UL 60079-15

Explosive atmospheres – Part 15: Equipment protection by type of protection "n"

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UL Standard for Safety for Explosive atmospheres – Part 15: Equipment protection by type of protection "n", UL 60079-15

Fifth Edition, Dated April 7, 2020

Summary of Topics

This new edition of ANSI/UL 60079-15, the Standard for Safety for Explosive Atmospheres – Part 15: Equipment Protection by Type of Protection "n", (Edition 5.0, Issued by the 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 January 18, 2019 and November 29, 2019.

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Standard for Explosive Atmospheres – Part 15: Equipment Protection by Type of Protection "n"

First Edition – December, 2002
Second Edition – Not published
Third Edition – July, 2009
Fourth Edition – February, 2013

Fifth Edition

April 7, 2020

This ANSI/UL Standard for Safety consists of the Fifth Edition.

The most recent designation of ANSI/UL 60079-15 as an American National Standard (ANSI) occurred on April 7, 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.

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CONTENTS

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Bibliography

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PREFACE

This UL Standard is based on IEC Publication 60079-15: fifth edition Explosive Atmospheres – Part 15: Equipment Protection by Type of Protection ″n″. IEC publication 60079-15 is copyrighted by the IEC.

This edition has been issued to satisfy UL Standards policy.

This is the UL Standard for Safety for Explosive Atmospheres – Part 15: Equipment Protection by Type of Protection ″n″.

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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

National Differences from the text of International Electrotechnical Commission (IEC) Publication 60079-15, Explosive atmospheres – Part 15: Equipment protection by type of protection "n", copyright 2017, are indicated by notations (differences) and are presented in bold text. The national difference type is included in the body.

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 15: Equipment protection by type of protection "n"

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.

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International Standard IEC 60079-15 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

This fifth edition cancels and replaces the fourth edition, published in 2010, and constitutes a technical revision.

This edition includes the following significant changes with respect to the previous edition:

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

FDIS	Report on voting
31/1339/FDIS	31/1355/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.

This International Standard is to be read in conjunction with IEC 60079-0.

A list of all parts of the IEC 60079 series, under the general title: *Explosives 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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		Type		
Changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
Requirements for enclosed break devices have been removed	–			C1
Requirements for type of protection “nA” has been removed	–			C2
Scope has been updated to allow equipment with internal working voltages over 15 kV such as starters for HID luminaires	1		X	
Definition for cable sealing box removed.	3	X		
Definitions for creepage distance and clearance removed as they are now in 60079-0	3	X		
Definition of non-sparking device “nA” removed, as the concept has been transferred to 60079-7	3			C2
Definition of duty cycle removed	3	X		
Definition of enclosed break device moved as the concept has been transferred to 60079-1	3			C1
Definition of hermetically sealed device revised	3	A1		
Definition for normally sparking device added	3.2	X		
Small component temperature clause removed, part of moving type of protection “nA” to 60079-7	5			C1
Minimum degree of protection requirements; clearance, creepage and separation requirements; determination of working voltage; conformal coating; CTI requirement; Insulation between conductive parts and measurement of creepage and clearance requirements have been removed.	6			C2
Connection facilities and terminal compartment requirements have been removed	–			C2
Supplementary requirements for non-sparking electrical rotating machines have been removed	–			C2
Supplementary requirements for non-sparking fuses and fuse assemblies have been removed	–			C2

Changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Supplementary requirements for non-sparking plugs and sockets have been removed	–			C2
Supplementary requirements for non-sparking luminaires have been removed	–			C2
Supplementary requirements for equipment incorporating non-sparking cells and batteries have been removed	–			C2
Supplementary requirements for non-sparking low power equipment have been removed	–			C2
rent transformers have been removed	–			C2
Supplementary requirements for non-sparking current transformers have been removed	–			C2
Requirements for other non-sparking electrical equipment have been removed	–			C2
General supplementary requirements for equipment producing arcs, sparks or hot surfaces have been removed	–			C2
Requirements for enclosed break devices have been removed	–			C1
Voltage and current limitations added for non-incendive components.	7.2			C6
The requirements for sealed devices have been extended to require more documentation,	9.1		X	
The +20K requirement for luminaire materials has been removed	9.5			C2
Notes 1-3 have been removed, as this information is covered elsewhere	10.1	X		
Entry device requirements added	10.1		X	
Industrial standard compliance and battery requirements added	10.2.1.2		X	
The exemption for manually operated sparking devices moved to here, creepage and clearance requirements in industrial standards added for switching devices, and cell and battery requirements added	10.2.1.2		X	
Requirements for cable glands and conduit entries have been clarified	10.2.3	X		
Requirements for gasketed windows expanded to allow a removable window mounted in a frame.	10.2.5.2		X	
Requirement to include documentation on the thermal stability of gaskets or seals added	10.2.6			C4
Requirements reworded for clarity	10.2.7	X		
Requirements for “nR” enclosures fitted with fans added.	10.2.9			C5
Type test requirements for enclosed break “nC” and “nA” equipment removed	–			C1, C2
The dielectric test after the leakage test for sealed devices has been eliminated unless the results of the leakage test are uncertain.	11.2.2		X	
Tests for sealed devices, screw lampholders, starters, lamps, ignitors, and ignitor pulses for luminaires have been removed	–			C2
All testing for batteries has been removed.	–			C2
All testing for electrical machines removed	–			C2
Routine test requirements re-written for sealed components, non-incendive components and restricted breathing equipment to take out the testing for enclosed break and nA equipment	12			C1, C2
Preparation of non-incendive component samples	11.1.1			C3
Marking requirements modified to remove labelling requirements for enclosed break components, nA equipment, and batteries.	–			C1, C2

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Changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Documentation requirements modified to remove to remove labelling requirements for enclosed break components, nA equipment, and batteries.	14			C1, C2
The instruction section has been expanded to include new requirements	15		X	
Annex A has been removed.	–			C2

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.

Explanation of the types of changes:

A) Definitions

1) 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.

2) 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.

3) 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

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A1 – It was determined that this was already covered by the sealed device definition

C1 – Enclosed break devices “nC” are now designated as “dc” and the requirements are located in IEC 60079-1:2014.

C2 – Type of protection “nA” is now designated as type of protection “ec” and the requirements for “ec” equipment are located in IEC 60079-7:2015.

C3 – Test time for the preparation of non-incendive component samples has been specified.

C4 – Additional documentation requirements for seals and gaskets.

C5 – As the pressure inside an enclosure fitted with fans can be affected by the operation of the fan, it is now specified that the restricted breathing test is conducted with fans operating and stationary.

C6 – The limitations from IEC 60079-15 Ed 3 were added.

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EXPLOSIVE ATMOSPHERES – Part 15: Equipment protection by type of protection "n"

1 Scope

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

This ~~part of IEC 60079~~ document specifies requirements for the construction, testing and marking for Group II electrical equipment with type of protection "n" which includes; sealed devices "nC", hermetically sealed devices "nC", non-incendive components "nC" and restricted breathing enclosures "nR" intended for use in explosive gas atmospheres. This ~~part of IEC 60079~~ document applies to electrical equipment where the rated input voltage does not exceed 15 kV r. m. s. AC or DC including where the internal working voltages of the Ex product exceeds 15 kV, for example starters for HID luminaires.

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

This ~~part of IEC 60079~~ document supplements and modifies the general requirements of ~~IEC 60079-0~~ UL 60079-0, except as indicated in Table 1. Where a requirement of this ~~part of IEC 60079~~ document conflicts with a requirement of ~~IEC 60079-0~~ UL 60079-0, the requirement of this ~~part of IEC 60079~~ document takes precedence.

Table 1
Relationship of ~~IEC 60079-15~~ UL 60079-15 to ~~IEC 60079-0~~ UL 60079-0

Clause of ~~IEC 60079-0~~ UL 60079-0			~~IEC 60079-0~~ UL 60079-0 clause application to ~~IEC 60079-15~~ UL 60079-15	
Ed. 6.0 (~~2011~~ 2013) (informative)	Ed. 7.0[1] ~~(future edition)~~ 2019 (informative)	Clause / Subclause title (normative)	Protected sparking "nC"	Restricted breathing "nR"
3	3	Definitions	Applies	Applies
4	4	Equipment grouping		
4.1	4.1	Group I	Excluded	Excluded
4.2	4.2	Group II	Applies	Applies
4.3	4.3	Group III	Excluded	Excluded
4.4	4.4	Equipment for a particular explosive atmosphere	Applies	Applies
5	5	Temperatures		
5.1	5.1	Environmental influences	Applies	Applies
5.2	5.2	Service temperature	Applies	Applies
5.3	5.3	Maximum surface temperature		
5.3.1	5.3.1	Determination of maximum surface temperature	Applies	Applies
5.3.2	5.3.2	Limitation of maximum surface temperature		

Table 1 Continued on Next Page

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Table 1 Continued

Clause of ~~IEC 60079-0~~ UL 60079-0			~~IEC 60079-0~~ UL 60079-0 clause application to ~~IEC 60079-15~~ UL 60079-15	
Ed. 6.0 (~~2011~~ 2013) (informative)	Ed. 7.0[1] ~~(future edition)~~ 2019 (informative)	Clause / Subclause title (normative)	Protected sparking "nC"	Restricted breathing "nR"
5.3.2.1	5.3.2.1	Group I equipment	Excluded	Excluded
5.3.2.2	5.3.2.2	Group II equipment	Applies	Applies
5.3.2.3	5.3.2.3	Group III electrical equipment	Excluded	Excluded
5.3.3	5.3.3	Small component temperature for Group I and Group II equipment	Applies	Excluded
–	5.3.4	Component temperature of smooth surfaces for Group I or Group II equipment (Applies for smaller than 10 000 mm^2 only)	Applies	Excluded
6	6	Requirements for all electrical apparatus		
6.1	6.1	General	Applies	Applies
6.2	6.2	Mechanical strength	Applies	Applies
6.3	6.3	Opening times	Excluded	Applies
6.4	6.4	Circulating currents	Applies	Applies
6.5	6.5	Gasket retention	Applies	Applies
6.6	6.6	Electromagnetic and ultrasonic radiating equipment	Applies	Applies
7	7	Non-metallic enclosures and non-metallic parts of enclosures		
7.1	7.1	General		
7.1.1	7.1.1	Applicability	Applies	Applies
7.1.2	7.1.2	Specification of materials	Applies	Applies
7.2	7.2	Thermal endurance		
7.2.1	7.2.1	Tests for thermal resistance	Applies	Applies
7.2.2	–	Material selection	Modified	Modified
–	7.2.2	Material selection	Applies	Applies
7.2.3	7.2.3	Alternative qualification for elastomeric sealing O-rings	Applies	Applies
7.3	7.3	Resistance to ultraviolet light	Applies	Applies
7.4	7.4	Electrostatic charges on external non-metallic materials		
7.4.1	7.4.1	Applicability	Applies	Applies
7.4.2	7.4.2	Avoidance of build-up of electrostatic charge on Group I or Group II electrical equipment	Applies	Applies
7.4.3	7.4.3	Avoidance of build-up of electrostatic charge on equipment for Group III	Excluded	Excluded
7.5	7.5	External conductive parts	Applies	Applies
8	8	Metallic enclosures and metallic parts of enclosures		
8.1	8.1	Material composition	Applies	Applies
8.2	8.2	Group I	Excluded	Excluded
8.3	8.3	Group II	Applies	Applies

Table 1 Continued on Next Page

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Table 1 Continued

Clause of ~~IEC 60079-0~~ UL 60079-0			~~IEC 60079-0~~ UL 60079-0 clause application to ~~IEC 60079-15~~ UL 60079-15	
Ed. 6.0 (~~2011~~ 2013) (informative)	Ed. 7.0[1] ~~(future edition)~~ 2019 (informative)	Clause / Subclause title (normative)	Protected sparking "nC"	Restricted breathing "nR"
8.4	8.4	Group III	Excluded	Excluded
NR	8.5	Copper alloys	Applies	Applies
9	9	Fasteners		
9.1	9.1	General	Applies	Applies
9.2	9.2	Special fasteners	Excluded	Excluded
9.3	9.3	Holes for special fasteners	Excluded	Excluded
9.3.3	–	Hexagon socket set screws	Excluded	Excluded
–	9.4	Hexagon socket set screws	Excluded	Excluded
10	10	Interlocking devices	Excluded	Excluded
11	11	Bushings	Applies	Applies
12	–	Materials used for cementing	Modified	Modified
–	12	Reserved for future use.	Modified	Modified
13	13	Ex components	Applies	Applies
14	14	Connection facilities	Applies	Applies
15	15	Connection facilities for earthing and bonding conductors	Applies	Applies
16	16	Entries into enclosures	Applies	Applies
17	17	Supplementary requirements for electric machines	Excluded	Excluded
18	18	Supplementary requirements for switchgear	Excluded	
18.1	18.1	Flammable dielectric	Excluded	Applies
18.2	18.2	Disconnectors	Excluded	Applies
18.3	18.3	Group I – Provisions for locking	Excluded	Excluded
18.4	18.4	Doors and covers	Excluded	Applies
19	–	Supplementary requirements for fuses	Excluded	Excluded
–	19	Reserved for future use.	Excluded	Excluded
20	20	Supplementary requirements for plugs and sockets		
20.1	20.1	General	Applies	Applies
20.2	20.2	Explosive gas atmospheres	Excluded	Excluded
20.3	20.3	Explosive dust atmospheres	Excluded	Excluded
20.4	20.4	Energized plugs	Applies	Applies
21	21	Supplementary requirements for luminaires		
21.1	21.1	General	Applies	Applies
21.2	21.2	Covers for luminaires of EPL Mb, EPL Gb or EPL Db	Excluded	Excluded
21.3	21.3	Covers for luminaires of EPL Gc or EPL Dc	Applies	Applies
21.4	21.4	Sodium lamps	Applies	Applies
22	22	Supplementary requirements for caplights and handlights		

Table 1 Continued on Next Page

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Table 1 Continued

Clause of ~~IEC 60079-0~~ UL 60079-0			~~IEC 60079-0~~ UL 60079-0 clause application to ~~IEC 60079-15~~ UL 60079-15	
Ed. 6.0 (~~2011~~ 2013) (informative)	Ed. 7.0[1] ~~(future edition)~~ 2019 (informative)	Clause / Subclause title (normative)	Protected sparking "nC"	Restricted breathing "nR"
22.1	22.1	Group I caplights	Excluded	Excluded
22.2	22.2	Group II and Group III caplights and handlights	Excluded	Applies
23	23	Equipment incorporating cells and batteries	Applies	Applies
23.12	23.12	Replacement battery pack	Applies	Applies
24	24	Documentation	Modified	Modified
25	25	Compliance of prototype or sample with documents	Applies	Applies
26	26	Type tests	Applies	Applies
26.4	26.4	Tests of enclosures		
26.4.1	26.4.1	Order of tests		
26.4.1.1	26.4.1.1	Metallic enclosures, metallic parts of enclosures and glass or ceramic parts of enclosures	Applies	Applies
26.4.1.2	26.4.1.2	Non-metallic enclosures or non-metallic parts of enclosures		
26.4.1.2.1	26.4.1.2.1	General	Applies	Applies
26.4.1.2.2	26.4.1.2.2	Group I electrical equipment	Excluded	Excluded
26.4.1.2.3	–	Group II and Group III electrical equipment	Modified	Modified
–	26.4.1.2.3	Group II and Group III electrical equipment	Applies	Applies
26.4.2	26.4.2	Resistance to impact	Applies	Applies
26.4.3	26.4.3	Drop test	Applies	Applies
26.4.4	26.4.4	Acceptance criteria	Applies	Applies
26.4.5	26.4.5	Degree of protection by enclosure	Applies	Applies
26.5	26.5	Thermal tests		
26.5.1	26.5.1	Temperature measurement	Applies	Applies
26.5.1.1	26.5.1.1	General	Applies	Applies
26.5.1.2	26.5.1.2	Service Temperature	Applies	Applies
26.5.2	26.5.2	Thermal shock test	Applies	Applies
26.5.3	26.5.3	Small component ignition test (Group I and Group II)	Applies	Excluded
26.6	26.6	Torque test for bushings	Applies	Applies
26.7	26.7	Non-metallic enclosures or non-metallic parts of enclosures		
26.7.1	26.7.1	General	Applies	Applies
26.7.2	–	Test temperatures	Modified	Modified
–	26.7.2	Test temperatures	Applies	Applies
26.8	–	Thermal endurance to heat	Modified	Modified
–	26.8	Thermal endurance to heat	Applies	Applies
26.9	26.9	Thermal endurance to cold	Applies	Applies
26.10	26.10	Resistance to light		
26.10.1	26.10.1	General	Applies	Applies

Table 1 Continued on Next Page

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Table 1 Continued

Clause of ~~IEC 60079-0~~ UL 60079-0			~~IEC 60079-0~~ UL 60079-0 clause application to ~~IEC 60079-15~~ UL 60079-15	
Ed. 6.0 (~~2011~~ 2013) (informative)	Ed. 7.0[1] ~~(future edition)~~ 2019 (informative)	Clause / Subclause title (normative)	Protected sparking "nC"	Restricted breathing "nR"
26.10.2	26.10.2	Light exposure	Applies	Applies
26.10.3	26.10.3	Acceptace criteria	Applies	Applies
26.11	26.11	Resistance to chemical agents for Group I electrical equipment	Excluded	Excluded
26.12	26.12	Earth continuity	Applies	Applies
26.13	26.13	Surface resistance test of parts of enclosures of non-metallic materials	Applies	Applies
26.14	26.14	Measurement of capacitance		
26.14.1	26.14.1	General	Applies	Applies
26.14.2	26.14.2	Test procedure	Applies	Applies
26.15	26.15	Verification of ratings of ventilating fans	Excluded	Excluded
26.16	26.16	Alternative qualification of elastomeric sealing Orings	Applies	Applies
–	26.17	Transferred charge test	Applies	Applies
27	27	Routine tests	Applies	Applies
28	28	Manufacturers responsibility	Applies	Applies
29	29	Marking		
29.1	29.1	Applicability	Applies	Applies
29.2	29.2	Location	Applies	Applies
29.3	29.3	General	Applies	Applies
29.4	29.4	Ex marking for explosive gas atmospheres	Applies	Applies
29.5	29.5	Ex marking for explosive dust atmospheres	Excluded	Excluded
29.6	29.6	Combined types (or levels) of protection	Applies	Applies
29.7	29.7	Multiple types of protection	Applies	Applies
29.8	29.8	Ga equipment using two independent Gb types (or levels) of protection	Excluded	Excluded
–	29.9	Boundary wall	Excluded	Excluded
29.9	29.10	Ex Components	Applies	Applies
29.10	29.11	Small Ex Equipment and small Ex Components	Applies	Applies
29.11	29.12	Extremely small equipment and extremely small Ex Components	Applies	Applies
29.12	29.13	Warning markings	Applies	Applies
29.13	–	Alternate marking of equipment protection levels (EPLs)	Applies	Applies
29.13.1	–	Alternate marking of type of protection for explosive gas atmospheres	Applies	Applies
29.13.2	–	Alternate marking of type of protection for explosive dust atmospheres	Excluded	Excluded
29.14	29.14	Cells and batteries	Applies	Applies

Table 1 Continued on Next Page

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Table 1 Continued

Clause of ~~IEC 60079-0~~ UL 60079-0			~~IEC 60079-0~~ UL 60079-0 clause application to ~~IEC 60079-15~~ UL 60079-15	
Ed. 6.0 (~~2011~~ 2013) (informative)	Ed. 7.0[1] ~~(future edition)~~ 2019 (informative)	Clause / Subclause title (normative)	Protected sparking "nC"	Restricted breathing "nR"
29.15	29.15	Electrical machines operated with a converter	Applies	Applies
29.16	29.16	Examples of marking	Examples only	Examples only
30	30	Instructions		
30.1	30.1	General	Applies	Applies
30.2	30.2	Cells and batteries	Applies	Applies
30.3	30.3	Electric machines	Excluded	Excluded
30.4	30.4	Ventilating fans	Excluded	Excluded
–	30.5	Cable glands	Applies	Applies
Annex A	Annex A	Supplementary requirements for Ex cable glands	Applies	Applies
Annex B	Annex B	Requirements for Ex components	Applies	Applies
Annex C	Annex C	Example of rig for resistance to impact test	Informative Annex	Informative Annex
Annex D	Annex D	Motors supplied by converters	Informative Annex	Informative Annex
Annex E	Annex E	Temperature evaluation of electric machines	Informative Annex	Informative Annex
Annex F	Annex F	Guideline flowchart for tests of non-metallic enclosures or non-metallic parts of enclosures (26.4)	Informative Annex	Informative Annex
–	Annex G	Guidance flowchart for tests of cable glands	Informative Annex	Informative Annex
–	Annex H	Shaft voltages resulting in motor bearing or shaft brush sparking. Discharge energy calculation	Informative Annex	Informative Annex

Applies – This requirement of ~~IEC 60079-0~~ UL 60079-0 is applied without change.

Excluded – This requirement of ~~IEC 60079-0~~ UL 60079-0 does not apply.

Modified – This requirement of ~~IEC 60079-0~~ UL 60079-0 is modified as detailed in this standard.

NOTE 1 The clause number in the above table is shown for information only. The applicable requirements of ~~IEC 60079-0~~ UL 60079-0 are identified by the clause title which is normative. This document was written against the specific requirements of ~~IEC 60079-0~~ UL 60079-0 (ed. 7.0). The clause numbers for the previous edition are shown for information only. This is to enable the general requirements of ~~IEC 60079-0~~ UL 60079-0 (ed. 6.0) to be used where necessary with ~~this part of IEC 60079-0~~ document. Where there is a conflict between requirements, the later edition requirements take precedence.

NOTE 2 A shaded row in the above table indicates that this is a clause heading. In cases where the applicability is the same for all of the sub-clauses the 'Applies' or 'Excluded' is listed in the heading row and the sub-clauses are not expanded. Where the application of the individual sub-clauses may be different, these are expanded in the above table and the applicability for each is listed.

NOTE 3 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.

[1] ~~Under preparation. Stage at the time of publication: IEC/FDIS 60079-0:2017.~~

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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.

IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60079-7, *Explosive atmospheres – Part 7: Equipment protection by increased safety "e"*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60079-0 and the following 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

3.1
devices and components “nC”

3.1.1
hermetically-sealed device “nC”
device which is so constructed that it cannot be opened and is sealed effectively by fusion to prevent entry of an external atmosphere

3.1.2
non-incendive component “nC”
component having contacts for making or breaking a specified ignition capable circuit but in which the contacting mechanism is designed and constructed so that the component is not capable of causing ignition of the specified explosive gas atmosphere

Note 1 to entry: The enclosure of the non-incendive component is not intended to either exclude the explosive gas atmosphere or contain an explosion. This is usually applied to specially constructed switch contacts that are mechanically designed to quench any arc or spark so that they are not a source of ignition.

3.1.3
sealed device “nC”
device which is so constructed that it cannot be opened during normal service and is sealed effectively to prevent entry of an external atmosphere

3.2
normally sparking device
device with spacings in line with the industrial requirements and which produces arcs and sparks during normal operating conditions

Note 1 to entry: Normally sparking devices include switches, relays, and contactors not otherwise Ex protected.

3.3
restricted-breathing enclosure “nR”
enclosure that is designed to restrict the entry of gases, vapours and mists

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3.4
sealing device
device employing a method other than encapsulation to prevent the flow of a gas or a liquid between equipment and a conduit or between separate parts of the equipment by providing sealing facilities

Note 1 to entry: This device is not a device covered by IEC TS 60079-40.

3.5
separation
shortest distance through solid insulating material between two conductive parts

3.6
test port
facility to test the integrity of restricted breathing equipment in the field after installation, during initial inspection and during maintenance

3.7
type of protection "n"
type of protection applied to electrical equipment such that, in normal operation and in certain specified regular expected occurrences, it is not capable of igniting a surrounding explosive gas atmosphere

Note 1 to entry: Additionally, the requirements of this standard are intended to ensure that a malfunction capable of causing ignition is not likely to occur.

4 General

4.1 Equipment grouping and temperature classification

Equipment grouping and temperature classification shall be in accordance with the equipment grouping and temperature classification clauses of IEC 60079-0.

4.2 Potential ignition sources

In normal operation and in certain regular expected occurrences specified by this standard, the equipment 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 7 to 10;

b) develop a maximum surface temperature in excess of the maximum value appropriate to the temperature class of the equipment, 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 7 to 10 as appropriate, or is otherwise shown to be safe as specified in 5.

4.3 Equipment requirements

Equipment or components which in normal operation produce arcs, sparks or hot surfaces which otherwise would be capable of igniting a surrounding atmosphere shall be protected against causing ignition by one or more of the following methods, all of which provide Equipment Protection Level Gc:

a) non-incendive component (see Clause 7);

b) hermetically sealed device (see Clause 8);

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c) sealed device (see Clause 9);

d) restricted-breathing enclosure (see Clause 10).

5 Maximum surface temperatures

The maximum surface temperature shall be determined in accordance with the determination of maximum temperature classification requirements of IEC 60079-0. The surface to be considered shall be the external surface of the equipment including the surface of internal parts of non-incendive components to which the explosive gas atmosphere has access.

NOTE This is often the outside surface of type of protection “nC” components located within level of protection “ec” equipment.

6 Requirements for electrical equipment

6.1 General

Electrical equipment with type of protection ″n″ shall comply with the requirements of this standard and the applicable parts of IEC 60079-0 for the method(s) of protection used.

6.2 Electric strength insulation from earth or frame

Where the electrical circuits within the equipment are not connected directly to the frame of the equipment or not intended to be connected to the frame in service, the insulation or separation distance used shall withstand without breakdown one of the following tests:

a) either as given in a relevant industrial standard for the individual items of electrical equipment; or

b) if no such test requirement exists, at the test voltage according to 1), or 2) below, and maintained for at least 1 min without dielectric breakdown occurring.

1) for equipment supplied with voltages not exceeding 90 V peak or in which internal voltages not exceeding 90 V peak are present, 500 V r.m.s, $^{+5}_{0}$ %;

2) for other equipment, or where internal voltages in excess of 90 V peak are present, (2*U* + 1 000 V) r.m.s, $^{+5}_{0}$ % or 1 500 V r.m.s. $^{+5}_{0}$ %, whichever is the greater.

The use of a DC test voltage is allowed as an alternative to the specified AC test voltage and shall be 170 % of the specified AC r.m.s test voltage for insulated windings or 140 % of the specified AC r.m.s test voltage for situations where air or creepage distance is the insulating medium.

NOTE *U* is the higher of either the rated supply voltage or the maximum voltage occurring within the equipment.

For equipment with galvanically isolated parts, the test voltages shall be applied separately, at the appropriate voltage, to each part.

7 Requirements for non-incendive components

7.1 Type testing

Non-incendive components shall be subjected to the type test specified in 11.1.

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7.2 Circuit limitations

Non-incendive components shall be limited to a maximum rating of 254 V AC, r.m.s. or DC and 16 A AC, r. m.s. or DC.

NOTE The contact arrangements of a non-incendive component quench an incipient flame and such that an external explosive atmosphere is not ignited. The use of non-incendive components is limited to circuits having electrical characteristics which are similar to those of the circuit of which the components were a constituent when tested, or to less dangerous circuits, for example in terms of voltage, current, inductance capacitance, inrush current or overload conditions.

8 Requirements for hermetically sealed devices

8DV DR *Modification of Clause 8 to replace with the following:*

Hermetically sealed devices, in which the seal is made by fusion of metal to metal, ceramic to metal or glass to metal are considered as meeting the requirements for sealed devices without test.

The enclosure shall be capable of withstanding normal handling and assembly operations without damage to the seal.

9 Requirements for sealed devices

9.1 Non-metallic materials

When the sealed device does not form part of the outer Ex Equipment enclosure it shall be tested according to 11.2. Where the device is constructed with a separate housing and base that are sealed together, the housing and base of the device are not considered to be part of the seal.

The documents according to IEC 60079-0 shall include a data sheet or statement from the sealed device manufacturer to show that the materials used for the seals have a thermal stability adequate for the service temperature range to which they will be subjected. The materials used for the seals 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. This data sheet or statement may be on the sealing or encapsulating material, or may be on the overall sealed device itself.

When the sealed device forms all or part of the outer enclosure of the Ex Equipment the enclosure requirements of IEC 60079-0 apply.

9.2 Opening

Sealed devices shall be so constructed that they cannot be opened in normal operation.

9.3 Internal spaces

Sealed devices shall have a total free internal volume not exceeding 100 cm^3, and shall be provided, where necessary, with external connections, for example flying leads or external terminals.

9.4 Handling

The device shall be capable of withstanding normal handling and assembly operations without damage.

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9.5 Gasket and seals

9.5DV DR *Modification of Clause 9.5 to replace with the following:*

Gasket and seals, including poured seals, shall be positioned so that they are not subject to mechanical damage under normal operating conditions and they shall retain their sealing properties over the expected life of the device.

NOTE The Sealed device requirements of this standard address the use of gaskets and seals that are not subjected to any flexural stress on the parts of the seal which are used to exclude entry of an external atmosphere as part of normal operation (i.e. static seals). The Sealed device requirements of this standard do not address gaskets and seals that are subjected to stress that causes flexing on the parts of the seal which are used to exclude entry of an external atmosphere as part of normal operation (i.e. dynamic seals). An example of a static seal is the seal for a miniature "ice cube" relay where the actuation means involves an internal coil and contacts, with an example of a dynamic seal being a toggle switch or motor where the actuation means extends outside the sealed body. IEC/TC 31 MT 60079-15, responsible for maintaining IEC 60079-15, is developing an Amendment to address dynamic seals for Sealed devices.

9.6 Type tests

The type tests described in 11.2 shall be performed.

10 Requirements for restricted-breathing enclosures

10.1 General

Restricted breathing equipment shall be limited in dissipated power such that the temperature measured on the outside does not exceed the maximum surface temperature requirements of IEC 60079-0.

Restricted breathing enclosures shall only be assessed as complete equipment including all options and accessories.

Either the equipment shall be delivered with entry devices in place or alternatively in the instruction manual for the "nR" equipment clear information shall be given for proper selection of the entry devices.

10.2 Constructional requirements

10.2.1 Type of equipment

10.2.1.1 Equipment containing normally sparking devices

10.2.1.1DV.1 DR *Modification of Clause 10.2.1.1 to replace with the following:*

Restricted breathing equipment containing normally arcing or sparking devices, or equipment with hot surfaces designed to have frequent temperature cycles, shall be limited in dissipated power such that the maximum temperature measured on any outside surface of the enclosure does not exceed the ambient temperature by more than 20 K during normal operation.

Arcing and sparking parts may be included provided they are constructed in accordance with the applicable safety requirements of the relevant industrial standards.

~~**NOTE 1 It is not a requirement of this standard that compliance with these industrial standards be verified.**~~

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NOTE 2 Luminaires, as normally employed, are considered to have an infrequent temperature cycle.

NOTE 3 Consideration of temperature is due to the increased risk of drawing the explosive atmosphere into the enclosure when the equipment is de-energized. Consideration of duty cycle is due to the increased probability that the equipment might be de-energized when flammable gas or vapour surrounds the enclosure.

10.2.1.2 Equipment not containing normally sparking devices

10.2.1.2DV.1 DR *Modification of Clause 10.2.1.2 to replace with the following:*

Restricted breathing equipment with no normally arcing or sparking devices, but containing hot surfaces in normal operation, shall be limited in dissipated power such that the temperature measured on the outside does not exceed the marked temperature class.

Switching devices which cannot be used for other functions and would not be operated in normal operation, such as a fire alarm switch, shall not be considered to be a normally arcing or sparking device.

The clearance and creepage distances shall be in accordance with the applicable safety requirements of the relevant industrial standards.

~~**NOTE It is not a requirement of this standard that compliance with these industrial standards be verified.**~~

Manually operated normally sparking devices located within an enclosure that have been considered to be not accessible in normal operation without the use of a tool (see fastener general requirements of ~~IEC~~ UL 60079-0), may be evaluated as non-sparking components. These components shall be identified in the documentation prepared in accordance with the documentation requirements of ~~IEC~~ UL 60079-0.

10.2.2 Cells and batteries

Cells or batteries shall only be of the sealed type in accordance with the requirements for level of protection “ec” in IEC 60079-7. The additional “ec” marking for the cells or batteries does not need to appear in the external marking of the restricted breathing device.

10.2.3 Cable glands and conduit entries

10.2.3.1 Cable glands

Cable glands, whether integral or separate, shall meet the requirements of IEC 60079-0.

Where cable glands are integral with the enclosure or specific to the enclosure they shall be tested as part of the enclosure.

Where the cable glands are neither integral with nor permanently fixed to the enclosure the cable gland shall meet the requirements of IEC 60079-0 and in addition the test given in 11.3 and the installation instructions provided with the equipment shall contain information on the selection of and installation of cable glands. See Clause 15.

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10.2.3.2 Conduit entries

Where conduit sealing devices are neither integral with nor permanently fixed to the enclosure the conduit sealing devices shall meet the requirements of IEC 60079-0 and in addition the test given in 11.3 and the installation instructions provided with the equipment shall contain information on the selection of and installation of conduit sealing devices. See Clause 15.

10.2.4 Operating rods, spindles and shafts

Openings in enclosures for rods, spindles or shafts shall have means to ensure the type of protection “nR”, and shall not rely on grease or compound as a sole means to maintain sealing integrity , both when the spindles, rods or shafts are in motion and when they are at rest.

10.2.5 Windows

10.2.5.1 Cemented windows

A window design employing a cemented joint shall be such that it is cemented either directly into the wall of the enclosure so as to form with the latter an inseparable assembly, or into a frame such that the assembly can be replaced as a unit.

10.2.5.2 Gasketed windows

A window design employing a gasket to ensure type of protection “nR” shall be such that it is mounted directly in the wall or cover of the enclosure. Alternatively a gasketed window, may also be mounted in a separate gasketed frame which is then attached to the enclosure or cover.

10.2.6 Gasket and seal requirements

Resilient gaskets and seals shall be positioned so that they are not subject to mechanical damage under normal operating conditions. The manufacturer shall specify a recommended replacement frequency and this shall be included in the instructions as specified in Clause 15.

The documents according to IEC 60079-0 shall include a data sheet or statement from the gasket or seal manufacturer to show that the materials used for the seals have a thermal stability adequate for the service temperature range to which they will be subjected. The materials used for the seals 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.

10.2.7 Non-resilient seals

Non-resilient seals for restricted breathing equipment 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.

NOTE Non resilient seals do not require continuing internal stress to perform their function.

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10.2.8 Test port

10.2.8.1 General

Equipment containing normally sparking devices shall be provided with a test port to enable testing of the restricted breathing properties to be carried out after installation, during initial inspection and during maintenance.

The fitting of test ports on restricted breathing equipment might not always be practical, for instance if the only part of the restricted breathing enclosure accessible from the outside of the overall enclosure is a glass globe.

Equipment where the nominal volume of the enclosure changes due to pressure during type testing shall always be equipped with a test port.

10.2.8.2 Test port exemptions

10.2.8.2.1 Luminaires

Gaskets and seals shall be fixed in position and shall be designed so that they can be readily replaced. Hard setting adhesives shall not be used.

If adhesives are used they should be pre-applied to the gasket material.

Luminaires may be exempted from the fitting of test port provided the following conditions are met:

a) there are no normally arcing or sparking devices present in the restricted breathing enclosure, see also 10.2.1.2; and

b) resilient gaskets and seals are mechanically protected so that they are not subject to mechanical damage during field installation or replacement; and

c) the gaskets or seals exposed during re-lamping are of a type that can be readily replaced during the re-lamping process.

10.2.8.2.1DV.1 DR *Modification of Clause 10.2.8.2.1, fourth paragraph to replace with the following:*

For equipment that does not have a test port fitted, the Specific Conditions of Use ~~marking shall include the symbol "X",~~ shall be specified in accordance with of ~~IEC~~ UL 60079-0, and ~~the specific conditions of use to be employed~~ shall be specified in the documentation 10.2.8.2.3).

10.2.8.2.2 Other restricted breathing equipment

10.2.8.2.2DV DR *Modification of Clause 10.2.8.2.2 to replace with the following:*

Where opening of the equipment is not normally required in use, it may also be exempted from the fitting of the test port. The warning label given in item a) of Table 2 shall be affixed to the equipment. For equipment that does not have a test port fitted, the Specific Conditions of Use ~~marking shall include the symbol "X",~~ in accordance with of ~~IEC~~ UL

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60079-0, and ~~the specific conditions of use to be employed~~ shall be specified in the documentation 10.2.8.2.3).

Where opening of the equipment may occur for maintenance it may be exempted from the fitting of test port provided the following conditions are met:

a) there are no normally arcing or sparking devices present in the restricted breathing enclosure, see also 10.2.1.2, and

b) resilient gasket seals are mechanically protected so that they are not subject to mechanical damage during field installation or replacement, and c) the "nR" equipment is factory wired for the "nR" part with indirect entry for the field wiring.

10.2.8.2.3 Gasket and sealing replacement

The instructions shall contain information regarding the conditions under which it is necessary to replace the gasket or seal after any activity that requires the enclosure to be opened e.g. re-lamping of a luminaire.

To ensure that the "nR" properties will not be defeated by the opening and closing operation and based on the fact that without a test port a test of the restricted breathing properties in the field is not possible, the instructions shall include a requirement to replace the involved gaskets as part of this process.

Testing procedure

Restricted breathing equipment exempted from the fitting of a test port shall be typed tested in accordance with 11.3.2.2 and in addition routine tested in accordance with 12.2.2.1.2.

10.2.9 Internal fans

If internal fans are fitted, the suction shall not induce a depression at a potential source of leakage. The restricted breathing test of 11.3.2.2 shall be conducted both with the fan operating and the fan stationary.

10.3 Temperature limitation

If equipment is designed for different but fixed internal configurations, the worst case combination shall be used for determination the maximum surface temperature during the type test.

If equipment may be equipped with a variable combination of internal components, the surface temperature rise during type test may be measured with dummy loads. For this equipment, a routine test for determining the temperature class is required. The temperature rise of equipment under test may alternatively be calculated under the limitations given in 12.4.

10.4 Additional requirements for restricted-breathing luminaires

10.4.1 Mounting arrangement

The mounting arrangement for restricted-breathing luminaires shall be so designed that the luminaire can pass the test for restricted-breathing whether or not it is mounted and any gaskets and/or special components necessary for this purpose shall be supplied with the luminaire.

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10.4.2 Reflectors

Where provision has been made on the luminaire for the attachment of reflectors, the means of attachment shall not impair the restricted-breathing properties of such luminaries.

10.4.3 Surface temperatures of restricted-breathing luminaires

Only the external surface of a restricted-breathing luminaire operating under both normal and abnormal conditions shall be considered for determining the temperature classification or maximum surface temperature.

The specified abnormal conditions are given in IEC 60079-7 for level of protection “ec”.

11 Type Tests

11.1 Tests for non incendive components

11.1.1 Preparation of non-incendive component samples

For non-incendive components, the contacts shall be preconditioned by 6 000 cycles of operations at a rate of approximately six times per minute when carrying the rated electrical load.

The component shall be arranged to ensure that the test atmosphere has access to the contacts and that a resulting explosion will be detected.

The samples should be prepared by using one of the methods below and then shall successfully withstand the test in 11.1.2.2.

– Remove the housing adjacent to the contacts to permit free access of the air-gas mixture to the contacts.

– Drill at least two holes 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 an explosion detection device (e.g., a pressure transducer) may be connected to the component to detect ignition.

– Draw a vacuum within the test chamber and maintain the vacuum for a minimum of 100 seconds. Fill the test chamber with the specified air-gas mixture and maintain the concentration for a minimum of 100 seconds before applying the required electrical load. An explosion detection device (e. g., a pressure transducer) shall be connected to the component to detect ignition.

11.1.2 Test conditions for non-incendive components

11.1.2.1 General

The device or component, which shall be arranged to have the most adverse dimensions permitted by the construction drawings, shall be filled with and surrounded by an explosive mixture according to the stated group of the equipment, as follows:

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