

**AMERICAN NATIONAL STANDARD**

**ANSI/ISA-61241-0 (12.10.02)-2006 (R2015)**

**Electrical Apparatus for Use in Zone 20, Zone 21  
and Zone 22 Hazardous (Classified) Locations –  
General Requirements**

**Approved 29 September 2015**

ANSI/ISA-61241-0 (12.10.02)-2006 (R2015), Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations – General Requirements

ISBN: 978-1-941546-37-6

Copyright © 2015 by IEC and ISA. Not for resale. Printed in the United States of America. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic mechanical, photocopying, recording, or otherwise), without the prior written permission of the Publisher.

ISA

67 Alexander Drive

P.O. Box 12277

Research Triangle Park, North Carolina 27709

## Preface

This preface, as well as all footnotes and annexes, is included for information purposes and is not part of ANSI/ISA-61241-0 (12.10.02)-2015.

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 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](http://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 ISA12.10:

<b>NAME</b>	<b>COMPANY</b>
A. Engler, Chair	Det Norske Veritas DNV
M. Coppler,* Managing Director	Ametek Inc.
S. Arnold*	Ametek Drexelbrook
D. Bishop	David N Bishop Consultant
E. Briesch	Underwriters Laboratories Inc.
R. Buschart	Cable Tray Institute
R. Fontaine	FM Approvals
J. Kuczka	Killark
E. Massey	Rockwell Automation
A. Page	MSHA Approval & Certification Center
P. Schimmoeller	CSA International
T. Schnaare	Rosemount Inc.
D. Wechsler	Dow Chemical Company
R. Wigg	E-x Solutions International Pty. Ltd.

\* One vote per company.

The following people served as members of 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	David N Bishop Consultant
H. Bockle	R. Stahl Inc.
K. Boegli	Phoenix Contact Inc.
D. Burns	Shell Exploration & Production Company
R. Buschart	Cable Tray Institute
R. Cardinal	Bently Nevada LLC
C. Casso	Nabors Industries
J. Cospolich	Waldemar S Nelson & Company Inc.
S. Czaniecki	Intrinsic Safety Concepts Inc.

J. Dolphin	PSC Solutions
T. Dubaniewicz	NIOSH
U. Dugar	Mobil Chemical Company
A. Engler	Det Norske Veritas DNV
W. Fiske	Intertek Testing Services
G. Garcha	GE Energy
D. Hohenstein	Pepperl + Fuchs Inc.
D. Jagger	Bifold-Fluid Power
P. Jonscher	Adalet PLM
F. Kent	Honeywell Inc.
J. Kavscek	Industrial Scientific Corporation
J. Kuczka	Killark
B. Larson	Turck Inc.
E. Massey	Rockwell Automation
A. Mobley	3M Company
S. Nguyen	Siemens Milltronics Ltd.
A. Page	MSHA Approval & Certification Center
P. Schimmoeller	CSA International
R. Seitz	Artech Engineering
D. Wechsler	Dow Chemical Company
R. Wigg	E-x Solutions International Pty. Ltd.

This standard was approved for publication by the ISA Standards and Practices Board on 18 May 2006.

**NAME**

I. Verhappen, Vice President  
F. Amir  
D. Bishop  
M. Coppler  
B. Dumortier  
W. Holland  
E. Icyan  
A. Iverson  
R. Jones  
K. Lindner  
V. Maggioli  
T. McAviney  
A. McCauley  
G. McFarland  
R. Reimer  
N. Sands  
H. Sasajima  
T. Schnaare  
J. Tatera  
R. Webb  
W. Weidman  
J. Weiss  
M. Widmeyer  
M. Zielinski

**COMPANY**

Syncrude Canada Limited  
E I Du Pont Company  
David N Bishop Consultant  
Ametek Inc.  
Schneider Electric  
Consultant  
ACES Inc.  
Ivy Optiks  
Consultant  
Endress + Hauser Process Solutions AG  
Feltronics Corporation  
Jacobs Engineering Group  
Chagrin Valley Controls Inc.  
Emerson Process Mgmt. Pwr & Water Solutions  
Rockwell Automation  
E I du Pont  
Yamatake Corporation  
Rosemount Inc.  
Tatera & Associates Inc.  
Robert C Webb PE  
Worley Parsons  
KEMA Inc.  
Stanford Linear Accelerator Center  
Emerson Process Management

The following members of ISA12 reaffirmed this standard in 2015.

<b>NAME</b>	<b>COMPANY</b>
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
K. Boegli	Consultant
D. Burns	Shell P&T – Innovation / R&D
M. Dona	Santos Ltd.
T. Dubaniewicz	NIOSH
D. El Tawy	Solar Turbines Incorporated
W. Fiske	Intertek
G. Garcha	GE Water and Power
R. Holub	The DuPont Company Inc.
P. Kavscek	Industrial Scientific Corporation
E. Leubner	Eaton's Crouse-Hinds Business
N. Ludlam	FM Approvals Ltd.
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
R. Wigg	E-x Solutions International Pty. Ltd.

This standard was reaffirmed by the Standards and Practices Board on 7 September 2015.

<b>NAME</b>	<b>COMPANY</b>
N. Sands, Vice President	DuPont
D. Bartusiak	ExxonMobil Research & Engineering
P. Brett	Honeywell Inc.
E. Cosman	OIT Concepts, LLC
D. Dunn	Phillips 66
J. Federlein	Federlein & Assoc. Inc.
B. Fitzpatrick	Wood Group Mustang
J. Gilsinn	Kenexis Consulting
J. Hauet	KB Intelligence
J. Jamison	Encana Corp.
K. P. Lindner	Endress + Hauser Process Solutions AG
V. Maggioli	Feltronics Corp.
T. McAvinew	Instrumentation and Control Engineering, LLC
V. Mezzano	Fluor Corporation
C. Monchinski	Automated Control Concepts Inc.
H. Sasajima	Azbil Corp.
T. Schnaare	Rosemount Inc.
J. Tatera	Tatera & Associates Inc.
K. Unger	Stone Technologies Inc.
I. Verhappen	Orbis Engineering Field Services
W. Weidman	WCW Consulting
J. Weiss	Applied Control Solutions LLC
M. Wilkins	Yokogawa IA Global Marketing (USMK)
D. Zetterberg	Chevron Energy Technology Co.

This page intentionally left blank.



## Contents

1	Scope .....	15
2	<del>Normative</del> References .....	16
3	<del>Terms and</del> Definitions .....	18
4	Construction .....	24
4.1	General.....	24
4.2	<del>Principles for design and testing of apparatus for use in Zone 20</del> .....	24
4.3	Opening enclosures .....	24
4.4	Environmental conditions.....	25
5	Temperatures.....	25
5.1	Maximum surface temperature.....	25
5.2	<del>Maximum surface temperature with respect to dust layers above 50 mm</del> .....	25
5.3	Ambient temperature .....	25
6	Enclosure materials.....	26
6.1	Non-metallic enclosures and non-metallic parts of enclosures .....	26
6.2	Enclosures containing light metals .....	27
7	Fasteners.....	28
7.1	Access to live parts .....	28
7.2	Compatible material .....	28
8	Interlocking devices.....	28
9	Bushings.....	28
9.1	Prevention of turning .....	28
9.2	Torque tests.....	28
10	Materials used for cementing .....	28
10.1	Documentation .....	28
10.2	Thermal stability.....	28
10.3	<del>Verification</del> .....	28
11	Ex components .....	29
11.1	General.....	29
11.2	Mounting.....	29
11.3	Internal mounting .....	29
11.4	External mounting .....	29
12	Connection facilities and terminal compartments .....	29
12.1	Attached cables .....	29
12.2	Terminal access .....	29
12.3	Creepage and clearance.....	29
13	Connection facilities for earthing or bonding conductors .....	30
13.1	Internal connection.....	30
13.2	<del>External connection</del> .....	30
13.3	<del>Facility not required</del> Apparatus not requiring earthing.....	30
13.4	<del>Effective connection</del> Size of conductor connection .....	30

13.5	Effective contact.....	31
13.6	Environmental .....	31
13.7	Use of light metal .....	31
14	<del>Cable and conduit entries</del> Entries into enclosures .....	31
14.1	<del>Intended use</del> Identification of entries .....	31
14.2	<del>Construction</del> Cable glands.....	31
14.3	<del>Integral part of the apparatus</del> .....	32
14.4	Prevention of twisting .....	32
14.5	<del>Method of attaching</del> Enclosure entry .....	32
14.6	Blanking elements .....	32
14.7	Branching point temperatures .....	32
15	Radiating equipment .....	34
15.1	<del>For lasers and other continuous wave source</del> .....	34
15.2	<del>Ultrasonic sources</del> .....	34
16	Supplementary requirements for specific electrical apparatus - Rotating electrical machines .....	35
16.1	Ventilation openings for external fans .....	35
16.2	Construction and mounting of the ventilating systems .....	35
16.3	Clearances for the ventilating system <del>for use in Zone 20 or 21</del> .....	35
16.4	Materials for external fans and fanhoods.....	35
17	Switchgear.....	36
17.1	Flammable dielectric .....	36
17.2	Interlocking .....	36
17.3	Indication of open position .....	36
17.4	Openings .....	36
18	Fuses .....	36
19	Plugs and sockets .....	37
19.1	Plugs and sockets construction.....	37
19.2	Bolted plugs and sockets.....	39
19.3	For Zone 21 and Zone 22 .....	39
19.4	Plugs remaining energised .....	39
20	Luminaires .....	39
20.1	Light transmitting covers .....	39
20.2	Guards.....	39
20.3	Mounting.....	39
20.4	Covers.....	40
20.5	<del>Parts remaining energized</del> .....	40
20.6	Types of lamps.....	40
21	<del>Caplights, caplamps and handlamps</del> <del>handlamps</del> <del>handlights</del> .....	40
21.1	Leakage.....	40
21.2	Separate enclosures .....	40
22	Apparatus incorporating cells and batteries.....	40
22.1	General.....	40

23	Verification and tests .....	43
23.1	General.....	43
23.2	Verification of documents .....	43
23.3	Compliance of prototype or sample with documents .....	43
23.4	Type tests .....	44
24	Routine verifications and tests .....	50
25	Manufacturer's responsibility .....	50
26	<del>Verifications and tests on modified or repaired electrical apparatus .....</del>	<del>51</del>
27	<del>Clamping tests of cable entries for non-armoured and braided cables.....</del>	<del>51</del>
27.1	<del>Cable entries with clamping by the sealing ring .....</del>	<del>51</del>
27.2	<del>Cable entries with clamping by filling compound.....</del>	<del>52</del>
27.3	<del>Cable entries with clamping by means of a clamping device .....</del>	<del>52</del>
27.4	<del>Tensile test .....</del>	<del>53</del>
27.5	<del>Mechanical strength .....</del>	<del>53</del>
28	<del>Clamping tests of cable entries for armoured cables .....</del>	<del>53</del>
28.1	<del>Clamping tests where the armourings are clamped by a device within the gland ...</del>	<del>53</del>
28.2	<del>Clamping tests where the armourings are not clamped by a device within the gland .....</del>	<del>54</del>
29	Marking.....	54
29.1	General.....	54
29.2	Marking of all electrical apparatus .....	54
29.3	Multiple protection techniques .....	55
29.4	Order of marking .....	55
29.5	Reduced marking .....	55
29.6	<u>External grounding or bonding terminal.....</u>	56
30	Examples of marking .....	56
30.1	Apparatus type of protection "maD" for use in Zone 20 .....	56
30.2	Apparatus type of protection "iaD" for use in Zone 20.....	56
30.3	Apparatus type of protection "pD" for use in Zone 21 .....	56
30.4	<del>Apparatus type of protection "tD", Practice A (see IEC 61241-1); temperature tested under 500 mm dust layer, for use in Zone 21 .....</del>	<del>57</del>
30.5	<del>Apparatus type of protection "tD", Practice B (see IEC 61241-1) for use in Zone 22 .....</del>	<del>57</del>
30.6	<del>Apparatus type of protection "tD", Practice A (see IEC 61241-1) for use in Zone 22 .....</del>	<del>57</del>
	Annex A (informative) – <u>Common standards – Safety requirements for electrical equipment.....</u>	59
	Annex B (informative) – <u>Equipment grounding.....</u>	61
	Annex C (informative) – <u>United States major deviations.....</u>	63
	Bibliography .....	71

This page intentionally left blank.

## Foreword

All text of IEC 61241-0:2004 (1<sup>st</sup> edition) is included. U.S. National Deviations are shown by ~~strikeout~~ through text deleted and underline under text added. There are three annexes in this standard. All are informative and are not considered part of this standard.

IEC 61241-0:2004 has been withdrawn and replaced by IEC 60079-0:2011, *Explosive atmospheres - Part 0: Equipment - General requirements*. ANSI/ISA-61241-0 (12.10.02)-2006 (R2015) is being maintained for the 2017 publication of NFPA 70: *National Electrical Code*®, in which the ISA standard is referenced.

This page intentionally left blank.

## 1 Scope

This ~~standard part of IEC 61241~~ specifies general requirements for the design, construction, testing and marking ~~of which is applicable to electrical apparatus protected by any recognized safeguard protection~~ technique for use in areas where combustible dust may be present in quantities that could lead to a fire or explosion hazard.

This standard is supplemented or modified by the following standards parts of IEC 61241 concerning specific types of protection:

- ANSI/ISA-61241-1 (12.10.03), Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations – Protection by Enclosures “tD” Part 1: Protection by enclosures ‘tD’
- ANSI/ISA-61241-2 (12.10.06), Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations – Protection by Pressurization “pD” Part 2: Protection by pressurization ‘pD’ (under consideration)
- ANSI/ISA-61241-11 (12.10.04), Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations – Protection by Intrinsic Safety “iD” Part 11: Intrinsically safe apparatus
- ANSI/ISA-61241-18 (12.10.07), Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations – Protection by Encapsulation “mD” Part 18: Protection by encapsulation ‘mD’

~~NOTE IEC 61241-14 gives guidance on the selection and installation of the apparatus. Apparatus within the scope of this standard may also be subjected to additional requirements in other standards—for example, IEC 60079-0.~~

The application of electrical apparatus in atmospheres which may contain explosive gas as well as combustible dust, whether simultaneously or separately, requires additional protective measures.

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

Where the apparatus has to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion, additional methods of protection may be necessary. The method used is not to adversely affect the integrity of the enclosure.

This standard does not apply to dusts of explosives that do not require atmospheric oxygen for combustion, or to pyrophoric substances.

This standard is not applicable to electrical apparatus intended for use in underground parts of mines as well as those parts of surface installations of such mines endangered by firedamp and/or combustible dust.

This standard does not take account of any risk due to an emission of flammable or toxic gas from the dust.

Electrical apparatus and Ex components for use in explosive dust atmospheres shall also comply with the applicable requirements for similar apparatus for use in unclassified locations.