UL 60079-17

STANDARD FOR SAFETY

Explosive Atmospheres – Part 17: Electrical Installations Inspection and Maintenance

UL Standard for Safety for Explosive Atmospheres – Part 17: Electrical Installations Inspection and Maintenance, UL 60079-17

Fifth Edition, Dated May 12, 2017

Summary of Topics

This revision of UL 60079-17 dated July 28, 2021 is being issued to update the title page to reflect the reaffirmation of its ANSI approval. No changes in requirements have been made.

This standard is an adoption of IEC 60079-17, Explosive Atmospheres – Part 17: Electrical Installations Inspection and Maintenance (fifth edition issued by IEC November 2013) with US National Differences.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The requirements are substantially in accordance with Proposal(s) on this subject dated May 28, 2021.

No Text on This Page

MAY 12, 2017
(Title Page Reprinted: July 28, 2021)

ANSI/UL 60079-17-2017 (R2021)

UL 60079-17

Standard for Explosive Atmospheres – Part 17: Electrical Installations Inspection and Maintenance

Fifth Edition

May 12, 2017

This ANSI/UL Standard for Safety consists of the Fifth Edition including revisions through July 28, 2021.

The most recent designation of ANSI/UL 60079-17 as a Reaffirmed American National Standard (ANS) occurred on July 28, 2021. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

No Text on This Page

CONTENTS

No Text on This Page

Preface (UL)

This UL Standard is based on IEC Publication 60079-17: fifth edition Explosive atmospheres – Part 17: Electrical installations inspection and maintenance. IEC publication 60079-17 is copyrighted by the IEC.

Efforts have been made to synchronize the UL edition number with that of the corresponding IEC standard with which this standard is harmonized. As a result, one or more UL edition numbers have been skipped to match that of the IEC edition number.

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

The following people served as members of STP 60079 and participated in the review of this standard:

NAME	COMPANY
*B. Zimmermann, Chair	R Stahl Inc.
*T. Adam	FM Approvals LLC
R. Allen	Honeywell Inc.
J. Anderson	Thermon Mfg. Co.
D. Ankele	UL LLC
P. Becker	nVent
S. Blais	Emerson/Appleton Group
K. Boegli	KBB Consulting
R. Brownlee	Pepperl + Fuchs Inc.
D. Burns	Shell P&T — Innovation / R&D
*J. Chambers	UL LLC
R. Chalmers	Industrial Scientific Corp.
*C. Coache	National Fire Protection Association
*M. Cole	Hubbell Canada LP
M. Coppler	LabTest Certification Inc.
*R. Deadman	UL LLC
*K. Dhillon	LabTest Certification Inc.
M. Dona	Beach Energy
T. Dubaniewicz	NIOSH
G. Edwards	Rosemount Inc.
M. Egloff	Montana Tech, University of Montana
M. Ehrmann	R Stahl Inc
D. El Tawy	Siemens Energy
*A. Engler	Det Norske Veritas DNV
M. Fillip	National Oilwell Varco
W. Fiske	Intertek
Z. Fosse	DEKRA Certification Inc
G. Gurinder	Gurinder Garcha Consulting
D. Grady	Talema Group

NAME	COMPANY
J. Hickle	Caterpillar Inc.
R. Holub	DuPont
E. Hong	Solar Turbines Inc.
D. Jang	National Research Council Canada
*B. Johnson	Thermon Mfg. Co.
R. Johnson	Source IEC
*P. Kelly	UL LLC
S. Kiddle	ABB Inc
*M. Kornitsky	FM Approvals LLC
S. Lambaz	Littelfuse Inc.
W. Lawrence	FM Approvals LLC
E. Leubner	Eaton's Crouse-Hinds Business
W. Lockhart	GE Gas Power
W. Lowers	WCL Corp.
*N. Ludlam	FM Approvals Ltd.
M. Marrington	Index
R. Martin	USCG
E. Massey	L E Massey
W. McBride	CONAM Construction Co.
T. Michalski	Killark Electric Mfg. Co.
*J. Miller	MSA Innovation LLC
B. Miller	Mettler-Toledo LLC
N. Minquez	Proyel Co
*O. Murphy	Honeywell Inc.
D. Nedorostek	Bureau of Safety & Environmental Enforcement (BSEE)
A. Page	Bud Page Consultant Inc.
R. Parks	National Instruments
L. Ricks	ExVeritas North America LLC
P. Rigling	Eaton Electric Ltd - MTL
*K. Robinson	Occupational Safety and Health Adm.
J. Ruggieri	General Machine Corp.
S. Sam	Tundra Oil & Gas
J. Scheller	ABB Motor and Mechanical Inc.
P. Schimmoeller	CSA Group
*T. Schnaare	Rosemount Inc.
R. Seitz	ARTECH Engineering
S. Sharma	Lindsay Corp.
J. Silliman	3M
K. Singh	Ex Safet Services and Solutions
G. Sitnik	QPS America Inc.
J. Smith	SGS
G. Steinman	ABB Installation Products
*R. Teather	Det Norske Veritas Certification Inc.
L. Vlagea	General Monitors
D. Wechsler	American Chemistry Council
N. Wienhold	Rosemount Inc.

NAME	COMPANY
R. Wigg	E-x Solutions International Pty Ltd.
*K. Wolf	Intertek
T. Woods	Bently Nevada
R. Zalosh	Firexplo

* Non-voting member

No Text on This Page

National Differences

National Differences from the text of International Electrotechnical Commission (IEC) Publication 60079-17, Explosive Atmospheres – Part 17: Equipment Installations Inspection and Maintenance, copyright 2013 are indicated by notations (differences) and are presented within the body of the UL printed standard in bold text using legislative mark-ups (strike-out and underline).

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

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

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

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

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

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

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

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

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

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

No Text on This Page

FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES – Part 17: Electrical installations inspection and maintenance

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60079-17 has been prepared by subcommittee 31J: Classification of hazardous areas and installation requirements, of IEC technical committee 31: Equipment for explosive atmospheres.

This fifth edition cancels and replaces the fourth edition published in 2007 and constitutes a technical revision.

The significant technical changes with respect to the previous edition are as follows:

• Equipment specific inspection tables for luminaires, heating systems and motors have been added into Annex A to supplement the general protection concept tables.

• Document has been updated to complement the changes made to IEC 60079-14 for initial inspection.

The text of this standard is based on the following documents:

FDIS	Report on voting
31J/224/FDIS	31J/229/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This International Standard is to be used in conjunction with IEC 60364-6.

A list of all parts of the IEC 60079 series, under the general title *Explosive atmospheres*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

• amended.

INTRODUCTION

Electrical installations in hazardous areas possess features specially designed to render them suitable for operations in such atmospheres. It is essential for reasons of safety in those areas that, throughout the life of such installations, the integrity of those special features is preserved. This standard provides the details for initial inspection and on-going inspections as either;

a) regular periodic inspections thereafter, or,

b) continuous supervision by skilled personnel.

When necessary, maintenance may also be needed.

Correct functional operation of hazardous area installations does not mean, and should not be interpreted as meaning, that the integrity of the special features referred to above is preserved.

Inspections are carried out in accordance with this standard, however for older installations the details for the equipment and installations requirements should be referenced to the standards applied at the date of the installation.

NOTE Standards applied at the date of installation may not have been IEC standards.

No Text on This Page

EXPLOSIVE ATMOSPHERES – Part 17: Electrical installations inspection and maintenance

1 Scope

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

This ~~part of the IEC 60079~~ standard ~~series~~ applies to users and covers factors directly related to the inspection and maintenance of electrical installations within hazardous areas only, where the hazard may be caused by flammable gases, vapours, mists, dusts, fibres or flyings.

It does not include:

• other fundamental installation and inspection requirements for electrical installations;

• the verification of electrical equipment;

• the repair and reclamation of explosion protected equipment ~~(see IEC 60079-19)~~.

This standard supplements the requirements of ~~IEC 60364-6~~ NFPA 70B.

In the case of dusts, fibres or flyings the level of housekeeping may influence the inspection and maintenance requirements.

This standard is intended to be applied where there can be a risk due to the presence of explosive gas or dust mixtures with air or combustible dust layers under normal atmospheric conditions. It does not apply to:

• underground mining areas,

• dusts of explosives that do not require atmospheric oxygen for combustion,

• pyrophoric substances.

Where references are made to other IEC 60079 standards, the reference requirements found in these standards apply as modified by any applicable U.S. National Differences.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

2DV DR *Modification of Clause 2 references to replace with the following:*

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

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

~~IEC 60079-2, *Explosive atmospheres – Part 2: Equipment protection by pressurized enclosures "p"*~~

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

~~IEC 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*~~

~~IEC 60079-10-2, *Explosive atmospheres – Part 10-2: Classification of areas – Combustible dust atmospheres*~~

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

~~IEC 60079-14, *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*~~

~~IEC 60079-15, *Explosive atmospheres – Part 15: Equipment protection by type of protection "n"*~~

~~IEC 60079-19, *Explosive atmospheres – Part 19: Equipment repair, overhaul and reclamation*~~

~~IEC 60079-31, *Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure "t"*~~

~~IEC 60364-6, *Low-voltage electrical installations – Part 6: Verification*~~

~~IEC 61241-4, *Electrical apparatus for combustible dust atmospheres – Part 4: Type of protection "pD"*~~

ISA 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*

ISA 60079-10-2, *Explosive atmospheres – Part 10-2: Classification of areas – Combustible dust atmospheres*

ISA 60079-29-1 (12.13.01), *Explosive atmospheres – Part 29-1: Gas Detectors – Performance Requirements for Detectors for Flammable Gases*

NFPA 70, *National Electrical Code*

NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*

NFPA 70E, *Standard for Electrical Safety in the Workplace*

UL 121203 *Portable Electronic products suitable for use in Class I and II, Division 2, Class I, Zone 2 and Class III, Division 1 and 2 hazardous (classified) locations*

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

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

UL 60079-2 ***Explosive atmospheres – Part 2: Equipment protection by pressurized enclosures "p"***

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

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

UL 60079-15 ***Explosive atmospheres – Part 15: Equipment protection by type of protection "n"***

UL 60079-31 ***Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure "t"***

3 Terms and definitions

3DV DR ***Modification of the first paragraph and NOTE, to replace with the following:***

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

~~**NOTE Additional definitions applicable to explosive atmospheres can be found in IEC 60050-426.**~~

3.1
close inspection
inspection which encompasses those aspects covered by a visual inspection and, in addition, identifies those defects, such as loose bolts, which will be apparent only by the use of access equipment

EXAMPLE Steps, (where necessary), and tools.
Note 1 to entry: Close inspections do not normally require the enclosure to be opened, or the equipment to be de-energized.

3.2
continuous supervision
frequent attendance, inspection, service, care and maintenance of the electrical installation by skilled personnel who have experience in the specific installation and its environment in order to maintain the explosion protection features of the installation in satisfactory condition

3.3
detailed inspection
inspection which encompasses those aspects covered by a close inspection and, in addition, identifies those defects, such as loose terminations, which will only be apparent by opening the enclosure, and/or using, where necessary, tools and test equipment

3.4
hazardous area
area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment

Note 1 to entry: For the purposes of this standard, an area is a three-dimensional region or space.

3.4DV DR *Modification of Clause 3.4 to add the following Note 2 after Note 1:*

Note 2 to entry: The National Electrical Code defines hazardous areas as hazardous (classified) locations.

3.5
initial inspection
inspection of all electrical equipment, systems and installations before they are brought into service

3.6
inspection
action comprising careful scrutiny of an item carried out either without dismantling, or with the addition of partial dismantling as required, supplemented by means such as measurement, in order to arrive at a reliable conclusion as to the condition of an item

3.7
maintenance
combination of any actions carried out to retain an item in, or restore it to, conditions in which it is able to meet the requirements of the relevant specification and perform its required functions

3.8
live maintenance
maintenance activities carried out while circuits are energized

3.9
non-hazardous area
area in which an explosive atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of equipment

3.9DV DR *Modification of Clause 3.9 to add the following Note:*

Note to entry: The National Electrical Code refers to non-hazardous areas as unclassified locations.

3.10
periodic inspection
inspection of all electrical equipment, systems and installations carried out on a routine basis

3.11
sample inspection
inspection of a representative proportion of the electrical equipment, systems and installations

3.12
skilled personnel
persons whose training has included instruction on the various types of protection and installation practices, the requirements of this standard, the relevant national regulations/company rules applicable to the installation and on the general principles of area classification

3.13
technical person with executive function

person providing technical management of the skilled personnel, having adequate knowledge in the field of explosion protection, having familiarity with the local conditions, having familiarity with the installation and who has overall responsibility and control of the inspection systems for the electrical equipment within hazardous areas

3.14
visual inspection
inspection which identifies, without the use of access equipment or tools, those defects, such as missing bolts, which will be apparent to the eye

3.15ADV D1 *Addition of Clause 3.15:*

gas free work permit (GFWP)

permit, resulting from approval by an authorized person under the application of a defined documented management work process, stating that work involving potential ignition sources may be performed in a hazardous (classified) location by ensuring that the atmosphere is free of ignitable concentrations of flammable gases or vapors

4 General requirements

4.1 Documentation

4.1DV DE *Modification of Clause 4.1 to replace with the following:*

For the purposes of inspection and maintenance, up-to-date documentation (verification dossier) including any modification records, of the following items shall be available:

a) zone classification of areas and, if included, the equipment protection level (EPL) required for each location (see ~~IEC~~ ISA 60079-10-1 and ~~IEC~~ ISA 60079-10-2),

b) for gases: equipment group (IIA, IIB or IIC) and temperature class requirements,

c) EPL (equipment protection level), when provided,

~~c~~ d) for dusts: equipment group (IIIA, IIIB or IIIC) and maximum surface temperature requirements,

~~d~~ e) equipment characteristics e.g. temperature ratings, type of protection, IP rating, corrosion resistance,

~~e~~ f) records sufficient to enable the explosion protected equipment to be maintained in accordance with its type of protection (see ~~IEC 60079-14~~ NFPA 70), (for example list and location of equipment, spares, certificates, technical information),

~~f~~ g) copies of previous inspection records,

~~g~~ h) copy of the ~~additional~~ initial inspection records ~~as detailed in IEC 60079-14~~.

NOTE The EPL (or Equipment Protection Level) may appear in the product marking and documentation. EPLs are designated as G for gas, D for dust, or M for mining and are then followed by a letter (a, b, or c) to give the user a better understanding as to whether the equipment provides either (a) a "very high," (b) a "high," or (c) an "enhanced" level of protection against ignition of an explosive atmosphere. For example, an Class I, Zone 1 AEx d

IIC T3 luminaire (which is suitable by protection concept for an application in Zone 1) may additionally be marked with an EPL or "Gb" to indicate that it was provided with a high level of protection, such as Class I, Zone 1 AEx d IIC T3 Gb.

~~**Requirements for other documentation that may be necessary are provided in IEC 60079-14 and IEC 60079-19.**~~

4.2 Qualification of personnel

4.2DV D2 ***Modification of Clause 4.2 to replace with the following:***

The inspection and maintenance of installations covered by this standard ~~shall~~ should be carried out only by experienced personnel, whose training has included instruction on the various types of protection and installation practices, the requirements of this standard, the relevant national regulations/company rules applicable to the installation and on the general principles of area classification (see Annex B). Appropriate continuing education or training ~~shall~~ should be undertaken by personnel on a regular basis. Evidence of the relevant experience and training claimed ~~shall~~ should be documented and available.

4.3 Inspections

4.3.1 General

4.3.1.1 Basic Principles

4.3.1.1DV.1 DE ***Modification of Clause 4.3.1.1, first paragraph to replace with the following:***

4.3.1.1DV.1.1 Before a plant also referred to as "facility" or equipment is brought into service, it shall be given an initial inspection. ~~As part of the plant commissioning and start up procedures, initial inspection and other additional requirements are provided in IEC 60079-14.~~

To ensure that the installations are maintained in a satisfactory condition for continued use within a hazardous area, either

a) regular periodic inspections, or

b) continuous supervision by skilled personnel,

and, where necessary, maintenance shall be carried out.

NOTE 1 In the case of dusts, fibres or flyings, housekeeping can influence the inspection and maintenance requirements.

Following any adjustment, maintenance, repair, reclamation, modification or replacement, the equipment or relevant parts of equipment concerned shall be inspected in accordance with the relevant items of the detailed column of Table 1DV, Table 2DV and Table 3DV.

The inspection activity should be sufficiently independent of any immediate demands of maintenance and/or other activities so as not to prejudice the reliability of any report findings from the inspection.

NOTE 2 Inspection personnel do not need to be members of an external independent organisation.

If at any time there is a change in the area classification or the Equipment Protection Level requirements or if any equipment is moved from one location to another, a check shall be made to ensure that the type of protection, group and surface temperature, where appropriate, are suitable for the revised conditions.

If plant or equipment is dismantled during the course of an inspection, precautions shall be taken during reassembly to ensure that the integrity of the type of protection is not impaired.

NOTE 3 This includes removing any residual dust and replacing gaskets correctly.

NOTE 4 The major factors effecting the deterioration of equipment include: susceptibility to corrosion, exposure to chemicals or solvents, likelihood of accumulation of dust or dirt, likelihood of water ingress, exposure to excessive ambient temperature, risk of mechanical damage, exposure to undue vibration. Other service factors include: training and experience of personnel, likelihood of unauthorized modifications or adjustments and likelihood of inappropriate maintenance, for example that which is not in accordance with the manufacturer's recommendation.

4.3.1.2 Verification of unmarked equipment

Where the certification plate or markings on explosion protected equipment is missing or illegible, alternative methods may be used to determine traceability to the certification details of the specific equipment. The method used could include: additional identification labels which incorporate unique tag numbers, serial numbers or reference to the installation databases. The method of attaching or fixing the labelling shall not reduce the integrity of the equipment.

4.3.1.2DV.1 D2 *Modification of Clause 4.3.1.2, second paragraph to replace with the following:*

4.3.1.2DV.1.1 The inventory and identification tagging method used for managing explosion protected equipment ~~shall~~ should be capable of tracking the replacement of equipment with replacement or repaired equipment, which may have different certification markings and details to the original equipment.

4.3.1.3 Acceptance of equipment in old installations

For existing equipment not able to be identified as being certified for use in a hazardous area it is necessary to establish that the equipment is suitable for on-going use. In order to correctly operate and maintain the equipment, an assessment will be necessary to verify the specification of the equipment, to determine it is fit-for-purpose in the specific location in order to determine the appropriate inspection and maintenance requirements. In these circumstances the procedure given in Annex C may be followed.

4.3.1.3DV DR *Modification of Clause 4.3.1.3, NOTE to replace with the following:*

NOTE This assessment is intended to apply to items in an installation that predate any requirement for the use of ~~certified~~ identified (see NFPA 70) electrical equipment in hazardous areas.

4.3.2 Grades of inspection

The grade of inspection may be visual, close or detailed. Table 1DV, Table 2DV and Table 3DV detail the checks required for these three grades of inspection on general and specific items of electrical equipment.

Visual and close inspections can be performed with the equipment energized. Detailed inspections will generally require the equipment to be isolated.

The grade of inspection selected for equipment using more than one type of protection (e.g. Ex “ed” equipment) shall be a combination of the relevant columns from the Table 1DV, Table 2DV and Table 3DV.

4.3.3 Types of inspection

4.3.3DV.1 D1 *Modification of Clause 4.3.3, first paragraph to replace with the following:*

4.3.3DV.1.1 Types of inspections include:

a) Initial inspections used to check that the selected type of protection and its installation are appropriate based on detailed inspections. ~~The requirements are covered in IEC 60079-14.~~ They are to be detailed inspections in accordance with Table 1DV, Table 2DV, and Table 3DV or modified tables in accordance with 5.7 as appropriate.

NOTE A full initial inspection is not required if an equivalent inspection has been performed by the manufacturer and it is unlikely that the installation process will have affected those items inspected by the manufacturer. For example, an initial detailed inspection of internal flamepaths of a flameproof motor or the internal joints of a Zone 21 AEx tb motor is not required; however, the terminal housing cover, which would have been removed to facilitate connection of the field wiring, should be inspected after as part of the installation process.

b) Periodic inspections which may be visual, close or detailed in accordance with Table 1DV, Table 2DV and Table 3DV, or modified tables in accordance with 5.7, as appropriate.

c) Sample inspections which may be visual, close or detailed in accordance with Table 1DV, Table 2DV and Table 3DV, or modified tables in accordance with 5.7, as appropriate. The size and composition of all samples shall be determined with regard to the purpose of the inspection.

> **Sample inspections should not be expected to reveal faults of a random nature, such as loose connections, but should be used to monitor the effects of environmental conditions, vibration, inherent design weakness, etc.**

d) Continuous supervision utilizing the visual or close inspections in accordance with Table 1DV, Table 2DV and Table 3DV, or modified tables in accordance with 5.7, as appropriate and in accordance with 4.5. Where the installation falls outside the capability for continuous supervision it shall be subject to periodic inspection.

The results of ~~all~~ (a – d above) inspections shall be recorded and retained, and may lead to a need for further actions. The requirements for continuous supervision are detailed in 4.5.5.

4.4 Periodic inspections

4.4.1 Personnel

Regular periodic inspection requires personnel who are competent for the inspection required, including that they:

a) have a knowledge of area classification/EPL and sufficient technical knowledge to understand its implications for the location under consideration;

b) have technical knowledge and understanding of the theoretical and practical requirements for electrical equipment and installations used in those hazardous areas;

c) understand the requirements of visual, close and detailed inspections as they relate to the installed equipment and installations.

NOTE Competencies and training may be identified in relevant national training and assessment frameworks.

4.4.2 Fixed installations

The grade of inspection and the interval between periodic inspections shall be determined taking account of the type of equipment, the manufacturer's guidance, if any, the factors governing its deterioration (see 4.3.1.1, Note 3), the area classification and/or the EPL requirements and the results of previous inspections. Where inspection grades and intervals have been established for similar equipment, installations and environments, this experience shall be used in determining the inspection strategy.

The interval between periodic inspections shall not exceed three years without seeking expert advice. The basis for changing the inspection period shall be documented.

Intervals between periodic inspections exceeding three years should be based on an assessment including relevant information.

Once an interval has been fixed, the installation should be subjected to additional interim sample inspections to support or modify the proposed interval and grade of inspection.

Ongoing review of the results of inspections will be required to justify the interval between, and grade of inspections.

A typical inspection procedure is shown diagrammatically in Annex A.

When large numbers of similar items such as luminaires, junction boxes, etc. are installed in a similar environment, it may be feasible to carry out periodical inspections on a sample basis provided that the number of samples in addition to the inspection frequency is subjected to review. It is, however recommended that all items be subjected at least to a visual inspection.

4.4.3 Movable equipment

Movable electrical equipment (hand-held, portable, and transportable) is particularly prone to damage or misuse and therefore the interval between periodic inspections may need to be reduced.

The interval between periodic inspections shall not exceed the following without seeking expert advice:

a) hand-held and portable equipment shall be visually checked by the user, before each use, to ensure that the equipment is not obviously damaged;

b) all equipment shall be submitted to a close inspection at least every 12 months;

c) enclosures which are frequently opened (such as battery housings) shall be given a detailed inspection at least every 6 months.

The basis for changing the inspection period shall be documented.

4.5 Continuous supervision by skilled personnel

4.5.1 Concept

Where an installation is visited on a regular basis, in the normal course of work, by skilled personnel who, in addition to satisfying the requirements of 4.4.1 a), b) and c), are:

a) aware of the process and environmental implications on the deterioration of the specific equipment in the installation, and

b) required to carry out visual and/or close inspections as part of their normal work schedule as well as detailed inspections as part of any replacement, or adjustment in accordance with 4.3.1.1,

then it may be possible to dispense with regular periodic inspection and utilize the frequent presence of the skilled personnel to ensure the on-going integrity of the equipment.

The use of continuous supervision by skilled personnel does not remove the requirement for initial and sample inspections.

Continuous supervision is not practicable for electrical equipment for which this kind of attendance cannot be provided (e.g. in the case of movable equipment). See also 4.5.4.

4.5.2 Objectives

The objective of continuous supervision is to enable the early detection of arising faults and their subsequent repair. It makes use of existing skilled personnel who are in attendance at the installation in the course of their normal work (e.g. erection work, alterations, inspections, maintenance work, checking for faults, cleaning work, control operations, switching operations, making terminal connections and disconnections, setting and adjustment work, functional tests, measurements) and who use their skill to detect faults and changes at an early stage.

4.5.3 Responsibilities

4.5.3.1 Technical persons with executive function

4.5.3.1DV D1 *Modification of Clause 4.5.3.1 to replace with the following:*

A technical person with executive function shall be identified for each installation and ~~shall~~ should carry out the following tasks:

a) assess the viability of the continuous supervision concept in light of the competence, skills and availability of personnel and their experience in relation to the particular installation;

b) define the scope of equipment to be considered under continuous supervision taking account of environmental conditions, frequency of attendance, special knowledge, work flow and location of equipment;

c) determine the frequency of inspection, the grade of inspection and the content of reporting such as to enable meaningful analysis of equipment performance;

d) ensure that the documentation referred to in 4.1 and 4.5.5 is made available;

e) ensure that skilled personnel are familiar with:

1) the concept of continuous supervision together with the needs for any reporting or analysis function;

2) the installation they attend;

3) the inventory of explosion protected equipment within their area of responsibility;

f) arrange for verification that:

1) process of continuous supervision is being adhered to;

2) skilled personnel are being given adequate time to carry out their inspections;

3) skilled personnel are receiving appropriate training and refresher training;

4) documentation is being completed correctly;

5) there is adequate technical support readily available to the skilled personnel;

6) the state of the electrical installation is known.

4.5.3.2 Skilled personnel

The skilled personnel shall be familiar with the concept of continuous supervision together with the needs for any reporting or analysis functions which may comprise the method of continuous supervision applicable to the specific installation.

In undertaking continuous supervision of plant and equipment the skilled personnel shall take account of the conditions of the installation and any changes which may occur.

4.5.4 Frequency of inspection

The frequency of the attendance and the inspections which support continuous supervision shall be determined having regard to the specific plant environment in relation to expected deterioration of the equipment (see 4.3.1.1), use and experience.

Unless experience indicates to the contrary, it may be considered that if a part of the installation has a significant inventory of explosion protected equipment is not visited routinely e.g. weekly, then it may be inappropriate to include it as part of the continuous supervision concept.

Where the skilled personnel have noted a condition change of the environment (e.g. invasion of solvent or increased vibration) those items of explosion protected equipment which could be sensitive to the change shall be checked on a more frequent basis.

NOTE It also follows that the skilled personnel will be able to inspect less frequently those items of equipment that experience shows are not susceptible to change.

4.5.5 Documents

Documentation of the installation shall provide sufficient information to:

a) provide a history of maintenance activities with the reason for such activities, and

b) verify the effectiveness of the continuous supervision approach.

Records shall be kept of defects found and remedial action taken.

The documentation may be part of normal maintenance documentation; however, the interrogation arrangements for the system should then be suitable to achieve the above-mentioned concepts.

NOTE The evidence that the skilled personnel are aware of the needs of the continuous supervision concept could be in the form of training programmes. Other evidence of this form of education is also possible.

4.5.6 Training

In addition to the requirements of 4.2, skilled personnel shall be provided with sufficient training to enable familiarity with the installation which they attend. This training shall include any plant, equipment, operational or environmental conditions which relate to their understanding of the needs of the explosion protection of equipment. Where any alterations or changes to the process or installation are effected this information shall be provided to the skilled personnel in a manner which supports their function as part of the continuous supervision process.

Where necessary, training in the concepts of continuous supervision shall be provided together with refresher or reinforcement seminars.

4.5.6DV.1 DR *Modification of Clause 4.5.6, third paragraph to replace with the following:*

4.5.6DV.1.1 The knowledge requirements of the technical person with executive function ~~shall~~ should include ~~a full understanding of~~ the provisions of ~~IEC~~ ISA 60079-10-1, ~~IEC~~ ISA 60079-10-2 as applicable to the location, ~~IEC 60079-14~~ and NFPA 70 ~~, and IEC 60079-19~~ in relation to area classification and/or EPLs and selection, erection, installation, repair and reclamation of equipment.

4.6 Maintenance requirements

4.6.1 Remedial measures and alterations to equipment

The general condition of all equipment shall be noted as required in 4.3, and appropriate remedial measures shall be taken where necessary. Care shall be taken, however, to maintain the integrity of the type of protection provided for the equipment; this may require consultation with the manufacturer.

4.6.1DV.1 D2 *Modification of Clause 4.6.1, second paragraph to replace with the following:*

4.6.1DV.1.1 Replacement parts shall be in accordance with the applicable documentation. Alterations to equipment shall not be carried out without appropriate authorization where they adversely affect the ~~safety~~ explosion protection of the equipment as stated in the applicable documentation.

4.6.1DV.2 D2 *Modification of Clause 4.6.1, third paragraph to delete. It does not apply.*

~~Repairs and reclamation of equipment shall be carried out in accordance with IEC 60079-19.~~

Care should be taken to avoid interfering with the means employed by the manufacturer to reduce the effects of static electricity.

When replacing lamps in luminaires the correct rating and type should be used, or excessive temperatures may result.

Consideration should be given to periodic replacement of lamps in increased safety luminaries before they reach the end of their life as this may can affect the temperature classification of the luminaire.

NOTE The etching, painting or screening of light transmitting parts or the incorrect positioning of the luminaires can lead to excessive temperatures.

4.6.2 Maintenance of flexible cords and cables

4.6.2DV D2 *Modification of Clause 4.6.2 title and paragraph to replace with the following:*

Maintenance of flexible cords and cables

Flexible cords and cables, flexible conduits, and their terminations are particularly prone to damage. They shall be inspected at regular intervals and shall be replaced if found to be damaged or defective.

4.6.3 Withdrawal from service

4.6.3DV DE *Modification of Clause 4.6.3 to replace with the following:*

If it is necessary for maintenance purposes to remove or withdraw equipment, etc., from service, the exposed conductors shall be:

a) correctly terminated in an appropriately protected enclosure, or

b) isolated from all sources of power supply and insulated, or

c) isolated from all sources of power supply and earthed.

If individual items of equipment is to be permanently removed the associated wiring shall be isolated from all sources of power supply and:

a) shall be removed, or

b) correctly labelled and terminated in an appropriate enclosure, or

c) shall be labelled and earthed at one end only and the other end of the cable shall be insulated by a secure means (e.g. heat shrink seals).

NOTE The use of self adhesive tape alone is not regarded as a secure means of insulation.

4.6.4 Fastenings and tools

Where special bolts and other fastenings or special tools are required, these items shall be available and shall be used.

4.7 Environmental conditions

Electrical equipment in a hazardous area can be adversely affected by the environmental conditions in which it is used. Additional consideration shall be given to the inspection interval, type and grade as well as the specific requirements of the inspection where adverse conditions may be expected. Some of the key elements to consider are:

– extremely low or high temperatures;

– pressure conditions;

– corrosive atmosphere;

– vibrations, mechanical impacts, friction or abrasion;

– wind;

– painting processes;

– solar radiation;

– chemicals;

– water and moisture;

– dust and dirt;

– plants, animals, insects.

The corrosion of metal, or the influences of chemicals (particularly solvents) on plastic or elastomeric components, may affect the type and degree of ingress protection of the equipment. If the enclosure or component is severely corroded, the part shall be replaced. Plastic enclosures may exhibit surface cracking which can affect the integrity of the enclosure. Metallic enclosures of equipment shall, where necessary, be treated with an appropriate protective coating as a precaution against corrosion, the frequency and nature of such treatment being determined by the environmental conditions.

It shall be verified that the design of the electrical equipment is acceptable for use in the environment likely to be encountered.

4.7DV DR *Modification of Clause 4.7, fourth paragraph to replace with the following:*

If the marking of the explosion protected equipment does not indicate a range of ambient temperatures, it should only be used over the range of –20 °C to +40 °C, while if a range is indicated the equipment should only be used within ~~this~~ the indicated range ~~(see IEC 60079-14)~~.

All parts of installations shall be kept clean and free from accumulations of dust and deleterious substances that could cause excessive rise in temperature.

Care shall be taken to ensure that the weather protection of the equipment is maintained. Damaged gaskets shall be replaced.

Anti-condensation devices, such as breathing, draining or heating elements, shall be checked to ensure correct operation.

If the equipment is subject to vibration, special care shall be taken to ensure that bolts and cable entries remain tight.

Care shall be taken to avoid the generation of static electricity during the cleaning of non-conductive electrical equipment.

4.8 Isolation of equipment

4.8.1 Installations other than intrinsically safe circuits

4.8.1DV D1 ***Modification of Clause 4.8.1 to replace with the following:***

Electrical equipment containing live parts, which is located in a hazardous area, shall not be opened except as described ~~in a), b) or c).~~ below:

a) Specific maintenance activities may require diagnostic tools and practices that require exposure of such circuits to facilitate testing or repair with tools or other diagnostic electrical equipment that may not be suitable for use in hazardous (classified) areas. In these cases, one methodology that may be utilized to control and mitigate the ignition risk hazards associated with this equipment or practice is a Gas Free Work Permit (GFWP) or comparable permitting process for a combustible dust location. The GFWP is a permit of operation that is controlled by a documented work management process, stating that work involving potential ignition sources may be performed in a hazardous (classified) location by ensuring that the atmosphere is free of ignitable concentrations of flammable gases or vapours. This permit is a written document requiring the review and approval by an authorized person as documented by the work management process in a position of authority for the location. A GFWP should incorporate the following:

1) A measurement to confirm the absence of an ignitable concentration of any flammable gas or vapour.

2) Sampling to confirm the continued absence of a flammable gas or vapour.

3) Contingency plans for emergencies.

~~a~~ b) Work, for which the exposure of live parts is necessary, may be carried out subject to the precautions which would be applied in a non-hazardous area~~,~~ and under a safe work procedure (see ~~IEC 60079-14~~ NFPA 70E).

This may require isolating of all incoming and outgoing connections including the neutral conductor. "isolation" in this context means withdrawal of fuses and links or the locking off of an isolator or switch in accordance with local lock out and tag out procedures.

Sufficient time may need to be allowed to permit any surface temperature or stored electrical energy to decay to a level below which it is incapable of causing ignition.

NOTE 1 The protective capabilities of an Class I, Zone 1 AEx d enclosure are always compromised by opening it, whereas Class I, Zone 1 AEx e and Class I, Zone 1 AEx n enclosures may be of lesser concern if moisture ingress is unlikely while they are opened.

~~b~~ c) Work, ~~A relaxation of the requirements for~~ on increased safety "e" equipment which also contains intrinsically safe apparatus is permitted on the intrinsically safe portion of

the equipment, if all bare live parts that are increased safety "e" ~~not protected by the type of protection "i"~~ have a separate internal cover and partitions providing at least the degree of protection IP30 when the enclosure of the apparatus is opened.

This equipment should be provided with an external label stating:

"WARNING – DO NOT OPEN WHEN NON-INTRINSICALLY SAFE CIRCUITS ARE ENERGIZED". Technically equivalent text may be used and multiple warnings may be combined.

NOTE 2 The purpose of the internal cover, when fitted, is to provide a minimum acceptable degree of protection against the access to energized non-intrinsically-safe circuits when the enclosure is opened for short periods to permit live maintenance of intrinsically-safe circuits. The cover is not intended to provide protection from electrical shock.

~~c) In locations requiring EPL Gc or Dc, the work may be carried out subject to the precautions which would be applied in a non-hazardous area, if a safety assessment shows that the following conditions are satisfied:~~

~~1) the proposed work on energized equipment does not produce sparks capable of ignition;~~

~~2) the circuits are of such a design as to preclude the production of such sparks;~~

~~3) the equipment and any associated circuits within the hazardous area do not include any hot surfaces capable of producing ignition.~~

~~If these conditions can be met, then work may be carried out subject only to the precautions which would be applied in a non-hazardous area.~~

~~The results of the safety assessment shall be recorded in documents which shall contain:~~

~~• the form(s) which the proposed work on energized equipment may take;~~

~~• the results of the assessment, including the results of any testing carried out during the assessment;~~

~~• any conditions in association with the maintenance of energized equipment which the assessment has shown to be necessary.~~

~~The assessors of the equipment shall:~~

~~• be familiar with the requirements of any relevant standards, the recommendations of any codes of practice, and any current interpretation;~~

~~• have access to all information necessary to carry out the assessment.~~

4.8.2 Intrinsically safe installations live maintenance

4.8.2DV D2 ***Modification of Clause 4.8.2 to replace with the following:***

Maintenance work may be carried out on energized intrinsically safe equipment when allowed by the relevant manufacturer's documentation ~~provided additional care is taken to prevent violation of circuits where more than one circuit is in the equipment,~~ subject to the conditions detailed below.

a) Maintenance work in hazardous areas

Any maintenance work shall be restricted to:

1) disconnection of, and removal or replacement of, items of electrical equipment and cabling;

2) adjustment of any controls necessary for the calibration of the electrical equipment or system;

3) removal and replacement of any plug-in components or assemblies;

4) any other maintenance activity specifically permitted by the relevant documentation;

5) use of any test instruments specified in the relevant documentation.

Where test instruments are not specified in the relevant documentation, only those instruments which do not affect the intrinsic safety of the circuit under test may be used.

The person carrying out any of the functions described above shall ensure that the intrinsically safe system or self-contained intrinsically safe equipment meets the requirements of the relevant documentation after completion of any of those functions.

b) Maintenance work on intrinsically safe circuits and equipment located in a non-hazardous area

Maintenance of associated ~~electrical~~ apparatus and parts of intrinsically safe circuits located in non-hazardous areas shall be restricted to that described in a) ~~whilst~~ above when such electrical apparatus or parts of circuits remain interconnected with parts of intrinsically safe systems located in hazardous areas.

Safety barrier earth connections shall not be removed without first disconnecting the hazardous area circuits, except where duplicate earth connections are provided, in this case a single earth may be removed to facilitate earth resistance ~~checking~~ measurement.

Other maintenance work on associated apparatus or parts of an intrinsically safe circuit ~~mounted~~ installed in a non-hazardous area shall be carried out only if the electrical apparatus or part of a circuit is disconnected from the part of the circuit located in a hazardous area.

4.9 Earthing and equipotential bonding

4.9DV DR *Modification of Clause 4.9 to replace with the following:*

Care shall be taken to ensure that the earthing and potential equalization bonding provisions in hazardous areas are maintained in good condition (see Table 1DV, items B6 and B7; Table 2DV, items B6 and B7; and Table 3DV, items B3 and B4.

NOTE The term earthing is identified by the NEC (NFPA 70) as grounding.

4.10 Specific conditions of use

4.10DV DR *Modification of Clause 4.10 to replace with the following:*

Specific conditions of use may apply to any type of certified explosion protected equipment ~~where the certificate number has a suffix marking of "X"~~. The certification and instruction documents shall be studied to ascertain the specific conditions of use and that these have been complied with.

4.11 Movable equipment and its connections

Precaution shall be taken to ensure that movable electrical equipment (portable, transportable and hand-held) is used only in locations appropriate to its type of protection, equipment group and surface temperature.

4.11DV DR *Modification of Clause 4.11, second paragraph to replace with the following:*

4.11DV.1.1 Ordinary industrial movable equipment, welding equipment, etc. ~~should~~ shall not be used in a hazardous area unless its use is managed under a safe work procedure (see ~~IEC 60079-14~~ GFWP in 4.8.1a) ~~and the specific location has been assessed to ensure that there is no explosive atmosphere present~~.

4.12 Inspection schedules (Table 1DV to Table 3DV)

4.12.1 General

4.12.1DV DE *Modification of Clause 4.12.1 to replace with the following:*

Care shall be taken when using test equipment in a ~~safe~~ non-hazardous area that may result in discharges in the hazardous area.

Items identified in the Table 1DV to Table 3DV and 4.12.2 to 4.12.11 ~~detail~~ illustrate only the key items related to hazardous area integrity. Other items may also apply along with specific details from the manufacturer's instructions and application requirements. Inspection schedules should be modified accordingly to suit the specific installation requirements.

The following requirements shall be ~~checked~~ verified against the site documentation ~~as defined in IEC 60079-14~~.

4.12.2 Equipment is appropriate to the EPL/zone requirements of the location

4.12.2DV DR *Modification of Clause 4.12.2 to replace with the following:*

Equipment meets the requirements for the EPL/zone of use for the location and area classification as defined in NFPA 70.

4.12.3 ~~Equipment~~ Material group

4.12.3DV DR *Modification of Clause 4.12.3 title and paragraph to replace with the following:*

~~Equipment~~ Material group

Equipment gas or dust group shall be correct for the location and area classification as defined in NFPA 70.

4.12.4 Equipment maximum surface temperature

4.12.4DV DR *Modification of Clause 4.12.4 to replace with the following:*

Equipment maximum surface temperature rating (temperature class) shall be correct for the location.

4.12.5 Equipment circuit identification

The purpose of this requirement is to facilitate the correct isolation of equipment whenever work is to be carried out. This can be achieved in a variety of ways, for example:

a) Equipment is fitted with a permanent label which specifies the source of supply.

b) Equipment is fitted with a tag number or the cable is fitted with a cable number adjacent to the equipment. The source of supply can be determined from a drawing or schedule by reference to the tag number or cable number.

c) Item is clearly and unambiguously shown on a drawing on which the source of supply is either identified directly or indirectly via a schedule.

The equipment circuit identification shall be maintained for safety reasons and shall be checked, for all equipment, at the periodic inspection. The availability of the necessary information shall be checked, for all equipment, at the periodic inspection. The requirement of a detailed inspection, to check that the information is correct, shall be carried out when the circuit is isolated in order to make other detailed checks.

4.12.6 Cable and conduit ~~gland~~ fittings

4.12.6DV DE *Modification of Clause 4.12.6 title and paragraphs to replace with the following:*

Cable and conduit ~~gland~~ fittings

Where the suitability and integrity of the ~~gland~~ cable and conduit fittings cannot be ascertained by close inspection it is necessary to undertake further investigation or a detailed inspection.

Under close inspection, ~~gland~~ cable and conduit fittings tightness may be checked by hand without removing weatherproofing tape or shrouds.

4.12.7 Type of cable and conduit

4.12.7DV DE *Modification of Clause 4.12.7 title and paragraph to replace with the following:*

Type of cable and conduit.

The type of cable and conduit ~~is~~ are in accordance with the site documentation and ~~IEC 60079-14~~ NFPA 70.

The type of cable is in accordance with the site documentation ~~and IEC 60079-14~~.

4.12.8 Sealing

4.12.8DV D2 *Modification of Clause 4.12.8 to replace with the following:*

The sealing of trunking/ducts/pipes/conduits, etc., is in accordance with the site documentation ~~and IEC 60079-14~~. In addition, conduit and cable seal fittings should be inspected to ensure the proper filling and curing.

4.12.9 Fault loop impedance or earthing resistance

4.12.9DV D1 *Modification of Clause 4.12.9 to replace with the following:*

The integrity of the ~~earthing~~ grounding shall be ~~checked~~ measured at the initial inspection by measurement of resistance of the grounding conductor. The measurement may be made using an intrinsically safe resistance measuring instrument (~~as the procedure specified by the~~ in accordance with the limitations of use and the procedure specified by the manufacturer). Detailed sample inspections may be carried out and the results ~~checked~~ verified against those obtained from the initial inspection.

Non-intrinsically safe measuring equipment may be used if a safe work procedure (see ~~IEC 60079-14~~ GFWP in 4.8.1a)) has been conducted and if the locations where potentially incendive sparking could occur.

NOTE Incendive sparks could occur in locations other than the place of test.

4.12.10 Insulation resistance for intrinsically safe systems

4.12.10DV DE *Modification of Clause 4.12.10 title and paragraph to replace with the following:*

Insulation resistance for intrinsically safe systems

The insulation resistance for intrinsically safe apparatus and associated cabling shall be measured at 500 V a.c. or 700 V d.c. The insulation resistance shall be at least 1,0 MΩ unless specifically defined in user documentation.

NOTE Test requirements for non-intrinsically safe circuits are covered in ~~IEC 60364-6~~ NFPA 70B.

4.12.11 Overload protection

4.12.11DV DE *Modification of Clause 4.12.11 to replace with the following:*

See ~~IEC 60079-14~~ NFPA 70, concerning the requirements for overload protection for rotating electrical machines. It is necessary to check that the protective device is set at the correct value for the application and not more than the rated current of the machine.

4.12.12 Lamps and luminaires

Lamps for luminaires shall be checked for conditions that may lead to excessive temperatures. Items that shall be checked include:

a) Incorrect ratings, type and position.

b) Lamps using non-conductive materials with a conductive coating.

c) Fluorescent lamps exhibiting end of life (EOL) effects, for fittings manufactured without end of life protection.

NOTE Indicators of EOL effects include low-level light, flickering, yellowish/reddish discharge near the electrode or severe end-blackening.

5 Additional inspection schedule requirements

5.1 Type of protection "d" – Flameproof enclosure (see Table 1DV and ~~IEC 60079-1~~ UL 60079-1)

5.1DV D2 *Modification of Clause 5.1 title and paragraphs to replace with the following:*

Type of protection "d" – Flameproof enclosure (see Table 1DV and ~~IEC 60079-1~~ UL 60079-1

When reassembling flameproof or explosionproof enclosures, all joints shall be thoroughly cleaned and greased as specified by the manufacturer to prevent corrosion and to assist in weather-proofing. Where the manufacturer's documentation does not address joint protection including use of grease then only corrosion inhibiting grease, such as petroleum jelly or soap-thickened mineral oils may be lightly applied before reassembly. The grease, if applied, shall be of a type that does not harden because of aging, does not contain an evaporating solvent, and does not cause corrosion of the joint surfaces. Care in the selection and application of greases should be taken to ensure the retention of the non-setting characteristics and to allow subsequent separation of the joint surfaces. Selection of a material other than those listed herein shall be the responsibility of the user to confirm suitability according to these requirements. Silicone based greases, if used, can affect some types of gas detectors – see ISA 60079-29-1 (12.13.01). ~~may be lightly smeared with a suitable grease, as specified in IEC 60079-14, to prevent corrosion and to assist weather-proofing.~~ Blind bolt-holes shall be kept clear of grease. Only non-metallic scrapers and non-corrosive cleaning fluids shall be used to clean flanges ~~(see IEC 60079-14)~~.

It is normally considered not necessary to check the diametric clearance of spigot, shaft, spindle and threaded joints, unless there is evidence of wear, distortion, corrosion or other damage, in which case reference shall be made to the manufacturer's documents.

Inspection check A16 of Table 1DV should be applied when a visual examination of flanged joint surfaces suggests that the maximum gap dimensions may be exceeded.

Joints which are not normally capable of being dismantled need not be subjected to the inspection checks A13 and A16 of Table 1DV.

Bolts, screws and similar parts, upon which the type of protection depends, shall only be replaced by ~~similar~~ identical parts in accordance with the manufacturer's design.

5.2 Type of protection "e" – Increased safety (see Table 1DV and ~~IEC 60079-7~~ UL 60079-7)

5.2DV D1 *Modification of Clause 5.2 title and paragraphs to replace with the following:*

Type of protection "e" – Increased safety (see Table 1DV and ~~IEC 60079-7~~ UL 60079-7)

The windings of Class I, Zone 1 AEx " e " motors are protected by suitable devices to ensure that the limiting temperature cannot be exceeded in service (including stalling).

It is ~~therefore~~ necessary to check that the protective device is so selected such that the tripping time from a cold start, ~~taken from~~ the time delay characteristic of the protective device, ~~for the current ratio I_A/I_N of the motor to be protected,~~ is not longer than the stated time t_E on the marking plate of the motor with a maximum tolerance of +20 % .

In the case of a repaired motor, time t_E ~~may~~ could be reduced ~~and~~ requiring that the protective device setting ~~should be checked (see IEC 60079-19)~~ be adjusted to the revised value.

~~**The tripping time in service should be checked against the results from the initial inspection**~~

~~**NOTE It may or may not be necessary to measure the tripping times at the periodic inspection.**~~

5.3 Type of protection "i" – Intrinsic safety (see Table 2DV and ~~IEC~~ UL 60079-11)

5.3DV D1 *Modification of Clause 5.3 title to replace with the following:*

Type of protection "i" – Instrinsic safety (see Table 2DV and ~~IEC~~ UL 60079-11)

NOTE 5.3.1 to 5.3.11 are valid for all three levels of protection "ia", "ib" and "ic" of intrinsic safety.

5.3.1 General

5.3.1DV D1 *Modification of Clause 5.3.1 to add the following before the first paragraph:*

The requirements below are applicable to all three levels of protection "ia", "ib" and "ic" of intrinsic safety.

Where the intelligence incorporated in the system permits the frequent monitoring of the status of an instrument loop, some parts of the inspection procedure may be waived. For example, if an installation can confirm the presence of a specific instrument by checking a unique serial number, there is no necessity to read the label periodically.

5.3.2 Documentation

5.3.2DV D2 *Modification of Clause 5.3.2 to replace with the following:*

The documentation referred to in Table 2DV, as a minimum, includes details of:

a) circuit safety documents~~, where appropriate~~;

b) manufacturer, equipment type and ~~certificate numbers~~ certifications, level of protection and, in case of gases, ~~equipment~~ material group and temperature class and, in case of dust, ~~equipment~~ material group and the maximum surface temperature;

c) ~~where appropriate,~~ electrical parameters such as capacitance and inductance, length, type and route of cables;

d) special requirements of the equipment certificate(s) and ~~detailed methods by which~~ how such requirements are met in the particular installation;

e) physical location of each item in the plant.

5.3.3 Labelling

Labels shall be inspected to ensure that they are legible and comply with the requirements laid down in the appropriate documentation to ensure that the equipment actually fitted is that specified.

5.3.4 Unauthorized modifications

The requirement to check that there are "no unauthorized modifications" can present some problems, in that it is difficult to detect alteration to, for example, a printed circuit board. Nevertheless, some consideration should be given to the possibility of there having been some unauthorized modification.

It may be possible to utilize the fact that the soldering associated with most repairs/alterations is not of the same type or quality as the original. Photographs of the original boards, supported by listings of the key components upon which the safety of the circuit depends, may be useful.

5.3.5 Associated apparatus (safety interface) between intrinsically safe and non-intrinsically safe circuits

5.3.5DV DE *Modification of Clause 5.3.5 to replace with the following:*

Associated apparatus shall be inspected to ensure that it is of the correct type and rating in accordance with the ~~descriptive~~ system ~~document~~ control drawing. Where the associated apparatus is a shunt diode safety barrier, the security of the earth connections ~~relating to the integrity of the device~~ shall be checked (see also 5.3.9)

5.3.6 Cables

5.3.6DV DE *Modification of Clause 5.3.6 to replace with the following:*

Installations shall be inspected to ensure that the cables used comply with the control drawing and documentation. Particular care shall be taken when utilizing spare ~~cores~~ conductors in multicore cables containing more than one intrinsically safe circuit and to the protection afforded where cables containing intrinsically safe systems and other cables ~~run~~ are installed in the same pipe, duct or cable tray.

5.3.7 Cable ~~screens~~ shields

5.3.7DV DE *Modification of Clause 5.3.7 title and paragraph to replace with the following:*

Cable ~~screens~~ shields

Installations shall be inspected to ensure that cable ~~screens~~ shields are earthed in accordance with the appropriate control drawing and documentation. ~~Particular attention shall be paid to i~~ Installations utilizing multicore cables which contain more than one intrinsically safe system may require inspection to ensure adequate separation of circuits.

5.3.8 Point-to-point connections

5.3.8DV DR *Modification of Clause 5.3.8 to replace with the following:*

This check is only required at the initial inspection ~~(see IEC 60079-14)~~.

5.3.9 Earth continuity of non-galvanically isolated circuits

5.3.9DV DR *Modification of Clause 5.3.9 to replace with the following:*

On initial inspection, the resistance of the earth connection between intrinsically safe circuits and the earth point should have been measured and documented.

If the measurement of the resistance to earth involves carrying out electrical testing within the hazardous area or testing within the non-hazardous area which could impair the intrinsically safe circuit, the test equipment used shall be specifically designed for use on intrinsically safe circuits unless the effect on the intrinsically safe circuit will only exist during the test and those responsible for the hazardous area can guarantee that, for the duration of the test, it will be free from an explosive (gas and dust) atmosphere (see GFWP in 4.8.1a)).

Where connections show evidence of degradation or corrosion indicating the potential loss of integrity a representative sample of connections, ~~selected by the person responsible for the integrity of the equipment~~ shall be measured periodically to confirm the continuing integrity of the connections and the results checked against those obtained from the initial inspection.

5.3.10 Earth connections to maintain the integrity of the intrinsic safety

The resistance of the earth connections necessary to maintain the integrity of the intrinsically safe system (such as transformer screen earth, barrier relay frame earth) shall be measured as in 5.3.9. There is no requirement to measure the earth loop impedance of mains powered equipment associated with intrinsically safe circuits other than that required for normal control room instrumentation to protect against electric shock. Since, in some equipment, the intrinsic safety earthing is internally connected to the equipment frame, any impedance measurements (such as between the earth pin of the plug and the equipment frame, or the equipment frame and the control panel) shall be made using a tester specifically designed for use on intrinsically safe circuits.

5.3.11 Intrinsically safe circuit earthing and/or insulation

The insulation testing of intrinsically safe circuits is necessary to confirm that they are earthed or insulated from earth throughout, whichever of these conditions is required by the original design. This requirement may be unnecessary if an earth fault is self-revealing, for example, if a circuit "fails safe" as result of an earth fault or the circuit uses an earth leakage monitoring device. Insulation testing of intrinsically safe systems or circuits shall only be carried out using a test device specifically approved for connection to such circuits.

5.3.11DV.1 D1 ***Modification of Clause 5.3.11, second paragraph to replace with the following:***

5.3.11DV.1.1 Where, in order to carry out these tests, the common earth connection to a group of barriers is disconnected, the tests can only be made if either the plant is free from hazard (see GFWP in 4.8.1a)), or if power is removed completely from all the circuits which depend upon that common earth connection.

This test is only required on a sample basis.

5.3.12 Separation between intrinsically safe and non-intrinsically safe circuits

5.3.12DV D2 ***Modification of Clause 5.3.12 to replace with the following:***

Junction boxes and enclosures containing associated apparatus shall be inspected to ensure that the segregation between intrinsically safe and non-intrinsically safe wiring and connections ~~is~~ are maintained and that they contain only the wiring specified in the control drawing or documentation appropriate to any system passing through them. Raceways containing intrinsically safe wiring and circuits shall be inspected to ensure the segregation between intrinsically safe and non-intrinsically safe wiring is maintained. See also ~~IEC 60079-14~~ NFPA 70.

5.4 Type of protection “p” and “pD” – Pressurized enclosure (see Table 3DV, ~~IEC 60079-2~~ UL 60079-2 and IEC 61241-4)

5.4DV DR ***Modification of Clause 5.4 title and paragraph to replace with the following:***

Type of protection “p” and “pD” – Pressurized enclosure (see Table 3DV, ~~IEC 60079-2~~ UL 60079-2 ~~and IEC 61241-4)~~

Explosion protected equipment type "p" or "pD" shall be inspected in accordance with Table 3DV, and with ~~IEC 60079-2~~ UL 60079-2 for gases or ~~IEC 61241-4 for~~ dusts. ~~See also IEC 60079-14.~~

5.5 Type of protection “n” (see Table 1DV or Table 2DV and IEC 60079-15)

5.5.1 General

5.5.1DV DC *Modification of Clause 5.5.1 to replace with the following:*

Explosion protected equipment type “nA”, “nC” and “nR” shall be inspected in accordance with the “n” column of Table 1DV.

~~Explosion protected equipment to type of protection “"nL” shall be inspected in accordance with Table 2DV (see 5.3).~~

5.5.2 Restricted breathing enclosures

Restricted breathing enclosures with provision for routine checking shall be subjected to periodic pressure test measurement (see IEC 60079-15) at intervals of six months or more, as experience dictates.

5.6 Type of protection “t” and “tD” – Protection by enclosure (see Table 1DV and ~~IEC 60079-31~~ UL 60079-31 ~~and IEC 61241-1~~)

5.6DV D2 *Modification of Clause 5.6 title and paragraph to replace with the following:*

Type of protection "t" and "tD" – Protection by enclosure (see Table 1DV and ~~IEC 60079-31~~ UL 60079-31 ~~and IEC 61241-1~~

Explosion protected equipment type "ta", "tb", "tc", and “tD” shall be inspected in accordance with the "t/tD" column in Table 1DV.

5.7 Types of protection “m” and “mD” (encapsulation), “o”, (oil-immersion) ~~“op” (optical radiation)~~ and “q” (powder-filling)

5.7DV DR *Modification of Clause 5.7 title and paragraph to replace with the following:*

Types of protection "m" and "mD" (encapsulation), "o", (oil-immersion) ~~"op" (optical radiation)~~ and "q" (powder-filling)

Tables have not been prepared to illustrate the inspection requirements for "ma", "mb", "mc", "mD", "o", ~~"op"~~ and "q" types of protection. Table 1DV should be utilised as appropriate for the enclosure and its contents.

NOTE Inspection details for type of protection "o" are under consideration in ~~IEC 60079-6~~ UL 60079-6.

6 Inspection tables

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

Table 1DV
Inspection schedule for ~~Ex "d", Ex "e", Ex "n" and Ex "t/td"~~ AEx d, AEx e, AEx n and AEx t/tD

Check that: X = required for all types, n = type "n" only, t = type "t" and"tD" only		~~Ex "d"~~ AEx d			~~Ex "e"~~ AEx e			~~Ex "n"~~ AEx n ~~Ex "t/tD"~~AEx t/tD		
		Grade of inspection								
		D	C	V	D	C	V	D	C	V
A	GENERAL (ALL EQUIPMENT)									
1	Equipment is appropriate to the EPL/Zone requirements of the location	X	X	X	X	X	X	X	X	X
2	~~Equipment~~ Material group is correct	X	X		X	X		X	X	
3	Equipment temperature class is correct (only for gas)	X	X		X	X		n	n	
4	Equipment maximum surface temperature is correct only for dust							t	t	
5	Degree of protection (IP grade) of equipment is appropriate for the level of protection/group/conductivity	X	X	X	X	X	X	X	X	X
6	Equipment circuit identification is correct	X			X			X		
7	Equipment circuit identification is available	X	X	X	X	X	X	X	X	X
8	Enclosure, glass parts and glass-to-metal sealing gaskets and/or compounds are satisfactory	X	X	X	X	X	X	X	X	X
9	There is no damage or unauthorized modifications	X			X			X		
10	There is no evidence of unauthorized modifications		X	X		X	X		X	X
11	Bolts, cable entry devices (direct and indirect) and blanking elements are of the correct type and are complete and tight									
	– physical check	X	X		X	X		X	X	
	– visual check			X			X			X
12	Threaded covers on enclosures are of the correct type, are tight and secured									
	– physical check	X	X							
	– visual check			X						
13	Joint surfaces are clean and undamaged and gaskets, if any, are satisfactory and positioned correctly	X								
14	Condition of enclosure gaskets is satisfactory	X			X			X		
15	There is no evidence of ingress of water or dust in the enclosure in accordance with the IP rating	X			X			X		
16	Dimensions of flanged joint gaps are:	X								

Table 1DV Continued on Next Page

Table 1DV Continued

Check that: X = required for all types, n = type "n" only, t = type "t" and"tD" only		~~Ex "d"~~ AEx d			~~Ex "e"~~ AEx e			~~Ex "n"~~ AEx n ~~Ex "t/tD"~~AEx t/tD		
		Grade of inspection								
		D	C	V	D	C	V	D	C	V
	– within the limits in accordance with manufacturer's documentation or – within maximum values permitted by relevant construction standard at time of installation or – within maximum values permitted by site documentation									
17	Electrical connections are tight				X			X		
18	Unused terminals are tightened				X			n		
19	Enclosed-break and hermetically sealed devices are undamaged							n		
20	Encapsulated components are undamaged				X			n		
21	Flameproof components are undamaged	X			X			n		
22	Restricted breathing enclosure is satisfactory – (type "nR" only)							n		
23	Test port, if fitted, is functional – (type "nR" only)							n		
24	Breathing operation is satisfactory – (type "nR" only)	X			X			n		
25	Breathing and draining devices are satisfactory	X	X		X	X		n	n	
	EQUIPMENT SPECIFIC (LIGHTING)									
26	Fluorescent lamps are not indicating EOL effects				X	X	X	X	X	X
27	HID lamps are not indicating EOL effects	X	X	X	X	X	X	X	X	X
28	Lamp type, rating, pin configuration and position are correct	X			X			X		
	EQUIPMENT SPECIFIC (MOTORS)									
29	Motor fans have sufficient clearance to the enclosure and/or covers, cooling systems are undamaged, motor ~~foundations~~ mounts have no indentations or cracks.	X	X	X	X	X	X	X	X	X
30	The ventilation airflow is not impeded	X	X	X	X	X	X	X	X	X
31	Insulation resistance (IR) of the motor windings is satisfactory	X			X			X		
B	INSTALLATION – GENERAL									
1	Type of cable, cords, and associated fittings are appropriate and installed correctly ~~is appropriate~~	X			X			X		
2	There is no obvious damage to cables or cords including fittings and connectors	X	X	X	X	X	X	X	X	X
3	Sealing of ~~trunking~~ cable transits or wall penetrations, ducts, pipes and/or conduits is satisfactory	X	X	X	X	X	X	X	X	X

Table 1DV Continued on Next Page

Table 1DV Continued

Check that: X = required for all types, n = type "n" only, t = type "t" and"tD" only		~~Ex "d"~~ AEx d			~~Ex "e"~~ AEx e			~~Ex "n"~~ AEx n ~~Ex "t/tD"~~AEx t/tD		
		Grade of inspection								
		D	C	V	D	C	V	D	C	V
4	~~Stopping boxes~~ Conduit and cable ~~boxes~~ seal fittings are correctly filled and cured	X								
5	Integrity of conduit system and interface with ~~mixed~~ cable system maintained	X			X			X		
6	Earthing connections, including any supplementary earthing bonding connections are satisfactory (for example connections are tight and conductors are of sufficient cross-section)									
	– physical check	X			X			X		
	– visual check		X	X		X	X		X	X
7	Fault loop impedance (~~TN~~ 4 wire systems) or earthing resistance (~~IT~~ resistance grounded systems) is satisfactory	X			X			X		
8	Automatic electrical protective devices are set correctly (auto-reset not possible)	X			X			X		
9	Automatic electrical protective devices operate within permitted limits	X			X			X		
10	Specific conditions of use (if applicable) are complied with	X			X			X		
11	Cables not in use are correctly terminated	X			X			X		
12	Obstructions adjacent to flameproof flanged joints are in accordance with ~~IEC 60079-14~~ the manufacturer's instructions	X	X	X						
13	Variable voltage/frequency installation complies with documentation	X	X		X	X		X	X	
	INSTALLATION – TRACE HEATING SYSTEMS									
14	Temperature sensors function according to manufacturer's documents	X			X			t		
15	Safety cut off devices function according to manufacturer's documents	X			X			t		
16	The setting of the safety cut off is sealed	X	X		X	X				
17	Reset of a heating system safety cut off possible with tool only	X	X		X	X				
18	Auto-reset is not possible	X	X		X	X				
19	Reset of a safety cut off under fault conditions is prevented	X			X					
20	Safety cut off independent from control system	X			X					
21	Level switch is installed and correctly set, if required	X			X					
22	Flow switch is installed and correctly set, if required	X			X					
	INSTALLATION – MOTORS									

Table 1DV Continued on Next Page

Table 1DV Continued

Check that: X = required for all types, n = type "n" only, t = type "t" and"tD" only		~~Ex "d"~~ AEx d			~~Ex "e"~~ AEx e			~~Ex "n"~~ AEx n ~~Ex "t/tD"~~AEx t/tD		
		Grade of inspection								
		D	C	V	D	C	V	D	C	V
23	Motor protection devices operate within the permitted t_E or t_A time limits.				X					
C	ENVIRONMENT									
1	Equipment is adequately protected against corrosion, weather, vibration and other adverse factors	X	X	X	X	X	X	X	X	X
2	No undue accumulation of dust and dirt	X	X	X	X	X	X	X	X	X
3	Electrical insulation is clean and dry				X			X		
(D = detailed, C = close, V = visual)										

Table 2DV DR *Modification to Table 2 to replace with the following:*

Table 2DV
Inspection schedule for ~~Ex "i"~~ AEx i installations

Check that: X = required		Grade of inspection		
		D	C	V
A	EQUIPMENT			
1	Circuit and/or equipment documentation is appropriate to the EPL/Zone	X	X	X
2	Equipment installed is that specified in the documentation	X	X	
3	Circuit and/or equipment category and group correct	X	X	
4	IP rating of equipment is appropriate to the Group III material present	X	X	
5	Equipment temperature class is correct	X	X	
6	Ambient temperature range of the apparatus is correct for the installation	X	X	
7	~~Service~~ Process temperature range of the apparatus is correct for the installation	X	X	
8	Installation is clearly labelled	X	X	
9	Enclosure, glass parts and glass-to-metal sealing gaskets and/or compounds are satisfactory	X		
10	Cable glands and blanking elements are the correct type, complete and tight – physical check – visual check	X	X	X
11	There are no unauthorized modifications	X		
12	There is no evidence of unauthorized modifications		X	X
13	Diode safety barriers, galvanic isolators, relays and other energy limiting devices are of the approved type, installed in accordance with the certification requirements and securely earthed where required	X	X	X
14	Condition of enclosure gaskets is satisfactory	X		
15	Electrical connections are tight	X		
16	Printed circuit boards are clean and undamaged	X		

Table 2DV Continued on Next Page