



Standards
Certification
Education & Training
Publishing
Conferences & Exhibits

Setting the Standard for Automation™

AMERICAN NATIONAL STANDARD

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

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

**Approved 13 June 2006
Second Printing 13 February 2007**

NOTICE OF COPYRIGHT

This is a copyright document and may not be copied or distributed in any form or manner without the permission of ISA. This copy of the document was made for the sole use of the person to whom ISA provided it and is subject to the restrictions stated in ISA's license to that person.

It may not be provided to any other person in print, electronic, or any other form. Violations of ISA's copyright will be prosecuted to the fullest extent of the law and may result in substantial civil and criminal penalties.



Documents
Document Sharing Hub

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

ISBN: 978-1-55617-990-7

Copyright © 2006 by 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)-2006.

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 DOCUMENT, 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 DOCUMENT OR A LICENSE ON REASONABLE TERMS AND CONDITIONS THAT ARE FREE FROM UNFAIR DISCRIMINATION.

EVEN IF ISA IS UNAWARE OF ANY PATENT COVERING THIS DOCUMENT, THE USER IS CAUTIONED THAT IMPLEMENTATION OF THE DOCUMENT 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 DOCUMENT. ISA IS NOT RESPONSIBLE FOR IDENTIFYING ALL PATENTS THAT MAY REQUIRE A LICENSE BEFORE IMPLEMENTATION OF THE DOCUMENT OR FOR INVESTIGATING THE VALIDITY OR SCOPE OF ANY PATENTS BROUGHT TO ITS ATTENTION. THE USER SHOULD CAREFULLY INVESTIGATE RELEVANT PATENTS BEFORE USING THE DOCUMENT FOR THE USER'S INTENDED APPLICATION. HOWEVER, ISA ASKS 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 SP12.10:

NAME	COMPANY
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 ISA SP12:

NAME	COMPANY
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. Kovscek	Industrial Scientific Corporation



J. Kuczka
B. Larson
E. Massey
A. Mobley
S. Nguyen
A. Page
P. Schimmoeller
R. Seitz
D. Wechsler
R. Wigg

Killark
Turck Inc.
Rockwell Automation
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 18 May 2006.

NAME

I. Verhappen, Vice President
F. Amir
D. Bishop
M. Coppler
B. Dumortier
W. Holland
E. Iccayan
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

Synchrude 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
Yamatate Corporation
Rosemount Inc.
Tatera & Associates Inc.
Robert C Webb PE
Worley Parsons
KEMA Inc.
Stanford Linear Accelerator Center
Emerson Process Management

This page intentionally left blank.

Contents

1	Scope	13
2	~~Normative~~ References	14
3	~~Terms and~~ Definitions	16
4	Construction	22
4.1	General.....	22
4.2	~~Principles for design and testing of apparatus for use in Zone 20~~	22
4.3	Opening enclosures	22
4.4	Environmental conditions.....	23
5	Temperatures.....	23
5.1	Maximum surface temperature.....	23
5.2	~~Maximum surface temperature with respect to dust layers above 50 mm~~	23
5.3	Ambient temperature	23
6	Enclosure materials.....	24
6.1	Non-metallic enclosures and non-metallic parts of enclosures	24
6.2	Enclosures containing light metals	25
7	Fasteners.....	26
7.1	Access to live parts	26
7.2	Compatible material	26
8	Interlocking devices.....	26
9	Bushings.....	26
9.1	Prevention of turning	26
9.2	Torque tests.....	26
10	Materials used for cementing	26
10.1	Documentation	26
10.2	Thermal stability.....	26
10.3	~~Verification~~	26
11	Ex components	27
11.1	General.....	27
11.2	Mounting.....	27
11.3	Internal mounting	27
11.4	External mounting	27
12	Connection facilities and terminal compartments.....	27
12.1	Attached cables	27
12.2	Terminal access	27
12.3	Creepage and clearance.....	27
13	Connection facilities for earthing or bonding conductors	28
13.1	Internal connection.....	28
13.2	~~External connection~~	28
13.3	~~Facility not required~~ Apparatus not requiring earthing.....	28
13.4	~~Effective connection~~ Size of conductor connection	28



13.5	Effective contact.....	29
13.6	Environmental	29
13.7	Use of light metal	29
14	~~Cable and conduit entries~~ Entries into enclosures	29
14.1	~~Intended use~~ Identification of entries	29
14.2	~~Construction~~ Cable glands.....	29
14.3	~~Integral part of the apparatus~~	30
14.4	Prevention of twisting	30
14.5	~~Method of attaching~~ Enclosure entry	30
14.6	Blanking elements	30
14.7	Branching point temperatures	30
15	Radiating equipment	32
15.1	~~For lasers and other continuous wave source~~	32
15.2	~~Ultrasonic sources~~	32
16	Supplementary requirements for specific electrical apparatus - Rotating electrical machines	33
16.1	Ventilation openings for external fans	33
16.2	Construction and mounting of the ventilating systems	33
16.3	Clearances for the ventilating system ~~for use in Zone 20 or 21~~	33
16.4	Materials for external fans and fanhoods.....	33
17	Switchgear	34
17.1	Flammable dielectric	34
17.2	Interlocking	34
17.3	Indication of open position	34
17.4	Openings	34
18	Fuses	34
19	Plugs and sockets	35
19.1	Plugs and sockets construction.....	35
19.2	Bolted plugs and sockets.....	37
19.3	For Zone 21 and Zone 22	37
19.4	Plugs remaining energised	37
20	Luminaires	37
20.1	Light transmitting covers	37
20.2	Guards.....	37
20.3	Mounting.....	37
20.4	Covers.....	38
20.5	~~Parts remaining energized~~	38
20.6	Types of lamps.....	38
21	~~Caplights, caplamps and handlamps~~ <u>handlights</u>	38
21.1	Leakage.....	38
21.2	Separate enclosures	38
22	Apparatus incorporating cells and batteries.....	38
22.1	General.....	38

23	Verification and tests	41
23.1	General	41
23.2	Verification of documents	41
23.3	Compliance of prototype or sample with documents	41
23.4	Type tests	42
24	Routine verifications and tests	48
25	Manufacturer's responsibility	48
26	~~Verifications and tests on modified or repaired electrical apparatus~~	~~49~~
27	~~Clamping tests of cable entries for non-armoured and braided cables~~	~~49~~
27.1	~~Cable entries with clamping by the sealing ring~~	~~49~~
27.2	~~Cable entries with clamping by filling compound~~	~~50~~
27.3	~~Cable entries with clamping by means of a clamping device~~	~~50~~
27.4	~~Tensile test~~	~~51~~
27.5	~~Mechanical strength~~	~~51~~
28	~~Clamping tests of cable entries for armoured cables~~	~~51~~
28.1	~~Clamping tests where the armourings are clamped by a device within the gland ...~~	~~51~~
28.2	~~Clamping tests where the armourings are not clamped by a device within the gland~~	~~52~~
29	Marking	52
29.1	General	52
29.2	Marking of all electrical apparatus	52
29.3	Multiple protection techniques	53
29.4	Order of marking	53
29.5	Reduced marking	53
29.6	<u>External grounding or bonding terminal</u>	54
30	Examples of marking	54
30.1	Apparatus type of protection "maD" for use in Zone 20	54
30.2	Apparatus type of protection "iaD" for use in Zone 20	54
30.3	Apparatus type of protection "pD" for use in Zone 21	54
30.4	~~Apparatus type of protection "tD", Practice A (see IEC 61241-1); temperature tested under 500 mm dust layer, for use in Zone 21~~	~~55~~
30.5	~~Apparatus type of protection "tD", Practice B (see IEC 61241-1) for use in Zone 22~~	~~55~~
30.6	~~Apparatus type of protection "tD", Practice A (see IEC 61241-1) for use in Zone 22~~	~~55~~
	Annex A (informative) – <u>Common standards – Safety requirements for electrical equipment</u>	57
	Annex B (informative) – <u>Equipment grounding</u>	59
	Annex C (informative) – <u>United States major deviations</u>	61
	Bibliography	69

This page intentionally left blank.

Foreword

All text of IEC 61241-0:2004 (1st 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.



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.

NOTE Requirements for safety of electrical equipment in ordinary (unclassified) locations can be found in ANSI Standards, NEMA Standards, Federal Regulations, etc. Apparatus listed by a Nationally Recognized Testing Laboratory is considered to meet the applicable requirements found in these standards. A list of commonly applied standards is shown in informative Annex A.

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 60034-5:2000, *Rotating electrical machines – Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification*

~~IEC 60079-0:2004, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*~~
ANSI/ISA-60079-0 (12.00.01)-2005, *Electrical Apparatus for Use in Class I, Zones 0, 1 & 2 Hazardous (Classified) Locations: General Requirements*

~~IEC 60079-7:2001, *Electrical apparatus for explosive gas atmospheres – Part 7: Increased safety*~~
ANSI/ISA-60079-7 (12.16.01)-2002, *Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations: Increased Safety “e”*

~~IEC 60079-11:1999, *Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety*~~
ANSI/ISA-60079-11 (12.02.01)-2002, *Electrical Apparatus for Use in Class I, Zones 0, 1 & 2 Hazardous (Classified) Locations: Intrinsic Safety*

IEC 60086-1:2000, *Primary batteries – Part 1: General*

IEC 60093: *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*

IEC 60095 (all parts), *Lead-acid starter batteries*

IEC 600192:2001, *Low-pressure sodium vapour lamps – Performance specifications*

IEC 60216-1:2001, *Electrical insulating materials – Properties of thermal endurance – Part 1: Ageing procedures and evaluation of test results*

IEC 60216-2:1990, *Guide for the determination of thermal endurance properties of electrical insulating materials – Part 2: Choice of test criteria*

IEC 60243-1:1998, *Electrical strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60285:1993, *Alkaline secondary cells and batteries – Sealed nickel-cadmium cylindrical rechargeable single cells*¹⁴

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

IEC 60623:2001, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Vented nickel-cadmium prismatic rechargeable single cells*

¹⁴ Cancelled and replaced by IEC 61951-1 (2003).

IEC 60662:1980, *High-pressure sodium vapour lamps*

IEC 60947-3:1999, *Low-voltage switchgear and control gear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

IEC 61056 (all parts), *General purpose lead-acid batteries (valve-regulated types)*

IEC 61150:1992, *Alkaline secondary cells and batteries – Sealed nickel-cadmium rechargeable monobloc batteries in button cell design*

~~IEC 61241 1: Electrical apparatus for use in the presence of combustible dust – Part 1: Protection by enclosures “tD”~~ ISA 61241-1 (12.10.03), *Electrical Apparatus for Use in Zone 21 and Zone 22 Hazardous (Classified) Locations – Protection by Enclosures “tD”*

~~IEC 61241 14: Electrical apparatus for use in the presence of combustible dust – Part 14: Selection and installation~~

IEC 61241-20-1: *Electrical apparatus for use in the presence of combustible dust – Part 20: Test methods – Section 1, Methods for determining the minimum ignition temperatures of dust*

ANSI/ISA-61241-10 (12.10.05)-2004, *Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations – Classification of Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations*

ISO 48:1994, *Rubber, vulcanized or thermoplastic – Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 178:2001, *Plastics – Determination of flexural properties*

ISO 179 (all parts), *Plastics – Determination of Charpy impact properties*

ISO 262:1998, *ISO general-purpose metric screw threads – Selected sizes for screws, bolts and nuts*

ISO 273:1979, *Fasteners – Clearance holes for bolts and screws*

ISO 286-2:1988, *ISO system of limits and fits – Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

ISO 527 (all parts), *Plastics – Determination of tensile properties*

ISO 965 (all parts), *ISO general-purpose metric screw threads – Tolerances*

ISO 1818:1975, *Vulcanized rubbers of low hardness*²⁵

ISO 4014:1999, *Hexagon head bolts – Product grades A and B*

ISO 4017:1999, *Hexagon head screws – Product grades A and B*

ISO 4026:2003, *Hexagon socket set screws with flat point*

ISO 4027:2003, *Hexagon socket set screws with cone point*

²⁵Withdrawn standard.

ISO 4028:2003, *Hexagon socket set screws with dog point*

ISO 4029:2003, *Hexagon socket set screws with cup point*

ISO 4032:1999, *Hexagon nuts, style 1 – Product grades A and B*

ISO 4762:1997, *Hexagon socket head cap screws*

ISO 4892 (all parts), *Plastics – Methods of exposure to laboratory light sources*

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

ANSI/UL 746B, *Polymeric Materials – Long-Term Property Evaluations*

ANSI/UL 746C, *Polymeric Materials – Use in Electrical Equipment Evaluations*

ANSI/NFPA 70:2005, *National Electrical Code*[®]

3 ~~Terms and Definitions~~

For the purpose of this document, the following definitions apply.

3.1

dust

small solid particles including fibers and flyings in the atmosphere which settle out under their own weight, but which may remain suspended in air for some time (includes dust and grit as defined in ISO 4225)

3.2

combustible dust

dust, ~~fibres~~ fibers or flyings that can burn or glow in air and could form explosive mixtures with air at atmospheric pressure and normal temperatures

3.3

conductive dust

dust, ~~fibres or flyings with electrical resistivity equal to or less than $10^3 \Omega \cdot m$~~ metal dust

3.4

explosive dust atmosphere

mixture with air, under atmospheric conditions, of flammable substances in the form of dust, ~~fibres~~ fibers or flyings in which, after ignition, ~~combustion spreads throughout the unconsumed mixture~~ permits self sustaining propagation

[IEV 426-02-4, modified]

3.5

minimum ignition temperature of a dust layer

lowest temperature of a hot surface at which ignition occurs in a dust layer of specified thickness on this hot surface

[3.3 of IEC 61241-2-1]

3.6

minimum ignition temperature of a dust cloud

lowest temperature of the hot inner wall of a furnace at which ignition occurs in a dust cloud in air contained therein

[3.5 of IEC 61241-2-1, modified]

3.7

electrical apparatus

items applied as a whole or in part for the utilization of electrical energy

NOTE These include, amongst others, items for the generation, transmission, distribution, storage, measurement, regulation, conversion, and consumption of electrical energy and items for telecommunications.

3.8

rating

set of rated values and operating conditions

3.9

enclosure

all the walls, doors, covers, cable entries, rods, spindles, shafts, etc., which contribute to the type of protection of and/or the degree of protection (IP) of the electrical apparatus

3.10

dust-tight enclosure

enclosure capable of preventing the ingress of all observable dust particles

3.11

dust-protected enclosure

enclosure in which the ingress of dust is not totally prevented but does not enter in sufficient quantity to interfere with the safe operation of the equipment

NOTE Dust should not accumulate in a position within the enclosure where it is liable to cause an ignition hazard.

3.12

type of protection

specific measures applied to electrical apparatus to avoid ignition of a surrounding explosive atmosphere by such apparatus

3.13

maximum surface temperature

highest temperature which is attained by any part of the surface of electrical apparatus when tested under the defined dust-free or dust layer conditions at the specified maximum ambient temperature

NOTE This temperature is attained under the test condition. Increasing the layer thickness can increase this temperature due to the thermal insulation properties of dust.

3.14**maximum permissible surface temperature**

highest temperature a surface of electrical apparatus is allowed to reach in practical service to avoid ignition

NOTE The maximum permissible surface temperature will depend upon the type of dust, whether as a cloud or layer, if a layer, its thickness, and the application of a safety factor (see IEC 61241-14, clause 6)

3.15**~~zones~~**

~~areas classified for explosive dust atmospheres are divided into zones; based upon the frequency and duration of the occurrence of explosive dust/air atmospheres~~

3.16**Zone 20**

~~place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently an area where combustible dust or ignitable fibers and flyings are present continuously or for long periods of time in quantities sufficient to be hazardous~~

3.17**Zone 21**

~~place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur, occasionally, in normal operation an area where combustible dust or ignitable fibers and flyings are likely to exist occasionally under normal operation in quantities sufficient to be hazardous~~

3.18**Zone 22**

~~place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only an area where combustible dust or ignitable fibers and flyings are not likely to occur under normal operation in quantities sufficient to be hazardous~~

3.19**cable entry gland**

device permitting the introduction of one or more electric and/or fibre optics cables into an electrical apparatus so as to maintain the relevant type of protection

3.20**conduit entry**

means of introducing a conduit into an electrical apparatus so as to maintain the relevant type of protection

3.21**compression element**

element of a cable ~~entry gland~~ acting on the sealing ring to enable the latter to fulfil its function

3.22**clamping device**

element of a cable ~~entry gland~~ for preventing tension or torsion in the cable from being transmitted to the connections

3.23

sealing ring

ring used in a cable or conduit entry to ensure the sealing between the entry and the cable or conduit

3.24

terminal compartment

separate compartment or part of a main enclosure, communicating, or not, with the main enclosure, and containing connection facilities

3.25

connection facilities

terminals screws and other parts, used for the electrical connection of conductors of external circuits

3.26

bushing

insulating device carrying one or more conductors through an internal or external wall of an enclosure

3.27

cell

assembly of electrodes and electrolyte that constitutes the smallest electrical unit of a battery

3.28

primary cell or battery

electrochemical system capable of producing electrical energy by chemical reaction

3.29

secondary cell or battery

electrically rechargeable electrochemical system capable of storing electrical energy and delivering it by chemical reaction

3.30

open cell or battery

secondary cell, or battery, having a cover provided with an opening through which gaseous products may escape

[IEV 486-01-18, modified]

3.31

sealed valve-regulated cell or battery

cell or battery which is closed under normal conditions, but which has an arrangement which allows the escape of gas if the internal pressure exceeds a predetermined value

NOTE The cell cannot normally receive an addition to the electrolyte.

[IEV 486-01-20, modified]

3.32**sealed gas-tight cell or battery**

a cell or battery which remains closed and does not release either gas or liquid when operated within the limits of charge or temperature specified by the manufacturer

[IEV 486-01-21, modified]

NOTE 1 Such cells and batteries may be equipped with a safety device to prevent dangerously high internal pressure. The cell or battery does not require addition to the electrolyte and is designed to operate during its life in its original sealed state.

NOTE 2 The above definition is taken from ~~EN 50020~~ ANSI/ISA-60079-11. It differs from IEC definitions 486-01-20 and IEC 486-01-21 by virtue of the fact it applies to either a cell or battery.

3.33**battery**

assembly of two or more cells electrically connected to each other to increase the voltage or capacity

NOTE Where the terms "cell" or "cells" are used, the text refers to individual single cells. Where the terms "battery" or "batteries" is used, the text refers to both cells and batteries.

3.34**capacity**

quantity of electricity or electric charge, which a fully charged battery can deliver under specified conditions

3.35**nominal voltage** (of a cell or battery)

voltage specified by the manufacturer

3.33**maximum open circuit voltage** (of a cell or battery)

voltage which is the maximum attainable voltage under normal conditions, that is, from either a new primary cell, or a secondary cell just after a full charge

NOTE See Table 3 and Table 4 which show the maximum open circuit voltage for acceptable cells.

3.37**charging**

act of forcing current through either a secondary cell or battery in the opposite direction to the normal flow to restore the energy stored originally

3.38**reverse charging**

act of forcing current through either a primary cell or secondary cell in the same direction as the normal flow

NOTE For example, in an expired battery.

3.39**deep discharge**

event which reduces a cell voltage below that recommended by the cell or battery manufacturer

3.40

inherently safe (ihs) cell (or battery)

primary cell or battery in which the short-circuit current and maximum surface temperature are limited to a safe value by its internal resistance

3.41

Ex component

part of electrical apparatus or a module (other than an Ex cable gland), which is not intended to be used alone and requires additional consideration when incorporated into electrical apparatus or systems for use in explosive atmospheres

~~part of electrical apparatus for potentially explosive atmospheres, which is not intended to be used alone in such atmospheres and requires additional certification when incorporated into electrical apparatus or systems for use in potentially explosive atmospheres~~

3.42

"X" symbol

~~symbol used as a suffix to a certificate reference to denote special conditions for safe use~~

3.43

"U" symbol

~~"U" is the symbol used as a suffix to a certificate reference to denote an Ex component.~~

~~NOTE The symbols "X" and "U" should not be used together.~~

3.44

certificate

document that assures the conformity of a product, process, system, person, or organisation with specified requirements

NOTE 1 The certificate may be either the supplier's declaration of conformity, or the purchaser's recognition of conformity, or certification (as a result of action by a third party) as defined in ISO/IEC 17000.

~~document confirming that the apparatus is in conformity with the requirements, the type tests and, where appropriate, the routine tests in the standard referred to therein~~

~~NOTE 1 A certificate can relate to Ex apparatus or an Ex component.~~

~~NOTE 2 A certificate may be produced by the manufacturer, the user, or a third party, for example, an IEC Ex Accepted Certification Body, a national certification body, or an authorized person.~~

3.45

continuous operating temperature (COT)

maximum temperature which ensures the stability and integrity of the material for the expected life of the apparatus, or part, in its intended application

3.46

service temperature

temperature reached when the apparatus is operating at rated conditions

NOTE Each apparatus may reach different service temperatures in different parts.

4 Construction

4.1 General

Electrical apparatus for use in ~~potentially~~ explosive dust atmospheres shall comply with the requirements of this standard.

NOTE If the electrical apparatus has to withstand particularly adverse service conditions (for example rough handling, humidity effects, ambient temperature variations, effects of chemical agents, corrosion) these should be specified to the manufacturer by the user ~~and are not the responsibility of the testing station.~~

~~4.2 Principles for design and testing of apparatus for use in Zone 20~~

~~Apparatus for Zone 20 needs special consideration.~~

~~The apparatus shall be designed to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring a very high level of protection.~~

~~Apparatus in Zone 20 is intended for use in areas in which explosive atmospheres caused by air/dust mixtures are present continuously, for long periods or frequently. Apparatus in this zone must ensure the requisite level of protection, even in the event of rare incidents relating to equipment, and is characterized by means of protection such that either~~

- ~~— in the event of failure of one means of protection, at least an independent second means provided the requisite level of protection; or~~
- ~~— the requisite level of protection is assured in the event of two faults occurring independently of each other.~~

~~The special requirements for Zone 20 shall be investigated under simulated working conditions as stated by the manufacturer.~~

~~NOTE 1 Apparatus for measurement and control techniques (e.g. instrumentation, sensors, controls) are typical applications under dust of excessive layers.~~

~~NOTE 2 Power engineering apparatus (such as motors, luminaires, plugs and sockets) should wherever practicable be placed outside of such areas.~~

4.3 Opening enclosures

Enclosures for use in Zone 20 or 21 which can be opened more quickly than the time necessary

- to allow incorporated capacitors, charged by a voltage of 200 V or more, to discharge to a value of residual energy of 0,2 mJ, or residual energy level of 0,4 mJ if the charging voltage is less than 200 V, or
- to allow the cooling of enclosed hot components to a surface temperature below the temperature class of the electrical apparatus

shall be marked with the following or equivalent warning:

“WARNING - AFTER DE-ENERGIZING, DELAY X MINUTES BEFORE OPENING”

“X” being the value in minutes of the delay required.