# UL 121201

## STANDARD FOR SAFETY

Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations

UL Standard for Safety for Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations, UL 121201

Ninth Edition, Dated September 15, 2017

***Summary of Topics***

***This revision to ANSI/UL 121201 dated April 1, 2021 is being issued to include the following changes in requirements:***

***– Revisions to opening of sealed devices; 3.11, 3.34, 13.1.8***

***– Revisions to Consideration of Normal operating conditions; 3.30, 4.1.1***

***– Revisions to the application of general industrial / ordinary locations requirements; 4.2.1, 4.4.1, 4.4.2, 5.6.0, Annex B***

***– Revisions to Li ion batteries used in Division 2 portable equipment; 5.2.2, Annex A***

***– Revisions to the sealed device requirements; 13.1.5***

***– Revisions to the Drop test for portable equipment; 16.2.1***

***– Revisions to correct reference in Clauses 5.1.2 and 5.3.1.***

***As noted in the Commitment for Amendments statement located on the back side of the title page, UL and CSA are committed to updating this harmonized standard jointly. CSA and UL will issue revisions to this standard bearing their date of issue.***

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated June 12, 2020 and November 6, 2020.

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CSA Group
CSA C22.2 No. 213-17
Third Edition

Underwriters Laboratories Inc.
UL 121201
Ninth Edition

# Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations

September 15, 2017

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Approved American National Standard

ANSI/UL 121201-2021

**Commitment for Amendments**

This standard is issued jointly by the Canadian Standards Association (operating as "CSA Group") and Underwriters Laboratories Inc. (UL). Comments or proposals for revisions on any part of the standard may be submitted to CSA Group or UL at anytime. Revisions to this standard will be made only after processing according to the standards development procedures of CSA Group, and UL. CSA Group and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue.

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This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquiries@csagroup. org and include "Proposal for change" in the subject line: Standard designation (number); relevant clause, table, and/or figure number; wording of the proposed change; and rationale for the change.

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This ANSI/UL Standard for Safety consists of the Ninth Edition including revisions through April 1, 2021. The most recent designation of ANSI/UL 121201 as an American National Standard (ANSI) occurred on April 1, 2021. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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# PREFACE

This is the harmonized CSA Group and UL standard for Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations. It is the Third edition of CSA-C22.2 No. 213 and the Ninth edition of UL 121201. This edition of CSA-C22.2 No. 213 supersedes the previous edition published in 2016. This edition of UL 121201 supersedes the previous ISA-12.12.01-2015 edition published on August 21, 2015. This harmonized standard has been jointly revised on April 1, 2021. For this purpose, CSA Group and UL are issuing revision pages dated April 1, 2021.

This harmonized standard was prepared by the CSA Group and Underwriters Laboratories Inc. (UL).

Efforts have been made to synchronize the UL edition number with that of the previous corresponding ISA standard with which this standard is now harmonized with CSA. As a result, one or more UL edition numbers have been skipped to align per the previous ISA edition number.

The ISA-12.12.01-2015 standard is being maintained until September 15, 2022 for reference purposes only.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

This standard was reviewed by the CSA Integrated Committee on Hazardous Location Products, under the jurisdiction of the CSA Technical Committee on Industrial Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee.

### Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

> Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

### Level of Harmonization

This standard uses the IEC format but is not based on, nor is it considered equivalent to, an IEC standard.

This standard is published as an identical standard for CSA Group and UL.

An identical standard is a standard that is exactly the same in technical content except for national differences resulting from conflicts in codes and governmental regulations. Presentation is word for word except for editorial changes.

### Reasons for Differences From IEC

There is no corresponding IEC standard.

### Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules

of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

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# 1 Scope

## 1.1 Introduction

1.1.1 The purpose of this standard is to provide minimum requirements for the design, construction, and marking of electrical equipment or parts of such equipment for use in Class I and Class II, Division 2 and Class III, Divisions 1 and 2 hazardous (classified) locations.

1.1.2 This equipment, in normal operation, is not capable of causing ignition of the surrounding atmosphere under the conditions prescribed in this standard, although the equipment may contain electronic components used in an incendive circuit and may also have field wiring that is an incendive circuit.

1.1.3 In addition, it is the intent of this document to establish uniformity in test methods for determining the suitability of the equipment and associated circuits and components as they relate to potential ignition of a specific flammable gas or vapour-in-air mixture, combustible dust, easily ignitible fibers, or flyings.

## 1.2 Applicable to Class I and II, Division 2 and Class III, Divisions 1 and 2 locations

1.2.1 This standard applies only to equipment, circuits, and components for use in Class I and II, Division 2 and Class III, Divisions 1 and 2 hazardous (classified) locations as defined in the National Electrical Code® (NEC®) ANSI/NFPA 70 or in the Canadian Electrical Code, Part I (CE Code, Part I) CSA C22.1.

NOTE 1 Some equipment designed for use in unclassified locations is permitted by the NEC® or CE Code, Part I for installation in Division 2 locations. The judgment of acceptability for the installation would be determined by the authority having jurisdiction. Such equipment would not have the hazardous location marking or documentation described in this standard. It is anticipated that such equipment would comply with the other requirements in this standard and that the determination of compliance is elementary (e.g., a noharcing instrument inside a Type 4 or Type 12 enclosure used in a Class II, Division 2 location).

NOTE 2 Throughout this standard, references to CAN/CSA C22.2 No. 60079-0 and UL 60079-0 are made as CSA/UL 60079-0. Similarly references to CAN/CSA C22.2 No. 60079-1 and UL 60079-1 are made as CSA/UL 60079-1. Similarly references to CAN/CSA C22.2 No. 60079-11 and UL 60079-11 are made as CSA/UL 60079-11. Similarly references to CAN/CSA C22.2 No. 60079-15 and UL 60079-15 are made as CSA/UL 60079-15.

NOTE 3 The US and Canadian adoptions of IEC 60079-0, IEC 60079-1, IEC 60079-6, IEC 60079-11, and IEC 60079-15 may be adopted at different revision levels and may have different National Deviations.

## 1.3 Applicable to associated nonincendive field wiring apparatus

1.3.1 This standard also applies to associated nonincendive field wiring apparatus located in a non-hazardous (unclassified) location specifically designed to directly connect to nonincendive field wiring in Class I and II, Division 2 and Class III, Divisions 1 and 2 hazardous (classified) locations.

NOTE The 2015 CE Code, Part I does not address nonincendive field wiring circuits in Class II or Class III hazardous locations.

## 1.4 Applicable ambient conditions

1.4.1 The requirements of this standard are based on consideration of the following ambient conditions:

a) a lower ambient temperature of -50°C or higher;

b) an upper ambient temperature of 40 °C or lower;

c) an oxygen concentration of not greater than 21 percent by volume; and

d) a pressure of 80 kPa (0.8 bar) to 110 kPa (1.1 bar).

NOTE Equipment specified for atmospheric conditions beyond the above limits may be subject to additional investigation.

### 1.5 Not applicable to specified ignition mechanisms

1.5.1 This standard is not applicable to mechanisms of ignition from external sources, such as static electricity or lightning, that are not related to the electrical characteristics of the equipment.

### 1.6 Not applicable to specific products

1.6.1 This standard does not apply to electric luminaires for use in Class I and II, Division 2 and Class III hazardous (classified) locationswhich are within the scope of::

a) in the United States: UL 844; and

b) in Canada: CSA C22.2 No. 137.

1.6.2 This standard does not apply to electric motors, electric heaters, electrical resistance trace heating, and similar heat-producing products for use in Class I and II, Division 2 and Class III hazardous (classified) locations, except where they are an integral part of the equipment under evaluation.

Where electric motors, electric heaters, electrical resistance trace heating or similar heat-producing products are an integral part of the equipment under evaluation, applicable requirements within the scope of the following standards shall be considered:

a) in the United States

i) UL 1836 (for electric motors);

ii) UL 823 (for electric heaters); and

iii) UL 60079-30-1 (for electrical resistance trace heating).

b) in Canada: CSA C22.2 No. 60079-30-1.

1.6.3 In the United States, this standard does not apply to battery-operated flashlights and lanterns for use in Class I and II, Division 2 and Class III hazardous (classified) locations which are within the scope of UL 783.



## 2 Reference publications

2.1 Products covered by this standard shall comply with the referenced installation codes and standards noted in Annex A.

## 3 Definitions

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

3.1 ASSOCIATED NONINCENDIVE FIELD WIRING APPARATUS – apparatus in which the circuits are not necessarily nonincendive themselves, but that affect the energy in nonincendive field wiring circuits and are relied upon to maintain nonincendive energy levels. Associated nonincendive field wiring apparatus may be either of the following:

a) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location.

b) Electrical apparatus not so protected that shall not be used in a hazardous (classified) location.

NOTE 1 Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and can also have connections for other electrical apparatus.

NOTE 2 The term "Associated Nonincendive Field Wiring Apparatus" is not defined in the Canadian Electrical Code, Part I (CE Code, Part I), but the use of associated equipment to provide a nonincendive circuit for field wiring is allowed for in F9.1 and J18.066 of the CE Code, Part I.

3.2 CONTINUOUS OPERATING TEMPERATURE (COT) – temperature range which ensures the stability and integrity of the material for the expected life of the equipment, or part, in its intended application (such as the Temperature Index {TI} corresponding to the 20 000 h point on the thermal endurance graph without loss of flexural strength exceeding 50%, determined in accordance with IEC 60216-1 and IEC 60216-2 and based on the flexing property in accordance with ISO 178, RTI-mechanical per UL 746B, or other rating system establishing long term thermal stability of the material).

3.3 CONTROL DRAWING – a drawing or other document provided by the manufacturer of the nonincendive field wiring apparatus or the associated nonincendive field wiring apparatus that details the allowed interconnections with other circuits or equipment. The control drawing includes the applicable electrical parameters to permit selection of equipment for interconnection.

3.4 DUST-TIGHT – enclosures constructed so that dust will not enter under specified test conditions.

3.5 ENCLOSED-BREAK DEVICE – device incorporating electrical contacts that are made and broken and that will withstand an internal explosion of the flammable gas or vapor which can enter it without suffering damage and without communicating the internal explosion to the external flammable gas or vapor.

NOTE 1 The principle difference between enclosed-break devices and explosionproof/flameproof enclosures is that the dimensions are not controlled and that safety factors have not been added.

NOTE 2 Extracted from 60079-15 Ed 4.

3.6 FIELD WIRING CONNECTIONS – terminations intended for connection by the installer in the field

NOTE: Extracted from 60079-0 Ed 6.

3.7 HAZARDOUS (CLASSIFIED) LOCATIONS – locations where fire or explosion hazards can exist due to flammable gases, flammable liquid-produced vapors, combustible liquid-produced vapors, combustible dusts, or ignitible fibers/flyings

NOTE 1 Extracted from the NEC®.

NOTE 2 In the Canadian Electrical Code, Part I, this is referred to as a "hazardous location".

NOTE 3 Throughout this standard, the terms "hazardous (classified) locations" and "hazardous locations" are used interchangeably.

3.8 HERMETICALLY SEALED DEVICE – a device that is sealed against the entrance of an external atmosphere and in which the seal is made by fusion of metal to metal, ceramic to metal, or glass to metal.

3.9 INCENDIVE CIRCUIT – a circuit in which any arc or thermal effect produced under normal operating conditions is capable of igniting the flammable gas-, vapor-, dust-air mixture, fibers, or flyings.

3.10 MAINTENANCE, CORRECTIVE – any maintenance activity that is not normal in the operation of the equipment and requires access to the equipment's interior. Such activities are expected to be performed by qualified personnel who are aware of the hazards involved. Such activities typically include locating causes of faulty performance, replacing defective components, and adjusting service controls, or the like.

3.11 MAINTENANCE, OPERATIONAL – any maintenance activity, excluding corrective maintenance, that is intended to be performed by the operator and is required for the equipment to serve its intended purpose. Such operational maintenance activities typically include opening of the enclosure for charging or replacement of batteries, the correcting of "zero" on a panel instrument, changing charts, keeping of records, and adding ink, or the like.

NOTE Battery charging that does not require opening of the enclosure (such as by inductive means) need not be considered a maintenance function and can be considered a normal operating condition.

3.12 MAKE/BREAK COMPONENT – a component having contacts that can interrupt a circuit (even if the interruption is transient in nature). Examples of make/break components are relays, circuit breakers, servo potentiometers, adjustable resistors, switches, connectors, and motor brushes.

Installation codes refer to make-and-break and sliding contacts.

3.13 MAXIMUM EXTERNAL CAPACITANCE ($C_o$ or $C_a$) – maximum value of capacitance in a circuit that can be connected to the connection facilities of the associated nonincendive field wiring apparatus.

3.14 MAXIMUM EXTERNAL INDUCTANCE ($L_o$ or $L_a$) – maximum value of inductance in a circuit that can be connected to the connection facilities of the associated nonincendive field wiring apparatus.

3.15 MAXIMUM EXTERNAL INDUCTANCE TO RESISTANCE RATIO ($L_o/R_o$ or $L_a/R_a$) ratio of inductance ($L_o$) to resistance ($R_o$) of any external circuit that can be connected to the connection facilities of the associated nonincendive field wiring apparatus.

3.16 MAXIMUM INPUT CURRENT ($I_i$ or $I_{max}$) – maximum current (peak a.c. or d.c.) that can be applied to the connection facilities of the nonincendive field wiring apparatus.

3.17 MAXIMUM INPUT POWER ($P_i$) – maximum power in an external circuit that can be applied to the connection facilities of the nonincendive field wiring apparatus.

3.18 MAXIMUM INPUT VOLTAGE ($U_i$ or $V_{max}$) – maximum voltage (peak a.c. or d.c.) that can be applied to the connection facilities of the nonincendive field wiring apparatus.

3.19 MAXIMUM INTERNAL CAPACITANCE ($C_i$) – total equivalent internal capacitance which is considered as appearing across the connection facilities of the nonincendive field wiring apparatus.

3.20 MAXIMUM INTERNAL INDUCTANCE ($L_i$) – total equivalent internal inductance which is considered as appearing at the connection facilities of the nonincendive field wiring apparatus.

3.21 MAXIMUM INTERNAL INDUCTANCE TO RESISTANCE RATIO ($L_i$ /$R_i$) – ratio of inductance ($L_i$) to resistance ($R_i$) that is considered as appearing at the connection facilities of the nonincendive field wiring apparatus.

3.22 MAXIMUM OUTPUT CURRENT ($I_o$ or $I_{sc}$) – maximum output current (peak a.c. or d.c.) in a circuit that can be provided by the connection facilities of the associated nonincendive field wiring apparatus under normal operation.

3.23 MAXIMUM OUTPUT VOLTAGE ($U_o$ or $V_{oc}$) – maximum output voltage (peak a.c. or d.c.) in a circuit that can appear under open-circuit conditions at the connection facilities of the associated nonincendive field wiring apparatus under normal operation.

3.24 MAXIMUM OUTPUT POWER ($P_o$) – maximum electrical power in a circuit that can be provided by the connection facilities of the associated nonincendive field wiring apparatus under normal operation.

3.25 NONINCENDIVE CIRCUIT – a circuit, other than nonincendive field wiring, in which any arc or thermal effect produced under normal operating conditions is not capable of igniting the flammable gas-, vapor-, dust-air mixture, fibers, or flyings. The circuit is evaluated under prescribed test conditions.

3.26 NONINCENDIVE COMPONENT – a component having contacts for making or breaking an incendive circuit where the contacting mechanism is constructed so that the component, under normal operating conditions, is not capable of igniting the flammable gas or vapor-air mixture. The housing of a nonincendive component is not intended to exclude the flammable atmosphere or contain an explosion. The component is evaluated under prescribed test conditions.

3.27 NONINCENDIVE EQUIPMENT – equipment having electrical/electronic circuitry that is not capable, under normal operating conditions, of causing ignition of a specified flammable gas-, vapor-, dust-air mixture fibers, or flyings due to arcing or thermal means.

3.28 NONINCENDIVE FIELD WIRING – wiring that enters or leaves an equipment enclosure and, under normal operating conditions of the equipment, is not capable, due to arcing or thermal effects, of igniting the flammable gas-, vapor-, dust- air mixture, fibers, or flyings. Normal operation includes opening, shorting, or grounding the field wiring.

NOTE Extracted from NEC®.

3.29 NONINCENDIVE FIELD WIRING APPARATUS – nonincendive equipment intended to be connected to nonincendive field wiring.

NOTE The Canadian Electrical Code, Part I (CE Code, Part I) does not use this term directly, but the concept is supported in F11 of the CE Code, Part I.

3.30 NORMAL OPERATING CONDITIONS – conditions under which equipment conforms electrically and mechanically with its design specification and is used within the conditions specified by the manufacturer. These conditions include the following, as a minimum:

a) addressing all declared supply voltage, current, and frequency, including declared tolerances;

b) addressing all declared environmental conditions (including process interface);

c) all tool-removable enclosures or parts of enclosures remaining in place;

d) any part of the enclosure that can be opened or removed without a tool, is opened or removed;

e) any control that is operable without using a tool, being adjusted to the “worst case” position; and

f) opening or grounding of any one or shorting of any two of the nonincendive field-wiring conductors that result in the “worst case” condition.

3.31 OIL IMMERSED EQUIPMENT – equipment immersed in a protective liquid in such a way that an explosive atmosphere that can be above the liquid or outside the enclosure cannot be ignited.

3.32 OPERATOR-ACCESSIBLE – readily accessible to the operator during normal use without use of a tool.

3.33 PLUG-IN COMPONENT – a lightweight connecting component not attached in any way outside of the connection points (similar to header jumpers, IC chips, snap-in fuses, some batteries, and SD/PC cards).

3.34 SEALED DEVICE – a device so constructed that it is sealed effectively against entry of an external atmosphere, and is not opened during normal operation or for any maintenance activities.

3.35 SERVICE TEMPERATURE – maximum or minimum temperature reached at specific points of the equipment when the equipment is operating at rated conditions, including ambient temperature and any external sources of heating or cooling.

NOTE 1 Equipment can reach different service temperatures in different parts or for different enclosure orientations.

NOTE 2 Rated conditions include the electrical supply and load, duty cycle, or duty type, as assigned by the manufacturer, typically as shown in the marking.

3.36 UNCLASSIFIED LOCATIONS – locations determined to be neither Class I, Division 1; Class I, Division 2; Class I, Zone 0; Class I, Zone 1; Class I, Zone 2; Class II, Division 1; Class II, Division 2; Class III, Division 1; Class III, Division 2; Zone 20; Zone 21; Zone 22; or any combination thereof.

NOTE Zone 20, Zone 21, and Zone 22 are not included in the 2012 or earlier editions of the CE Code, Part I.

NOTE In the Canadian Electrical Code, Part I, this is referred to as ordinary locations or as "non-hazardous locations".

## 4 General requirements

### 4.1 Requirements based upon normal operating conditions

4.1.1 Requirements for equipment intended to be used in Class I and Class II, Division 2 and Class III, Divisions 1 and 2 hazardous (classified) locations are established on the basis that the equipment in its normal operating condition (see Clause 3.30) is not capable of causing ignition in a hazardous (classified) location.

### 4.2 General-purpose requirements

4.2.1 Equipment covered by this Standard shall comply with the unclassified location requirements (also referred to as ordinary location or general-purpose requirements) for the particular equipment except as specifically amended herein. In the United States, the standard used shall be an ANSI standard. In Canada, the standard used shall be a Canadian National standard. See Annex B for a list of commonly applied standards covering the unclassified location requirements.

NOTE: For battery powered portable equipment, applicable ordinary location standards include CSA and UL 61010-1, CSA and UL 62368-1, UL 508, CSA and UL 60950-1. One of the concerns regarding this type of equipment is the risk of fire associated with the battery.

4.2.2 In Canada, general requirements applicable to this Standard are provided in CAN/CSA-C22.2 No. 0.

NOTE Compliance with the Canadian ordinary location or general-purpose requirements includes compliance with CAN/CSA-C22.2 No. 0.

4.2.3 Where a requirement of this standard conflicts with an applicable safety requirement of the relevant industrial standards, the requirements of this standard shall take precedence.

### 4.3 Consideration of subsequent conditions following nonincendive field wiring faults

4.3.1 Subsequent arcs or thermal effects within the equipment, resulting from opening, shorting, or grounding of nonincendive field wiring, shall be taken into consideration, as they affect the suitability of the equipment for use in Division 2 and Class III locations.

### 4.4 Component standards

4.4.1 A component of the equipment covered by this Standard shall comply with the unclassified location requirements (also referred to as ordinary location or general-purpose requirements) for the particular component, except as specifically amended herein. In the United States, the standard used shall be an ANSI standard. In Canada, the standard used shall be a Canadian National standard. See Annex B for a list of commonly applied standards covering the unclassified location requirements for such components generally used in the equipment covered by this Standard.

4.4.2 All conditions of acceptability associated with the components (sometimes referred to as the schedule of limitations) shall be addressed so as to determine compliance associated with the required risks of fire, electric shock, and injury to persons requirements, in addition to the risks of explosion requirements.

## 5 Requirements for Class I, Division 2 equipment

### 5.1 General

5.1.1 To ensure that under normal operating conditions the equipment is not capable of causing ignition in a hazardous (classified) location, protection shall be provided according to at least one of the following:

a) Clauses 5.1.2 – 5.6, 9, 16 and 18 as applicable; or

b) the following types of protection requirements, as applicable:

i) in the United States: Class I, Zone 2 AEx types of protection requirements in accordance with the UL 60079 series of standards including Division marking requirements and any applicable installation restrictions in accordance with the NEC (such as sealing of flameproof enclosures);and

ii) in Canada: Gc Ex types of protection requirements in accordance with the CSA 60079 series of standards and any applicable installation restrictions in accordance with the CE Code, Part I (such as sealing of flameproof enclosures).

5.1.2 Each make/break component shall be one or more of the following:

a) a normally nonarcing component that meets the requirements of Clause 8;

b) used in a nonincendive circuit that meets the requirements of Clause 7;

c) a nonincendive component that meets the requirements of Clause 12;

d) a sealed device that meets the requirements of Clause 13;

e) an enclosed-break device that meets the requirements of Clause 14; or

f) immersed in oil that meets the requirements of Clause 17.

5.1.3 Equipment shall comply with the thermal ignition requirements of Clause 10.

## 5.2 Enclosures

5.2.1 Enclosures shall provide a suitable degree of protection against deterioration of the equipment that would adversely affect its suitability for use in Class I, Division 2 locations.

5.2.2 For portable devices incorporating a Li Ion rechargeable battery, so as to minimize battery failures resulting in the device becoming a source of ignition, one of the following minimum enclosure ratings is required:

a) in the United States: IP54 in accordance with NEMA ANSI/IEC 60529 or Type 3 in accordance with UL 50E, along with UL 50.

b) in Canada: IP54 in accordance with CAN/CSA C22.2 No. 60529 or Type 3 in accordance with CAN/CSA-C22.2 No. 94.2, along with CAN/CSA-C22.2 No. 94.1.

## 5.3 Fuses used in circuits subject to overloading

5.3.1 Fuses used in circuits that are subject to overloading in normal use shall be:

a) housed in an enclosure suitable for Division 1 locations;

b) evaluated in accordance with a type of protection listed in 5.1.2 b) – f); or

c) *deleted*

d) a nonindicating, filled, current-limiting type.

NOTE 1 Examples of circuits that are subject to overloading in normal use include a motor circuit where a possibility of a stalled motor opening the fuse exists, or where there is the possibility of an overload not caused by a fault in the circuit. Reference 501.115(B)(3) of NFPA 70:2020 (NEC) or 18-150(2)(d) of CSA C22.1-2018 (CE Code) as applicable.

NOTE 2 *Deleted*

## 5.4 Fuses replaceable from outside of the enclosure

5.4.1 If a fuse can be replaced from outside of the enclosure without the use of a tool, a switch suitable for the location where it is installed shall also be provided to remove power from the fuse. The switch need not be integral to the equipment if the equipment installation instructions indicate the need for such a switch. The fuseholder shall be provided with a warning in accordance with 9.8.1.

NOTE A typical construction to which this requirement applies is a fuseholder mounted through the wall of an enclosure with the threaded cap external to the enclosure and removable without the use of a tool. Reference 501.105(B)(5) of NFPA 70:2014 (NEC).

## 5.5 Circuit breakers

5.5.1 A circuit breaker that can be manually switched off during normal operating conditions (i.e. having an accessible handle) shall be:

a) housed in an enclosure suitable for Division 1 locations; or

b) evaluated in accordance with a type of protection listed in 5.1.2 b) – e);

### 5.6 Batteries and battery-powered equipment

5.6.0 Potential adverse conditions that may result from the charging and discharging of batteries in hazardous (classified) locations, and in unclassified locations if so intended, shall be addressed as follows:

a) in the United States, in accordance with the applicable ANSI standards (see Clause 4.4.1)

b) In Canada, in accordance with the applicable Canadian National standards (see Clause 4.4.1).

5.6.1 Operator accessible batteries and any components that are used to limit the short circuit currents below a value that will ignite the specified test gas mixture, and are not an integral part of the battery, shall be constructed as follows:

a) current-limiting components shall be enclosed in a manner that will reduce the likelihood of defeating the current limitation;

b) the construction of the battery compartment of portable equipment shall comply with 16.1;

c) the equipment shall be marked as indicated in 9.3.1; and

d) if changing of the battery does not meet the nonincendive circuit requirements of 5.1.2 b), the equipment shall be additionally marked as indicated in 9.3.2.

## 6 Requirements for Class II, Division 2, Class III, Divisions 1 and 2 equipment

### 6.1 Protection methods

6.1.1 Equipment shall be protected by one or more of the following:

a) the use of a sealed device that meets the requirements of Clause 13;

b) the use of an enclosure that meets the requirements of Clauses 15 and 16.4, as applicable;

c) the use of an enclosure that meets the dust-tight requirements of the following, as applicable;

i) in the United States: UL 50E along with UL 50 as applicable; and

ii) in Canada: CAN/CSA C22.2 No. 94.2, along with CAN/CSA C22.2 No. 94.1 as applicable.

d) the use of an enclosure that meets the requirements of Type 4, Type 4X, Type 6, or Type 6P of the following, as applicable:

i) in the United States: UL 50E, along with UL 50 as applicable; and

ii) in Canada: CAN/CSA C22.2 No. 94.2, along with CAN/CSA C22.2 No. 94.1 as applicable:

e) a nonincendive circuit that meets the requirements of Clause 7, with consideration for possible ignition in accordance with 7.2, including the shorting of any components and traces due to the entrance or accumulation of dust, and this entrance or accumulation of dust shall not result in ignition or charring of the dust due to the temperature of any part or parts that could be exposed to the dust;

f) connections on the exterior of an enclosure that meet the requirements of 8.8; or

g) the following types of protection requirements, as applicable:

i) in the United States: Zone 22 AEx types of protection requirements in accordance with the ISA/ UL 60079 series of standards for the United States, including Division marking requirements and any applicable installation restrictions in accordance with the NEC; and

ii) in Canada: Dc Ex types of protection requirements in accordance with the CSA 60079 series of standards and any applicable installation restrictions in accordance with the CE Code, Part I.

NOTE When using an enclosure as noted above that meets the dust-tight requirements of UL 50/CAN/CSA C22.2 No. 94.1 and UL 50E/ CAN/CSA C22.2 No. 94.2, or that meets the Type 4, Type 4X, Type 6, or Type 6P requirements of UL 50/CAN/CSA C22.2 No. 94.1 and UL 50E, the intent of the impact test in 16.4 is addressed by the impact testing required by UL 50/ CAN/CSA C22.2 No. 94.1 and UL 50E/CAN/CSA C22.2 No. 94.2.

### 6.2 Portable battery-powered equipment

6.2.1 Portable battery-powered equipment marked for use in Class II Group G locations only or marked for use in Class III locations only, or both, need not have all electrical components and wiring enclosed, nor have the shorting of any components and traces introduced, provided both the following conditions are met:

a) Entrance or accumulation of dust does not result in ignition or charring of the dust due to the temperature of any part or parts that could be exposed to the dust.

b) Circuits with make/break components shall comply with the nonincendive circuit requirements when tested with a propane-air mixture in accordance with the spark-ignition test (see 11.1, 11.2, and 7.1).

### 6.3 Thermal ignition

6.3.1 Equipment shall comply with the thermal ignition requirements of Clause 10.

### 6.4 Gasket and seal specification

6.4.1 Gaskets and seals shall be determined to be suitable for the maximum and minimum service temperature to which they are exposed.

NOTE A manufacturer's rating or declaration is a means of determining suitability.

6.4.2 Gaskets and seals used in enclosures specified in 6.1(c) or 6.1(d) are considered suitable for a minimum temperature of -25°C and a maximum temperature of 60°C based upon the testing required by the standards listed in 6.1(c) and 6.1(d).

## 7 Nonincendive circuits and nonincendive field wiring

### 7.1 Spark ignition evaluation

7.1.1 Either of the following two methods may be employed to determine that a circuit(s) or field wiring is nonincendive:

a) testing the circuit according to Clause 11; or

b) comparing the maximum calculated or measured values of current, voltage, and associated inductances and capacitances to the appropriate values in the reference curves and tables from the Assessment of intrinsically safe circuits annex of CSA/UL 60079-11 to establish that the current and voltage levels are below those specified in 7.3; for Class II and III locations the curves for propane shall be used.

NOTE Short term voltage excursions that occur when connecting photovoltaic modules or panels are not considered to create a significant risk of ignition in Division 2 hazardous (classified) locations due to the relatively short duration of the event.

## 7.2 Nonincendive circuit evaluation

7.2.1 When evaluating a circuit as nonincendive, the following shall be considered at each point where a spark can normally occur:

a) discharge of a capacitive circuit;

b) interruption of an inductive circuit;

c) intermittent making and breaking of a resistive circuit; and

d) opening or grounding of any one or shorting of any two of the nonincendive field-wiring conductors.

## 7.3 Evaluation by analysis

7.3.1 The maximum voltage and current levels (d. c. or a. c. peak) in circuits determined to be nonincendive by the comparison method, for given circuit constants, shall be less than the applicable reference curves and tables from the Assessment of intrinsically safe circuits annex of CSA/UL 60079-11.

7.3.2 The maximum normal output voltage and the maximum short-circuit current shall be determined under the worst-case normal operating conditions.

7.3.3 For line-connected equipment, the input voltage shall be increased to 110 percent of nominal line voltage (or adjusted to the maximum value if a range is specified and the upper value of the range is not less than 110% of the nominal line voltage).

7.3.4 Component tolerance need not be taken into account.

NOTE 1 The reference curves and tables from the Assessment of intrinsically safe circuits annex of CSA/UL 60079-11 apply only to circuits whose output voltage/current characteristic is a straight line drawn between open-circuit voltage and short-circuit current. Circuits with nonlinear outputs are subject to special investigation; e.g., guidance is provided in IEC 60079-25.

NOTE 2 The capacitive circuit reference curves and tables from the Assessment of intrinsically safe circuits annex of CSA/UL 60079-11 represent capacitor discharge only. They do not include the additional current that can be available from the power supply.

NOTE 3 The output of photovoltaic modules should be considered as nonlinear, and special investigation should be done using the parameters for voltage at maximum power and current at maximum power.

NOTE 4 The reference curves and tables from the Assessment of intrinsically safe circuits annex of CSA/UL 60079-11 do not include tabulated inductance and current values from the inductive circuit curves. For the constant energy portion of the inductive circuit curves, the following equation can be used to calculate these values: $E = 0.5 \times L \times I^2$.

## 7.4 Associated nonincendive field wiring apparatus

7.4.1 For evaluating associated nonincendive field wiring apparatus, the maximum output voltage ($U_o$), and maximum output current ($I_o$) shall be used with the applicable ignition reference curves and tables from the Assessment of intrinsically safe circuits annex of CSA/UL 60079-11 to determine the maximum external capacitance ($C_o$) and maximum external inductance ($L_o$).

### 7.5 Nonincendive field wiring apparatus

7.5.1 For evaluating nonincendive field wiring apparatus, the maximum internal capacitance ($C_i$) and maximum internal inductance ($L_i$) shall be determined. These parameters shall be below the limits shown in the reference curves and tables from the Assessment of intrinsically safe circuits annex of CSA/UL 60079-11 based on the maximum input voltage ($U_i$) and the maximum input current ($I_i$) of the nonincendive field wiring apparatus.

### 7.6 Nonincendive field wiring circuit

7.6.1 For evaluating nonincendive field wiring circuits, the maximum input voltage ($U_i$) of the nonincendive field wiring apparatus shall be equal to or greater than the maximum output voltage ($U_o$) of the associated nonincendive field wiring apparatus. Additionally, the maximum input current ($I_i$) of the nonincendive field wiring apparatus shall be equal to or greater than the maximum output current ($I_o$) of the associated nonincendive field wiring apparatus.

7.6.2 For nonincendive field wiring apparatus that controls its own operating current, the maximum input current ($I_i$) of the nonincendive field wiring apparatus need not correspond to the maximum output current ($I_o$) of the associated nonincendive field wiring apparatus (e. g., 4-20 mA measurement and control equipment). Likewise, the maximum input voltage ($U_i$) of nonincendive field wiring apparatus that controls its own normal operating voltage need not be greater than the maximum output voltage ($U_o$) of the associated nonincendive field wiring apparatus (e.g., current to pressure valve controllers that are voltage clamped at the terminals). Details of the permitted connections shall be provided on a control drawing.

### 7.7 Interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus

7.7.1 Nonincendive field wiring enables interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus not specifically examined in combination as a system when one of the following conditions is true:

a) normal operating voltage or current not controlled by the nonincendive field wiring apparatus

$U_i \geq U_o$; $I_i \geq I_o$; $C_o \geq C_i + C_{cable}$; $L_o \geq L_i + L_{cable}$

b) normal operating current controlled by the nonincendive field wiring apparatus ($I_i$ of the nonincendive field wiring apparatus need not be greater than the $I_o$ of the associated nonincendive field wiring apparatus)

$U_i \geq U_o$; $C_o \geq C_i + C_{cable}$; $L_o \geq L_i + L_{cable}$

c) normal operating voltage controlled by the nonincendive field wiring apparatus ($U_i$ of the nonincendive field wiring apparatus need not be greater than the $U_o$ of the associated nonincendive field wiring apparatus)

$I_i \geq I_o$; $C_o \geq C_i + C_{cable}$; $L_o \geq L_i + L_{cable}$

d) normal operating current and voltage controlled by the nonincendive field wiring apparatus (neither $I_i$ nor $U_i$ of the nonincendive field wiring apparatus need be greater than the corresponding parameter of the associated nonincendive field wiring apparatus)

$C_o \geq C_i + C_{cable}$; $L_o \geq L_i + L_{cable}$

## 8 Normally nonarcing components

### 8.1 Components considered as nonarcing in normal operation

8.1.1 Make/break components that are to be considered nonarcing in normal operation shall comply with the requirements of 8.2 – 8.8, as applicable.

### 8.2 Connectors and plug-in components

8.2.1 Connectors and plug-in components used in incendive circuits and incorporated within equipment shall be considered normally nonarcing if disconnection is not required under operational conditions and either:

a) each connection or group of connections is secured with a mechanical retaining device which may or may not be an integral part of the connector and does not rely on friction alone; or

b) disconnection requires a separating force of at least 15 N.

8.2.2 If accessible during normal operating conditions, connectors in an incendive circuit shall be provided with a warning marking in accordance with 9.7.1.

8.2.3 Plug-in components less than 30 grams need only pass a pull test of 3 times the weight of the component.

### 8.3 Plug-in fuses that can be replaced in normal operating conditions

8.3.1 In incendive circuits, fuses that are removable during normal operating conditions shall comply with the requirements of 8.2. The fuseholders for such fuses shall be provided with a warning marking in accordance with 9.8 and located adjacent to the fuseholder.

### 8.4 Circuit breakers

8.4.1 Circuit breakers that cannot be manually switched off, i.e., have only a reset button, may be used in circuits that are not subject to overloading in normal use. All such circuit breakers shall be provided with a warning marking in accordance with 9.9.1 and located adjacent to the circuit breaker.

### 8.5 Lamps

8.5.1 In incendive circuits, removable lamps that are accessible during normal operating conditions shall be removable only with the use of a tool. The lampholders for such lamps shall be provided with a warning marking in accordance with 9.7.1 and located adjacent to the lampholder. The lamp shall be protected to prevent breakage of the bulb.

8.5.2 A tool need not be required to remove the lamp if the lamp is accessible only after removal of a separate protective cover. The cover need not require a tool to remove.

### 8.6 Connectors

8.6.1 Operator accessible connectors that are used for connection to nonincendive field wiring shall be non-interchangeable with other field wiring connectors on the same equipment, except

a) where interchange does not affect the nonincendive nature of the circuits; or

b) where connectors are so identified that interchanging is unlikely.

## 8.7 Manually operated components

8.7.1 If accessible only by the use of a tool, manually operated make/break components in an incendive circuit are considered normally nonarcing components.

NOTE Circuit breakers may be used in circuits that are not subject to overloading in normal use.

## 8.8 Connections on exterior of enclosure

8.8.1 External plugs and sockets for connections in potentially incendive circuits either

- between two pieces of electrical equipment (by means of a cable or cord assembly involving a plug and socket on one or both ends); or

- between premises wiring and a piece of electrical equipment (by means of a cable or cord assembly involving a plug and socket only on the equipment end)

shall be protected against unintentional separation as follows:

a) A means shall be provided to mechanically secure the plug or socket that is part of the equipment, to the mating plug or socket that is part of the intended cable assembly that is constructed as follows:

1) an interconnection means involving two or more engaged threads or a means in which separation shall be possible only with the aid of a tool;

2) when not secured, the means shall be captive to the equipment or the cable assembly; and

3) the means shall be provided with a warning marking in accordance with 9.10.1.

b) The equipment installation instructions shall identify the intended cable assembly and repeat the warning in 9.10.1.

8.8.2 The plugs and sockets referenced in 8.8.1 shall be capable of being connected to one of the wiring methods as permitted by the NEC for the US or CE Code, Part I, for Canada for the hazardous location in accordance with any applicable restrictions including issues such as the routing, support and maximum length.

NOTE See the following United States and Canadian Code references for additional details on some permitted wiring methods for Class I locations. Similar requirements exist for Class II and Class III locations:

a) Sections 501.105(B)(6) or 501.140 of the NEC or Rule J18-160 of the CE Code, Part I for Extra-hard usage cord;

b) Section 501.105(B) of the NEC for Power-limited tray cable (Types PLTC or PLTC-ER), Instrumentation tray cable (Types ITC or ITC-ER) and Tray cable (Types TC or TC-ER)) ; and

c) Rule J18-152 of the CE Code, Part I for Tray cable (Type TC), Armoured cable with overall non-metallic jacket (TECK90), Control and Instrumentation cable (Type ACIC) and Non-armoured control and instrumentation cable (Type CIC).

8.8.3 In the United States, cable assemblies and the associated separate plugs and sockets referenced in 8.8.1, shall be in accordance with UL 2238 or UL 2237.

In Canada, external plugs, receptacles and connectors shall be in accordance with CSA C22.2 No. 159.

Alternatively, cable assemblies and the associated separate plugs and sockets may be used that comply with other relevant standards provided these other standards include requirements that address the following:

a) The voltage and current rating of the cable assemblies and the associated separate plugs and sockets.

b) For field wiring applications, the suitability of the cable assemblies and the associated separate plugs and sockets for field installation.

c) Use of the cable assemblies and the associated separate plugs and sockets with one or more of the permitted wiring methods in 8.8.2.

NOTE Connectors evaluated to UL 1977 are not suitable for field wiring applications.

8.8.4 For Class II, Division 2 and Class III equipment, or for Class I, Division 2 equipment marked with an ingress protection rating (Type or IP Code), provision shall be made for maintaining that ingress protection whether the cable assembly is connected to the equipment or not, within the enclosure and within the connector body. This provision shall be a factory-provided means integral to the equipment or cable assembly (such as a tethered gasketed end-cap) unless instructions indicate that a cable assembly is to always be connected during operation, and is only to be disconnected / reconnected by trained service personnel.

8.8.5 Where a product has multiple enclosures, factory wired connections between enclosures may use any of the wiring methods and any applicable restrictions identified in 8.8.2 along with strain relief provisions in accordance with the applicable general purpose requirements.

## 9 Marking

***Advisory Note:*** *In Canada, there are two official languages, English and French. Annex C lists acceptable French translations of the markings specified in this standard. All markings required by this standard may have to be in other languages to conform with the language requirements where the product is to be used.*

### 9.1 General-purpose marking

9.1.1 In addition to the marking required for general-purpose equipment, the minimum marking shall include the information in 9.2 – 9.11 as applicable. This information shall be readily visible before installation. The marking should be in a location that is likely to be visible after installation of the equipment.

### 9.2 Hazardous location related marking

9.2.1 For equipment to be installed in a hazardous location: Class, Division, and Group(s) or in lieu of Group(s), a specific gas or vapor shall be marked.

NOTE Equipment evaluated only for a specific dust, fiber, or flying is subject to additional investigation.

Class I or Class II Equipment that attains surface temperatures higher than 100°C, shall be marked either by:

a) the temperature code as given in the temperature classifications in Table 1; or

b) the specific temperature as measured according to Clause 10.

Electrical equipment designed for use in an ambient temperature range of -25° C to + 40° C does not require marking the ambient temperature range. However, electrical equipment designed for other than this ambient temperature range shall be marked.

NOTE 1 The ambient temperature range may be a reduced range, e.g. -5 °C ≤ Tamb ≤ 30°C.

The scope of the standard allows temperature between -50° C and 40° C to be evaluated without special investigation; however, the default temperature range of the NEC is -25° C to 40° C. Temperature ratings outside of this range must be marked on the equipment per the NEC.

**Table 1**
**Temperature classifications (T codes)**

| Degrees °C | Temperature Code |
|---|---|
| 450 | T1 |
| 300 | T2 |
| 280 | T2A |
| 260 | T2B |
| 230 | T2C |
| 215 | T2D |
| 200 | T3 |
| 180 | T3A |
| 165 | T3B |
| 160 | T3C |
| 135 | T4 |
| 120 | T4A |
| 100 | T5 |
| 85 | T6 |



9.2.2 For associated nonincendive field wiring apparatus, a statement that the equipment provides nonincendive field wiring outputs and the hazardous location suitability of the output: Class, Division, and Group(s). In lieu of Group(s), a specific gas, or vapor may be indicated.

NOTE Equipment evaluated only for a specific dust, fiber, or flying is subject to additional investigation.

9.2.3 Any other information or cautions necessary for the installation and safe operation of the equipment shall be provided.

The international symbol ⚠ may be used to refer the operator to the equipment instructions for these other information and cautions.

9.2.4 On small electrical equipment where there is limited space, a reduction in the marking is permitted. The following lists the minimum marking that is required on the equipment:

a) the hazardous location suitability: Class, Division, and Group(s). In lieu of Group(s), a specific gas or vapor.

NOTE Equipment evaluated only for a specific dust, fiber, or flying is subject to additional investigation.

b) the following abbreviations may be used:

1) Class – Cl or C;

2) Division – Div or D; and

3) Group – Gr or Gp or Grp.

c) the international symbol ⚠, if used, refers the operator to the equipment instructions.

### 9.3 Information for battery-powered equipment

9.3.1 Battery-powered equipment involving operator accessible batteries shall be marked to indicate the type, size, and voltage of batteries to be used or marked with the specific battery (e.g., by manufacturer and model number).

9.3.2 Where required by 5.6.1 (d), the equipment shall be marked with the following wording, or equivalent:

WARNING – EXPLOSION HAZARD – BATTERIES MUST ONLY BE CHANGED IN AN AREA FREE OF IGNITIBLE CONCENTRATIONS.

### 9.4 Nonincendive field wiring connections

The following information shall either be marked on the equipment or contained in the control drawing for equipment with nonincendive field wiring connections:

9.4.1 Connections for nonincendive field wiring shall be clearly identified.

9.4.2 For associated nonincendive field wiring apparatus:

a) $U_o$;

b) $I_o$;

c) $C_o$;

d) $L_o$; and

e) $P_o$ (optional).

NOTE In addition to the above, parameter $L_0/R_0$ may also be marked.

#### 9.4.3 Nonincendive field wiring apparatus

9.4.3.1 For normal operating voltage or current not controlled by the nonincendive field wiring apparatus:

a) $U_i$;

b) $I_i$;

c) $C_i$;

d) $L_i$; and

e) $P_i$ (optional).

9.4.3.2 For normal operating current controlled by the nonincendive field wiring apparatus:

a) $U_i$;

b) $C_i$;

c) $L_i$; and

d) $P_i$ (optional).

9.4.3.3 For normal operating voltage controlled by the nonincendive field wiring apparatus:

a) $I_i$;

b) $C_i$;

c) $L_i$; and

d) $P_i$ (optional).

9.4.3.4 For normal operating current and voltage controlled by the nonincendive field wiring apparatus:

a) $C_i$;

b) $L_i$; and

c) $P_i$ (optional).

Equipment supplied, as a system, including cables supplied for field wiring, need only comply with 9.4.1.

NOTE 1 In addition to the above, parameter $L_i$ /$R_i$ may also be marked.

NOTE 2 General-purpose standards such as CAN/CSA-C22.2 No. 61010-1 and UL 61010-1 require the marking of the rated values of the supply voltages or rated range of the supply voltages, and either;

a) the maximum rated power in either watts or volt-amperes; or

b) the maximum rated input current.

9.4.4 The associated nonincendive field wiring apparatus and nonincendive field wiring apparatus shall be marked with the control drawing reference.

### 9.5 Optional zone marking (US only)

9.5.1 In addition, equipment may be marked for the following Zone classified areas based on compliance with the applicable Division 2 requirements in this standard:

a) (for Class I, Division 2 equipment) Class I, Zone 2 Group IIA (or IIB, or IIC as applicable) and the maximum surface temperature or temperature class;

b) (for Class II, Division 2 equipment) Zone 22 Group IIIB and the maximum surface temperature; and

c) (for Class III equipment) Zone 22 Group IIIA and the maximum surface temperature.

9.5.2 The temperature class when applicable shall be in accordance with 10.2. The correlation between Groups for Zones and Groups for Divisions are shown in Table 2.

NOTE 1 Where the electrical equipment is suitable for use only in a particular gas, the chemical formula or name of the gas is used in lieu of the gas group symbol.

NOTE 2 Products marked as AEx are based upon the ANSI/ISA/UL 60079 series and products marked as Ex for Canada are based upon the CAN/CSA C22.2 No. 60079 series.

**Table 2**
**Correlation between Groups for Zone and Groups for Divisions**

| Class I, Division 2 Group | Class I, Zone 2 Groups |
|---|---|
| A | IIC |
| B | (IIB + $H_2$)* |
| C | IIB |
| D | IIA |
| *Note (IIB + $H_2$) is not a Group as defined by the NEC® | |
| **Class II, Division 2 Groups** | **Zone 22 Groups** |
| F | IIIB |
| G | IIIB |
| **Class III** | **Zone 22 Groups** |
| – | IIIA |

## 9.6 Alternate use of Division parameter designations for nonincendive field wiring

9.6.1 For practical reasons, the symbols used for voltage, current capacitance, inductance, and L/R ratio may be replaced by the symbols defined in North American standards. A comparison is shown in Table 3. Division and zone parameters should not be mixed.

**Table 3**
**Nonincendive field wiring parameters**

| Electrical parameter | Zone parameters | Division parameters |
|---|---|---|
| **Associated nonincendive field wiring apparatus** | | |
| Maximum output voltage | $U_o$ | $V_{oc}$ |
| Maximum output current | $I_o$ | $I_{sc}$ |
| Maximum output power | $P_o$ | $P_o$ |
| Maximum external capacitance | $C_o$ | $C_a$ |
| Maximum external inductance | $L_o$ | $L_a$ |
| Maximum external inductance to resistance ratio | $L_o/R_o$ | $L_a/R_a$ |
| **Nonincendive field wiring apparatus** | | |
| Maximum input voltage | $U_i$ | $V_{max}$ |
| Maximum input current | $I_i$ | $I_{max}$ |
| Maximum internal capacitance | $C_i$ | $C_i$ |
| Maximum internal inductance | $L_i$ | $L_i$ |
| Maximum input power | $P_i$ | $P_i$ |
| Maximum internal inductance to resistance ratio | $L_i/R_i$ | $L_i/R_i$ |

## 9.7 Connectors and lampholders

9.7.1 Connectors and lampholders required to be marked according to 8.2.2 and 8.5.1 shall be marked with the following or an equivalent warning:

WARNING – EXPLOSION HAZARD. DO NOT REMOVE OR REPLACE WHILE CIRCUIT IS LIVE UNLESS THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.

9.7.2 If practical, this marking shall be either on or adjacent to the component. Otherwise, this marking shall be displayed on a prominent place on the enclosure.

### 9.8 Fuseholders

9.8.1 Fuseholders required to be marked according to 5.4.1 or to 8.3.1 shall be marked with the following or an equivalent warning:

WARNING – EXPLOSION HAZARD. DO NOT REMOVE OR REPLACE FUSE WHEN ENERGIZED.

9.8.2 If practical, this marking shall be either on or adjacent to the fuseholder and visible prior to replacement. Otherwise, this marking shall be displayed on a prominent place on the enclosure.

### 9.9 Circuit breakers

9.9.1 Circuit breakers, required to be marked according to 8.4.1 shall be marked with the following or an equivalent warning:

WARNING – EXPLOSION HAZARD. DO NOT RESET CIRCUIT BREAKER UNLESS POWER HAS BEEN REMOVED FROM THE EQUIPMENT OR THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.

### 9.10 External plugs and sockets

9.10.1 Connections required to be marked according to 8.8.1 shall be marked with the following or an equivalent warning:

WARNING – EXPLOSION HAZARD. DO NOT CONNECT OR DISCONNECT WHEN ENERGIZED.

9.10.2 This marking shall be provided such that it is likely to be readily visible after installation. This marking may be on the securement means or the plug / socket portion of the cable assembly. It could be necessary to provide more than one warning marking to assure ready visibility.

### 9.11 Oil immersed equipment

9.11.1 Oil immersed equipment, required to be marked according to 17.3.3 shall be marked with the following or an equivalent warning:

WARNING – EXPLOSION HAZARD. MAINTAIN THE OIL LEVEL ABOVE THE REQUIRED LEVEL UNLESS POWER HAS BEEN REMOVED FROM THE EQUIPMENT OR THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.

9.11.2 This marking shall be provided such that it is likely to be readily visible after installation.

### 9.12 Multiple warning markings

9.12.1 Multiple warnings may be combined into one equivalent warning.

## 10 Surface temperature requirements

### 10.1 Determination of maximum surface temperature

10.1.1 The maximum temperature of any surface that may come in contact with a flammable gas or vapor-in-air mixture, dust, fibers, or flyings shall be determined under normal operating conditions using the applicable general-purpose requirement. Such measurements need not be made on the internal parts of sealed devices. Measurements shall be made at any convenient ambient temperature, corrected linearly to 40°C or higher marked ambient. The equipment may have more than one temperature class, such as for multiple ambient temperature ratings.

NOTE Although the equipment may be marked for an upper ambient less than 40°C, the temperature classification is based upon 40°C in accordance with the CE Code, Part I and the NEC®.

### 10.2 Surface temperature

10.2.1 For Class I, Division 2 equipment except for small components meeting the requirements of 10.3, the maximum temperature of any surface that can come in contact with the atmosphere shall not exceed:

a) the temperature class assigned;

b) the maximum surface temperature assigned; or

c) if appropriate, the ignition temperature of the specific gas for which it is intended.

10.2.2 For Class II, Division 2 equipment, the maximum temperature of any surface that can come in contact with the atmosphere shall not exceed:

a) the temperature class assigned; or

b) the maximum surface temperature assigned.

10.2.3 For Class III equipment, the maximum surface temperature of any surface that can come in contact with the atmosphere shall not exceed 120° C (for equipment that may be overloaded) or not greater than 165°C (for equipment not subject to overloading).

### 10.3 Surface temperature of small components

10.3.1 The surface temperature of components having a total surface area of not more than 10 000 $mm^2$ may exceed the temperature class marked on the electrical equipment, if they are not ignition capable with a safety margin of:

a) 50 K for T1 – T3C; or

b) 25 K for T4 – T6.

This safety margin shall be ensured by experience of similar components or by tests of the electrical equipment itself in representative explosive mixtures for the specific temperature class.

During the tests, the safety margin may be provided by increasing the ambient temperature or by increasing the power dissipation of the component. For methane, the second option is recommended.

10.3.2 Small components, for example transistors or resistors, whose temperature exceeds that permitted for the temperature classification shall be acceptable providing that they conform to one of the following:

a) When tested in accordance with the small component ignition test of CSA/UL 60079-0, small components shall not cause ignition of the flammable mixture and any deformation or deterioration caused by the higher temperature shall not impair the type of protection.

b) For T4 classification, small components shall conform to Table 4.

c) For T5 classification, the surface temperature of a component with a surface area smaller than 1 000 $mm^2$ (excluding lead wires) shall not exceed 150°C.

**Table 4**
**Assessment for T4 classification according to component size and ambient temperature**

| Total surface area excluding wire terminations | Requirement for T4 classification |
|---|---|
| < 20 $mm^2$ | Surface temperature ≤ 275°C |
| ≥ 20 $mm^2$ | Power dissipation ≤ 1.3 W* |
| ≥ 20 $mm^2$ ≤ 1 000 $mm^2$ | Surface temperature ≤ 200°C |
| * Reduced to 1.25 W with 50°C ambient temperature, 1.2 W with 60°C ambient temperature, 1.1 W with 70°C ambient temperature, or 1.0 W with 80°C ambient temperature. | |

For potentiometers, the surface to be considered shall be that of the resistance element and not the external surface of the component. The mounting arrangement and the heat-sinking and cooling effect of the overall potentiometer construction shall be taken into consideration during the test. Temperature shall be measured on the track with that current which flows under the test conditions required by this standard. If this results in a resistance value of less than 10% of the track resistance value, the measurements shall be carried out at 10% of the track resistance value.

## 11 Spark ignition testing of nonincendive circuits

### 11.1 Spark test apparatus

11.1.1 The spark test apparatus used for performing ignition tests on circuits shall conform with the Spark test apparatus for intrinsically safe circuits of CSA/UL 60079-11 based upon a 1.0 safety factor.

11.1.2 The spark test apparatus shall be connected in the circuit under test at each point where a spark can normally occur, taking into account the requirements of this standard.

11.1.3 The spark test apparatus shall be verified according to the Spark test apparatus for intrinsically safe circuits of CSA/UL 60079-11 using a safety factor of 1.0 after each ignition test. Gas mixtures shall be according to the Compositions of explosive test mixtures adequate for 1,0 safety factor table of CSA/UL 60079-11, with the IIC composition applicable to both Group A and Group B applications.

11.1.4 The ignition test shall be considered invalid if the verification test is unsatisfactory.

### 11.2 Ignition test conditions

11.2.1 There shall be no ignition of the test mixture when the circuit is tested under normal operating conditions for the following number of revolutions of the tungsten wire holder in the spark test apparatus:

a) for d.c. circuits, not less than 400 revolutions with 200 revolutions at each polarity; and

b) for a.c. circuits, not less than 1 000 revolutions.

## 12 Evaluation of nonincendive components

### 12.1 Ratings, preconditioning, and test for nonincendive components

12.1.1 A nonincendive component is limited in use to the rating for which it has been satisfactorily tested according to 12.2.

12.1.2 A nonincendive component shall be preconditioned by being operated a minimum of 6 000 times at the rate of approximately 6 times per minute while carrying its normal electrical load.

12.1.3 Components intended for use with high inrush current loads (e.g., motor or tungsten lamp loads) shall be subjected to overload testing that is representative of actual circuit applications. Preconditioning and overload conditions shall be according to the requirements of national standards that cover these applications.

### 12.2 Spark ignition test for nonincendive components

12.2.1 Following the preconditioning test, the nonincendive component shall be placed in a suitable test chamber of at least 10 times the volume of the component.

The component shall be connected to the maximum rated source of energy and power, and maximum rated load, in terms of voltage, current, frequency, and minimum power factor.

12.2.2 A nonincendive component shall be filled with and surrounded by a gas mixture as follows:

a) according to the Compositions of explosive test mixtures adequate for 1,0 safety factor table of CSA/UL 60079-11, with the IIC composition applicable to both Group A and Group B applications; or

b) for apparatus that is intended for use in a specific gas or vapor – in-air, the most easily ignitable concentration of that gas or vapor – in-air mixture.

The samples should be prepared by using one of the methods in 12.2.2.1 to 12.2.2.3 and then successfully withstand the test in 12.2.3.

12.2.2.1 Method A

The housing adjacent to the contacts shall be removed to permit free access of the air-gas mixture to the contacts.

12.2.2.2 Method B

At least two holes shall be drilled in the enclosure that will assure propagation of an ignition from the inside to the outside of the enclosure. The test gas shall flow through the device. A tube may be connected to one of the holes for this purpose. If necessary, explosion detection (e.g., a pressure transducer) may be connected to the component to detect ignition.

12.2.2.3 Method C

A vacuum shall be drawn within the test chamber and maintained for a minimum of 100 seconds. The test chamber shall be filled with the specified air-gas mixture and the concentration shall be maintained for a minimum of 100 seconds before applying the required electrical load. Explosion detection (e.g., a pressure transducer) shall be used to detect ignition.

12.2.3 The component shall be operated a minimum of 50 times at not less than 10-second intervals, renewing the air-gas mixture after each set of 10 operations (or more frequently, if necessary to ensure the presence of the air-gas mixture within the nonincendive component). There shall be no ignition of the air-gas mixture either within the component or within the surrounding atmosphere.

## 13 Evaluation of sealed devices

### 13.1 Ratings, construction, preconditioning, and test for sealed devices

13.1.1 Sealed devices other than hermetically sealed devices shall be subjected to the requirements specified in 13.1.4 to 13.1.7.

13.1.2 Hermetically sealed devices shall be considered to meet these requirements without test.

13.1.3 Except as permitted in 13.1.2, the free internal volume of the sealed device shall be less than 100 $cm^3$.

13.1.4 Resilient gasket seals or poured seals shall be arranged so that they are not subject to mechanical damage during normal operating conditions and shall retain their sealing properties for the intended conditions of use.

13.1.5 The sealed device itself, or the sealing and encapsulating material of the sealed device, shall have a continuous operating temperature at least 20K higher than the maximum service temperature and equal to the minimum service temperature to which it is exposed.

Alternatively, the sealed device itself, or the sealing and encapsulating material of the sealed device, may have a continuous operating temperature equal to the maximum and minimum service temperature to which it is exposed if it is subjected to the Temperature aging requirements in this Standard based on the maximum service temperature prior to the air leakage test in Clause 13.2.

Where the sealed device is fixed equipment or an internal part of fixed equipment, and the device is constructed with a separate housing and base that are sealed together, the housing and base of the device need not be considered part of the seal. Where the sealed device is portable equipment or an internal part of portable equipment, and the device is constructed with a separate housing and base that are sealed together, the housing and base of the device shall be considered part of the seal.

NOTE 1 For fixed equipment applications involving seal material with continuous operating temperature at least 20K higher than the maximum service temperature and equal to the minimum service temperature to which it is exposed, a manufacturer's COT ratings or declaration regarding the COT ratings is a means of determining suitability.

NOTE 2 For all portable equipment applications, and for fixed equipment applications involving seal material with a COT that is not at least 20K higher than the maximum service temperature, a manufacturer's declaration regarding the specific manufacturer and part number of the housing and base material relied upon to comply with the applicable requirements is a means of determining suitability.

13.1.6 A sealed device shall have structural integrity and shall be constructed of materials suitable for the intended environment with full consideration for anticipated atmospheric contaminants and corrosive compounds. The enclosure shall be sufficiently rugged to withstand normal handling and assembly operations without damage to any seals provided.

13.1.7 To ensure that damage affecting safety of operation will not occur during normal operating conditions of the sealed device, three samples shall be subjected to the air leakage test according to 13.2.

13.1.8 Sealed devices shall be so constructed that they cannot be opened during normal operation or for any maintenance activities. These requirements apply to the device design, and not just only to when it is operated in a hazardous (classified) location.

### 13.2 Air leakage test

13.2.1 Each of the three samples shall pass one of the following tests:

a) At an initial temperature of 25 ± 2° C the test samples shall be immersed in water at a temperature of 50 ± 2° C to a minimum depth of 25 mm for a minimum of 1 minute. If no bubbles emerge from the samples during this test, they are considered to be "sealed" for the purpose of this standard.

b) The test sample shall be immersed to a minimum depth of 75 mm in water contained in an enclosure that can be partially evacuated. The air pressure within the enclosure shall then be reduced by at least 16 kPa. If no bubbles emerge from the samples during this test, samples are considered to be sealed for the purpose of this standard.

c) The test sample shall be shown to leak at a rate not greater than $10^{-5}$ ml of air per second at a minimum pressure differential of 101 kPa by means of a suitable leak rate detector.

## 14 Evaluation of enclosed-break devices

### 14.1 Ratings, construction, preconditioning, and test for enclosed-break devices

14.1.1 Devices intended for connection to field wiring shall comply with the entries for flameproof enclosures requirements of CSA/UL 60079-1.

14.1.2 The free internal volume shall not exceed 20 $cm^3$.

14.1.3 Enclosures that do not serve as the external equipment enclosure shall be capable of withstanding normal handling and assembly operations without damage to seals. When the enclosure also serves as the external equipment enclosures, the enclosure requirements of this standard shall apply.

14.1.4 Poured seals and encapsulating compounds shall have a continuous operating temperature (COT) range that includes a minimum temperature that is below, or equal to, the minimum service temperature and a maximum temperature that is at least 10 K above the maximum service temperature.

14.1.5 Devices shall be limited to a maximum rating of 690 V a.c., r.m.s. or d.c. and 16 A a.c. r.m.s. or dc.

14.1.6 One sample of the enclosed-break devices shall be subjected to the testing in 14.2. After the testing, the device shall show no visible signs of damage, no external ignition shall occur, and there shall be no failure to clear the arc when the switch contacts are opened.

### 14.2 Tests for enclosed-break devices

14.2.1 Any elastomeric or thermoplastic material which is used for the purpose of sealing a cover which is intended to be opened in service, or which is unprotected against mechanical or environmental damage, shall be removed wholly or partially before the device is subjected to the make and break tests, when such removal will result in a more onerous test.

14.2.2 For the make and break test, the device shall be arranged to have the most adverse dimensions permitted by the construction drawings, and then filled with and surrounded by an explosive mixture according to the stated group of the equipment, as follows:

a) Group D: (55 ±0,5) % hydrogen/air at atmospheric pressure;

b) Group C: (37 ±0,5) % hydrogen/air at atmospheric pressure; or

c) Group A, B: (40 ±1) % hydrogen, (20 ±1) % oxygen and the remainder nitrogen at atmospheric pressure or alternatively (27,5 ±1,5) % hydrogen/air at an overpressure at a pressure equal to 1,5 times atmospheric pressure.

With the explosive mixture introduced into the arc chamber of the device, the enclosed contacts shall switch the maximum rated load regarding voltage, current, frequency, and minimum power factor

A make and break test shall be made 10 times with a fresh explosive mixture for each test.

In all cases, it shall be ensured that the explosive mixture entered the arc chamber of the device and that there was no ignition of the external atmosphere.

Testing within a pressure vessel is one means to ensure that the explosive mixture entered the arc chamber of the device.

## 15 Enclosure ingress protection for Class II and III

### 15.1 Construction and tests for enclosures

15.1.1 A gasket used to make an enclosure dust-tight shall be made of material acceptable for the purpose. A gasket of elastomeric or thermoplastic material may be used if it is resistant to aging when tested in accordance with 15.5.

Gaskets shall be either secured or captive if they could be dislodged during installation or maintenance of the equipment.

15.1.2 An enclosure that is required to exclude the entry of dust shall pass any one of the tests according to 15.2, 15.3, or 15.4.

15.1.3 For the tests in 15.2 or 15.4, a length of conduit may be installed in the enclosure under test to equalize the internal and external pressures, but it shall not serve as a drain.

15.1.4 When determining the spray application, the term "test length" is determined based on the dimensions for each point of potential dust entry into the enclosure under test (including but not limited to, seams, joints, and external operating mechanisms).

### 15.2 Dust-blast method

15.2.1 The enclosure shall be subjected to a blast of compressed air mixed with dry Type 1 general-purpose Portland cement (or equivalent) using a suction-type sandblast gun that is equipped with a 4.8 mm diameter air jet and a 9.5 mm diameter nozzle. The air shall be at a supply pressure of 620 – 690 kPa. The cement shall be supplied by a suction feed.

15.2.2 A minimum of 6 kg/m of test length (sum of height, width, and depth) of the enclosure under test shall be applied at a minimum rate of 2.3 kg per minute. The nozzle shall be held 305 – 381 mm from the enclosure, and the blast of air and cement shall be directed at all points of potential dust entry, such as, but not limited to, seams, joints, and external operating mechanisms.

15.2.3 The enclosure shall be deemed to pass the test if no visible dust is detected inside the enclosure at the end of the test.

15.2.4 Alternatively, the enclosure may comply with the Outdoor dust test – Dust blast method from UL 50E/CSA C22.2 No. 94.2.

### 15.3 Circulating dust method

15.3.1 The test shall be made using equipment in which talcum powder is maintained in suspension in a suitable closed chamber. The talcum powder used shall pass through a square-meshed sieve whose nominal wire diameter is 50 µm and whose nominal width between wires is 75 µm. The amount of talcum powder used shall be 2 kg/$m^3$ of the test chamber volume. It shall not have been used for more than 20 tests.

15.3.2 The enclosure under test shall be supported inside the test chamber and the pressure inside the enclosure is maintained below the surrounding atmospheric pressure by a vacuum pump. The suction connection shall be made to a hole specifically provided for this test. If not otherwise specified in the relevant product standard, this hole shall be in the vicinity of the vulnerable parts. If it is impracticable to make a special hole, the suction connection shall be made to the cable inlet hole. If there are other holes (e.g., more cable inlet holes or drain holes) these shall be treated as intended for normal use on site. The object of this test is to draw into the enclosure, by means of depression, a volume of air 80 times the volume of the sample enclosure tested without exceeding the extraction rate of 60 volumes per hour. In no event shall the depression exceed 2 kPa (20 mbar).

If an extraction rate of 40 – 60 volumes per hour is obtained, the duration of the test shall be 2 hours. If, with a maximum depression of 2 kPa (20 mbar) of water, the extraction rate is less than 40 volumes per hour, the test shall be continued until 80 volumes have been drawn through, or a period of 8 hours has elapsed.

15.3.3 If it is not possible to place the complete assembly in the test chamber, one of the following procedures shall be used:

a) individual testing of separate enclosed sections of the apparatus;

b) testing of representative parts of the apparatus (such as doors, ventilating openings, joints, and shaft seals), with the vulnerable parts of the apparatus (such as terminals and slip rings) in position at the time of testing; or

c) testing of smaller apparatus having the same full-scale design details.

The enclosure shall be deemed to pass the test if no visible dust is detected inside the enclosure at the end of the test.

Alternatively, the enclosure may comply with the dust test for first characteristic numeral 6 from IEC 60529.

### 15.4 Atomized-water method

15.4.1 The enclosure shall be sprayed with atomized water using a nozzle that produces a round pattern 76 – 102 mm in diameter, 305 mm from the nozzle. The air pressure shall be 207 ±6 kPa. The water shall be supplied by a suction feed with a siphon height of 102 – 204 mm. A minimum of 485 ml/m of test length (sum of height, width, and depth) of the enclosure under test shall be applied at a minimum rate of 11 liters per hour. The nozzle shall be held 305 – 381 mm from the enclosure, and the spray of water shall be directed at all points of potential dust entry including, but not limited to, seams, joints, and external operating mechanisms.

15.4.2 The enclosure shall be deemed to pass the test if no visible water is detected inside the enclosure at the end of this test.

15.4.3 Alternatively, the enclosure may comply with the atomized-water method (Method A) from UL 50E/CSA C22.2 No. 94.2.

### 15.5 Gasket test

15.5.1 A gasket of an elastomeric or thermoplastic material, or a composition gasket utilizing an elastomeric material, shall be of such quality that three test specimens of dimension in accordance with the test specimens table of UL 157 have a tensile strength of not less than 75 percent and an elongation of not less than 60 percent of values determined for unaged samples, when subjected to temperature aging per 15.6.

15.5.2 Gaskets with a rated maximum service temperature in accordance with UL 157 at least equal to the service temperature or a COT at least 20 K higher than the service temperature need not be subject to this test.

15.5.3 As an alternative to the gasket elongation and tensile testing of 15.5, one entire enclosure may be tested to either 15.2, 15.3, or 15.4 after preconditioning the entire enclosure to the temperature aging of 15.6.

### 15.6 Temperature aging

15.6.1 For a Class II/Class III enclosure that contains a gasket or seal of elastomeric or thermoplastic material or a composition gasket utilizing an elastomeric material, three enclosure gasket samples or one complete enclosure sample shall be selected.

15.6.2 The selected sample(s) shall be subjected to one of the following aging methods in a circulating air oven:

a) For any service temperature, a temperature determined in accordance with the following formula:

$$t = 2685e^{-(0.0693)(T-T1)}$$

where

t = the test time in hours (168 hr minimum)

e = 2.7183

T = the aging temperature in °C

T1 = the maximum service temperature in °C (40°C minimum)

b) For a service temperature not greater than 75° C, 168 to 198 hrs in an ambient of (90 ±5)% relative humidity and at a temperature of (20 ±2) K above the maximum service temperature but at least 80°C.

c) For a service temperature greater than 75°C, 85 to 115 hours at (95 ±2)°C and (90 ±5)% relative humidity followed by a period of 85 to 115 hours at a temperature of (20 ±2) K higher than the maximum service temperature.

15.6.3 Alternatively, the samples shall be conditioned in accordance with the requirements of thermal endurance to heat per CSA/UL 60079-0 or CSA/UL 60079-15. When using CSA/UL 60079-0, the test temperature may be reduced to 10 K above the service temperature, instead of 20 K above the service temperature.

## 16 Drop tests and impact tests

### 16.1 Portable equipment

16.1.1 Portable equipment (equipment intended to be carried by hand or carried on the person ready for use) shall be subjected to a drop test as specified in 16.2. There shall be no damage to the equipment that can invalidate compliance with the requirements in this standard.

Note: Damage to the equipment includes dislodging of components which could cause shorting or which interrupt an incendive circuit.

### 16.2 Drop test for portable equipment

16.2.1 A sample shall be subjected to the following thermal conditioning:

a) Seven (7) days at a uniform temperature of at least 10° C (18° F) higher than the maximum temperature of the material measured under worst case normal operating conditions, but not less than 70°C (158°F); and

b) directly followed by cooling to the minimum rated ambient temperature.

Within 10 minutes of this thermal conditioning, the equipment shall be dropped six times, not more than once on any one equipment surface, from a height of at least 1 m onto a smooth concrete floor. A nonrestrictive guide may be used.

There shall be no ejection of the battery (or batteries) and there shall be no damage that invalidates compliance with the requirements in this standard.

16.2.2 The drop test in CSA/UL 60079-0 may be used as an alternative. The testing shall be performed after the required thermal endurance to heat and to cold and to the required impact testing at the specified maximum and minimum temperatures as specified in CSA/UL 60079-0.

### 16.3 Impact test for fixed or stationary equipment used in Class I location

16.3.1 The equipment shall be examined to ensure there is no damage that can affect its acceptability for use in Division 2 locations after any specified impact test in the applicable general-purpose standards.

### 16.4 Impact test for fixed or stationary equipment used in Class II or Class III location

16.4.1 One sample of equipment with non-metallic enclosures or parts of enclosures (including gaskets and windows) intended for use in Class II, or Class III hazardous (classified) locations shall be subject to a 2.7 joules impact test prior to dust tests.

16.4.2 The point(s) of impact shall be the place(s) considered to be the weakest. No location shall be subjected to more than one impact. The equipment shall be tested completely assembled, and with any guards installed that are normally supplied as part of the equipment. Ambient temperature for the test shall be at the lower ambient temperature of the equipment as marked on the equipment label or listed in the product literature.

16.4.3 The test mass shall be fitted with a steel hemisphere of 25 mm diameter. The equipment shall be positioned on a steel or concrete base so the direction of impact is normal to the surface being tested. The base shall have a mass of at least 20 kg.

16.4.4 The impact test in CSA/UL 60079-0 may be used as an alternative. The testing shall be performed after the required thermal endurance to heat and to cold and at the specified maximum and minimum temperatures as specified in CSA/UL 60079-0.

## 17 Evaluation of an oil immersed equipment

### 17.1 General

17.1.1 Equipment is considered to be of the oil-immersed type if no electrical connections, joints, terminals, or arcing parts are located above the required oil level.

17.1.2 For equipment being protected by oil immersion, the general-purpose requirements shall specifically address oil immersion for use in unclassified locations.

Note: For example, transformers have been evaluated to the requirements of CSA C277.3 or C227.4 and/or ANSI/IEEE C57.12.00 and IEEE C57.12.90.

### 17.2 Enclosure

17.2.1 An enclosure having a construction complying with general purpose requirements may be used if the enclosure has the strength and rigidity necessary to resist abuses to which it is likely to be subjected without resulting in leakage of oil, reduction of spacings, loosening or displacement of parts, or other serious defects.

### 17.3 Oil requirements

17.3.1 Equipment shall be constructed so that all electrical connections, terminals, and arcing parts are immersed to a depth below the required oil level in accordance with the general-purpose requirements for liquid immersion of the particular equipment. Alternatively, the minimum immersion depth requirements of CSA/UL 60079-6 may be applied.

17.3.2 The protective liquid specification shall be in accordance with the general-purpose requirements for liquid immersion of the particular equipment. Alternatively, the protective liquid specification requirements of CSA/UL 60079-6 may be applied.

17.3.3 Oil-immersed equipment shall be provided with a visible oil-level indicator, marked with the minimum, normal, and maximum oil levels, and shall also bear a warning marking in accordance with 9.11.1.

### 17.4 Temperature test

Equipment shall be subjected to a temperature test in accordance with 10 to determine the maximum temperatures on the external surfaces, free surface of the oil, or other surfaces that may be exposed to the gas- or vapor-air.

## 18 Manufacturer's instructions

### 18.1 Information in addition to that required by general-purpose standards

18.1.1 The manufacturer's instructions shall include, in addition to the information required for unclassified locations (nonhazardous locations), the information shown in 9.2.1 and 18.2 – 18.5, to emphasize the precautions required when operating the equipment in a Division 2 location.

### 18.2 Information for connections on exterior of enclosure

18.2.1 Documentation accompanying plugs and sockets for connection on the exterior of enclosures, in accordance with 8.8.1, shall address the following:

a) the necessary action to release the captive mechanical securement of the plug and socket;

b) the following warning or equivalent: “WARNING – EXPLOSION HAZARD. DO NOT CONNECT OR DISCONNECT WHEN ENERGIZED”;

c) the permitted plugs and sockets for interconnection to each other;

d) the permitted wiring methods for assembly to the plugs and sockets; and

e) installation to be in accordance with any applicable restrictions of the NEC for the US or CE Code, Part I for Canada, including issues such as the routing, support and length of the wiring method.

Documentation accompanying plugs and sockets for connection on the exterior of enclosures in accordance, with 8.8.4, shall address the means for maintaining the ingress protection whether the plug or socket assembly is connected to the equipment or not (for example, a tethered cap).

### 18.3 Information for equipment with nonincendive field wiring connections

18.3.1 The following or equivalent information for use of the equipment shall be included.

18.3.2 A control drawing shall be provided for all nonincendive field wiring apparatus or associated nonincendive field wiring apparatus. A nonincendive field wiring system could consist of equipment investigated as a system or equipment investigated under the nonincendive field wiring concept. If the nonincendive field wiring and the associated nonincendive field wiring are investigated as a system, the control drawing shall provide information for proper connection and installation. If the nonincendive field wiring or associated nonincendive field wiring apparatus is investigated separately, the control drawing shall include applicable electrical parameters to permit selection of apparatus for interconnection.

18.3.3 The control drawing shall contain notes to explain the following if applicable:

a) the polarity requirements for associated nonincendive field wiring apparatus;

b) that associated nonincendive field wiring apparatus shall not be connected in parallel unless this is permitted by the associated nonincendive field wiring apparatus approval;

c) how to calculate the allowed capacitance and inductance values for the field wiring used in the nonincendive field wiring circuit;

d) the hazardous (classified) locations in which the apparatus may be located; and

e) permissible connections to simple apparatus.

18.3.4 The control drawing shall provide the following information where applicable: the Division parameters, the Zone parameters, or both, as shown in Table 3, may be used to designate electrical parameters on the apparatus and in the installation documents and control drawing.

### 18.4 Information for component replacement or equipment disconnection

18.4.1 The following warning or equivalent warnings in 18.4.2 and 18.4.3 for component replacement or equipment disconnection shall be included.