UL 60079-0

STANDARD FOR SAFETY

Explosive Atmospheres – Part 0: Equipment – General Requirements

UL Standard for Safety for Explosive Atmospheres – Part 0: Equipment – General Requirements, UL 60079-0

Seventh Edition, Dated March 26, 2019

Summary of Topics

This revision of ANSI/UL 60079-0 dated April 15, 2020 includes the following changes in requirements:

> ***Addition of Supplementary Requirements for Factory-Wiring Between Enclosures; 3.95ADV.1, Clause 19DV***
>
> ***Addition of Electronic Medium for Required Instructions; 30.6ADV***
>
> ***Alignment with 2020 NEC for Clause 1DV, Table 4ADV and 29.4DV.***

This standard is an adoption of IEC 60079-0, Explosive atmospheres – Part 0: Equipment – General requirements, (seventh edition issued by IEC December 2017) as a new IEC-based UL standard with US Differences.

The new requirements are substantially in accordance with Proposal(s) on this subject dated December 27, 2019 and February 14, 2020.

No Text on This Page

MARCH 26, 2019
(Title Page Reprinted: April 15, 2020)

UL 60079-0

Standard for Explosive Atmospheres – Part 0: Equipment – General Requirements

First Edition – December 2002
Second Edition – Not Printed
Third Edition – Not Printed
Fourth Edition – August 2005
Fifth Edition – October 2009
Sixth Edition – July 2013

Seventh Edition

March 26, 2019

This ANSI/UL Standard for Safety consists of the Seventh edition including revisions through April 15, 2020.

The most recent designation of ANSI/UL 60079-0 as an American National Standard (ANSI) occurred on April 15, 2020. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

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.

No Text on This Page

CONTENTS

Bibliography

Preface (UL)

This UL Standard is based on IEC Publication 60079-0: Seventh edition, Explosive Atmospheres – Part 0: Equipment – General Requirements. IEC publication 60079-0 is copyrighted by the IEC.

This is the UL Standard for Safety for Explosive Atmospheres – Part 0: Equipment – General Requirements.

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.

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National Differences from the text of International Electrotechnical Commission (IEC) Publication 60079-0, Explosive atmospheres – Part 0: Equipment – General requirements, copyright 2017, are indicated by notations (differences) and are presented in bold text.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

DR – These are National Differences based on the **national regulatory requirements**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES – Part 0: Equipment – General requirements

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60079-0 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

This seventh edition cancels and replaces the sixth edition, published in 2011. This edition constitutes a technical revision.

The significance of the changes between IEC Standard, IEC 60079-0, Edition 6 (2011) and IEC 60079-0, Edition 7 (2017) are as listed below:

Explanation of the significance of the changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Throughout document, “electrical equipment” replaced by “equipment” where appropriate.	Multiple	X		
Scope List of “Type of “Protection” and “Product” standards combined into one list.	1	X		
Definitions used in multiple sub-parts added. Definitions harmonized across sub-parts and added to 60079-0 where appropriate. Battery definitions updated	3	X		
Clarification of the way that information on process temperature influences can be expressed.	5.1.2	X		
Clarification regarding the determination of service temperatures when dust layers are present	5.2	X		
Clarification on the need to provide service temperature information for Ex Components in the Schedule of Limitations	5.2	X		
Relocation of EPL Da dust layer requirements from IEC 60079-18 & IEC 60079-31	5.3.2.3.1	A1		
Clarified that for EPL Db, a maximum specified dust layer of greater than 200 mm is not permitted as thicker layers have no additional effect on maximum surface temperature.	b)	X		
Added for EPL Db, a dust layer in a specified orientation, marked as T_L	c)		X	
Clarified that for EPL Dc, no dust layer tests are required.	5.3.2.3.3	X		
Clarified that the “temperature” is the temperature of the air surrounding the component	5.3.3	X		
Subdivided section dealing with higher permitted surface temperatures for “smooth” surfaces. Corrected area from 1 000 mm^2 to 10 000 mm^2.	5.3.4	X		
Clarified that the “Ex” requirements of IEC 60079 supplement those of the relevant industrial standards.	6.1	X		
Added requirement that where an adhesive is used to secure a gasket, it shall be used within its COT and shall comply with the requirements for cements.	6.5			C1
Requirements relocated to IEC 60079-28	former 6.6.2	A2		
Ultrasonic requirements updated based on latest research work	6.6.3		X	
Added reference to IEC 60079-28	6.6.4	A2		
Material identification parameters have been revised to reflect reasonably obtainable information	7.1.2.2	X		
“RTI-mechanical” has been clarified to include “RTI-mechanical strength” and “RTI-mechanical impact”	7.1.2.2	X		
Material identification parameters have been revised to reflect reasonably obtainable information	7.1.2.3	X		
Relocated information on “cements” from Clause 12.	7.1.2.4	X		
“RTI-mechanical” has been clarified to include “RTI-mechanical strength” and “RTI-mechanical impact”. Requirements for cements aligned with the requirements for elastomers.	7.2.2	X		
Relocation of 10 K margin for EPL Gc or Dc from IEC 60079-15, IEC 60079-18 & IEC 60079-31	7.2.2	A3		
Added clarification with respect to gaskets and seals where only the outer edge is potentially exposed to light.	7.3	X		

Explanation of the significance of the changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Clarification added that one or more of the described techniques may be used	7.4.2	X		
Added additional relaxation for the case where a surface is in contact with an earthed surface on only two of four sides.	7.4.2 b)		X	
Added reference to IEC 60243-1 and IEC 60243-2 for test method to require a 4 kV DC test.	7.4.2 c)			C2
Additional guidance added with respect to the possible Specific Conditions of Use	7.4.2 e)	X		
New option added for portable, mains-powered equipment with earth-connected guard	7.4.2 f)		X	
Added option for determination of maximum transferred charge.	7.4.2 g) Table 10		X	
Added missing limits (same as 7.4.2)	7.4.3 a)	X		
Clarified that it is a dc test that is conducted	7.4.3 b)	X		
Clarified that this requirement is not applied to personal or portable equipment	7.5	X		
Clarified Group I limits	8.2	X		
Clarified Group II, EPL Ga limits	8.3	X		
Added limitation for external surfaces of >65% copper	8.5			C3
Added clarification as to what is considered a tool	9.1	X		
Clarified that the tolerance class of the set screw is not critical, only that it not protrude from the threaded hole after tightening.	9.4	X		
Information on cements transferred to Clause 7	12	X		
Required that Ex Component Certificates require a Schedule of Limitations in all cases	13.5		X	
Revised to clarified that all connection facilities may not be a “Compartment”.	14	X		
Sub-clause split to separate the requirements for protective earthing and equipotential bonding into separate sections	15.3 15.4	X		
Section split to separate secureness of electrical connections from the internal earth continuity plate.	15.6 15.7	X		
Non-threaded Group I cable glands are no longer required to be Ex Components.	16.3		X	
Non-threaded Group I blanking elements are no longer required to be Ex Components.	16.4		X	
Scope of Clause 17 clarified to define applicability	17	X		
Additional guidance notes added to address bearings	17.3	X		
Clarified applicability to disconnectors, interlocks, and maintenance switches.	18.2	X		
Fuse requirements deleted as they are addressed in the individual sub-parts	19	X		
Added requirements for EPL Gc and Dc	20.1			C4
The test circuit requirements for a flameproof connection have been removed as they are more completely specified in IEC 60079-1.	20.2	X		
The impact test requirements for luminaires are relocated to Table 15	21.1 Table 15	X		
Clarified interlock switch operation for flameproof luminaires	21.2	X		
Clarified that some Types of Protection permit connection of cells in parallel	23.2	X		

Explanation of the significance of the changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
New cell types and data added based on latest available data	Table 13		X	
New cell types and data added based on latest available data	Table 14			C5
Clarification of what documentation is to be prepared regarding the explosion safety aspects of the equipment	24	X		
Clarification that the type tests are to take into consideration the installation instructions	26.2	X		
Clarification that the “glass” requirements also apply to “ceramic” parts	26.4.1.1	X		
Added a permission to interchange the order of tests at the “lower test temperature” and the “upper test temperature”.	26.4.1.2.2 26.4.1.2.3	X		
Clarified the construction of the impact test fixture	26.4.2	X		
Clarified the impact tests for glass parts	26.4.2	X		
Added clarification to deal with the new IPX9 ratings	26.4.5.1		X	
Clarified the test voltage for maximum surface temperature	26.5.1.3	X		
Relocation of EPL Da dust layer requirements from IEC 60079-18 & IEC 60079-31	26.5.1.3	A1		
Relocation of EPL Db specified dust layer requirements from IEC 60079-31	26.5.1.3	A4		
Added for EPL Db, a dust layer in a specified orientation, marked as T_L	26.5.1.3		B1	
Clarified that for EPL Dc, the testing is conducted without a dust layer.	26.5.1.3	X		
Relocation of thermal endurance to heat 10K relaxation for Gc equipment from IEC 60079-15, IEC 60079-18, & IEC 60079-31	Table 17	X		
Clarification of a consistent way to address elastomeric materials exposed to ultraviolet light	26.10	X		
Replacement of “oil No. 2” with the revised designation of “oil IRM 902”.	26.11	X		
Option added for testing at lower voltages when low resistance materials are encountered	26.13		X	
Transferred charge test added based on IEC TS 60079-32-2	26.17		X	
The reference to a specific instruction document instead of an “X” condition relocated to e) instead of a note giving a permission	29.3 e)	X		
Updated to reflect the additional levels of protection already shown in the sub-parts: “da”, “dc”, “eb”, “ec”, “oc”, “op is”, “op pr”, “op sh”, “pxb”, “pyb”, “pzc”, “qb”, “sa”, “sb”, and “sc”.	29.4 b)	X		
Text added to address marking of “Ex associated equipment”	29.4		X	
Updated to reflect the additional levels of protection already shown in the sub-parts: “ic”, “op is”, “op pr”, “op sh”, “pxb”, “pyb”, “pzc”, “sa”, “sb”, and “sc”.	29.5 b)	X		
Clarified marking of EPL Da, EPL Db with no dust layer, EPL Db with a specified dust layer, and EPL Dc.	29.5 d)	X		
Introduced marking for EPL Db with a dust layer in a specified orientation	29.5 d)		X	
Text added to address marking of “Ex associated equipment”	29.5		X	
Text added to address marking of equipment intended to be installed in a boundary wall.	29.9		X	
The marking of Ex Component enclosure was aligned with the marking requirements of IEC 60079-1 and IEC 60079-7	29.10	X		

Explanation of the significance of the changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
The alternate marking of EPL has been deleted.	former 29.13			C6
Marking for electric machines operated with a converter clarified	29.15	X		
Instruction material guidance clarified	30.1	X		
Additional instruction material for electric machines added	30.3			C7
Additional instruction material for cable glands added	30.5 A.5			C8
Allow ISO 10807 hose assemblies to be used with cable glands.	A.1		X	
Clarify testing with stainless steel mandrels	A.3	X		
Reduction of the time / slippage permitted	A.3.1.1		X	
Clarify impact testing of cable glands	A.3.3 Figure A.3	X		
Clarified the order of tests	A.3.4	X		
Clarified remarks	Annex B	X		
Aligned Figure with text	Figure C.1	X		
Clarified operation of electric machines from converters	Annex D (informative)	X		
Clarified temperature testing of electric machines	Annex E (informative)	X		
Flowchart for Cable Gland testing	Annex G (informative)	X		
Guidance of electric machine shaft voltages	Annex H (informative)	X		

NOTE The technical changes referred to include the significance of technical changes in the revised IEC Standard, but they do not form an exhaustive list of all modifications from the previous version. More guidance may be found by referring to the Redline Version of the standard.

Explanations:

A) Definitions

Minor and editorial changes clarification
decrease of technical requirements
minor technical change
editorial corrections

These are changes which modify requirements in an editorial or a minor technical way. They include changes of the wording to clarify technical requirements without any technical change, or a reduction in level of existing requirement.

Extension addition of technical options

These are changes which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements for equipment that was fully compliant with the previous standard. Therefore, these will not have to be considered for products in conformity with the preceding edition.

Major technical changes	addition of technical requirements increase of technical requirements

These are changes to technical requirements (addition, increase of the level or removal) made in a way that a product in conformity with the preceding edition will not always be able to fulfil the requirements given in the later edition. These changes have to be considered for products in conformity with the preceding edition. For these changes additional information is provided in clause B) below.

NOTE These changes represent current technological knowledge. However, these changes should not normally have an influence on equipment already placed on the market.

B) Information about the background of changes

A1 The dust layer requirements for EPL Da are unchanged from what previously existed in IEC 60079-18, Ed 4 and IEC 60079-31, Ed 2, but have been relocated to IEC 60079-0 to allow consistent application in all Types of Protection.

A2 IEC 60079-28 now includes all requirements for optical radiation for all EPLs.

A3 The COT requirements for EPL Gc or Dc are unchanged from what previously existed in IEC 60079-15, Ed 4, IEC 60079-18, Ed 4, and IEC 60079-31, Ed 2, but have been relocated to IEC 60079-0 to allow consistent application in all Types of Protection.

A4 The dust layer requirements for EPL Db with a specified dust layer depth are unchanged from what previously existed in IEC 60079-31, Ed 2, but have been relocated to IEC 60079-0 to allow consistent application in all Types of Protection.

B1 Dust layer requirements for EPL Db with a dust layer in a specified orientation have been added.

C1 It is recognized that the new requirements were, in many cases, already applied. The change is to ensure that they are uniformly and consistently applied.

C2 Require that the test be conducted at 4 kV DC.

C3 The limitation applies to external surfaces of other than cable glands, blanking elements, thread adapters and bushings.

C4 The added requirements for tool securing and marking are consistent with the approach in IEC 60079-15

C5 Voltage values were changed following additional research due to the complicated assessment and sometimes unspecified construction of Li/Ion-cells. It was found that some voltage values previously stated were too low.

C6 The now required EPL marking may be other than that permitted by the Level of Protection to account for limiting restrictions of material or plastic material surface area.

C7 Additional instruction material for electric machines required to facilitate selection, installation, and maintenance.

C8 Additional instruction material for cable glands required to facilitate selection and installation.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
31/1345/FDIS	31/1356/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 60079 series, under the general title *Explosive atmospheres*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore. iec. ch" in the data related to the specific document. At this date, the document will be

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

• amended.

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EXPLOSIVE ATMOSPHERES – Part 0: Equipment – General requirements

1 Scope

1DV DR *DE Modification of Clause 1 to replace with the following:*

This ~~part of IEC 60079~~ document specifies the general requirements for construction, testing and marking of Ex Equipment and Ex Components intended for use in explosive atmospheres. Explosive atmospheres are identified by the National Electrical Code®, ANSI/NFPA 70 as hazardous (classified) locations and include the following specified locations:

- Zone 0
- Zone 1
- Zone 2
- Zone 20
- Zone 21
- Zone 22

See 6.1 for the relationship of the Equipment Protection Level (EPL) to the Zone area classification.

The standard atmospheric conditions (relating to the explosion characteristics of the atmosphere) under which it may be assumed that Ex Equipment can be operated are:

• temperature –20 °C to +60 °C;

• pressure 80 kPa (0,8 bar) to 110 kPa (1,1 bar); and

• air with normal oxygen content, typically 21 % v/v.

This ~~part of IEC 60079~~ document and other standards supplementing this standard specify additional test requirements for Ex Equipment operating outside the standard temperature range, but further additional consideration and additional testing may be required for Ex Equipment operating outside the standard atmospheric pressure range and standard oxygen content. Such additional testing may be particularly relevant with respect to Types of Protection that depend on quenching of a flame such as 'flameproof enclosures "d"' ~~(IEC 60079-1)~~ or limitation of energy, 'intrinsic safety "i"' ~~(IEC 60079-11)~~.

NOTE 1 Although the standard atmospheric conditions above give a temperature range for the atmosphere of -20 °C to +60 °C, the normal ambient temperature range for the Ex Equipment is –20 °C to +40 °C, unless otherwise specified and marked. See 5.1.1. It is considered that – 20 °C to +40 °C is appropriate for many items of Ex Equipment and that to manufacture all Ex Equipment to be suitable for a standard atmosphere upper ambient temperature of +60 °C would place unnecessary design constraints.

NOTE 2 Requirements given in this standard result from an ignition hazard assessment made on equipment. The ignition sources taken into account are those found associated with this type of equipment, such as hot surfaces,

electromagnetic radiation, mechanically generated sparks, mechanical impacts resulting in thermite reactions, electrical arcing and static electric discharge in normal industrial environments.

NOTE 3 Where an explosive gas atmosphere and a combustible dust atmosphere are, or can be, present at the same time, the simultaneous presence of both often warrants additional protective measures. ~~Additional guidance on the use of Ex Equipment in hybrid mixtures (mixture of a flammable gas or vapour with a combustible dust or combustible flyings) is given in IEC 60079-14.~~

DE ~~IEC 60079~~ This standard does not specify requirements for safety, other than those directly related to the explosion risk.

Ignition sources like adiabatic compression, shock waves, exothermic chemical reaction, self-ignition of dust, naked flames and hot gases/liquids, are not addressed by this standard.

NOTE 4 Although outside the scope of this standard, such equipment would typically be subjected to a hazard analysis that identifies and lists all of the potential sources of ignition by the equipment and the measures to be applied to prevent them becoming effective. See ISO/IEC 80079-36.

This document is supplemented or modified by the following parts and technical specifications:

– IEC 60079-1: Gas – Flameproof enclosures "d";

– IEC 60079-2: Gas and dust – Pressurized enclosure "p";

– IEC 60079-5: Gas – Powder filling "q";

– IEC 60079-6: Gas – Liquid immersion "o";

– IEC 60079-7: Gas – Increased safety "e";

– IEC 60079-11: Gas and dust – Intrinsic safety "i";

~~– IEC 60079-13: Gas and dust – Equipment protection by pressurized room “p” & artificially ventilated room “v”;~~

– IEC 60079-15: Gas – Type of protection “n”;

– IEC 60079-18: Gas and dust – Encapsulation "m";

– IEC 60079-25: Gas and dust – Intrinsically safe electrical systems

– IEC 60079-26: Gas – Equipment with equipment protection level (EPL) Ga

– IEC 60079-28: Gas and dust – Protection of equipment and transmission systems using optical radiation

~~– IEC 60079-29-1: Gas detectors – Performance requirements of detectors for flammable gases~~

– IEC 60079-29-4: Gas detectors – Performance requirements of open path detectors for flammable gases

– IEC/IEEE 60079-30-1: Gas and dust – Electrical resistance trace heating – General and testing requirements.

– IEC 60079-31: Dust – Protection by enclosure "t"

~~**– IEC 60079-33: Gas and dust – Special protection "s"**~~

~~**– IEC 60079-35-1: Caplights for use in mines susceptible to firedamp – General requirements – Construction and testing in relation to the risk of explosion**~~

~~**– IEC TS 60079-39: Gas – Intrinsically safe systems with electronically controlled spark duration limitation**~~

~~**– IEC TS 60079-40: Gas – Requirements for process sealing between flammable process fluids and electrical systems**~~

~~**– ISO 80079-36: Gas and dust – Non-electrical equipment for explosive atmospheres – Basic method and requirements**~~

Where references are made to IEC, IEC/IEEE, ISO, and ISO/IEC standards, the referenced requirements found in these standards shall apply as modified by any applicable U. S. National Differences for that standard (see Clause 2).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

2DV DR ***Modification of Clause 2 references to replace with the following:***

ANSI/NFPA 70, ***National Electrical Code***

ASTM D5964, ***Standard practice for rubber IRM 901, IRM 902, and IRM 903 replacement oils for ASTM No. 1, ASTM No. 2, and ASTM No. 3***

~~**IEC 60034-1,*Rotating electrical machines – Part 1: Rating and performance***~~

IEC 60034-5, ***Rotating electrical machines – Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification***

~~**IEC 60079-1, Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures "d"**~~

IEC 60079-20-1, ***Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data***

~~**IEC 60079-26,** ***Explosive atmospheres – Part 26: Equipment with Equipment Protection Level (EPL) Ga***~~

~~**IEC 60079-35-1, *Explosive atmospheres – Part 35-1: Caplights for use in mines susceptible to firedamp – General requirements – Construction and testing in relation to the risk of explosion***~~

IEC 60086-1, *Primary batteries – Part 1: General*

IEC 60192, *Low-pressure sodium vapour lamps – Performance specifications*

IEC 60216-1, *Electrical insulating materials – Thermal endurance properties – Part 1: Ageing procedures and evaluation of test results*

IEC 60216-2, *Electrical insulating materials – Thermal endurance properties – Part 2: Determination of thermal endurance properties of electrical insulating materials – Choice of test criteria*

IEC 60243-1, *Electric strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60423, *Conduit systems for cable management – Outside diameters of conduits for electrical installations and threads for conduits and fittings*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60662, *High-pressure sodium vapour lamps – Performance specifications*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

~~**IEC 60947-1, *Low-voltage switchgear and controlgear – Part 1: General rules***~~

IEC 62626-1, *Low-voltage switchgear and controlgear enclosed equipment – Part 1: Enclosed switch-disconnectors outside the scope of IEC 60947-3 to provide isolation during repair and maintenance work*

ISO 48, *Rubber, vulcanized or thermoplastic – Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 178, *Plastics – Determination of flexural properties*

ISO 179 (all parts), *Plastics – Determination of Charpy impact properties*

ISO 262, *ISO general-purpose metric screw threads – Selected sizes for screws, bolts and nuts*

ISO 273, *Fasteners – Clearance holes for bolts and screws*

ISO 527-2, *Plastics – Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics*

ISO 965-1, *ISO general-purpose metric screw threads – Tolerances – Part 1: Principles and basic data*

ISO 965-3, ***ISO general-purpose metric screw threads – Tolerances – Part 3: Deviations for constructional screw threads***

ISO 3601-1, ***Fluid power systems – O-rings – Part 1: Inside diameters, cross-sections, tolerances and designation codes***

ISO 3601-2, ***Fluid power systems – O-rings – Part 2: Housing dimensions for general applications***

ISO 4014, ***Hexagon head bolts – Product grades A and B***

ISO 4017, ***Hexagon head screws – Product grades A and B***

ISO 4026, ***Hexagon socket set screws with flat point***

ISO 4027, ***Hexagon socket set screws with cone point***

ISO 4028, ***Hexagon socket set screws with dog point***

ISO 4029, ***Hexagon socket set screws with cup point***

ISO 4032, ***Hexagon nuts, style 1 – Product grades A and B***

ISO 4762, ***Hexagon socket head cap screws***

ISO 4892-2, ***Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps***

ISO 7380, ***Hexagon socket button head screws***

ISO 14583, ***Hexalobular socket pan head screws***

UL 347, ***High Voltage Industrial Control Equipment***

UL 486E, ***Equipment Wiring Terminals for use with Aluminum and/or Copper Conductors***

UL 508, ***Industrial Control Equipment***

~~ANSI/~~UL 746B, ***Polymeric Materials – Long-Term Property Evaluations***

~~ANSI/~~UL 746C, ***Polymeric Materials – Used in Electrical Equipment Evaluations***

UL 60034-1, ***Rotating electrical machines – Part 1: Rating and performance***

UL 60079-1, ***Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures "d"***

UL 60079-26, ***Explosive atmospheres – Part 26: Equipment with Equipment Protection Level (EPL) Ga***

UL 60947-1, ***Low-voltage switchgear and controlgear – Part 1: General rules***

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

• IEC Electropedia: available at http://www.electropedia.org/

• ISO Online browsing platform: available at http://www.iso.org/obp

NOTE Additional definitions applicable to explosive atmospheres can be found in IEC 60050-426.

3.1
ambient temperature
temperature of the air or other media, in the immediate vicinity of the equipment or component

Note 1 to entry: This does not refer to the temperature of any process media, unless the equipment or component is totally immersed in the process media. See 5.1.1.

Note 2 to entry: If Ex Equipment or an Ex Component is located inside or adjacent to another piece of equipment, the “ambient temperature” is the temperature of the air or other media surrounding the Ex Equipment or Ex Component and may be higher than the ambient air surrounding the complete equipment due to the additional heat dissipated within the complete equipment.

Note 3 to entry: The ambient temperature referred to in the IEC 60079 series is only related to the explosion safety of the Ex Equipment or Ex Component.

3.2
area, hazardous
area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment

3.3
area, non-hazardous
area in which an explosive atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of equipment

3.4
associated apparatus
electrical apparatus which contains both intrinsically safe and non-intrinsically safe circuits and is constructed so that the non-intrinsically safe circuits cannot adversely affect the intrinsically safe circuits

Note 1 to entry: Associated apparatus is either:

a) additionally protected by a Type of Protection suitable for use in the appropriate explosive atmosphere, or

b) not protected by a Type of Protection suitable for use in the appropriate explosive atmosphere and therefore is not to be used within an explosive atmosphere

3.5
Ex associated equipment
auxiliary equipment used in conjunction with explosion-protected equipment to maintain specific aspects of the Type of Protection of the explosion-protected equipment

Note 1 to entry: Examples include special time/current relays for increased safety motors, pressurization control systems, power limits for encapsulated Ex Equipment, and the like.

Note 2 to entry: Ex associated equipment is either:

a) additionally protected by a Type of Protection suitable for use in the appropriate explosive atmosphere; or

b) not protected by a Type of Protection suitable for use in the appropriate explosive atmosphere and therefore is not to be used within an explosive atmosphere,

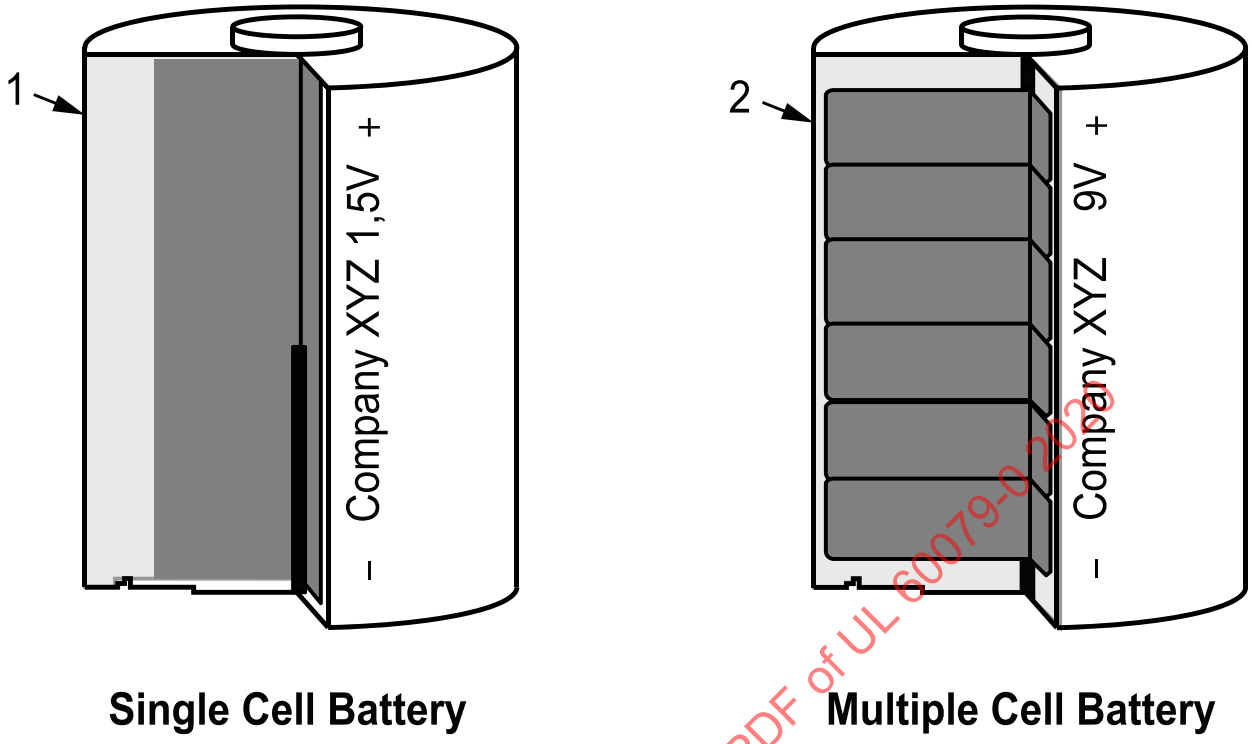
Note 3 to entry: A similar concept is applied to intrinsic safety where it is referred to as “associated apparatus”. See 3.4. A single piece of equipment may include both Ex associated equipment and associated apparatus.

3.6
auto-ignition temperature
AIT
lowest temperature (of a surface) at which, under specified conditions (according to IEC 60079-20-1), an ignition of a flammable gas or vapour in mixture with air or air/inert gas occurs

3.7
cells and batteries

3.7.1
battery
one or more cells fitted with devices necessary for use, for example, terminals, marking and protective devices

Note 1 to entry: See Figure 1 for examples of typical battery constructions.



Key
1 Cell Case/Battery Case
2 Batter Cases

Figure 1

Typical battery examples

3.7.2
capacity
electric charge which a battery or cell can deliver under specified discharge conditions

Note 1 to entry: The SI unit for electric charge, or quantity of electricity, is the coulomb (1 C = 1 A × s) but in practice, capacity is usually expressed in ampere hours (Ah).

3.7.3
cell
basic functional unit, consisting of an assembly of electrodes, electrolyte, case, terminals and usually separators, that is a source of electric energy obtained by direct conversion of chemical energy

Note 1 to entry: See primary cell and secondary cell.

3.7.4
charging
operation during which a secondary cell or battery is supplied with electric energy from an external circuit which results in chemical changes within the cell and thus the storage of energy as chemical energy

3.7.5
deep discharge
event which reduces a cell voltage below that recommended by the cell or battery manufacturer

3.7.6
maximum open-circuit voltage
<cell or battery>
voltage of a new primary battery or of a fully charged secondary battery when the discharge current is zero

Note 1 to entry: See Table 13 and Table 14 which show the maximum open-circuit voltage for acceptable cells.

3.7.7
nominal voltage
<cell or battery>
suitable approximate value of the voltage used to designate or identify a cell or battery or an electrochemical system

3.7.8
vented cell or battery
secondary cell, or battery, having a cover provided with an opening through which gaseous products may escape

3.7.9
primary cell or battery
cell or battery which is not designed to be electrically recharged

3.7.10
reverse charging
act of forcing current through either a primary cell or secondary cell in the same direction as the normal flow, generally due to the reverse polarity in an expired cell of a series connected battery

3.7.11
sealed cell
secondary cell which remains closed and does not release either gas or liquid when operated within the limits specified by the cell manufacturer

Note 1 to entry: A sealed cell is often equipped with a safety device to protect against a dangerously high internal pressure and is designed to operate during its life in its original sealed state.

3.7.12
valve-regulated cell or battery
cell or battery which is closed under normal conditions but which has an arrangement which allows the escape of gas if the internal pressure exceeds a pre-determined value

Note 1 to entry: The cell cannot normally receive an addition to the electrolyte.

3.7.13
secondary cell or battery
cell which is designed to be electrically recharged

Note 1 to entry: The recharge is accomplished by way of a reversible chemical reaction.

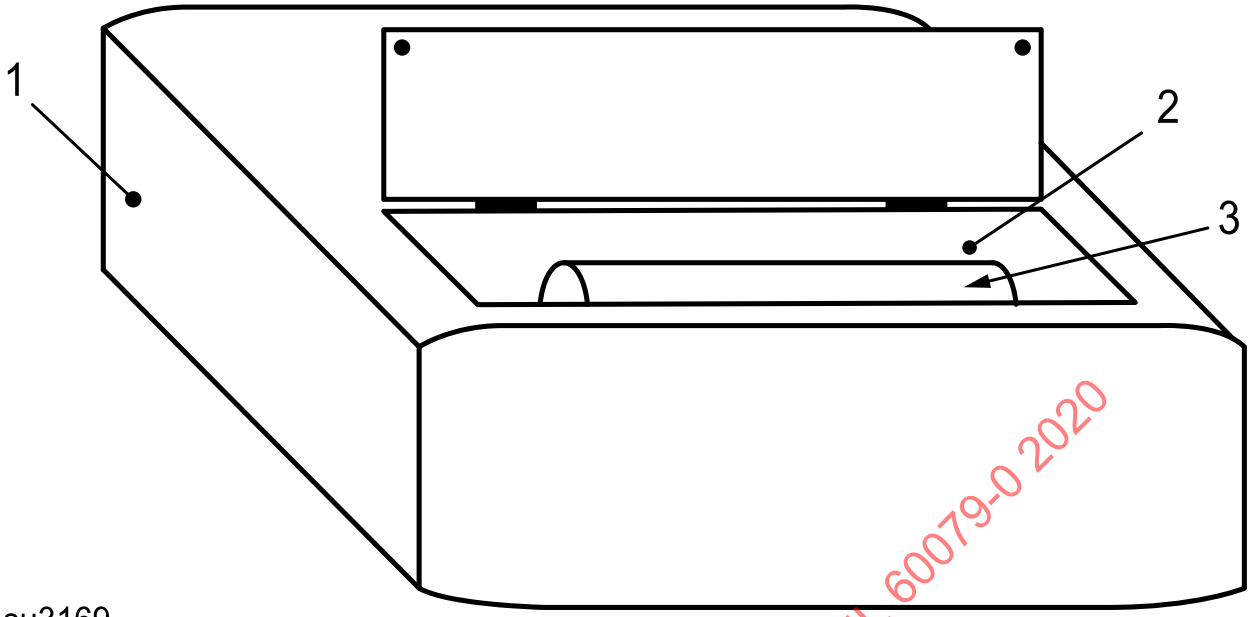
3.7.14
battery compartment
compartment of the equipment that accommodates one or more cells and batteries

Note 1 to entry: The battery compartment is an integral part of the equipment.

Note 2 to entry: A battery compartment may be a battery container.

3.7.15
battery container
enclosure to contain one or more cells or batteries

Note 1 to entry: See Figure 2 for examples of typical battery constructions.



Key
1 Equipment
2 Battery Compartment
3 Cell/Battery/Replaceable Battery Pack

Figure 2

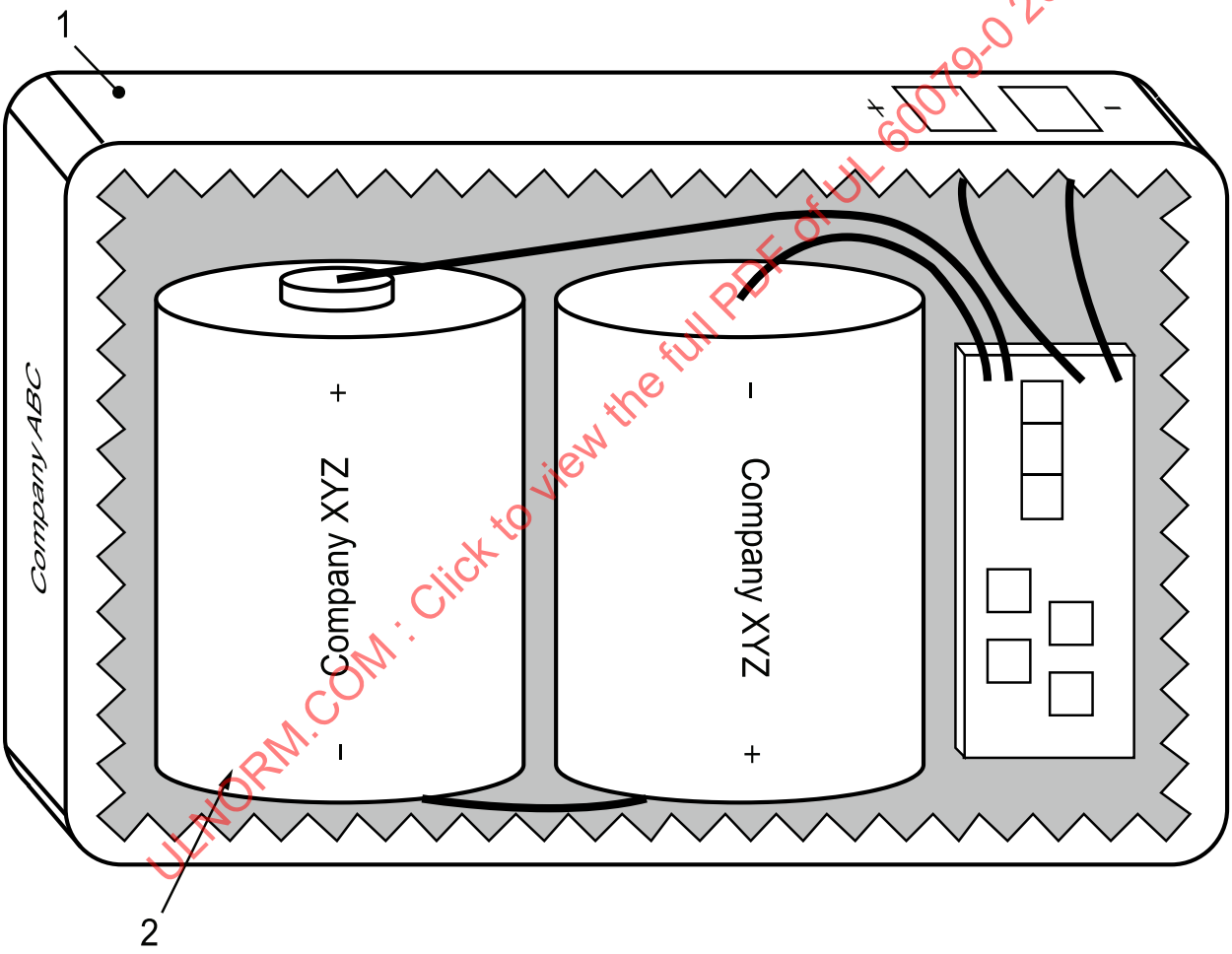
Typical battery compartment

3.7.16
battery case
cell case
cell or battery enclosure that is an integral part of the construction of the cell or battery

Note 1 to entry: The case can be sealed, valve-regulated, or vented.

3.7.17
replaceable battery pack
assembly consisting of one or more interconnected cells, along with any integrated protective components, which form a complete replaceable battery

Note 1 to entry: See Figure 3 for examples of typical replaceable battery pack construction.



su3170

Key
1 Battery Container
2 Cell/Battery

Figure 3

Typical replaceable battery pack