995
15 - 21	July 27, 1994
22, 22A, 23, 24	July 12, 1995
25 - 40	July 27, 1994
41, 42, 42A	July 12, 1995
43 - 48	July 27, 1994
49 - 51	October 6, 1995

JULY 27, 1994

(Title Page Reprinted: October 6, 1995)

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UL 1203

Standard for

**Explosion-Proof and Dust-Ignition-Proof
Electrical Equipment for Use in
Hazardous (Classified) Locations**

First Edition – January, 1987

Second Edition

July 27, 1994

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

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 1-55989-641-8

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INTRODUCTION

1 Scope

1.1 These requirements cover explosion-proof and dust-ignition-proof electrical equipment for installation and use in hazardous (classified) locations, Class I, Division 1, Groups A, B, C, and D, and Class II, Division 1, Groups E, F, and G, in accordance with the National Electrical Code, NFPA 70.

1.1.1 These requirements also cover explosion-proof electrical equipment for installation and use in Class I, Zone 1, Groups IIA, IIB, and IIC hazardous (classified) locations.

1.1.1 added October 6, 1995

1.2 These requirements do not cover intrinsically safe electrical circuits of electrical equipment for use in hazardous (classified) locations, or equipment for use in hazardous (classified) locations specifically covered in a separate standard.

1.3 These requirements cover equipment for use only under the following atmospheric conditions:

- a) A minimum ambient temperature of minus 25°C (minus 13°F),
- b) An oxygen concentration not greater than 21 percent by volume, and
- c) A nominal barometric pressure of one atmosphere.

1.4 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 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 General

2.1.1 Equipment covered by this standard shall also comply with the applicable requirements for similar equipment for use in ordinary locations.

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.

2.4 Components

2.4.1 Except as indicated in 2.4.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.4.2 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 a product covered by this standard, or
- b) Is superseded by a requirement in this standard.

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

2.4.4 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.

3 Enclosure Types

3.1 An enclosure shall comply with the applicable requirements specified in Table 3.1.

3.2 An enclosure that is intended for use in other environmental conditions shall also comply with the applicable requirements for each enclosure type, for example Type 3, 4X, or 6, specified in the Standard for Enclosures for Electrical Equipment, UL 50.

3.3 A Type 3, 3R, 3S, 4, 4X, 6, or 6P enclosure may also be marked "Raintight" if no water enters the enclosure or "Rainproof" if no water enters the enclosure at a point higher than the lowest live part. Compliance with these requirements shall be determined by the applicable tests in the Standard for Enclosures for Electrical Equipment, UL 50.

Table 3.1
Enclosure types for hazardous locations

Type number	Application	Requirements
7	Class I, Division 1, Groups A, B, C, or D – Indoor Hazardous Locations – Air-Break Equipment	Part I, Sections 4 – 25
9	Class II, Division 1, Groups E, F, or G – Indoor Hazardous Locations – Air-Break Equipment	Part II, Sections 26 – 46

3A Class I, Zone, and Group Equivalency

3A.1 Class I, Zone 1, Group IIA

3A.1.1 Explosion-proof electrical equipment intended to be marked in accordance with 49.2.1 shall comply with all the requirements for explosion-proof electrical equipment for use in Class I, Group D hazardous (classified) locations.

3A.1.1 added October 6, 1995

3A.2 Class I, Zone 1, Group IIB

3A.2.1 Explosion-proof electrical equipment intended to be marked in accordance with 49.2.2 shall comply with all the requirements for explosion-proof electrical equipment for use in Class I, Group C hazardous (classified) locations.

3A.2.1 added October 6, 1995

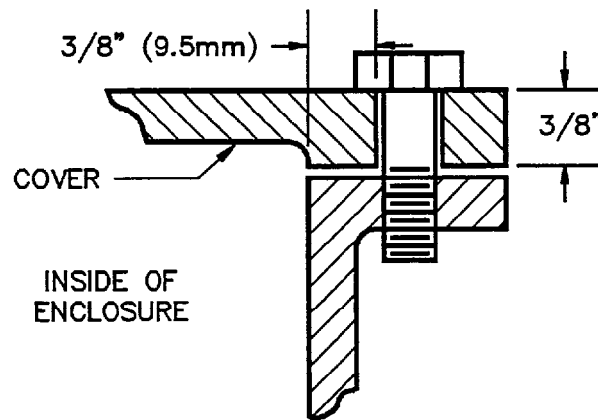
3A.3 Class I, Zone 1, Group IIC

3A.3.1 Explosion-proof electrical equipment intended to be marked in accordance with 49.2.3 shall comply with all the requirements for explosion-proof electrical equipment for use in both Class I, Group A and Class I, Group B hazardous (classified) locations.

3A.3.1 added October 6, 1995

Figure 6.3
3/8-inch (9.5-mm) wide flat joint

(See 6.2.1.3(b) and 6.3.1.1)



SB0521A

6.2.1.4 The width of a joint in an enclosure having a free internal volume of not more than 6 cubic inches (0.1 dm³) shall not be less than 1/4 inch (6.4 mm). For an enclosure for Group C locations, the clearance between the joint surfaces shall not be more than 0.004 inch (0.10 mm). For an enclosure for Group D locations, the clearance between the joint surfaces shall not be more than 0.006 inch (0.15 mm).

6.2.1.5 An enclosure may have a venting section to relieve internal explosion pressures. A joint in a vented enclosure may have a width of not less than 1/4 inch (6.4 mm), and a clearance of not more than 0.005 inch (0.013 mm), if the maximum explosion pressure developed during the explosion tests does not exceed 5 psig (34.5 kPa). A venting section shall afford protection against propagation of flame.

6.2.2 Threaded joints

6.2.2.1 A threaded joint shall be made up with the number of fully engaged threads specified in Table 6.1. Threads shall not be finer than specified in Table 6.1.

Table 6.1
Thread engagement

Maximum diameter of threaded sections, inch (mm)	Maximum acceptable number of threads per inch (per 25.4 mm)	Minimum acceptable number of threads engaged
No limit	20	5
3/8 (9.5)	24	5
Over 3/8	24	6
Over 3/8	28	7
Over 3/8	32	8

6.2.2.2 A joint of the serrated type with thread contour shall not have more than 20 serrations per inch and shall have at least five fully-engaged and tightly-clamped serrations.

6.2.3 Labyrinth joints

6.2.3.1 Joints of the labyrinth type shall be investigated in accordance with the requirements in 14.25.

6.2.3.1 revised October 6, 1995

6.2.4 Bolts in joint width

6.2.4.1 A bolt may be located in a 3/4 inch (19.1 mm) or wider joint if the distance from the inside of the enclosure to the nearest edge of the clearance hole for the bolt is not less than 1/2 inch (12.7 mm), and the diametrical clearance between the bolt and the clearance hole is not more than 0.045 inch (1.14 mm), measured over the shank or the major diameter of the threads, for a length of not less than one-half the required width of joint specified in Figure 6.1. The distance from inside the enclosure to the edge of the nearest clearance hole is measured with the cover in the most unfavorable position. See 6.2.4.4 and Figure 6.4.

6.2.4.2 All bolt holes in a joint width shall be bottomed or the bolts or screws for fastening a cover shall each engage at least five full threads in a tapped hole.

6.2.4.3 A bolt in a joint width may be provided with a lock washer.

6.2.4.4 The requirements in 6.2.4.1 and 6.2.4.2 apply, in general, to machine screws having a round cross section. Screws that form their own machine-type thread and have been investigated for securing enclosure parts may also be located in the joint width if they comply with the requirements in 6.2.4.1 and 6.2.4.2, except for measurement of the bolt clearance. In determining the clearance between a thread-forming screw and its clearance hole, the bolt dimension to be used is the minimum dimension of the cross section over the threads.

- i) Maximum operating temperature or operating temperature code as specified in Table 49.1, if the operating temperature exceeds 100°C (212°F). This marking is to be based on the maximum temperature attained in the temperature tests. The operating temperature or temperature code shall be near the marking required by (e). It shall be identified as "Operating Temperature _____," or "Operating Temperature Code _____," or the equivalent.
- j) For Class I equipment, if the operating temperature exceeds 100°C (212°F), a cautionary statement consisting of the word "CAUTION" and the following or equivalent wording: "To reduce the risk of fire or explosion, do not install where the marked operating temperature exceeds the ignition temperature of the hazardous atmosphere(s)."

Table 49.1
Temperature marking

Maximum operating temperature		Operating temperature code or identification number
°C	°F	
450	842	T1
300	572	T2
280	536	T2A
260	500	T2B
230	446	T2C
215	419	T2D
200	392	T3
180	356	T3A
165	329	T3B
160	320	T3C
135	275	T4
120	248	T4A
100	212	T5
85	185	T6

49.2.1 In addition to, or as an alternative to, the marking requirement in 49.2(e), equipment that has been investigated and found to comply with the requirements for Class I, Group D locations may additionally or alternatively be marked Class I, Zone 1, Group IIA.

49.2.1 added October 6, 1995

49.2.2 In addition to, or as an alternative to, the marking requirement in 49.2(e), equipment that has been investigated and found to comply with the requirements for Class I, Group C locations may additionally or alternatively be marked Class I, Zone 1, Group IIB.

49.2.2 added October 6, 1995

49.2.3 In addition to, or as an alternative to, the marking requirement in 49.2(e), equipment that has been investigated and found to comply with the requirements for both Class I, Group A, and Class I, Group B locations may additionally or alternatively be marked Class I, Zone 1, Group IIC.

49.2.3 added October 6, 1995

49.2.4 Equipment marked Group IIB may also be marked Group IIA.

49.2.4 added October 6, 1995

49.2.5 Equipment marked Group IIC may also be marked Group IIA, Group IIB, or both Group IIA and Group IIB.

49.2.5 added October 6, 1995

49.3 The markings specified in 49.2 shall be:

- a) Permanently attached to the equipment,
- b) Legible and prominent, and
- c) Located so that they will be visible after installation of the equipment.

49.4 Unless the proper wiring connections are plainly evident, wiring terminals shall be marked, or the equipment shall be provided with a wiring diagram to indicate the connections. Equipment requiring the use of heater elements in the installation shall be provided with a heater table.

49.5 If a wiring diagram or heater table is necessary, each shall be secured to the device. The diagram or table may be a paper label if it is:

- a) Located within the enclosure where it is visible and legible on opening the enclosure, and
- b) Protected against mechanical damage.

49.6 Portable equipment shall be marked with instructions regarding replacement of the power-supply cord. The instructions are to include the following, or equivalent information: "For replacement purposes, use No. ___ AWG Type ___ power-supply cord only." These instructions shall be legible and permanent in nature, and may be on a paper sticker if located within the terminal compartment and protected against mechanical damage.

49.7 Cord-connected equipment employing a packing gland requiring dismantling during cord replacement shall be marked or provided with instructions regarding its installation and replacement.

49.8 Cord-connected equipment that is shipped without the flexible power-supply cord or the attachment fitting attached shall be provided with instructions regarding the installation of these components. These instructions shall be:

- a) Provided as a permanent part of the equipment, or
- b) Contained on a removable tag secured to the equipment.

49.9 Equipment with a factory-installed conduit seal shall be marked "Leads factory sealed", or the equivalent. This information shall be:

- a) Provided as a permanent part of the equipment, or
- b) Contained on a paper sticker or removable tag located where it will be readily visible during installation.

49.10 Equipment intended to have sealing fittings installed as mentioned in the Exception to 14.16 shall be permanently marked where readily visible during and after installation with the word "WARNING" and the following or the equivalent wording: "To reduce the risk of ignition of hazardous atmospheres, conduit runs must have a sealing fitting connected within 18 inches of the enclosure."

49.11 Equipment that has been tested and found acceptable for exposure to Class I and Class II location conditions at the same time shall be marked with the following or equivalent wording: "Suitable for simultaneous use in Class I, Group ____ and Class II, Group ____ locations" together with the operating temperature or operating temperature code.

49.11.1 In accordance with the exceptions to 10.1.1.2 and 31.1.1.2, instructions to install a fitting providing a smooth, rounded inlet hole shall be provided if a conduit opening is not:

- a) Provided with a conduit stop,
- b) Well-rounded, or
- c) Threaded as specified in Table 10.2.

Revised 49.11.1 effective July 16, 1997

49.12 If a manufacturer produces equipment at more than one factory, each unit shall have a distinctive marking to identify it as the product of a particular factory.



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July 12, 1995

Revision pages for

Standard for

**Explosion-Proof and Dust-Ignition-Proof Electrical
Equipment for Use in Hazardous (Classified) Locations**

UL 1203, Second Edition

Attached to this transmittal notice is a revision of the Second edition of UL 1203.

A CHANGE ON A PAGE DATED JULY 12, 1995 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 EXCEPT FOR PARAGRAPHS 10.1.1.1.1, 10.1.1.2, 10.1.1.7, 31.1.1.1, 31.1.1.2, 31.1.1.6, 49.11.1, TABLE 10.2, AND FIGURE 10.1, WHICH BECOME EFFECTIVE JULY 16, 1997 AS INDICATED IN THE SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEM. TO RETAIN THE REQUIREMENTS IN EFFECT UNTIL JULY 16, 1997, DO NOT DISCARD THE PREVIOUS PAGES CONTAINING THE REQUIREMENTS SPECIFIED ABOVE UNTIL THIS FUTURE EFFECTIVE DATE.

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 or Recognition and Follow-Up Services after the effective date and understanding of this should be signified in writing.

The new and revised requirements are substantially in accordance with UL's bulletin on this subject dated October 28, 1994. The bulletin is now obsolete and may be discarded.

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 – 20	July 27, 1994
21, 22, 22A, 23, 24	July 12, 1995
25 – 27	July 27, 1994
28	July 12, 1995
29 – 40	July 27, 1994
41, 42, 42A	July 12, 1995
43 – 49	July 27, 1994
50	July 12, 1995

8.4 A tapped hole shall not be provided in a sintered-metal part employed as a venting section of an enclosure.

9 Drain and Breather Fittings in Enclosures

9.1 If provided, a drain fitting shall:

- a) Drain a liquid from the enclosure without removal of any part of the fitting,
- b) Be located or protected to prevent damage to the fitting, and
- c) Be permanently attached to the enclosure.

Exception: A fitting need not be permanently attached if it is installed in an opening acceptable for the attachment of conduit. See 10.1.1.1 – 10.1.1.10.

9.2 The metal-to-metal joint between a drain fitting and the enclosure shall comply with the requirements specified for joints in the enclosure.

9.3 A drain fitting shall prevent the passage of flames and sparks capable of igniting the surrounding atmospheres.

9.4 A breather fitting shall comply with the applicable requirements in 9.1 – 9.3.

10 Supply Connections

10.1 Fixed equipment

10.1.1 General

10.1.1.1 Equipment intended to be permanently installed shall have provision for connection to threaded rigid metal conduit or other wiring methods in accordance with Articles 501 or 502 in the National Electrical Code, NFPA 70-1993.

10.1.1.1 revised July 12, 1995

10.1.1.1.1 A conduit opening shall be provided with at least five full threads.

10.1.1.2 revised and separated into 10.1.1.1.1 and 10.1.1.2 effective July 16, 1997

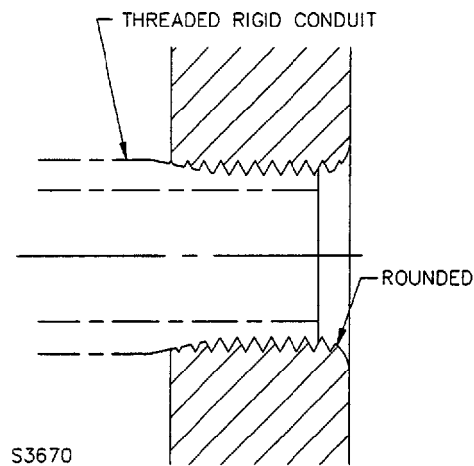
10.1.1.2 Each conduit opening shall be provided with:

- a) A smooth and well-rounded integral conduit stop, having a throat or inner diameter as specified in Table 10.1,
- b) A smooth and well-rounded inner end as shown in Figure 10.1, or
- c) Threads not exceeding the maximum number specified in Table 10.2 for the conduit size.

Exception: The opening need not comply with this requirement if instructions are provided in accordance with 49.11.1.

10.1.1.2 revised and separated into 10.1.1.1.1 and 10.1.1.2 effective July 16, 1997

Figure 10.1
Conduit opening without conduit stop



Added Figure 10.1 effective July 16, 1997

10.1.1.3 If an integral conduit stop is provided, it shall be smooth and well-rounded, having a throat or inner diameter as specified in Table 10.1.

10.1.1.3 revised July 12, 1995

Table 10.1
Throat diameter of conduit stop

Trade size of conduit		Throat diameter of conduit stop, inches (mm)	
Inches	(mm OD)	Minimum	Maximum
1/2	(21.3)	0.560 (14.22)	0.622 (15.80)
3/4	(26.7)	0.742 (18.85)	0.824 (20.93)
1	(33.4)	0.944 (23.98)	1.049 (26.64)
1-1/4	(42.2)	1.242 (31.55)	1.380 (35.05)
1-1/2	(48.3)	1.449 (36.80)	1.610 (40.89)
2	(60.3)	1.860 (47.24)	2.067 (52.50)
2-1/2	(73.0)	2.222 (56.44)	2.469 (62.71)
3	(88.9)	2.761 (70.13)	3.068 (77.93)
3-1/2	(101.6)	3.193 (81.10)	3.548 (90.12)
4	(114.3)	3.623 (92.02)	4.026 (102.26)
5	(141.3)	4.542 (115.37)	5.047 (128.19)
6	(168.3)	5.458 (138.63)	6.065 (154.05)

Table 10.1 revised July 12, 1995

10.1.1.4 If an integral conduit stop is provided in the conduit opening of an enclosure for Class I, Group A or B locations, the threads shall be tapered 3/4 inch per foot (62.5 mm/m).

10.1.1.4 revised July 12, 1995

10.1.1.5 If an integral conduit stop is provided in a conduit opening of an enclosure for Class I, Group C or D locations, the threads may be of the straight type or tapered 3/4 inch per foot (62.5 mm/m).

10.1.1.5 revised July 12, 1995

10.1.1.6 If an integral conduit stop is not provided in the conduit opening, the threads shall be tapered 3/4 inch per foot (62.5 mm/m).

10.1.1.7 If the threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, there shall not be less than five full threads and not more than specified in Table 10.2.

10.1.1.7 deleted effective July 16, 1997

Table 10.2
Number of threads in a conduit opening without an
integral stop

Trade size of conduit Inches (mm OD)		Number of threads per Inch (25.4 mm)	Maximum number of threads
1/2	(21.3)	14	6
3/4	(26.7)	14	6
1	(33.4)	11-1/2	6
1-1/4	(42.2)	11-1/2	6
1-1/2	(48.3)	11-1/2	7
2	(60.3)	11-1/2	7
2-1/2	(73.0)	8	7
3	(88.9)	8	8
3-1/2	(101.6)	8	8
4	(114.3)	8	9
5	(141.3)	8	9
6	(168.3)	8	9

Revised Table 10.2 effective July 16, 1997

10.1.1.8 All openings for connection to conduit, except those necessary for installation, shall be furnished with metal plugs engaging at least five full threads.

10.1.1.9 **10.1.1.9 deleted July 12, 1995**

10.1.1.10 A conduit hub not integrally cast with an enclosure shall:

- Have a wall thickness before threading not less than that of the corresponding trade-size conduit,
- Not depend upon friction alone to prevent it from turning, and
- Comply with the Secureness Test on Conduit Hubs, Section 19.

10.1.1.10 revised July 12, 1995

10.1.2 Conduit seals

10.1.2.1 A factory-installed conduit seal incorporated as part of the equipment shall:

- Comply with the requirements in 10.1.2.2, 10.1.2.3, 14.17, 15.2, 16.1, and 16.2; and
- Be marked as specified in 49.9.

10.1.2.2 If a conduit seal is incorporated, the wires or conductors shall be securely held and tightly sealed where they pass into the enclosure. If a sealing compound or cement is used, it shall:

- a) Provide a tight fit,
- b) Neither soften nor crack under service conditions,
- c) Be resistant to the solvent action of the hazardous locations chemicals to which it may be exposed,
- d) Be resistant to moisture and aging, and
- e) Not be less than 5/8 inch (15.9 mm) deep.

The sealing compound shall not flow or creep at the operating temperature of the device, and if of the softening type, have a softening point not less than 93°C (200°F) as determined by the Standard Test for Softening Point by Ring-and-Ball Apparatus, ASTM E28-92.

10.1.2.3 If a nipple is used to retain the sealing compound for the lead wires of the device, the depth of seal shall not be less than the internal diameter of the nipple, or 5/8 inch (15.9 mm), whichever is greater. Depending on the compound, the size of the lead wires, and the construction of the sealing well, a greater depth of sealing compound may be necessary to form a tight seal. Means shall be provided in the nipple to anchor the sealing compound.

10.1.3 Leads

10.1.3.1 All wire leads, other than grounding leads, for connection of the equipment to the supply circuit shall not be less than 4 inches (101.6 mm) long.

10.1.3.2 A grounding lead, when provided, shall not be less than 6 inches (152.4 mm) long.

10.2 Cord-connected equipment

10.2.1 General

10.2.1.1 All external metal parts of portable equipment that may be struck by or strike against foreign objects shall be made of brass, bronze, or aluminum.

10.2.1.2 Portable equipment shall have provision for connection of Type S, SO, SOO, ST, STO, STOO, or equivalent flexible cord with a grounding conductor. The terminal enclosure shall be of a construction that permits the cord to be replaced. The enclosure that contains the terminals for connection of the flexible-cord conductors shall completely enclose the terminals.

10.2.1.3 If a power-supply cord is provided, the insulation of the equipment-grounding conductor shall be green with or without one or more yellow stripes and no other conductor shall be so identified. The equipment-grounding conductor shall be connected to the grounding terminal of the equipment by means other than solder.

10.2.1.4 If provided, an attachment plug shall be of the grounding type, acceptable for use in the same hazardous location classes and groups as the equipment.

10.2.1.5 If a power-supply cord or attachment plug, or both, are not provided, the equipment shall be marked as indicated in 49.8.

- c) The grounding-terminal symbol illustrated in Figure 10.1 may be used, but, if used alone, the symbol shall be defined in the installation instructions provided with the equipment.

Figure 10.1
Grounding-terminal symbol



(IEC PUBLICATION 417, SYMBOL 5019)

Symbol Definition — A terminal that must be connected to earth ground prior to making any other connections to the equipment.

10.2.5.5 A readily removable (not staked or otherwise held captive) part of an equipment-grounding terminal, such as a setscrew or a clamping member, shall not be colored green or otherwise identified as part of the grounding terminal if the part may be interchanged with a similar part of another terminal on the device.

10.2.5.6 If provided, the grounding member of the attachment plug and the grounding conductor of the power-supply cord and dead metal parts of portable equipment required to be bonded in accordance with 10.2.5.1 shall be electrically connected as determined by test.

11 Protection Against Corrosion

11.1 All ferrous-metal parts other than stainless steel shall be protected against corrosion, except at joint surfaces and conduit threads, by zinc or cadmium coating, plating, enameling, painting, varnishing, or lacquering. Nitrocellulose-base finishes such as lacquers shall be free of runs, globules, and accumulations. Joint surfaces and conduit threads may be electroplated with zinc or cadmium. An enclosure of ferrous metal other than stainless steel shall be subjected to the Rust-Resistance Test, Section 17.

11.2 Brass, copper, or lead alloy (terne) coatings are not acceptable for coating ferrous-metal parts as protection against corrosion.

12 Materials Applied to Joint Surfaces

12.1 A corrosion-inhibiting grease, such as petrolatum or soap-thickened mineral oil, may be applied to metal joint surfaces before assembly.

12.2 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.

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

Exception No. 1: A sealing material may be applied to the contacting surfaces of a joint that is not intended to be and need not be opened to install or service the equipment if the application of the material complies with the requirements in 6.1.2 and 14.21.

Exception No. 2: A metallic paint or other noninsulating coating may be applied to a threaded joint surface or a threaded conduit opening if the joint surface or opening, with the paint or coating applied:

- a) Prevents the passage of flame, hot particles, or sparks capable of igniting the surrounding atmosphere during the explosion tests, see 14.11; and*
- b) Complies with the requirements in 21.2.1 – 21.2.3.*

12.3 revised July 12, 1995

12.4 Joint surfaces may be electroplated. The metal plating shall not be more than 0.0003 inch (0.008 mm) thick.

PERFORMANCE

13 Temperature Test

13.1 Under operating conditions, equipment shall not attain a temperature at any point on the exterior surface that exceeds:

- a) 100°C (212°F), or
- b) The maximum operating temperature or operating temperature code marked on the equipment – see 49.2(i).

13.2 If the equipment is intended for use in an ambient temperature of 40°C (104°F) or less, the test is to be conducted at an ambient of 40°C. If the equipment is for use in an ambient higher than 40°C, the test is to be conducted at the higher ambient.

13.3 The operating temperature or operating temperature code shall be based on operation in an ambient as specified in 13.2. The temperature code, if provided, shall be in accordance with Table 49.1. For equipment intended and marked for use where Class I and Class II conditions may exist simultaneously, the marked operating temperature or operating temperature code is to be based on the temperature attained during the test with dust blanket – see 35.10.

13.4 Temperatures are to be measured by thermocouples consisting of wires not larger than No. 24 AWG (0.21 mm²) and not smaller than No. 30 AWG (0.05 mm²).

13.5 Thermocouples are to be located at various points on the outside of the equipment enclosure.

29 Holes in Enclosures

29.1 A hole in an enclosure for securing a mechanism:

- a) Shall be bottomed,
- b) Shall be closed by welding of the part in place, or
- c) The screws securing the part shall engage at least three full threads and be secured against removal. If a self-tapping screw is used, it shall have a minimum of three full threads engaged when seated. A screw shall not have more than 32 threads per inch (per 25.4 mm).

29.2 A metal pin or a part press-fitted through the wall of an enclosure shall engage for at least 3/16 inch (4.8 mm). Such a part shall be secured against removal by welding, peening, or the equivalent.

29.3 Unless attachment complies with the requirements in 29.1 or 29.2, holes in the enclosure for attachment of a nameplate shall be bottomed. The remaining thickness at the bottomed hole shall not be less than 1/16 inch (1.6 mm).

29.4 A tapped hole shall not be provided in a sintered-metal part employed as a venting section of an enclosure.

30 Drain and Breather Fittings in Enclosures

30.1 A drain fitting shall:

- a) Drain a liquid from the enclosure without removal of any part of the fitting,
- b) Be located or protected to prevent damage to the fitting, and
- c) Be permanently attached to the enclosure.

Exception: A drain need not be permanently attached if it is installed in an opening acceptable for the attachment of conduit. See 31.1.1.1 – 31.1.1.9.

30.2 The metal-to-metal joint between a drain fitting and the enclosure shall comply with the requirements specified for joints in the enclosure.

30.3 A drain fitting shall prevent the entrance of dust to the inside of the enclosure.

30.4 A breather fitting shall comply with the applicable requirements in 30.1 – 30.3.

31 Supply Connections

31.1 Fixed equipment

31.1.1 General

31.1.1.1 Equipment intended for permanent installation shall have provision for connection to threaded rigid metal conduit or other wiring methods in accordance with Article 502 in the National Electrical Code, NFPA 70-1993.

31.1.1.1 revised July 12, 1995

31.1.1.1.1 A conduit opening shall be provided with at least 3-1/2 threads.

31.1.1.2 revised and separated into 31.1.1.1.1 and 31.1.1.2 effective July 16, 1997

31.1.1.2 Each conduit opening shall be provided with:

- a) A smooth and well-rounded integral conduit stop, having a throat or inner diameter as specified in Table 10.1,
- b) A smooth and well-rounded inner end as shown in Figure 10.1, or
- c) Threads not exceeding the maximum number specified in Table 10.2 for the conduit size.

Exception: *The opening need not comply with this requirement if instructions are provided in accordance with 49.11.1.*

31.1.1.2 revised and separated into 31.1.1.1.1 and 31.1.1.2 effective July 16, 1997

31.1.1.3 If an integral conduit stop is provided, it shall be smooth and well-rounded, having a throat or inner diameter as specified in Table 10.1.

31.1.1.3 revised July 12, 1995

31.1.1.4 If an integral conduit stop is provided in a conduit opening, the threads may be of the straight type or tapered 3/4 inch per foot (62.5 mm/m).

31.1.1.4 revised July 12, 1995

31.1.1.5 If an integral conduit stop is not provided in a conduit opening, the threads shall be tapered 3/4 inch per foot (62.5 mm/m).

31.1.1.5 revised July 12, 1995

31.1.1.6 If the threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, there shall not be less than 3-1/2 full threads and not more than specified in Table 10.2.

31.1.1.6 deleted effective July 16, 1997

31.1.1.7 All openings for connection to conduit, except those necessary for installation, shall be furnished with metal plugs engaging at least three full threads.

31.1.1.7 revised July 12, 1995

31.1.1.8 **31.1.1.8 deleted July 12, 1995**

31.1.1.9 A conduit hub not integrally cast with an enclosure shall:

- a) Have a wall thickness before threading not less than that of the corresponding trade-size conduit,
- b) Not depend upon friction alone to prevent it from turning, and
- c) Comply with the Test for Secureness of Conduit Hubs, Section 29.

31.1.1.9 revised July 12, 1995

31.1.2 Conduit seals

31.1.2.1 A factory-installed conduit seal incorporated as part of the equipment shall:

- a) Comply with the applicable requirements in 10.1.2.2, 10.1.2.3, and 37.1, and
- b) Be marked in accordance with 49.9.

31.2 Cord-connected equipment**31.2.1 General**

31.2.1.1 Cord-connected equipment shall comply with the requirements in 10.2.1.1 – 10.2.1.5 and 31.2.2.1 – 31.2.5.1.

31.2.2 Terminal enclosure

31.2.2.1 If each terminal is of a type that permits turning of a screw end, a head (wire-binding screw), or a nut in contact with strands of the cord conductor, the terminal enclosure shall:

- a) Prevent the entrance of dust, and
- b) Have joints in accordance with the requirements in Joints in Enclosures, Section 27.

i) Maximum operating temperature or operating temperature code as specified in Table 49.1, if the operating temperature exceeds 100°C (212°F). This marking is to be based on the maximum temperature attained in the temperature tests. The operating temperature or temperature code shall be near the marking required by (e). It shall be identified as "Operating Temperature _____," or "Operating Temperature Code _____," or the equivalent.

j) For Class I equipment, if the operating temperature exceeds 100°C (212°F), a cautionary statement consisting of the word "CAUTION" and the following or equivalent wording: "To reduce the risk of fire or explosion, do not install where the marked operating temperature exceeds the ignition temperature of the hazardous atmosphere(s)."

Table 49.1
Temperature marking

Maximum operating temperature		Operating temperature code or identification number
°C	°F	
450	842	T1
300	572	T2
280	536	T2A
260	500	T2B
230	446	T2C
215	419	T2D
200	392	T3
180	356	T3A
165	329	T3B
160	320	T3C
135	275	T4
120	248	T4A
100	212	T5
85	185	T6

49.3 The markings specified in 49.2 shall be:

- a) Permanently attached to the equipment,
- b) Legible and prominent, and
- c) Located so that they will be visible after installation of the equipment.

49.4 Unless the proper wiring connections are plainly evident, wiring terminals shall be marked, or the equipment shall be provided with a wiring diagram to indicate the connections. Equipment requiring the use of heater elements in the installation shall be provided with a heater table.