AMERICAN NATIONAL STANDARD

ANSI/ISA-60079-15 (12.12.02)-2012

Supercedes ANSI/ISA-60079-15 (12.12.02)-2009

Explosive atmospheres – Part 15: Equipment protection by type of protection "n" (Edition 4)

Approved 15 February 2013

Documents
Document Sharing Hub

Copyright International Society of Automation

Full document details: ANSI ISA 60079-15-2012

Commitment for Amendments

This standard is issued jointly by ISA and Underwriters Laboratories Incorporated (UL). Comments or proposals for revisions on any part of the standard may be submitted to ISA or UL at any time. Revisions to this standard will be made only after processing according to the standards development procedures of ISA and UL. ***ISA and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue.***

ISBN: 978-1-937560-65-2
Copyright © 2012
By ISA

These materials are subject to copyright claims of IEC, ANSI, and ISA. All rights reserved. Not for resale. Printed in the United States of America. No part of this publication may be reproduced in any form, including an electronic retrieval system, without the prior written permission of ISA. All requests pertaining to this standard should be submitted to ISA.

Copyright © 2013
Underwriters Laboratories Incorporated

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

The most recent designation of ANSI/ISA-60079-15 and ANSI/UL 60079-15 as an American National Standard occurred on 15 February 2013.

This ANSI/UL Standard for Safety, which consists of the fourth edition, is under continuous maintenance, whereby each revision is ANSI approved upon publication. 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 http://csds.ul.com.

Documents
Document Sharing Hub

Copyright International Society of Automation

Full document details: ANSI ISA 60079-15-2012

ISA
ANSI/ISA-60079-15
Fourth Edition

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

Explosive atmospheres – Part 15: Equipment protection by type of protection "n" (Edition 4)

Documents
Document Sharing Hub

Copyright International Society of Automation

Full document details: ANSI ISA 60079-15-2012

This page intentionally left blank.

Documents
Document Sharing Hub

Copyright International Society of Automation

Full document details: ANSI ISA 60079-15-2012

General Notes

This is the common ISA and UL standard for Explosive atmospheres – Part 15: Equipment protection by type of protection "n". It is the fourth edition of ANSI/ISA-60079-15 (superceding ANSI/ISA-60079-15 (12.12.02)-2009 and the fourth edition of ANSI/UL 60079-15.

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 the International Society of Automation (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 effective dates for these new, revised or deleted requirements are being determined.

Documents
Document Sharing Hub

Copyright International Society of Automation

Full document details: ANSI ISA 60079-15-2012

This page intentionally left blank.

Documents
Document Sharing Hub

Copyright International Society of Automation

Full document details: ANSI ISA 60079-15-2012

Preface (ISA)

This ISA standard is based on the 4th edition of IEC Publication 60079-15. It is the intention of the ISA12 Committee to develop an ANSI Standard that is harmonized with IEC 60079-15 to the fullest extent possible. This preface is included for informational purposes and is not part of ANSI/ISA-60079-15. The document is a modification of the IEC document and includes U.S. deviations encompassing both additions and deletions of information. The significant changes with respect to the previous edition are listed below:

– addition of equipment protection levels;
– removal of the requirements for energy-limited “nL” and associated energy limited apparatus “[nL]”;
– removal of the requirements for encapsulated devices “nC”;
– requirements for electrical connections expanded and clarified
– requirements for luminaire ballasts expanded and clarified;
– requirements for evaluation and testing of motor rotors clarified;
– 15 kV limit for equipment protection by type of protection "n" added;
– spacing requirement for voltages above 10 kV modified;
– requirements for restricted breathing enclosures modified;
– modification to requirements for motor rotors and stators;
– addition of Annex A (informative);
– undated references to IEC 60079-0 included.

The standards referenced within this document may contain provisions which, through reference in this text, constitute requirements of this document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the standards indicated within this document. Members of IEC and ISO maintain registers of currently valid International Standards. ANSI maintains registers of currently valid U.S. National Standards.

This document has been prepared as part of the service of the International Society of Automation (ISA) toward a goal of uniformity in the field of instrumentation. To be of real value, this document should not be static but should be subject to periodic review. Toward this end, the Society welcomes all comments and criticisms and asks that they be addressed to the Secretary, Standards and Practices Board; ISA; 67 Alexander Drive; P. O. Box 12277; Research Triangle Park, NC 27709; Telephone (919) 549-8411; Fax (919) 549-8288; E-mail: standards@isa.org.

The ISA Standards and Practices Department is aware of the growing need for attention to the metric system of units in general, and the International System of Units (SI) in particular, in the preparation of instrumentation standards. The Department is further aware of the benefits to USA users of ISA standards of incorporating suitable references to the SI (and the metric system) in their business and professional dealings with other countries. Toward this end, this Department will endeavour to introduce SI-acceptable metric units in all new and revised standards, recommended practices, and technical reports to the greatest extent possible. IEEE/ASTM SI 10, *American National Standard for Metric Practice*, and future revisions, will be the reference guide for definitions, symbols, abbreviations, and conversion factors.

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

It is the policy of ISA to encourage and welcome the participation of all concerned individuals and interests in the development of ISA standards, recommended practices, and technical reports. Participation in the ISA standards-making process by an individual in no way constitutes endorsement by the employer of that individual, of ISA, or of any of the standards, recommended practices, and technical reports that ISA develops.

CAUTION — ISA DOES NOT TAKE ANY POSITION WITH RESPECT TO THE EXISTENCE OR VALIDITY OF ANY PATENT RIGHTS ASSERTED IN CONNECTION WITH THIS DOCUMENT, AND ISA DISCLAIMS LIABILITY FOR THE INFRINGEMENT OF ANY PATENT RESULTING FROM THE USE OF THIS DOCUMENT. USERS ARE ADVISED THAT DETERMINATION OF THE VALIDITY OF ANY PATENT RIGHTS, AND THE RISK OF INFRINGEMENT OF SUCH RIGHTS, IS ENTIRELY THEIR OWN RESPONSIBILITY.

PURSUANT TO ISA'S PATENT POLICY, ONE OR MORE PATENT HOLDERS OR PATENT APPLICANTS MAY HAVE DISCLOSED PATENTS THAT COULD BE INFRINGED BY USE OF THIS DOCUMENT AND EXECUTED A LETTER OF ASSURANCE COMMITTING TO THE GRANTING OF A LICENSE ON A WORLDWIDE, NON-DISCRIMINATORY BASIS, WITH A FAIR AND REASONABLE ROYALTY RATE AND FAIR AND REASONABLE TERMS AND CONDITIONS. FOR MORE INFORMATION ON SUCH DISCLOSURES AND LETTERS OF ASSURANCE, CONTACT ISA OR VISIT WWW.ISA.ORG/STANDARDSPATENTS.

OTHER PATENTS OR PATENT CLAIMS MAY EXIST FOR WHICH A DISCLOSURE OR LETTER OF ASSURANCE HAS NOT BEEN RECEIVED. ISA IS NOT RESPONSIBLE FOR IDENTIFYING PATENTS OR PATENT APPLICATIONS FOR WHICH A LICENSE MAY BE REQUIRED, FOR CONDUCTING INQUIRIES INTO THE LEGAL VALIDITY OR SCOPE OF PATENTS, OR DETERMINING WHETHER ANY LICENSING TERMS OR CONDITIONS PROVIDED IN CONNECTION WITH SUBMISSION OF A LETTER OF ASSURANCE, IF ANY, OR IN ANY LICENSING AGREEMENTS ARE REASONABLE OR NON-DISCRIMINATORY.

ISA REQUESTS THAT ANYONE REVIEWING THIS DOCUMENT WHO IS AWARE OF ANY PATENTS THAT MAY IMPACT IMPLEMENTATION OF THE DOCUMENT NOTIFY THE ISA STANDARDS AND PRACTICES DEPARTMENT OF THE PATENT AND ITS OWNER.

ADDITIONALLY, THE USE OF THIS DOCUMENT MAY INVOLVE HAZARDOUS MATERIALS, OPERATIONS OR EQUIPMENT. THE DOCUMENT CANNOT ANTICIPATE ALL POSSIBLE APPLICATIONS OR ADDRESS ALL POSSIBLE SAFETY ISSUES ASSOCIATED WITH USE IN HAZARDOUS CONDITIONS. THE USER OF THIS DOCUMENT MUST EXERCISE SOUND PROFESSIONAL JUDGMENT CONCERNING ITS USE AND APPLICABILITY UNDER THE USER'S PARTICULAR CIRCUMSTANCES. THE USER MUST ALSO CONSIDER THE APPLICABILITY OF ANY GOVERNMENTAL REGULATORY LIMITATIONS AND ESTABLISHED SAFETY AND HEALTH PRACTICES BEFORE IMPLEMENTING THIS DOCUMENT.

THE USER OF THIS DOCUMENT SHOULD BE AWARE THAT THIS DOCUMENT MAY BE IMPACTED BY ELECTRONIC SECURITY ISSUES. THE COMMITTEE HAS NOT YET ADDRESSED THE POTENTIAL ISSUES IN THIS VERSION.

The following people served as members of ISA Subcommittee ISA12.12:

NAME	COMPANY
R. Masek, Chair	CSA Group
M. Coppler, Managing Director	Det Norske Veritas Certification Inc.
N. Abbatiello	Speer Equipment Inc.

Documents
Document Sharing Hub

Copyright International Society of Automation

Full document details: ANSI ISA 60079-15-2012

S. Arnold	Ametek Drexelbrook
W. Bennett	Mine Safety Appliances Co.
S. Blais	EGS Electrical Group
K. Boegli	Phoenix Contact
S. Czaniecki	Endress + Hauser Canada
A. Engler	Det Norske Veritas DNV
D. Genender	Pepperl + Fuchs Inc.
P. Kelly	UL LLC
S. Kiddle	ABB Inc.
G. Kozinski	GE Infrastructure Sensing
J. Kuczka	Killark
C. Kurtzman	Rosemount Inc.
B. Larson	Turck Inc.
W. Lawrence	FM Approvals LLC
E. Leubner	Cooper Crouse-Hinds
N. Ludlam	FM Approvals Ltd.
E. Massey	Baldor Electric Company
J. McCormick	Siemens Process Analytics
J. Miller	Detector Electronics Corporation
R. Parks	Intertek
D. Wechsler	Wechsler Consulting
R. Wigg	E-x Solutions International Pty. Ltd.

The following people served as members of ISA Committee ISA12:

NAME	COMPANY
T. Schnaare, Chair	Rosemount Inc.
W. Lawrence, Vice Chair	FM Approvals LLC
M. Coppler, Managing Director	Det Norske Veritas Certification Inc.
R. Allen	Honeywell Inc.
D. Ankele	UL LLC
S. Bihler	Zone Safe Solutions, Inc.
K. Boegli	Phoenix Contact
D. Burns	Shell P&T – Innovation / R&D
C. Casso	Nabors Industries
S. Czaniecki	Intrinsic Safety Concepts Inc.
M. Dona	Santos Ltd.
T. Dubaniewicz	NIOSH
D. El Tawy	Solar Turbines, Inc.
A. Engler	Det Norske Veritas DNV
W. Fiske	Intertek
R. Holub	DuPont Engineering
D. Jagger	Bifold-Fluid Power
J. Jonscher	Adalet PLM
P. Kovscek	Industrial Scientific Corporation
J. Kuczka	Killark
E. Leubner	Cooper Crouse-Hinds
N. Ludlam	FM Approvals Ltd.
R. Masek	CSA Group
E. Massey	Baldor Electric Company
J. Miller	Detector Electronics Corporation
A. Page	Consultant
R. Seitz	Artech Engineering
R. Sierra	USCG
M. Spencer	Columbia Gas Transmission

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

J. Thomas	Schlumberger
D. Wechsler	Wechsler Consulting
R. Wigg	E-x Solutions International Pty. Ltd.

This standard was approved for publication by the ISA Standards and Practices Board on 19 October 2012.

NAME	COMPANY
D. Dunn, Vice President	Aramco Services Co.
D. Bartusiak	ExxonMobil Chemical Company
P. Brett	Honeywell Inc.
J. Campbell	Consultant
M. Coppler	Det Norske Veritas Certification Inc.
E. Cosman	The Dow Chemical Co.
B. Dumortier	Schneider Electric
J. Federlein	Federlein & Assoc. Inc.
J. Gilsinn	US NIST
E. Icayan	ACES Inc.
J. Jamison	EnCana Corporation Ltd.
K. Lindner	Endress+Hauser Process Solutions AG
V. Maggioli	Feltronics Corp.
T. McAvinew	Instrumentation and Control Engineering LLC
R. Reimer	Rockwell Automation
S. Russell	Valero Energy Corp.
N. Sands	DuPont
H. Sasajima	Azbil Corp.
T. Schnaare	Rosemount Inc.
J. Tatera	Tatera & Associates Inc.
I. Verhappen	Yokogawa Canada Inc.
W. Weidman	WCW Consulting
J. Weiss	Applied Control Solutions LLC
M. Wilkins	Yokogawa IA Global Marketing (USMK)
D. Zetterberg	Chevron Energy Technology Company

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

National Differences

GENERAL

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 2010, 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 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.

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

This page intentionally left blank.

Documents
Document Sharing Hub

Copyright International Society of Automation

Full document details: ANSI ISA 60079-15-2012

CONTENTS

1 Scope 17
2 ~~Normative~~ References 22
3 Terms and definitions 24
4 General 26
4.1 Equipment grouping and temperature classification 26
4.2 Potential ignition sources 26
5 Temperatures 26
5.1 Maximum surface temperature 26
5.2 Small components 27
6 Requirements for electrical equipment 27
6.1 General 27
6.2 Opening times 27
6.3 Minimum degree of protection 27
6.4 Clearances, creepage distances and separations 28
6.5 Electric strength 36
7 Connection facilities and terminal compartments 36
7.1 General 36
7.2 Field wiring connections 37
7.3 Factory connections 38
8 Supplementary requirements for non-sparking electrical rotating machines 39
8.1 General 39
8.2 Machine enclosure 40
8.3 Terminal boxes 40
8.4 Conduit stopping boxes, cable sealing and dividing boxes 40
8.5 Connection facilities for external conductors 40
8.6 Neutral point connections 40
8.7 Radial air gap 41
8.8 Rotor cages 42
8.9 Stator winding insulation system 43
8.10 Surface temperature limitation 44
9 Supplementary requirements for non-sparking fuses and fuse assemblies 45
9.1 Fuses 45
9.2 Temperature class of equipment 45
9.3 Fuse mounting 45
9.4 Fuse enclosures 45
9.5 Replacement fuse identification 45
10 Supplementary requirements for non-sparking plugs and sockets 46
10.1 External Plugs and sockets for ~~external~~ field wiring connections 46
10.2 Maintaining degree of protection (IP code) 47
10.3 Sockets that do not have plugs inserted in normal operation 47
11 Supplementary requirements for non-sparking luminaires 47

Documents
Document Sharing Hub

Copyright International Society of Automation

Full document details: ANSI ISA 60079-15-2012

11.1 General ... 47
11.2 Construction ... 47
11.3 Luminaires for tubular fluorescent bi-pin lamps ... 51
11.4 Other equipment containing light sources ... 53
12 Supplementary requirements for equipment incorporating non-sparking cells and batteries ... 54
12.1 General ... 54
12.2 Categorization of cells and batteries ... 54
12.3 General requirements for cells and batteries of types 1 and 2 ... 55
12.4 Charging of type 1 and type 2 cells and batteries ... 57
12.5 Requirements for type 3 secondary batteries ... 57
12.6 Verification and tests ... 60
13 Supplementary requirements for non-sparking low power equipment ... 60
14 Supplementary requirements for non-sparking current transformers ... 61
15 Other non-sparking electrical equipment ... 62
16 General supplementary requirements for equipment producing arcs, sparks or hot surfaces ... 62
17 Supplementary requirements for enclosed-break equipment ~~devices~~ and non-incendive components producing arcs, sparks or hot surfaces ... 62
17.1 Type testing ... 62
17.2 Ratings ... 62
17.3 Construction of enclosed-break equipment ~~devices~~ ... 63
18 Supplementary requirements for hermetically-sealed components ~~devices~~ producing arcs, sparks or hot surfaces ... 63
19 Supplementary requirements for sealed components ~~devices~~ producing arcs, sparks or hot surfaces ... 63
19.1 Non-metallic materials ... 63
19.2 Opening ... 63
19.3 Internal spaces ... 64
19.4 Handling ... 64
19.5 Gasket and seals ... 64
19.6 Type tests ... 64
20 Supplementary requirements for restricted-breathing enclosures protecting equipment producing arcs, sparks or hot surfaces ... 64
20.1 General ... 64
20.2 Constructional requirements ... 65
20.3 Temperature limitation ... 68
20.4 Additional requirements for restricted breathing luminaires ... 68
21 General information on verification and tests ... 69
22 Type tests ... 69
22.1 Representative samples ... 69
22.2 Test configuration ... 69
22.3 Tests for enclosures on which the type of protection depends ... 69
22.4 Tests for enclosed break equipment ~~devices~~ and non incendive components ... 70

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

22.5 Tests for sealed component ~~devices~~ ... 71
22.6 Type test requirements for restricted-breathing enclosures ... 73
22.7 Test for screw lampholders ... 73
22.8 Test for starter holders for luminaires ... 74
22.9 Tests for electronic starters for tubular fluorescent lamps and for ignitors for high pressure sodium or metal halide lamps ... 74
22.10 Test for wiring of luminaires subject to high-voltage impulses from ignitors ... 76
22.11 Mechanical shock test for batteries ... 76
22.12 Insulation resistance test for batteries ... 77
22.13 Additional ignition tests for large or high-voltage machines ... 77
23 Routine verifications and tests ... 79
23.1 General ... 79
23.2 Specific routine tests ... 79
24 Marking ... 81
24.1 General ... 81
24.2 Additional marking for batteries ... 81
24.3 Examples of marking ... 82
25 Documentation ... 83
26 Instructions ... 83
Annex A (informative) Application, installation, and testing considerations for Ex “nA” asynchronous machines ... 85
Annex B (informative) United States major national differences ... 87

Figure 1 – Examples for determining clearances and creepage distances ... 35

Table 1 – Relationship of this part to ANSI/ISA-~~IEC~~ 60079-0 ... 17
Table 2 – Minimum creepage distances, clearances and separations ... 29
Table 3 – Tracking resistance of insulating materials ... 31
Table 4 – Separation in compound-filled cable sealing boxes ... 31
Table 5 – Assumed voltage of neutral points ... 41
Table 6 – Potential air gap sparking risk assessment for cage rotor ignition risk factors ... 43
Table 7 – Minimum distance between lamp and protective cover ... 48
Table 8 – Creepage distances and clearances at peak values of pulse voltages greater than 1,5 kV ... 51
Table 9 – Types and use of cells and batteries ... 55
Table 10 – Minimum creepage distances, clearances and separations for low power equipment ... 61
Table 11 – Insertion torque ... 74
Table 12 – Minimum removal torque ... 74
Table 13 – Explosion test mixtures ... 79
Table 14 – Text of warning markings ... 83

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

This page intentionally left blank.

Documents
Document Sharing Hub

Copyright International Society of Automation

Full document details: ANSI ISA 60079-15-2012

EXPLOSIVE ATMOSPHERES –

Part 15: Equipment protection by type of protection "n"

1 Scope

This standard ~~part of IEC 60079~~ specifies requirements for the construction, testing and marking for Group II electrical equipment with type of protection, "n" intended for use in explosive gas atmospheres. This standard applies to electrical equipment where the rated voltage does not exceed 15 kV r.m.s. a.c. or d.c.

This standard ~~part of IEC 60079~~ is applicable to non-sparking electrical equipment and also to electrical equipment 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 ANSI/ISA-~~IEC~~ 60079-0.

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

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

Clause of ANSI/ISA-~~IEC~~ 60079-0			ANSI/ISA-~~IEC~~ 60079-0 clause application to ANSI/ISA-~~IEC~~ 60079-15		
Ed. 5.0 (2009 ~~2007~~) (informative)	**Ed. 6.0[1] (future edition)** (informative)	**Clause / Subclause title** (normative)	**Protected sparking nC**	**Non sparking nA**	**Restricted breathing nR**
4	4	Equipment grouping	Applies	Applies	Applies
~~4.1~~	4.1	Group I	Excluded	Excluded	Excluded
4.2	4.2	Group II	Applies	Applies	Applies
4.3	4.3	Group III	Excluded	Excluded	Excluded
4.4	4.4	Equipment for a particular explosive atmosphere	Applies	Applies	Applies
5.1	5.1	Environmental influences	Applies	Applies	Applies
5.1.1	5.1.1	Ambient temperature	Applies	Applies	Applies
5.1.2	5.1.2	External source of heating or cooling	Applies	Applies	Applies
5.2	5.2	Service temperature	Applies	Applies	Applies

[1] Under consideration. ISA-60079-0 Ed 6 is under preparation. Changes to the final version may have an effect on the deletions shown.

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

Clause of ANSI/ISA-~~IEC~~ 60079-0			ANSI/ISA-~~IEC~~ 60079-0 clause application to ANSI/ISA-~~IEC~~ 60079-15		
Ed. 5.0 (2009 ~~2007~~) (informative)	**Ed. 6.0[1] (future edition)** (informative)	**Clause / Subclause title** (normative)	**Protected sparking nC**	**Non sparking nA**	**Restricted breathing nR**
5.3.1	5.3.1	Determination of maximum surface temperature	Applies	Applies	Applies
~~5.3.2.1~~	5.3.2.1	Group I electrical equipment	Excluded	Excluded	Excluded
5.3.2.2	5.3.2.2	Group II electrical equipment	Applies	Applies	Applies
5.3.2.3	5.3.2.3	Group III electrical equipment	Excluded	Excluded	Excluded
5.3.3	5.3.3	Small component temperature for Group I and Group II electrical equipment	Applies	Applies	Excluded
6.1	6.1	General	Applies	Applies	Applies
6.2	6.2	Mechanical strength	Applies	Applies	Applies
6.3	6.3	Opening times	Excluded	Excluded	Applies
6.4	6.4	Circulating currents	Applies	Applies	Applies
6.5	6.5	Gasket retention	Applies	Applies	Applies
6.6	6.6	Electromagnetic and ultrasonic radiating equipment	Applies	Applies	Applies
7.1.1	7.1.1	Applicability	Applies	Applies	Applies
7.1.2	7.1.2	Specification of materials	Applies	Applies	Applies
7.1.3	7.1.2.2	Plastic materials	Applies	Applies	Applies
7.1.4	7.1.2.3	Elastomeric materials	Applies	Applies	Applies
7.2	7.2	Thermal endurance	Applies	Applies	Applies
7.3	7.3	Resistance to light	Applies	Applies	Applies
7.4	7.4	Electrostatic charges on external non-metallic materials	Applies	Applies	Applies
7.5	9.1	Threaded holes	Applies	Applies	Applies
---	7.5	Accessible metal parts	Excluded	Excluded	Excluded
~~8.1.1~~	8.2	Group I	Excluded	Excluded	Excluded
8.1.2	8.3	Group II	Applies	Applies	Applies
8.1.3	8.4	Group III	Excluded	Excluded	Excluded
8.2	9.1	Threaded holes	Applies	Applies	Applies
9.1	9.1	General	Applies	Applies	Applies
9.2	9.2	Special fasteners	Excluded	Excluded	Excluded
9.3	9.3	Holes for special fasteners	Excluded	Excluded	Excluded

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

Clause of ANSI/ISA-~~IEC~~ 60079-0			ANSI/ISA-~~IEC~~ 60079-0 clause application to ANSI/ISA-~~IEC~~ 60079-15		
Ed. 5.0 (2009 ~~2007~~) (informative)	**Ed. 6.0[1] (future edition)** (informative)	**Clause / Subclause title** (normative)	**Protected sparking nC**	**Non sparking nA**	**Restricted breathing nR**
10	10	Interlocking devices	Excluded	Excluded	Excluded
11	11	Bushings	Applies	Applies	Applies
12	12	Materials used for cementing	Modified	Modified	Modified
13	13	Ex components	Applies	Applies	Applies
14	14	Connection facilities and termination compartments	Modified	Modified	Modified
15	15	Connection facilities for earthing and bonding conductors	Applies	Applies	Applies
16	16	Entries into enclosures	Applies	Applies	Applies
17	17	Supplementary requirements for rotating electrical machines	Excluded	Modified	Excluded
18	18	Supplementary requirements for switchgear	Applies	Applies	Applies
19	19	Supplementary requirements for fuses	Modified	Modified	Modified
20	20	Supplementary requirements for plugs and sockets	Modified	Modified	Modified
21	21	Supplementary requirements for luminaires	Modified	Modified	Modified
22	22	Supplementary requirements for caplights and handlights	Applies	Applies	Applies
23	23	Equipment incorporating cells and batteries	Modified	Modified	Modified
24	24	Documentation	Applies	Applies	Applies
25	25	Compliance of prototype or sample with documents	Applies	Applies	Applies
26.1	26.1	General	Applies	Applies	Applies
26.2	26.2	Test configuration	Applies	Applies	Applies
26.3	26.3	Tests in explosive test mixtures	Applies	Applies	Applies
26.4	26.4	Tests of enclosures	Applies	Applies	Applies
26.4.1.1	26.4.1.1	Metallic enclosures, metallic parts of enclosures and glass parts of enclosures	Applies	Applies	Applies

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

Clause of ANSI/ISA-~~IEC~~ 60079-0			ANSI/ISA-~~IEC~~ 60079-0 clause application to ANSI/ISA-~~IEC~~ 60079-15		
Ed. 5.0 (2009 ~~2007~~) (informative)	**Ed. 6.0[1] (future edition)** (informative)	**Clause / Subclause title** (normative)	**Protected sparking nC**	**Non sparking nA**	**Restricted breathing nR**
~~26.4.1.2.1~~	26.4.1.2.1	Group I electrical equipment	Excluded	Excluded	Excluded
26.4.1.2.2	26.4.1.2.2	Group II and Group III electrical equipment	Applies	Applies	Applies
26.4.2	26.4.2	Resistance to impact	Applies	Applies	Applies
26.4.3	26.4.3	Drop test	Applies	Applies	Applies
26.4.4	26.4.4	Acceptance criteria	Applies	Applies	Applies
26.4.5	26.4.5	Degree of protection by enclosure	Applies	Applies	Applies
26.5	26.5	Thermal tests	Applies	Applies	Applies
26.6	26.6	Torque test for bushings	Applies	Applies	Applies
26.7	26.7	Non-metallic enclosures or non-metallic parts of enclosures	Modified	Modified	Modified
26.8	26.8	Thermal endurance to heat	Modified	Modified	Modified
26.9	26.9	Thermal endurance to cold	Applies	Applies	Applies
26.10	26.10	Resistance to light	Applies	Applies	Applies
~~26.11~~	26.11	Resistance to chemical agents for Group I electrical equipment	Excluded	Excluded	Excluded
~~26.12~~	~~26.12~~	~~Earth continuity~~	~~Applies~~	~~Applies~~	~~Applies~~
26.13	26.13	Surface resistance test of parts of enclosures of non-metallic materials	Applies	Applies	Applies
26.14	-	Charging tests	Applies	Applies	Applies
26.15	26.14	Measurement of capacitance	Applies	Applies	Applies
---	26~~.~~.15	Verification of ratings of ventilating fans	Excluded	Excluded	Excluded
---	26.16	Alternative qualification of elastomeric sealing O-rings	Applies	Applies	Applies
27	27	Routine tests	Applies	Applies	Applies
28	28	Manufacturers responsibility	Applies	Applies	Applies
29	29	Marking	Applies	Applies	Applies
30	30	Instructions	Applies	Applies	Applies
Annex A	Annex A	Supplementary requirements for Ex cable glands	Applies	Applies	Applies

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

Clause of ANSI/ISA-~~IEC~~ 60079-0			ANSI/ISA-~~IEC~~ 60079-0 clause application to ANSI/ISA-~~IEC~~ 60079-15		
Ed. 5.0 (2009 ~~2007~~) (informative)	**Ed. 6.0[1] (future edition)** (informative)	**Clause / Subclause title** (normative)	**Protected sparking nC**	**Non sparking nA**	**Restricted breathing nR**
Annex B	Annex B	Requirements for Ex components	Applies	Applies	Applies
Annex C	Annex C	Example of rig for resistance to impact test	Applies	Applies	Applies
Annex D	Annex D	Introduction to an alternative risk assessment method encompassing "equipment protection levels" fro Ex equipment	Applies	Applies	Applies
---	Annex E	Temperature rise testing of electric machines	Applies	Applies	Applies
---	Annex F	Guideline flowchart for tests of non-metallic enclosures or non-metallic parts of enclosures	Applies	Applies	Applies
---	Annex G	Common standards – safety requirements for electrical equipment	Applies	Applies	Applies
---	Annex H	United States Major National Differences	Applies	Applies	Applies
---	Annex I	Equipment grounding	Applies	Applies	Applies
Applies : this requirement of ANSI/ISA-~~IEC~~ 60079-0 is applied without change. Excluded : this requirement of ANSI/ISA-~~IEC~~ 60079-0 does not apply. Modified : this requirement of ANSI/ISA-~~IEC~~ 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 ANSI/ISA-~~IEC~~ 60079-0 are identified by the clause title which is normative. This document was written against the specific requirements of ANSI/ISA-~~IEC~~ 60079-0 (ed. 5.0). The clause numbers for the previous edition are shown for information only. This is to enable the General Requirements ANSI/ISA-~~IEC~~ 60079-0 (ed. 5.0) to be used where necessary with this part of ANSI/ISA-~~IEC~~ 60079. Where there were no requirements, indicated by "NR" or there is a conflict between requirements, the later edition requirements take precedence.

NOTE 2 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 3 Compliance with this standard does not imply any removal of, or lowering of the requirements of any other standard with which the electrical equipment complies.

NOTE 4 This part of ANSI/ISA-~~IEC~~ 60079 supplements, and may enhance, the requirements for equipment 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 5 Type of protection "n" provides Equipment Protection Level (EPL) Gc. For further information, see ANSI/ISA-~~IEC~~ 60079-0.

Documents
Document Sharing Hub

Copyright International Society of Automation

Full document details: ANSI ISA 60079-15-2012

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-486B, *Wire Connectors*

ANSI/UL 486E, Standard for Safety Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

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

ANSI/UL 1598, Standard for Safety Luminaires

ANSI/UL 60947-7-1, Standard for Safety for Low-Voltage Switchgear and Controlgear Part 7-1: Ancillary Equipment Terminal Blocks for Copper Conductors

ANSI/UL 60947-7-2, Standard for Safety Low-Voltage Switchgear and Controlgear Part 7-2: Ancillary Equipment Protective Conductor Terminal Blocks for Copper Conductors

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

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

IEC/TS 60034-25, *Rotating electrical machines – Part 25: Guidance for the design and performance of a.c. 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 60061-1, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 1: Lamp caps*

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

~~IEC 60079-0:2007, *Explosive atmospheres – Part 0: Equipment – General requirements*~~

ANSI/ISA-60079-0 (12.00.01), *Explosive atmospheres – Part 0: Equipment – General Requirements*

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

ANSI/ISA-60079-1 (12.22.01), *Explosive Atmospheres - Part 1: Equipment Protection by Flameproof Enclosures "d"*

~~IEC 60079-11, *Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"*~~

ANSI/ISA-60079-11 (12.02.01), *Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"*

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

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 60228, *Conductors of insulated cables*

IEC 60238, *Edison screw lampholders*

IEC 60269-3, *Low-voltage fuses – Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications) – Examples of standardized systems of fuses A to F*

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

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

IEC 60598 (all parts), *Luminaires*

IEC 60598-1:2008, *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*

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

IEC 60947-7-1, *Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors*

IEC 60947-7-2, *Low-voltage switchgear and controlgear – Part 7-2: Ancillary equipment – Protective conductor terminal blocks for copper conductors*

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

IEC 60999-1, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1:General requirements and particular requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included)*

IEC 60999-2, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 2:Particular requirements for clamping units for conductors above 35 mm2 up to 300 mm2 (included)*

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

IEC 61184, *Bayonet lampholders*

IEC 61195, *Double-capped fluorescent lamps – Safety specifications*

IEC 61347-1:2007, *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)*

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

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*

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)*

UL 2237, *Multi-Point Interconnection Power Cable Assemblies for Industrial Machinery*

UL 2238, *Cable Assemblies and Fittings for Industrial Control and Signal Distribution*

3 Terms and definitions

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

3.1
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

3.2
clearance
shortest distance in air between two conductive parts

3.3
creepage distance
shortest distance along the surface of a solid insulating material in contact with air between two conductive parts

3.4
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]

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

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

3.6
sealing device
device employing a method other than encapsulation to prevent the flow of a gas or a liquid between apparatus and a conduit by providing sealing facilities

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

NOTE 2 An example of a specified regular expected occurrence is a luminaire with failed lamp.

3.7.1
non-sparking equipment ~~device~~ "nA"
equipment or component ~~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.

3.7.2
equipment ~~devices~~ and components "nC"

3.7.2.1
enclosed-break equipment ~~device~~ "nC"
equipment ~~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

NOTE The principle difference between enclosed break equipment ~~device~~ "nC" and flameproof "d" are that the dimensions are not controlled and that safety factors have not been added.

3.7.2.2
hermetically-sealed component ~~device~~ "nC"
component ~~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

3.7.2.3
non-incendive component "nC"
components 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 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.

3.7.2.4
sealed component ~~device~~ "nC"
component ~~device~~ which is so constructed that it cannot be opened during normal service and is sealed effectively to prevent entry of an external atmosphere

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

3.7.3
restricted-breathing enclosure "nR"
enclosure that is designed to restrict the entry of gases, vapours and mists

3.8
test port
facility to test the integrity of restricted breathing equipment in the field after installation, during initial inspection and during maintenance

4 General

4.1 Equipment grouping and temperature classification

Equipment grouping and temperature classification shall be in accordance with the equipment grouping and temperature clauses of ANSI/ISA-~~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 16 to 20;

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 16 to 20 as appropriate, or is otherwise shown to be safe as specified in 5.1.

Manually operated arcing or sparking components 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 ANSI/ISA-~~IEC~~ 60079-0), may be evaluated as non-sparking (nA) components. These components shall be identified in the documentation prepared in accordance with the documentation requirements of ANSI/ISA-~~IEC~~ 60079-0.

5 Temperatures

5.1 Maximum surface temperature

The maximum surface temperature shall be determined in accordance with the determination of maximum temperature requirements of ANSI/ISA-~~IEC~~ 60079-0. The surface to be considered shall be:

- for nR equipment and nC equipment: the external surface of the equipment;
- for type nA equipment: the surface of any part of the electrical equipment, including the surface of internal parts to which the explosive gas atmosphere might have access

NOTE This may be the outside surface of "nC" components located within "nA" equipment.

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

5.2 Small components

For evaluation of small components, the small component temperature requirements of ANSI/ISA-~~IEC~~ 60079-0 applies. Temperature relaxations for thin wires and printed circuit tracks contained in ANSI/ISA-~~IEC~~ 60079-11 may also be used in application of this standard.

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 ANSI/ISA-~~IEC~~ 60079-0 for the method(s) of protection used.

6.2 Opening times

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

6.3 Minimum degree of protection

6.3.1 General

Unless specified elsewhere in this standard, the enclosure of the equipment, when tested in accordance with ANSI/ISA-~~IEC~~ 60079-0 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 25) shall explain why and shall prescribe any special installation requirements which may be necessary and the equipment shall be marked ~~with the symbol "X"~~ to indicate this specific ~~special~~ condition of use (see the marking requirements of ANSI/ISA-~~IEC~~ 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 equipment 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 equipment is marked ~~with the symbol "X"~~ to indicate this specific condition of use (see the marking requirements of ANSI/ISA-~~IEC~~ 60079-0).

For protected equipment, the degree of protection shall be marked according to Clause 24.

NOTE 1 For requirements for rotating electrical machines, see Clause 8.

NOTE 2 For requirements for non-sparking low power equipment, see Clause 13.

6.3.2 Degree of protection provided by installation

Where the enclosure is completed by the installation of the equipment and the equipment is marked to indicate this specific condition of use (see the marking requirements of ANSI/ISA-60079-0) ~~the marking shall include the symbol "X"~~ and the manufacturer shall provide relevant information in the documentation in accordance with Clause 25.

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012

6.4 Clearances, creepage distances and separations

6.4.1 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 8.6;
– luminaires complying with 11.2.5;
– with regard to sealing by conformal coating, encapsulated or solid insulation separations only, equipment subject to the routine electric strength test of 6.5.2;
  – instruments and low power equipment complying with Clause 13.

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.

6.4.2 Determination of working voltage

Clearances and creepage distances shall be determined as a function of the working voltage specified by the manufacturer of the equipment. Where the equipment 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.

6.4.3 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 need only one coat, for example dip coating, brushing, vacuum impregnating, but the intention is to achieve an effective, lasting, unbroken seal. A solder mask alone is not considered as a conformal coating, but can be accepted as one of the two coats when an additional coat is applied, provided the solder mask is not damaged during soldering.

Where bare conductors emerge from the coating, the requirements given in Table 2 shall apply to the conformal coating.

6.4.4 Comparative tracking index (CTI)

The required values of creepage distance are dependent on the working voltage, the resistance to tracking of the electrical insulating material and its surface profile.

Table 3 gives the grouping of electrical insulating materials according to the CTI determined in accordance with IEC 60112 or ANSI/UL 746A. The material groups are identical with those given in IEC 60664-1. Inorganic insulating materials, for example glass and ceramics, do not track and need not therefore be subjected to the determination of the CTI. They are conventionally classified in material group I.

NOTE Transient overvoltages are ignored as they will not normally influence tracking phenomena. However, temporary and functional overvoltages may have to be considered depending upon the duration and frequency of occurrence. See 11.2.5 and Table 8 for pulse voltages in luminaire circuits or IEC 60664-1 for additional information.

Documents
Document Sharing Hub
Copyright International Society of Automation
Full document details: ANSI ISA 60079-15-2012