

**AMERICAN NATIONAL STANDARD**

**ANSI/ISA-60079-7 (12.16.01)-2008**  
**Supercedes ANSI/ISA-60079-7 (12.16.01)-2002**

**Explosive Atmospheres - Part 7:  
Equipment protection by increased safety "e"**

**Approved 15 October 2008**

### **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: 978-1-934394-82-3**

**Copyright © 2008**

**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.

---

**ISBN**

**Copyright © 2008 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-60079-7 and ANSI/UL 60079-7 as an American National Standard occurred on 15 October 2008.

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>.

**ISA**  
**ANSI/ISA-60079-7**  
*Fourth Edition*

**Underwriters Laboratories Inc.**  
**ANSI/UL 60079-7**  
*Fourth Edition*



**Explosive Atmospheres - Part 7:  
Equipment protection by increased safety "e"**

This page intentionally left blank.

## General Notes

This is the common ISA and UL standard for Explosive Atmospheres - Part 7: Equipment protection by increased safety "e". It is the fourth edition of ANSI/ISA-60079-7 and the fourth edition of ANSI/UL 60079-7. The document is a modification of the IEC document and includes U.S. deviations encompassing both additions and deletions of information.

ANSI/ISA-60079-7 and ANSI/UL 60079-7 contain identical requirements, and identical publication dates. The presentation and format of the standards material may differ between the two published standards.

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

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

### Level of harmonization

This standard adopts the IEC text with deviations.

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

### Interpretations

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

### UL Effective Date

The requirements in this standard are effective 15 October 2011.

This page intentionally left blank.

## Preface

This ISA standard is based on IEC Publication 60079-7. It is the intention of the ISA12 Committee to develop an ANSI Standard that is harmonized with IEC 60079-7 to the fullest extent possible.

This preface, as well as all footnotes and annexes, is included for information purposes and is not part of ANSI/ISA-60079-7 (12.16.01)-2008.

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 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 endeavor to introduce SI-acceptable metric units in all new and revised standards, recommended practices, and technical reports to the greatest extent possible. *Standard for Use of the International System of Units (SI): The Modern Metric System*, published by the American Society for Testing & Materials as IEEE/ASTM SI 10-97, and future revisions, will be the reference guide for definitions, symbols, abbreviations, and conversion factors.

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 ADHERES TO THE POLICY OF THE AMERICAN NATIONAL STANDARDS INSTITUTE WITH REGARD TO PATENTS. IF ISA IS INFORMED OF AN EXISTING PATENT THAT IS REQUIRED FOR USE OF THE STANDARD, IT WILL REQUIRE THE OWNER OF THE PATENT TO EITHER GRANT A ROYALTY-FREE LICENSE FOR USE OF THE PATENT BY USERS COMPLYING WITH THE STANDARD OR A LICENSE ON REASONABLE TERMS AND CONDITIONS THAT ARE FREE FROM UNFAIR DISCRIMINATION.**

**EVEN IF ISA IS UNAWARE OF ANY PATENT COVERING THIS STANDARD, THE USER IS CAUTIONED THAT IMPLEMENTATION OF THE STANDARD MAY REQUIRE USE OF TECHNIQUES, PROCESSES, OR MATERIALS COVERED BY PATENT RIGHTS. ISA TAKES NO POSITION ON THE EXISTENCE OR VALIDITY OF ANY PATENT RIGHTS THAT MAY BE INVOLVED IN IMPLEMENTING THE STANDARD. ISA IS NOT RESPONSIBLE FOR IDENTIFYING ALL PATENTS THAT MAY REQUIRE A LICENSE BEFORE IMPLEMENTATION OF THE STANDARD OR FOR INVESTIGATING THE VALIDITY OR SCOPE OF ANY PATENTS**

**BROUGHT TO ITS ATTENTION. THE USER SHOULD CAREFULLY INVESTIGATE RELEVANT PATENTS BEFORE USING THE STANDARD FOR THE USER'S INTENDED APPLICATION.**

**HOWEVER, ISA ASKS THAT ANYONE REVIEWING THIS STANDARD WHO IS AWARE OF ANY PATENTS THAT MAY IMPACT IMPLEMENTATION OF THE STANDARD NOTIFY THE ISA STANDARDS AND PRACTICES DEPARTMENT OF THE PATENT AND ITS OWNER. ADDITIONALLY, THE USE OF THIS STANDARD MAY INVOLVE HAZARDOUS MATERIALS, OPERATIONS OR EQUIPMENT. THE STANDARD CANNOT ANTICIPATE ALL POSSIBLE APPLICATIONS OR ADDRESS ALL POSSIBLE SAFETY ISSUES ASSOCIATED WITH USE IN HAZARDOUS CONDITIONS. THE USER OF THIS STANDARD 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 STANDARD.**

The following people served as members of the ISA Subcommittee ISA12.16:

<b>NAME</b>	<b>COMPANY</b>
K. Boegli, Chair	Phoenix Contact Inc.
M. Coppler, Managing Director	Ametek Inc.
S. Arnold	Ametek Drexelbrook
A. Ballard	Crouse Hinds Div. of Cooper Ind.
W. Berner	R Stahl Inc.
E. Briesch	Underwriters Laboratories Inc.
W. Brown	Maverick Engineering
C. Casso	Nabors Industries
S. Czaniecki	Intrinsic Safety Concepts Inc.
W. Fiske	Intertek
P. Hamer	Chevron Texaco Corp.
P. House	Thermon Industries
J. Jonscher	Adalet PLM
G. Kozinski	GE Infrastructure Sensing
J. Kuczka	Killark
W. Lawrence	FM Approvals LLC
E. Massey	Baldor Electric
J. Miller	Detector Electronics Corp.
C. Sandberg	Shell Oil
T. Schnaare	Rosemount Inc.
R. Seitz	Artech Engineering
K. Thompson	MSA Company

The following people served as members of ISA Committee ISA12:

<b>NAME</b>	<b>COMPANY</b>
T. Schnaare, Chair	Rosemount Inc.
W. Lawrence, Vice Chair	FM Approvals
M. Coppler, Managing Director	Ametek Inc.
N. Abbatiello	Optimization Technology
D. Ankele	Underwriters Laboratories Inc.
A. Ballard	Crouse Hinds Division of Cooper Industries



D. Bishop  
H. Bockle  
K. Boegli  
D. Burns  
R. Buschart  
S. Leverington  
C. Casso  
J. Cospolich  
S. Czaniecki  
J. Dolphin  
T. Dubaniewicz  
U. Dugar  
A. Engler  
W. Fiske  
G. Garcha  
D. Hohenstein  
D. Jagger  
P. Jonscher  
F. Kent  
P. Kovscek  
J. Kuczka  
B. Larson  
E. Massey  
J. Miller  
A. Mobley  
S. Nguyen  
A. Page  
P. Schimmoeller  
R. Seitz  
D. Wechsler  
R. Wigg

David N Bishop Consultant  
R. Stahl Inc.  
Phoenix Contact Inc.  
Shell Exploration & Production Company  
Cable Tray Institute  
Bently Nevada LLC  
Nabors Industries  
Waldemar S Nelson & Company Inc.  
Intrinsic Safety Concepts Inc.  
PSC Solutions  
NIOSH  
Mobil Chemical Company  
Det Norske Veritas DNV  
Intertek Testing Services  
GE Energy  
Pepperl + Fuchs Inc.  
Bifold-Fluid Power  
Adalet PLM  
Honeywell Inc.  
Industrial Scientific Corporation  
Killark  
Turck Inc.  
Rockwell Automation  
Detector Electronics Corporation  
3M Company  
Siemens Milltronics Ltd.  
MSHA Approval & Certification Center  
CSA International  
Artech Engineering  
Dow Chemical Company  
E-x Solutions International Pty. Ltd.

This standard was approved for publication by the ISA Standards and Practices Board on 12 August 2008.

**NAME**

**COMPANY**

T. McAviney, Vice President  
M. Coppler  
E. Cosman  
B. Dumortier  
D. Dunn  
J. Gilsinn  
W. Holland  
E. Icyan  
J. Jamison  
K. Lindner  
V. Maggioli  
A. McCauley  
G. McFarland  
R. Reimer  
N. Sands  
H. Sasajima  
T. Schnaare  
J. Tatera

Jacobs Engineering Group  
Ametek Inc.  
The Dow Chemical Company  
Schneider Electric  
Aramco Services Company  
NIST/MEL  
Consultant  
ACES Inc.  
Jamison & Associated Ltd.  
Endress+Hauser Process Solutions AG  
Feltronics Corporation  
Chagrin Valley Controls Inc.  
Emerson Process Mgmt Power & Water Solutions  
Rockwell Automation  
E I du Pont  
Yamatake Corporation  
Rosemount Inc.  
Tatera & Associates Inc.

I. Verhappen  
R. Webb  
W. Weidman  
J. Weiss  
M. Widmeyer  
M. Zielinski

MTL Instrument Group  
Robert C Webb PE  
Worley Parsons  
Applied Control Solutions LLC  
Consultant  
Emerson Process Management

## National Differences

### GENERAL

In the UL publication of this standard, National Differences from the text of International Electrotechnical Commission (IEC) Publication 60079-7, Explosive atmospheres - Part 7: Equipment protection by increased safety "e", copyright 2006, 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.

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

**D2** – These are National Differences based on **safety practices**. These are differences for IEC requirements that may be acceptable, but adopting the IEC requirements would require considerable retesting or redesign on the manufacturer's part.

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

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

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

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

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

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

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

This page intentionally left blank.

## CONTENTS

1	Scope .....	19
2	<u>Normative References</u> .....	19
3	Terms and Definitions .....	22
4	Constructional requirements for all electrical apparatus.....	24
4.1	General.....	24
4.2	Electrical connections.....	25
4.3	Clearances.....	28
4.4	Creepage distances .....	33
4.5	Solid electrical insulating materials .....	34
4.6	Windings.....	34
4.7	Temperature limitations .....	35
4.8	Wiring internal to apparatus.....	37
4.9	Degrees of protection provided by enclosures .....	37
4.10	<del>Fasteners</del> .....	37
5	Supplementary requirements for specific electrical apparatus.....	38
5.1	General.....	38
5.2	Rotating electrical machines .....	38
5.3	Luminaires .....	43
5.4	Cap lights and handlights .....	48
5.5	Measuring instruments and instrument transformers.....	48
5.6	Transformers other than instrument transformers .....	49
5.7	Batteries .....	49
5.8	General purpose connection and junction boxes .....	55
5.9	Resistance heaters (other than trace heaters).....	55
5.10	Other electrical apparatus .....	57
6	Type verifications and type tests.....	57
6.1	Dielectric strength .....	57
6.2	Rotating electrical machines .....	58
6.3	Luminaires designed for mains supply .....	60
6.4	Measuring instruments and instrument transformers.....	62
6.5	Transformers other than instrument transformers .....	63
6.6	Secondary batteries .....	63
6.7	General purpose connection and junction boxes .....	66
6.8	Resistance heating devices and resistance heating units .....	66
6.9	Terminal insulating material tests .....	67
6.10	<u>Terminal dielectric tests</u> .....	67
7	Routine verifications and routine tests .....	69
7.1	Dielectric tests .....	69
7.2	Dielectric tests for batteries .....	69
7.3	Inter-turn overvoltage tests.....	69
8	Ex component certificates.....	69

8.1	General.....	69
8.2	Terminals.....	69
9	Marking and instructions.....	70
9.1	General marking.....	70
9.2	Instructions for use.....	71
9.3	Warning markings .....	72
Annex A	(normative) Cage motors – Methods of test and of calculation.....	73
Annex B	(normative) Type tests for specific forms of resistance heating devices or resistance heating units (other than trace heater).....	75
Annex C	(informative) Cage motors – Thermal protection in service.....	77
Annex D	(informative) Resistance heating devices and units – Additional electrical protection.....	79
Annex E	(informative) Combinations of terminals and conductors for general purpose connection and junction boxes.....	81
Annex F	(informative) Dimensions of copper conductors.....	83
Annex G	(informative) Potential stator winding discharge risk assessment – Ignition risk factors .....	85
Annex H	(normative) Test procedure for T8, T10 and T12 lamps.....	87
Annex I	(informative) Introduction of an alternative risk assessment method encompassing ‘Equipment Protection Levels’ for Ex Equipment.....	93
Annex J	(informative) Bibliography.....	99
Annex K	(informative) United States major deviations.....	101
Figure 1	– Determination of creepage distances and clearances.....	33
Figure 2	– Minimum values of the time $t_E$ of motors in relation to the starting current ratio $I_A/I_N$ .....	41
Figure 3	– Arrangement for the luminaire vibration test.....	62
Figure A.1	– Diagram illustrating the determination of time $t_E$ .....	74
Figure E.1	– Example of defined terminal/conductor arrangement table .....	82
Figure H.1	– Asymmetric pulse test circuit.....	88
Figure H.2	– Asymmetric power detection circuit .....	90
Figure H.3	– Flow Chart – Asymmetric power test .....	91
Table 1	– Creepage distances and clearances .....	29
Table 2	– Tracking resistance of insulating materials.....	33
Table 3	– Limiting temperatures for insulated windings.....	36
Table 4	– Potential air gap sparking risk assessment for cage rotor ignition risk factors .....	40
Table 5	– Minimum distance between lamp and protective cover .....	44
Table 6	– Creepage distances and clearances for screw lamp caps .....	45
Table 7	– Resistance to the effect of short-circuit currents.....	48
Table 8	– Explosion test mixtures .....	59
Table 9	– Insertion torque and minimum removal torque.....	60

Table 10 – Value for pull-out tests .....	68
Table 11 – Creepage distances and clearances for screw lamp caps .....	72
Table 12 – Text of warning markings.....	72
Table F.1 – Standard cross-sections of copper conductors .....	83
Table G.1 – Potential stator winding discharge risk assessment – Ignition risk factors.....	85
Table I.1 – Traditional relationship of EPLs to Zones (no additional risk assessment).....	95
Table I.2 – Description of risk of ignition protection provided .....	96

This page intentionally left blank.



## Foreword

The entire text of IEC 60079-7:2006 is included in this document. U.S. National Deviations are shown by ~~strikeout~~ through deleted text and underlining of added text. There are ten annexes in this standard. Annexes A and B are normative and form part of the requirements of this standard. Annexes C, D, E, F, G, H, I, J, and K are informative and are not considered part of this standard.

This page intentionally left blank.

## 1 Scope

This ~~part of IEC 60079 standard~~ specifies the requirements for the design, construction, testing and marking of electrical apparatus with type of protection increased safety "e" intended for use in Class I, Zone 1 hazardous (classified) locations explosive gas atmospheres. This standard applies to electrical apparatus where the rated voltage does not exceed 11 kV r.m.s. a.c. or d.c. Additional measures are applied to ensure that the apparatus does not produce arcs, sparks, or excessive temperatures in normal operation or under specified abnormal conditions.

This standard supplements and modifies the general requirements of ANSI/ISA-60079-0 IEC 60079-0. Where a requirement of this standard conflicts with a requirement of ANSI/ISA-60079-0 IEC 60079-0, the requirement of this standard takes precedence.

NOTE Increased safety "e" can provide Equipment Protection Levels (EPL) Mb or Gb. For further information, see Annex I.

## 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.

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

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

IEC 60044-6, *Instrument transformers – Part 6: Requirements for protective current transformers for transient performance*

IEC 60050(426), *International Electrotechnical Vocabulary (IEV) – Chapter 426: Electrical apparatus for explosive atmospheres*

IEC 60061-1, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 1: Lamp caps*

IEC 60061-2, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 2: Lampholders*

IEC 60064, *Tungsten filament lamps for domestic and similar general lighting purposes – Performance requirements*

IEC 60068-2-6, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

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

IEC 60068-2-42, *Environmental testing – Part 2-42: Tests – Test Kc: Sulphur dioxide test for contacts and connections*

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