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Supersedes ANSI/ISA-60079-15 (12.12.02)-2003

**Electrical Apparatus for Use in Class I,
Zone 2 Hazardous (Classified)
Locations: Type of Protection "n"**

Approved 17 July 2009

Commitment for Amendments

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ISA
ANSI/ISA-60079-15
Third Edition

Underwriters Laboratories Inc.
ANSI/UL 60079-15
Third Edition



**Electrical Apparatus for Use in Class I, Zone 2 Hazardous (Classified) Locations:
Type of Protection “n”**

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General Notes

This is the common ISA and UL standard for Electrical apparatus for use in Class I, Zone 2 Hazardous (Classified) Locations: Type of Protection “n”. It is the third edition of ANSI/ISA-60079-15 (superseding ANSI/ISA-60079-15 (12.12.02)-2003) and the third edition of ANSI/UL 60079-15. The document is a modification of the IEC document and includes U.S. deviations encompassing both additions and deletions of information.

ANSI/ISA-60079-15 and ANSI/UL 60079-15 contain identical requirements, and identical publication dates. The presentation and format of the standards material may differ between the two published standards.

This common standard was prepared by ISA and Underwriters Laboratories Inc. (UL).

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 adopts the IEC text with deviations.

The requirements are presented in different formats. The ISA version of the standard illustrates the national differences from the IEC text through the use of legislative text (strike-out and underline). The UL version of the standard illustrates national differences immediately following the IEC text. National differences between the UL version and the ISA version shall be word for word except for editorial changes.

Interpretations

The interpretation by the SDO of an identical or equivalent standard shall be based on the literal text to determine compliance with the standard in accordance with the procedural rules of the SDO. If more than one interpretation of the literal text has been identified, a revision shall be proposed as soon as possible to each of the SDOs to more accurately reflect the intent.

UL Effective Date

The requirements in this standard are effective 31 July 2012.

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National Differences

GENERAL

National Differences from the text of International Electrotechnical Commission (IEC) Publication 60079-15, Electrical apparatus for explosive gas atmospheres – Part 15: Construction, test and marking of type of protection, “n” electrical apparatus, copyright 2005, are indicated by notations (differences) and are presented in bold text.

In the ISA publication of this standard, National Differences are presented using legislative text (strike-out and underline). The national difference type is identified in an informative annex.

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.

The UL printed standard includes the national difference types within the body of the text. The ISA printed standard includes the national difference types in an annex at the back of the standard.

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 based on **safety practices**. These are differences for IEC requirements that may be acceptable, but adopting the IEC requirements would require considerable retesting or redesign on the manufacturer’s part.

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 or figure. 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 or figure 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, or figure of the base IEC text.

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CONTENTS

1	Scope	19
2	~~Normative~~ References	22
3	Terms and definitions	25
4	General.....	27
4.1	Apparatus grouping and temperature classification	27
4.2	Potential ignition sources	28
5	Temperatures.....	28
5.1	Environmental influences.....	28
5.2	Service temperature	28
5.3	Maximum surface temperature.....	28
5.4	Surface temperature and ignition temperature.....	28
5.5	Small components.....	29
6	Requirements for electrical apparatus.....	29
6.1	General.....	29
6.2	Mechanical strength of apparatus	29
6.3	Opening times.....	29
6.4	Circulating currents	29
6.5	Gasket retention.....	29
6.6	Degree of protection of enclosure (IP).....	29
6.7	Clearances, creepage distances and separations.....	30
6.8	Electric strength	38
7	Non-metallic enclosures and non-metallic parts of enclosures	39
7.1	General.....	39
7.2	Thermal endurance	39
7.3	Electrostatic charges on external non-metallic materials of enclosures	40
7.4	Threaded holes	40
7.5	Thermal shock	40
7.6	Resistance to light.....	40
8	Enclosures containing light metals.....	40
8.1	Material composition	40
8.2	Threaded holes	40
9	Fasteners.....	40
9.1	General.....	40
9.2	Special fasteners	40
10	Interlocking devices.....	40
11	Bushings.....	40
12	Materials used for cementing.....	40
13	Ex components	41
13.1	Type of protection “n”	41

13.2	Mounting.....	41
13.3	Internal mounting	41
13.4	External mounting	41
14	Connection facilities and terminal compartments.....	41
14.1	General.....	42
14.2	Connection for external conductors.....	42
14.3	Internal connection facilities	43
15	Connection facilities for earthing or bonding conductors	43
16	Entries into enclosures	43
17	Supplementary requirements for non-sparking electrical machines	43
17.1	General.....	Error! Bookmark not defined.
17.2	Connection facilities for external conductors	Error! Bookmark not defined.
17.3	Neutral point connections	Error! Bookmark not defined.
17.4	Radial air gap.....	Error! Bookmark not defined.
17.5	Ventilation systems	Error! Bookmark not defined.
17.6	Bearing seals and shaft seals	Error! Bookmark not defined.
17.7	Rotor cages	Error! Bookmark not defined.
17.8	Surface temperature limitation	Error! Bookmark not defined.
17.9	Additional requirements for machines with rated voltage greater than 1.5 kV.....	Error! Bookmark not defined.
17.1	General.....	Error! Bookmark not defined.
17.2	Connection facilities for external conductors	Error! Bookmark not defined.
17.3	Neutral point connections	Error! Bookmark not defined.
17.4	Radial air gap.....	Error! Bookmark not defined.
17.5	Ventilation systems	Error! Bookmark not defined.
17.6	Bearing seals and shaft seals	Error! Bookmark not defined.
17.7	Rotor cages	Error! Bookmark not defined.
17.8	Stator winding insulation system.....	Error! Bookmark not defined.
17.9	Surface temperature limitation	Error! Bookmark not defined.
17.10	Additional requirements for machines with rated voltage greater than 1 kV.....	Error! Bookmark not defined.
18	Supplementary requirements for switchgear.....	50
19	Supplementary requirements for non-sparking fuses and fuse assemblies	51
19.1	Fuses.....	51
19.2	Temperature class of an apparatus	51
19.3	Fuse mounting	51
19.4	Fuse enclosures.....	51
19.5	Replacement fuse identification	51
20	Supplementary requirements for non-sparking plugs and sockets	51
20.1	Plugs and sockets for external connections.....	51
20.2	Maintaining degree of protection.....	52
20.3	Plugs and sockets for internal connections.....	52
20.4	Sockets that do not have plugs inserted in normal operation	52
21	Supplementary requirements for non-sparking luminaires.....	52
21.1	General.....	52

21.2	Construction.....	53
21.3	Other apparatus containing light sources	59
22	Supplementary requirements for apparatus incorporating non-sparking cells and batteries	59
22.1	Categorization of cells and batteries	59
22.2	General requirements for cells and batteries of types 1 and 2.....	61
22.3	Charging of type 1 cells and batteries	63
22.4	Charging of type 2 cells and batteries	63
22.5	Requirements for type 3 secondary batteries	64
22.6	Verification and tests.....	66
23	Supplementary requirements for non-sparking low power apparatus	67
24	Supplementary requirements for non-sparking current transformers	68
25	Other electrical apparatus	68
26	General supplementary requirements for apparatus producing arcs, sparks or hot surfaces.....	68
27	Supplementary requirements for enclosed-break <u>apparatus devices</u> and non-incendive components producing arcs, sparks or hot surfaces.....	69
27.1	Type testing	69
27.2	Ratings	69
27.3	Construction of enclosed-break <u>apparatus devices</u>	69
28	Supplementary requirements for hermetically-sealed <u>apparatus devices</u> producing arcs, sparks or hot surfaces	70
29	Supplementary requirements for sealed <u>apparatus devices</u> or encapsulated <u>apparatus devices</u> producing arcs, sparks or hot surfaces	70
29.1	Non-metallic materials.....	70
29.2	Opening	70
29.3	Internal spaces.....	70
29.4	Handling	70
29.5	Resilient gasket and seals	70
29.6	Encapsulating compounds	71
29.7	Thickness of encapsulant	71
29.8	Type tests	71
30	Supplementary requirements for energy-limited apparatus and circuits producing arcs, sparks or hot surfaces	71
30.1	General.....	71
30.2	Associated energy-limited apparatus	72
30.3	Energy-limited apparatus.....	72
30.4	Self protected energy-limited apparatus	72
30.5	Separation of conducting parts	72
30.6	Plugs and sockets	73
30.7	Protection against polarity reversal	73
30.8	Requirements for components on which energy limitation depends.....	73
30.9	Battery powered apparatus.....	74
30.10	Marking and documentation.....	74

31	Supplementary requirements for restricted-breathing enclosures protecting apparatus producing arcs, sparks or hot surfaces.....	74
31.1	General.....	74
31.2	Test point for restricted-breathing apparatus.....	74
31.3	Test point exemption.....	74
31.4	Gasket and seal requirements.....	75
31.5	Non-resilient seals.....	75
31.6	Maintenance considerations.....	75
31.7	Internal fans.....	75
32	General information on verification and tests.....	75
33	Type tests.....	75
33.1	Representative samples.....	75
33.2	Test configuration.....	75
33.3	Tests for enclosures on which the type of protection depends.....	76
33.4	Test for enclosed-break <u>apparatus devices</u> and non-incendive components.....	78
33.5	Tests for sealed <u>apparatus devices</u> and encapsulated <u>apparatus devices</u>	79
33.6	Assessment and test of energy-limited apparatus and circuits.....	82
33.7	Tests for restricted-breathing enclosures.....	82
33.8	Test for screw lampholders.....	82
33.9	Test for starter holders for luminaires.....	83
33.10	Tests for electronic starters for tubular fluorescent lamps and for ignitors for high pressure sodium or metal halide lamps.....	84
33.11	Test for wiring of luminaires subject to high-voltage impulses from ignitors.....	85
33.12	Mechanical shock test for batteries.....	85
33.13	Insulation resistance test for batteries.....	86
33.14	Additional ignition tests for large or high-voltage machines.....	86
34	Routine verifications and tests.....	88
34.1	General.....	88
34.2	Specific routine tests.....	88
35	Marking.....	89
35.1	General.....	89
35.2	Additional marking for batteries.....	89
35.3	Examples of marking.....	90
36	Documentation.....	91
37	Instructions.....	91
	Annex A (informative) – United States major deviations.....	93
	Annex B (informative) – Bibliography.....	97

Foreword (ISA)

All text of IEC 60079-15:2005 (3rd edition) is included. U.S. National Deviations are shown by strikeout through text deleted and underline under text added. Tables, or portions of tables, that are to be deleted are shown as shaded; figures to be deleted are marked with the overlay "X."

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1 Scope

This ~~standard~~ ~~part of IEC 60079~~ specifies requirements for the construction, testing and marking for Group II electrical apparatus with type of protection, "n" intended for use in ~~explosive gas atmospheres~~ Class I, Zone 2 hazardous (classified) locations as defined by the National Electrical Code® (NEC®), ANSI/NFPA 70.

This ~~part standard~~ is applicable to non-sparking electrical apparatus and also to electrical apparatus with parts or circuits producing arcs or sparks or having hot surfaces which, if not protected in one of the ways specified in this standard, could be capable of igniting a surrounding explosive gas atmosphere. This standard describes several different methods by which this can be achieved which may be combined with other methods described in ~~IEC~~ ANSI/ISA-60079-0.

This ~~part standard~~ supplements the general requirements in ~~IEC~~ ANSI/ISA-60079-0. The relationship of ~~IEC~~ ANSI/ISA-60079-0 to this ~~part standard~~ is as indicated in Table 1.

Table 1 – Relationship of this ~~part standard~~ to ~~IEC~~ ANSI/ISA-60079-0

Clause of ~~IEC~~ <u>ANSI/ISA-60079-0</u>		~~IEC~~ <u>ANSI/ISA-60079-0</u> clause application to ~~IEC~~ <u>ANSI/ISA-60079-15</u>				
		Type of protection nC	Non sparking apparatus nA and nAL	Restricted breathing apparatus nR	Energy limited apparatus nL	Associated energy limited apparatus [nL] and [AEX nL]
4	Apparatus grouping and temperature classification	Yes	Yes	Yes	Yes	Yes
5	Temperatures					
5.1	Environmental influences	Yes	Yes	Yes	Yes	Yes
5.2	Service temperature	Yes	Yes	Yes	Yes	Yes
5.3	Maximum surface temperature	Yes	Yes	Yes	Yes	No
5.4	Surface temperature and ignition temperature	No	No	No	No	No
5.5	Small components	Yes	Yes	Yes	Yes	No
6	Requirements for all electrical apparatus					
6.1	General	Yes	Yes	Yes	Yes	Yes
6.2	Mechanical strength of apparatus	Yes	Yes	Yes	Yes ^{c)}	No
6.3	Opening times	No	No	Yes	No	No
6.4	Circulating currents	Yes	Yes	Yes	No	No
6.5	Gasket retention	Yes	Yes	Yes	Yes	No

Clause of IEC ANSI/ISA-60079-0		IEC ANSI/ISA-60079-0 clause application to IEC ANSI/ISA-60079-15				
		Type of protection nC	Non sparking apparatus nA and nL	Restricted breathing apparatus nR	Energy limited apparatus nL	Associated energy limited apparatus [nL] and [AEx nL]
7	Non-metallic enclosures and non-metallic parts of enclosures					
7.1	General	Yes	Yes	Yes	Yes	No
7.2	Thermal endurance	Yes	Yes	Yes	Yes	No
7.3	Electrostatic charges on external non-metallic materials of enclosures	Yes	Yes	Yes	Yes	No
7.4	Threaded holes	Yes	Yes	Yes	Yes	No
8	Enclosures containing light metals					
8.1	Material composition	Yes	Yes	Yes	Yes	No
8.2	Threaded holes	Yes	Yes	Yes	Yes	No
9	Fasteners					
9.1	General	Yes	Yes	Yes	Yes	No
9.2	Special fasteners	No	No	No	No	No
9.3	Holes for special fasteners	No	No	No	No	No
10	Interlocking devices	No	No	No	No	No
11	Bushings	Yes	Yes	Yes	Yes	No
12	Materials used for cementing	No	No	No	No	No
13	Ex components	No	No	No	No	No
14	Connection facilities and terminal compartments	No	No	No	No	No
15	Connection facilities for earthing or bonding conductors	Yes	Yes	Yes	Yes	No
16	Entries into enclosures	Yes	Yes	Yes	Yes	No
17	Supplementary requirements for rotating electrical machines	No	Yes	No	No	No
18	Supplementary requirements for switchgear	Yes	Yes	Yes	No	No
19	Supplementary requirements for fuses	No	No	No	No	No
20	Supplementary requirements for plugs and sockets	No	No	No	No	No
21	Supplementary requirements for luminaires	No	No	No	No	No
22	Supplementary requirements for cap lights and handlights	Yes	Yes	Yes	No	No
23	Apparatus incorporating cells and batteries	Yes	Yes	Yes	Yes	No

Clause of ~~IEC~~ ANSI/ISA-60079-0		IEC ANSI/ISA-60079-0 clause application to ~~IEC~~ ANSI/ISA-60079-15				
		Type of protection nC	Non sparking apparatus nA and nL	Restricted breathing apparatus nR	Energy limited apparatus nL	Associated energy limited apparatus [nL] and [AEx nL]
24	Documentation	Yes	Yes	Yes	Yes	Yes
25	Compliance of prototype or sample with documents	Yes	Yes	Yes	Yes	Yes
26	Type tests					
26.1	General	Yes	Yes	Yes	Yes	Yes
26.2	Test configuration	Yes	Yes	Yes	Yes	Yes
26.3	Tests in explosive test mixtures	Yes	Yes	Yes	Yes	Yes
26.4	Tests of enclosures					
26.4.1	Order of tests	No	No	No	No	No
26.4.2	Resistance to impact	Yes	Yes	Yes	Yes	No
26.4.3	Drop test	Yes	Yes	Yes	Yes	No
26.4.4	Acceptance criteria for test for resistance to impact and drop test	Yes	Yes	Yes	Yes	No
26.4.5	Degree of protection IP by enclosures	No	No	No	No	No
26.5	Thermal tests					
26.5.1	Temperature measurement	Yes	Yes	Yes	Yes	No
26.5.2	Thermal shock test	Yes	Yes	Yes	Yes	No
26.5.3	Small component ignition test	Yes	Yes	No	Yes	No
26.6	Torque test for bushings	Yes	Yes	Yes	Yes	Yes
26.6.1	Procedure	Yes	Yes	Yes	Yes	Yes
26.6.2	Acceptance criteria	Yes	Yes	Yes	Yes	Yes
26.7	Non-metallic enclosures or of non-metallic parts of enclosures					
26.7.1	General	Yes	Yes	Yes	Yes	No
26.7.2	Temperatures during tests	Yes	Yes	Yes	Yes	No
26.8	Thermal endurance to heat	Yes	Yes	Yes	Yes	No
26.9	Thermal endurance to cold	Yes	Yes	Yes	Yes	No
26.10	Resistance to light	Yes	Yes	Yes	Yes	No
26.11	Resistance to chemical agents for Group I electrical apparatus	No	No	No	No	No
26.12	Earth continuity	Yes	Yes	Yes	Yes	No
26.13	Surface resistance test of parts of enclosures of non-metallic materials	Yes	Yes	Yes	Yes	No
26.14	Charging tests to verify the inability to store a dangerous charge	Yes	Yes	Yes	Yes	No

Clause of IEC ANSI/ISA-60079-0		IEC ANSI/ISA-60079-0 clause application to IEC ANSI/ISA-60079-15				
		Type of protection nC	Non sparking apparatus nA and nL	Restricted breathing apparatus nR	Energy limited apparatus nL	Associated energy limited apparatus [nL] and [AEx nL]
26.15	Measurement of capacitance to verify the inability to store a dangerous charge	Yes	Yes	Yes	Yes	Yes
26.15.1	Procedure	Yes	Yes	Yes	Yes	No
26.15.2	Acceptance criteria	Yes	Yes	Yes	Yes	No
27	Routine verifications and tests	Yes	Yes	Yes	Yes	Yes
28	Manufacturer's responsibility	Yes	Yes	Yes	Yes	Yes
28.1	Certificate	Yes	Yes	Yes	Yes	Yes
28.2	Responsibility for marking	Yes	Yes	Yes	Yes	Yes
29	Marking	Yes	Yes	Yes	Yes	Yes
30	Instructions	Yes	Yes	Yes	Yes	Yes
a) An entry of "Yes" in the table indicates the requirements of the referenced section of IEC ANSI/ISA-60079-0 apply. An entry of "No" indicates the requirements either do not apply or have been modified by IEC ANSI/ISA-60079-15. b) ~~Type of protection nC includes encapsulated devices, enclosed break devices, non-incendive components, sealed devices and hermetically sealed devices.~~ c) Clause 6.2 is a calling clause for the tests in 26.4 which are different for both portable and fixed apparatus.						

NOTE 1 A non-incendive component is limited in use to the particular circuit for which it has been shown to be non-ignition capable and, therefore, cannot be separately assessed as complying with this standard.

NOTE 2 Compliance with this standard does not imply any removal of, or lowering of the requirements of any other standard with which the electrical apparatus complies.

NOTE 3 This part supplements, and may enhance, the requirements for apparatus for normal industrial applications. Where compliance with other IEC standards is indicated, such as IEC 60034 for motors and IEC 60598-2 for luminaires, proving compliance to those standards is normally the responsibility of the manufacturer.

NOTE 4 The National Electrical Code® (NFPA 70®) through the 2008 edition only recognizes types of protection "nA", "nC" and "nR" and not "nL". See note in 35.1.

2 Normative References

The following referenced documents are indispensable for the application 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.

ANSI/NFPA 70, National Electrical Code®

ANSI/UL 248-1, Low Voltage Fuses, Part 1 General Requirements

ANSI/UL 486A, Wire Connectors

ANSI/UL 486B, Wire Connectors

ANSI/UL 746A, Standard for Polymeric Materials - Short Term Property Evaluations

~~IEC 60034 (all parts), Rotating electrical machines~~

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 60034-7, Rotating electrical machines – Part 7: Classification of type of construction, mounting arrangements and terminal box position (IM Code)~~

~~IEC 60034-25, Rotating electrical machines – Part 25: Guide for the design and performance of cage induction motors specifically designed for converter supply~~

IEC 60061 (all parts), *Lamp caps and holders together with gauges for the control of interchangeability and safety*

IEC 60068-2-27:1987, *Environmental testing – Part 2: Tests – Test Ea and guidance: Shock*

~~IEC 60079-0:2004, Electrical apparatus for explosive gas atmospheres – Part 0: General requirements~~

ANSI/ISA-60079-0 (12.00.01)-2005, Electrical Apparatus for Use in Class I, Zones 0, 1 & 2 Hazardous (Classified) Locations: General Requirements

~~IEC 60079-1, Electrical apparatus for explosive gas atmospheres – Part 1: Flameproof enclosures "d"~~

ANSI/ISA-60079-1 (12.22.01)-2005, Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations Type of Protection – Flameproof "d"

~~IEC 60079-11:1999, Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety "i"~~

ANSI/ISA-60079-11 (12.02.01)-2002, Electrical Apparatus for Use in Class I, Zones 0, 1, & 2 Hazardous (Classified) Locations: Intrinsic Safety "i"

IEC 60079-14, Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines)

IEC 60079-17, *Electrical apparatus for explosive gas atmospheres – Part 17: Inspection and maintenance of electrical installations in hazardous areas (other than mines)*

ANSI/ISA-60079-18 (12.23.01)-2005, Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations: Type of Protection - Encapsulation "m"

IEC 60081, *Double-capped fluorescent lamps – Performance specifications*¹

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60155, *Glow-starters for fluorescent lamps*

IEC 60238:1998, *Edison screw lampholders*¹

IEC 60269-3, *Low-voltage fuses – Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications)*

¹ A consolidated version of this standard exists.

IEC 60400, *Lampholders for tubular fluorescent lamps and starterholders* ¹

IEC 60529:2004:1989, *Degrees of protection provided by enclosures (IP Code)* ¹

IEC 60598-1:1996, *Luminaires – Part 1: General requirements and tests*

IEC 60598-2 (all parts), *Luminaires – Part 2: Particular requirements*

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

IEC 60927:1996, *Auxiliaries for lamps – Starting devices (other than glow starters) – Performance requirements* ¹

IEC 60998-2-4:1993, *Connecting devices for low-voltage circuits for household and similar purposes – Part 2-4: Particular requirements for twist-on connecting devices*

IEC 61048, *Auxiliaries for lamps – Capacitors for use in tubular fluorescent and other discharge lamp circuits – General and safety requirements* ¹

IEC 61184, *Bayonet lampholders*

IEC 61347-1, *Lamp controlgear – Part 1: General and safety requirements*

IEC 61347-2-1, *Lamp controlgear – Part 2-1: Particular requirements for starting devices (other than glow starters)*

IEC 61347-2-2, *Lamp controlgear – Part 2-2: Particular requirements for d.c. or a.c. supplied electronic step-down convertors for filament lamps*

IEC 61347-2-3, *Lamp controlgear – Part 2-3: Particular requirements for a.c. supplied electronic ballasts for fluorescent lamps* ²

IEC 61347-2-4, *Lamp controlgear – Part 2-4: Particular requirements for d.c. supplied electronic ballasts for general lighting*

IEC 61347-2-7, *Lamp controlgear – Part 2-7: Particular requirements for d.c. supplied electronic ballasts for emergency lighting*

IEC 61347-2-8, *Lamp controlgear – Part 2-8: Particular requirements for ballasts for fluorescent lamps*

IEC 61347-2-9, *Lamp controlgear – Part 2-9: Particular requirements for ballasts for discharge lamps (excluding fluorescent lamps)* ²

~~EN 50262, *Metric cable glands for electrical installations*~~

² A consolidated version of this standard exists.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC ANSI/ISA-60079-0 and the following apply.

3.1

(battery) container

enclosure to contain the battery

NOTE The cover is a part of the battery container.

3.2

cable sealing box

auxiliary enclosure provided specifically for the purpose of sealing the insulation of a cable (for example, oil insulated cable) where it is connected to an apparatus. The enclosure may also provide for the connection of separate cable tails to the cable

3.3

clearance

shortest distance in air between two conductive parts

[IEC 60664-1, definition 1.3.2]

3.4

creepage distance

shortest distance along the surface of an electrically insulating material between two conductive parts

3.5

duty cycle

repetitive variation of load in which the cycle time is too short for thermal equilibrium to be attained in the first cycle

[IEV 411-51-07]

3.6

energy limitation

concept applicable to circuits in which no spark or ~~any~~ thermal effect produced in the test conditions prescribed in this standard is capable of causing ignition of a given flammable gas or vapour

3.7

separation

shortest distance through solid insulating material between two conductive parts

3.8

~~sealing device~~

~~device to prevent the flow of a gas or a liquid between apparatus and a conduit by providing~~
~~sealing~~ ~~facilities~~

3.9

type of protection "n"

type of protection applied to electrical apparatus such that, in normal operation and in certain specified abnormal conditions, it is not capable of igniting a surrounding explosive gas atmosphere

NOTE 1 Additionally, the requirements of this standard are intended to ensure that a fault capable of causing ignition is not likely to occur.

NOTE 2 An example of a specified abnormal condition is a luminaire with failed lamp.

3.9.1

non-sparking apparatus device "nA"

apparatus device constructed to minimize the risk of occurrence of arcs or sparks capable of creating an ignition hazard during conditions of normal operation

NOTE For the purposes of this standard normal operation is considered to exclude the removal or insertion of components with the circuit energized

3.9.2

apparatus devices and components "nC"

3.9.2.1

encapsulated apparatus device "nC"

apparatus device, which may or may not contain voids, which is so constructed that it is totally immersed in an encapsulating compound so that it is sealed to prevent entry of an external atmosphere

NOTE For the purpose of this standard, an encapsulated device apparatus is considered to be a particular form of sealed device apparatus. It does not provide equivalent protection to encapsulated apparatus constructed in accordance with IEC ANSI/ISA-60079-18.

3.9.2.2

enclosed-break apparatus device "nC"

apparatus device incorporating electrical contacts that are made and broken and that will withstand an internal explosion of the flammable gas or vapour which may enter it without suffering damage and without communicating the internal explosion to the external flammable gas or vapour

3.9.2.3

hermetically-sealed apparatus device "nC"

apparatus device which is so constructed that the external atmosphere cannot gain access to the interior and in which the seal is made by fusion, for example by soldering, brazing, welding or the fusion of glass to metal

3.9.2.4

non-incendive component "nC"

components having contacts for making or breaking a specified ignition capable circuit but in which the contacting mechanism is constructed so that the component is not capable of causing ignition of the specified explosive gas atmosphere

NOTE The enclosure of the non-incendive component is not intended to either exclude the explosive gas atmosphere or contain an explosion.

3.9.2.5

sealed apparatus device "nC"

apparatus device which is so constructed that it cannot be opened during normal service and is sealed effectively to prevent entry of an external atmosphere

3.9.3**energy-limited apparatus “nL”**

electrical apparatus in which the circuits and components are constructed according to the concept of energy limitation

3.9.4**associated energy-limited apparatus “[nL]” or “[AEx nL]”**

electrical apparatus which contains both energy-limited and non-energy-limited circuits and is constructed so that the non-energy-limited circuits cannot adversely affect the energy-limited circuits. Associated energy-limited apparatus may be either:

- a) electrical apparatus which has an alternative method of protection included in this standard for use in the appropriate explosive gas atmosphere [nL];
- b) electrical apparatus which has an alternative type of protection listed in ~~IEC~~ ANSI/ISA-60079-0 for use in the appropriate explosive gas atmosphere [nL];
- c) electrical apparatus not so protected and which therefore shall not be used within an explosive gas atmosphere, for example, a recorder which is not of itself in an explosive gas atmosphere but is connected to a thermocouple situated within an explosive gas atmosphere where only the recorder input circuit is energy-limited [AEx nL]

3.9.5**self protected energy-limited apparatus “nA nL”**

apparatus which contains energy-limited sparking contacts, the circuits ~~(including, energy-limiting components and devices)~~ supplying energy-limited power to these contacts, as well as the non-energy limited source of supply to the circuit

3.9.6**restricted-breathing enclosure “nR”**

enclosure that is designed to restrict the entry of gases, vapours and mists

3.10**normal operation**

operation of apparatus conforming electrically and mechanically with its design specification and used within the limits specified by the manufacturer [based on ANSI/ISA-60079-0]

NOTE 1 The limits specified by the manufacturer may include persistent operational conditions, e.g. operation of a motor on a duty cycle.

NOTE 2 Variation of the supply voltage within stated limits and any other operational tolerance is part of normal operation.

4 General**4.1 Apparatus grouping and temperature classification**

Apparatus grouping and temperature classification shall be in accordance with Clause 4 of ~~IEC~~ ANSI/ISA-60079-0.

4.2 Potential ignition sources

In normal operation and in certain abnormal conditions specified by this standard, the apparatus shall not:

- a) produce an operational arc or spark unless that arc or spark is prevented from causing ignition of a surrounding explosive atmosphere by one of the methods described in Clauses 26 to 31;
- b) develop a maximum surface temperature in excess of the maximum value appropriate to the temperature class of the apparatus, unless the temperature of the surface or hot spot is prevented from causing ignition of a surrounding explosive atmosphere by one of the methods described in Clauses 26 to 31 as appropriate, or is otherwise shown to be safe as specified in 5.5

NOTE Contacts with provision for sliding are considered as sparking in normal operation unless precautions are taken such as clamping of the contact itself to the conductive track.

5 Temperatures

5.1 Environmental influences

5.1.1 Ambient temperature

For ambient temperature requirements, 5.1.1 of ~~IEC~~ ANSI/ISA-60079-0 applies.

5.1.2 External source of heating or cooling

For external sources of heating or cooling, 5.1.2 of ~~IEC~~ ANSI/ISA-60079-0 applies.

5.2 Service temperature

For service temperature, 5.2 of ~~IEC~~ ANSI/ISA-60079-0 applies.

5.3 Maximum surface temperature

5.3.1 Determination of maximum surface temperature

For determination of maximum surface temperature, 5.3.1 of ~~IEC~~ ANSI/ISA-60079-0 applies except for [nL] and [AEx nL] apparatus.

5.3.2 Limitation of maximum surface temperature

For limitation of maximum surface temperature, 5.3.2 of ~~IEC~~ ANSI/ISA-60079-0 applies except for [nL] and [AEx nL] apparatus.

5.4 Surface temperature and ignition temperature

The requirements of 5.4 of ~~IEC~~ ANSI/ISA-60079-0 do not apply and are replaced by the following:

Except for the internal parts of type nR enclosures and type nC ~~devices~~ apparatus and components, or components complying with 5.5, no surface of any part of an electrical apparatus, including the surface of internal parts to which the potentially explosive atmosphere

might have access, shall attain a temperature in excess of the maximum surface temperature prescribed in 5.4 of ~~IEC~~ ANSI/ISA-60079-0.

5.5 Small components

For evaluation of small components, 5.5 and 5.6 of ~~IEC~~ ANSI/ISA-60079-0 apply except for [nL] and [AEx nL] apparatus. Temperature relaxations for thin wires and printed circuit tracks contained in ~~IEC~~ ANSI/ISA-60079-11 may also be used in application of this standard.

6 Requirements for electrical apparatus

6.1 General

Electrical apparatus with type of protection "n" shall comply with the requirements of this standard and the applicable parts of ~~IEC~~ ANSI/ISA-60079-0 for the method(s) of protection used.

6.2 Mechanical strength of apparatus

Mechanical strength of apparatus shall comply with 6.2 of ~~IEC~~ ANSI/ISA-60079-0, except for [nL] and [AEx nL] apparatus.

6.3 Opening times

Except for nR restricted breathing enclosures, the requirements of 6.3 of ~~IEC~~ ANSI/ISA-60079-0 do not apply.

6.4 Circulating currents

The provisions of 6.4 of ~~IEC~~ ANSI/ISA-60079-0 apply, except for nL, [nL] or [AEx nL] apparatus.

6.5 Gasket retention

The provisions of 6.5 of ~~IEC~~ ANSI/ISA-60079-0 apply, except for [nL] and [AEx nL] apparatus.

6.6 Degree of protection of enclosure (IP)

6.6.1 Minimum degree of protection

Unless specified elsewhere in this standard, the enclosure of the apparatus, when tested in accordance with 33.3.4 shall provide at least the degree of protection described in a) or b) unless safety would not be impaired by contact with solid foreign bodies or water (for example, strain gauges, resistance thermometers, or thermocouples). In this case the documentation (see Clause 36) shall explain why and shall prescribe any special installation requirements which may be necessary and the apparatus shall be marked ~~with the symbol "X" to indicate this special condition of use (see Clause 29 of IEC 60079-0);~~ in accordance with 29.2 (i) of ANSI/ISA-60079-0.

a) IP54 where there are bare live parts or IP44 where there are insulated live parts;

b) IP4X where there are bare live parts, or IP2X where there are insulated live parts and the apparatus is intended for installation only in locations providing adequate protection against the entry of solid foreign objects or water capable of impairing safety, and the apparatus is marked ~~with the symbol "X" to indicate this special condition of use (see Clause 29 of IEC 60079-0);~~ in accordance with 29.2 (i) of ANSI/ISA-60079-0.

For protected apparatus, the degree of protection shall be marked according to Clause 35.

NOTE 1 For requirements for rotating electrical machines, see Clause 17.

NOTE 2 For requirements for non-sparking low power apparatus, see Clause 23.

6.6.2 Degree of protection provided by installation

Where the enclosure is completed by the installation of the apparatus, ~~the marking shall include the symbol "X"~~ the apparatus is marked in accordance with 29.2 (i) of ANSI/ISA-60079-0 and the manufacturer shall provide relevant information in the documentation in accordance with Clause 36.

6.7 Clearances, creepage distances and separations

6.7.1 General

Clearances, creepage distances and separations between conductive parts at different potentials shall meet the appropriate values given in Table 2, except in the following cases:

- neutral point connections of rotating electrical machines complying with 17.3;
- luminaires complying with 21.2.7;
- with regard to sealed, encapsulated or solid insulation separations only, apparatus subject to the routine electric strength test of 6.8.2;
- with regard to energy-limited apparatus, associated energy-limited apparatus and circuits (see Clause 30), where separations not meeting the above requirements may be assessed or tested on the basis that the relevant conducting parts are intermittently connected together, in which case consequential effects shall be taken into account;
- instruments and low power apparatus complying with Clause 23.
- portions of circuit boards meeting the voltage and power requirements of Clause 23 and separated from other circuits by the values given in Table 2.

A circuit which is not referred to earth in normal operation shall be assumed to be earthed at the point by which the highest voltage U is obtained.

6.7.2 Determination of working voltage

Clearances and creepage distances shall be determined as a function of the working voltage specified by the manufacturer of the apparatus. Where the apparatus is intended for more than one rated voltage or for a range of rated voltage, the value of the working voltage to be used shall be based on the highest value of rated voltage.

6.7.3 Conformal coating

A conformal coating, if applied, shall have the effect of sealing the conductors and the insulating material in question against ingress of moisture. It shall adhere to the conductive parts and the insulating material. If the conformal coating is applied by spraying then two separate coats are to be applied. Other methods of application require only one coat, for example dip coating, brushing, vacuum impregnating, but the intention is to achieve an effective, lasting, unbroken seal. A solder mask is considered as one of two coatings, provided it is not damaged during soldering.