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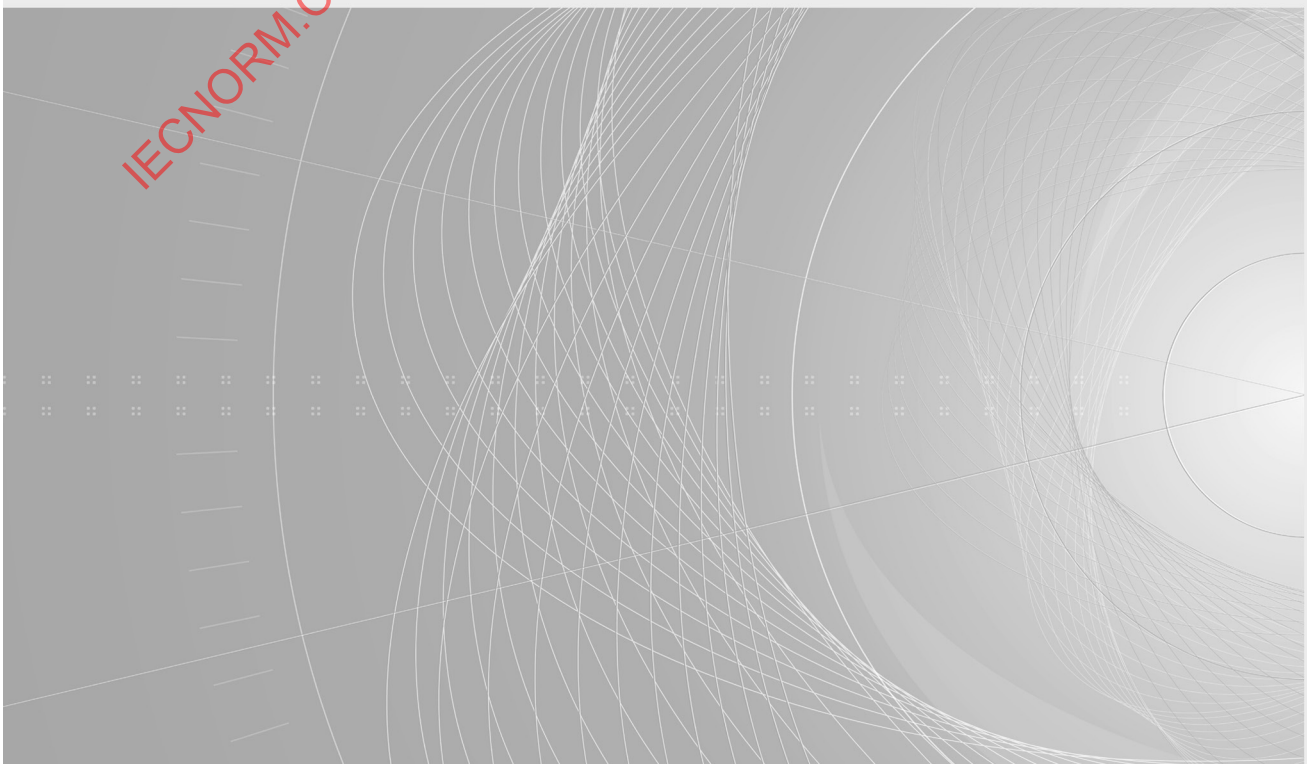
Edition 6.0 2023-12
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Explosive atmospheres –
Part 17: Electrical installations inspection and maintenance



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Explosive atmospheres –
Part 17: Electrical installations inspection and maintenance

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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EXPLOSIVE ATMOSPHERES –

Part 17: Electrical installations inspection and maintenance

FOREWORD

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.
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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60079-17:2013. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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. It is an International Standard.

This sixth edition cancels and replaces the fifth edition published in 2013. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

		Type		
Changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
Simplifying description of explosive gas and dust atmospheres in the Scope and uses of these terms throughout document	1	X		
Clarifies the exclusion of ventilated rooms in the Scope	1	X		
Aligns maintenance terms and definitions in 3.7 and 3.8 with IEV & 60079.	3	X		
Introducing new clause 4.4.1.2. **Manufacturer's documentation** for cross referencing in text without repetition	4	X		
Further guidance added into Note 4 regarding factors contributing to the deterioration of Ex Equipment.	4.4.1.1.		X	
Clarifies the change in terminology from previously used **Special Condition of Safe Use** to current terminology **Specific Conditions of Use**.	4.11		X	
Further requirements added regarding Type of Protection "o".	5.7			C1
Clarification added regarding use of inspection tables	6		X	
Minor editorial changes and correction made to Tables 1 to 4 but with no change to item numbering or content	Tables 1 to 4	X		
Modified reference in this standard to align all types of inspection with Continuous Supervision terms for example; Skilled Personnel and Technical Persons with Executive Function.	Annex B			C2
A typical assessment and test report is shown in C.5.14.	Annex C	X		
Introducing new items in the Bibliography	Bibliography	X		
NOTE The technical changes referred to include the significance of technical changes in the revised IEC Standard, but they do not form an exhaustive list of all modifications from the previous version.				

Explanations:

A Definitions

Minor and editorial changes

– clarification
– decrease of technical requirements
– minor technical change
– editorial corrections

These are changes which modify requirements in an editorial or a minor technical way. They include changes of the wording to clarify technical requirements without any technical change, or a reduction in level of existing requirement.

Extension

– addition of technical options

These are changes which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements from the previous standard.

Major technical changes

– addition of technical requirements

– increase of technical requirements

These are changes to technical requirements (addition, increase of the level or removal) made in a way that an overhaul or repair of product to the preceding edition will not always be able to fulfil the requirements given in the later edition. For these changes additional information is provided in clause B) below.

NOTE These changes represent current technological knowledge. However, these changes do not normally have an influence on equipment already placed on the market.

B Information about the background of 'major technical changes'

C1 Sub-clause 5.7 and Table 4 has been inserted based on text submitted by MT60079-6 *Explosive atmospheres – Part 6: Equipment protection by liquid immersion "o".*

C2 The previous reference to Responsible Person in Annex B usually reflects the roles and the responsibilities of a person rather than the technical knowledge, skills and competencies required to manage the activity of periodic inspection and maintenance of Ex equipment. The term used within the Continuous Supervision clauses of Technical Person With Executive Function provides clarity and harmonises the clauses within the document.

The text of this International Standard is based on the following documents:

Draft	Report on voting
31J/345/FDIS	31J/351/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

This International Standard is intended 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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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 document provides the details for initial inspection and on-going inspections as either:

a) regular periodic inspections thereafter, or,

b) continuous supervision by Skilled Personnel.

Where necessary, maintenance ~~may~~ might also be needed.

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

EXPLOSIVE ATMOSPHERES –

Part 17: Electrical installations inspection and maintenance

1 Scope

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

It does not include:

- other fundamental installation and inspection requirements for electrical installations;
- the verification of electrical equipment;
- protection or ventilation of rooms;
- gas detection systems;
- the repair, overhaul and reclamation of explosion protected equipment (see IEC 60079-19).

While this document does not include inspection of safety devices such as used in ventilated rooms (see IEC 60079-13), it does include the requirements for inspection and maintenance of individual items of equipment that will be part of such systems, for example motors or sensors.

This document supplements the requirements for inspection and testing in non-hazardous areas in IEC 60364-6.

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

This document is intended to be applied where there ~~can be~~ is a risk due to the potential 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.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 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*~~ *Explosive 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"*~~

3 Terms and definitions

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

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
close inspection
inspection that 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, for 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 that 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~~ can 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.~~

Note 1 to entry: IEC 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*, gives a classification of hazardous areas containing explosive gas atmospheres (see IEC 60050-426:2020, 426-03-03, 426-03-04 and 426-03-05).

Note 2 to entry: IEC 60079-10-2, *Explosive atmospheres – Part 10-2: Classification of areas – Explosive dust atmospheres*, gives a classification of hazardous areas containing explosive dust atmospheres (see IEC 60050-426:2020, 426-03-23, 426-03-24, and 426-03-25).

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

3.6
inspection
<for explosive atmospheres> 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
live maintenance

maintenance activities carried out while the associated apparatus, intrinsically safe apparatus, and circuits are energized

[SOURCE: IEC 60050-426: 2020, 426-11-51]

3.8
maintenance
<for explosive atmospheres> 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~~ routine actions taken to preserve the fully serviceable condition of the installed apparatus

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

3.10
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~~

people who meet specific requirements for the qualification of personnel

Note 1 to entry: The specific requirements for the qualification of personnel with respect to installation and maintenance are specified in Annex B.

3.13
Technical Persons with Executive Function
persons providing technical management of the Skilled Personnel, having adequate knowledge in the field of explosion protection, familiar with the local conditions, familiar 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 that identifies, without the use of access equipment or tools, those defects, such as missing bolts, which will be apparent to the eye

4 General requirements

4.1 Documentation

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~~ hazardous area classification ~~of areas~~ and, if included, the Equipment Protection Level (EPL) required for each location (see IEC 60079-10-1 and IEC 60079-10-2);

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

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

d) equipment characteristics for example ambient temperature ~~ratings~~ range, Type of Protection, IP rating, corrosion resistance;

e) records sufficient to enable the ~~explosion protected~~ Ex Equipment to be maintained in accordance with its Type of Protection (see IEC 60079-14) (for example list and location of equipment, spares, certificates, technical information); and

f) copies of previous inspection records, including initial inspection as detailed in IEC 60079-14.

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

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

4.2 ~~Qualification~~ Competence of personnel

~~The inspection and maintenance of installations covered by this standard shall 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 be undertaken by personnel on a regular basis. Evidence of the relevant experience and training claimed shall be documented and available.~~

The inspection and maintenance of installations covered by this document shall be carried out only by skilled personnel. The knowledge, skills, and competencies of Technical Persons with Executive Function and Skilled Personnel are given in Annex B.

Appropriate continuing education or training shall be undertaken by all personnel on a regular basis with all evidence documented and available for regular review.

4.3 Integrated systems

Integrated systems which provide protection in relation to the hazardous area installation, for example ventilation or pressurisation of rooms or gas detection systems, shall be inspected and maintained to ensure correct functioning in accordance with the requirements of the relevant standards.

NOTE The requirements for pressurised and ventilated rooms are given in IEC 60079-13.

4.4 Inspections

4.4.1 General

4.4.1.1 Basic principles

The inspection program should be sufficient to confirm ongoing suitability of the equipment for use in hazardous areas.

Before a new installation of plant or equipment is ~~brought into service~~ commissioned, 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.~~ Requirements for initial inspection are provided in IEC 60079-14, along with other guidance for the plant commissioning and start up procedures.

To ensure that the installations are maintained in a satisfactory condition for continued use within a hazardous area, and where necessary relevant maintenance is performed, they shall be subject to either:

a) regular periodic inspections by personnel with competence according to 4.2 and Annex B; or

b) continuous supervision by Skilled Personnel (see 4.6).

~~and, where necessary, maintenance shall be carried out.~~

NOTE 1 In the case of dust~~s~~ hazardous area, ~~fibres or flyings,~~ housekeeping can influence the inspection and maintenance requirements.

Inspections on existing installations shall be carried out in accordance with this document. However, for older installations the details for the equipment and installation requirements could be referenced to the standards that applied at the date of the installation.

NOTE 2 Standards applied at the date of installation might not have been IEC standards.

In cases where Ex Equipment is located outside of a hazardous area, for example due to changes on site, it should be maintained in accordance with its Type of Protection.

Following any adjustment, maintenance, repair, overhaul, ~~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 Tables 1, 2 and 3~~ given a detailed inspection.

The inspection activity shall 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~~ 3 It is not a requirement of this document that inspection personnel ~~do not need to be~~ are 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~~, maximum surface temperature for dusts, including any consideration of dust layers, and temperature class for gases, 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.~~

EXAMPLE 1 Removing any residual dust.

EXAMPLE 2 Correctly reinstating gaskets.

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.~~ Factors affecting the deterioration of Ex Equipment or installation can include accumulation of dust, water ingress, excessive ambient temperature, exposure to chemicals, susceptibility to corrosion, undue vibration or mechanical damage. Service factors affecting Ex Equipment or installation can include inappropriate maintenance, lack of training, experience or competency of personnel and the resulting unauthorised modifications or adjustments or inappropriate maintenance, for example that which is not in accordance with the manufacturer's requirements.

4.4.1.2 Manufacturer's documentation

Manufacturer's information can have additional requirements or recommendations for inspection and maintenance for example, types of grease that should be used, frequency of inspection under specific climatic conditions or torque that should be applied by fasteners.

The manufacturer's requirements or guidance take precedence over this document in the event of conflict, for example for testing frequency.

4.4.1.3 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; reference to the installation databases; etc. The method of attaching or fixing the labelling shall not reduce the integrity of the equipment.

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

4.4.1.4 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~~ should be followed.

NOTE This assessment is intended to apply to items in an installation that predate any requirement for the use of certified electrical equipment in hazardous areas.

4.4.2 Grades of inspection

4.4.2.1 General

Grades of inspection ~~may be~~ are visual, close ~~or~~ and detailed. Table 1, Table 2, Table 3, and Table 4 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 (for example Ex ~~"ed"~~"de" equipment) shall be a combination of the relevant columns from Table 1, Table 2, Table 3, and Table 4.

4.4.2.2 Use of inspection tables

The inspection Table 1, Table 2, Table 3, and Table 4 provides indicative checks that should be conducted as part of any inspection. The tables are not intended to be applied exactly as presented.

The inspection checks:

a) may be combined if suited to the final methodology for recording inspections

b) may be deleted if not relevant to the type of equipment being inspected

c) should be added to as appropriate

EXAMPLE Any other detail that might be needed to confirm ongoing service condition or compliance of the installation according to the nature of the site for motors is covered in Annex D.

Additional guidance for adverse service conditions is provided in Annex E.

4.4.3 Types of inspection

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.~~

Initial inspections as required by IEC 60079-14

A reduced inspection may be completed if an inspection equivalent to a detailed grade has been performed by the manufacturer. However, relevant detailed grade inspection checks from part B Installation, and C Environment, of Table 1, Table 2, Table 3, and Table 4 will still need to be carried out to ensure that the installation conforms to the requirements.

EXAMPLE 1 An initial detailed inspection of internal flamepaths of a flameproof motor or the internal joints of an Ex t motor is not required; however, the terminal housing cover, which would have been removed to facilitate connection of the field wiring as part of the installation process, should be inspected after. These requirements are also covered in IEC 60079-14.

EXAMPLE 2 An equipment assembly has had an initial inspection at a detailed grade by the assembly manufacturer, and a visual inspection is conducted at the final point of installation to verify that no damage has occurred in transport.

b) Periodic inspections which may be visual, close or detailed ~~in accordance with Tables 1, 2, and 3, or modified tables in accordance with 5.7, as appropriate~~ or a combination of types in accordance with 4.5.

c) Sample inspections which may be visual, close or detailed ~~in accordance with Tables 1, 2, and 3, or modified tables in accordance with 5.7, as appropriate~~ or a combination of types.

~~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. The size and composition of the samples selected shall be based on assessment of the installation (for example, Zones, Types of Protection, age, location, exposure, risk of damage and other factors).

d) Continuous supervision utilizing ~~the visual or close inspections in accordance with Tables 1, 2, and 3, or modified tables in accordance with 5.7, as appropriate and in accordance with 4.5~~ Skilled Personnel to carry out regular inspection and monitoring, equivalent to visual or close grades of inspection, in accordance with 4.6. ~~Where the installation falls outside the capability for continuous supervision it shall be subject to periodic inspection.~~

The results of all inspections shall be recorded, retained, and ~~may lead to a need for further actions~~ reviewed to consider if further action is necessary. ~~The requirements for continuous supervision are detailed in 4.5.5.~~

4.5 Periodic inspections

4.5.1 Personnel

Regular periodic inspection requires personnel who are both competent for the inspection required and the competency requirements as defined in clause 4.2 and Annex B~~, including that they~~, and who:

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.~~

A Technical Person with Executive Function shall be identified for each installation with overall responsibility and control of the inspection systems for the electrical equipment within the hazardous areas.

4.5.2 Fixed installations

The grade of inspection and the interval between periodic inspections shall be determined considering: the type of equipment, the manufacturer's guidance, if any, the factors governing its deterioration (see 4.4.1.1, Note 4), the area classification ~~and/~~or the EPL requirements and the results of previous inspections. The grade and frequency of inspection may be varied for different items of equipment at a site according to the individual factors for each item of equipment, for example the frequency of inspection might need to be increased in corrosive parts of a site but need not be applied across the entire site. Where the grade and frequency of inspections is varied from the minimum requirements of this document the inspection program should be documented.

Where inspection grades and intervals have been established for similar equipment, installations and environments, this experience ~~shall~~ should be used in determining the inspection ~~strategy~~ program.

The interval between periodic inspections shall not exceed three years without ~~seeking expert advice~~ conducting and documenting a risk assessment based on equipment type, location, environment and previous inspection history. ~~The basis for changing the inspection period shall be documented.~~ This risk assessment shall be conducted by an independent expert.

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

NOTE 'independent' does not necessarily imply an 'external body' or person to the user organisation.

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~~ subjected to ongoing review 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~~ periodic inspections may be carried out 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.

4.5.3 ~~Movable~~ Transportable, personal and portable equipment

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

The interval between periodic inspections shall not exceed the following without seeking ~~expert~~ advice from the manufacturer and Technical Person with Executive Function:

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

b) all personal, portable, and transportable equipment shall be submitted to a close inspection at least every 12 months; and

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.~~

4.6 Continuous supervision ~~by skilled personnel~~

4.6.1 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 4.5.1 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 identify any need for detailed inspections as part of any replacement, or adjustment in accordance with 4.4.1.1,

then it ~~may~~ might 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.

If the Skilled Personnel have the adequate competency, then those personnel may also carry out the detailed inspection.

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 (for example in the case of ~~movable~~ Transportable, personal and portable equipment), and in such cases the equipment shall be subject to periodic inspection. See 4.6.4.

4.6.2 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 (for example 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.

4.6.3 Responsibilities

4.6.3.1 Technical Persons with Executive Function

A Technical Person with Executive Function shall be identified for each installation and shall 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~~ Ex Equipment compliance;

d) ensure that the documentation referred to in 4.1 and 4.6.5 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; and

   3) the inventory of ~~explosion protected~~ Ex 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; and

   6) the state of the electrical installation is known.

4.6.3.2 Skilled Personnel

The Skilled Personnel shall be in addition 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~~ should take account of the conditions of the installation and any changes which ~~may~~ occur.

4.6.4 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~~ and expected deterioration of the equipment (see 4.4.1.1), use and experience.

Unless experience indicates to the contrary, ~~it may be considered that~~ if a part of the installation with a significant inventory of ~~explosion protected~~ Ex Equipment is not visited routinely for example weekly, then it ~~may be inappropriate to include it~~ should not be included as part of the continuous supervision concept.

Where the Skilled Personnel have noted a condition change of the environment (for example invasion of solvent or increased vibration) those items of explosion protected equipment which could be sensitive to the change shall be checked more frequently.

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.

4.6.5 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~~ if a) and b) above can be achieved by the documentation system.

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.

4.6.6 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.~~ When the process or installation is changed, training on the changes shall be provided.

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

The knowledge requirements of the Technical Persons with Executive Function shall include a full understanding of the provisions of IEC 60079-10-1, IEC 60079-10-2, IEC 60079-14, this document, and IEC 60079-19 in relation to area classification ~~and/~~or EPLs and electrical installations design, selection, erection~~, installation,~~ and inspection, equipment repair, overhaul and reclamation ~~of equipment~~.

4.7 Maintenance requirements

4.7.1 Remedial measures and ~~alterations~~ modifications 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~~ shall be maintained which can require consultation with the manufacturer.

Replacement parts shall be in accordance with the manufacturer's instructions or other applicable documentation. ~~Alterations~~ Modifications to equipment shall not be carried out without appropriate authorization where they adversely affect the safety of the equipment as stated in the manufacturer's instructions or other applicable documentation.

Repairs, overhaul 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 should not be interfered with.

When replacing lamps in luminaires the correct rating and type ~~should~~ shall be used, ~~or~~ otherwise excessive temperatures ~~may~~ can 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.~~

Lamps in increased safety luminaires should be replaced periodically to avoid any temperature rise that can occur at end-of-life.

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

4.7.2 Maintenance of flexible cables

Flexible 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.

4.7.3 Withdrawal from service

~~If it is necessary for maintenance purposes to withdraw equipment, etc., from service, the exposed conductors~~ Where equipment is temporarily withdrawn from service, the exposed conductors shall be:

a) correctly terminated in an appropriate enclosure;

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~~ Where equipment is ~~to be~~ permanently removed, the associated wiring shall be ~~isolated from all sources of power supply and~~:

1) removed; or

2) correctly terminated in an appropriate enclosure; or

3) earthed at ~~one end only and the other end of the cable shall be insulated by a secure means (e.g. heat shrink seals)~~ the supply end and, at the other end of the cable, the conductors shall be bonded together and then insulated by a secure means (for example epoxy pot-end).

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

4.7.4 Fastenings and tools

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

4.8 ~~Environmental conditions~~ External influences

~~Electrical equipment in a hazardous area~~ Ex Equipment 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~~ should be adjusted to suit anywhere adverse conditions ~~may~~ could 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~~ can affect the ~~type and~~ degree of ~~ingress~~ protection (IP) of the equipment. If the enclosure or component is severely corroded, the part shall be replaced. Plastic enclosures ~~may~~ can 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~~ installation of the electrical equipment is acceptable for use in the environment likely to be encountered.

If the marking of the ~~explosion protected~~ Ex Equipment does not indicate a range of ambient temperatures for which the equipment is designed, it ~~should only~~ shall be used ~~over~~ within the range of –20 °C to +40 °C, ~~while if a range is indicated the equipment should only be used within this range (see IEC 60079-14)~~. If a range is indicated for which the equipment is designed it shall be used within this range. If the ambient temperature is outside the temperature range, or if there is a temperature influence from other factors, for example the process temperature or exposure to solar radiation, the application shall be checked with the documented assessment (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~~ additional precautions should be taken to ensure that bolts and cable entries remain tight.

EXAMPLE The use of locknuts or threads which are resistant to vibration.

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

The cleaning of non-conductive electrical equipment shall use methods that avoid the generation of static electricity.

EXAMPLE Cleaning with a damp cloth.

4.9 Isolation of equipment

4.9.1 Installations other than intrinsically safe circuits

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

a) 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, under a safe work procedure (see IEC 60079-14).

   This ~~may~~ might require isolation 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.

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

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

b) A relaxation of the requirements for increased safety "e" equipment which also contains intrinsically safe apparatus is permitted, if all bare live parts not protected by the Type of Protection "i" have a separate internal cover providing at least the degree of protection IP30 when the enclosure of the apparatus is open.

   This equipment ~~should~~ will 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~~ are 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~~. The recording shall contain:

   - the form(s) which the proposed work on energized equipment ~~may~~ could take;
   - the results of the assessment, including the results of any testing carried out during the assessment; and
   - any ~~conditions in association with the maintenance of energized equipment~~ additional controls 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; and
   - have access to all information necessary to carry out the assessment.

4.9.2 Live maintenance on Intrinsically safe installations

4.9.2.1 General

~~Maintenance work may be carried out on energized intrinsically safe equipment 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.~~

Maintenance work may be carried out on energized intrinsically safe equipment subject to manufacturer's recommendations (see 4.4.1.2) and the following subclauses.

Where equipment contains more than one intrinsically safe circuit, any maintenance shall ensure that separation between the circuits is not compromised.

4.9.2.2 Maintenance work in hazardous areas

Any maintenance work shall be restricted to:

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

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

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

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

e) 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.

4.9.2.3 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 4.9.2.2 a) whilst such electrical apparatus or parts of circuits remain interconnected with parts of intrinsically safe systems located in hazardous areas.

Diode 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.

Other maintenance work on associated apparatus or parts of an intrinsically safe circuit mounted 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.

4.10 Earthing and equipotential bonding

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

Earthing and equipotential bonding provisions in hazardous areas shall be maintained in good condition (see Table 1, checks B6 and B7; Table 2, checks B6 and B7; Table 3, checks B3 and B4; and Table 4 checks B6 and B7).

4.11 Specific Conditions of Use

~~Specific conditions of use 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.~~

Specific Conditions of Use apply to any Ex Equipment marked with the symbol "X", usually as a suffix to the certificate number. Any Specific Conditions of Use contained within the certificate and manufacturer's instructions shall be complied with.

NOTE Prior to 2007, Specific Conditions of Use were referred to as "special conditions for safe use".

4.12 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.~~

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

Movable electrical equipment (transportable, personal and portable) shall only be used in locations appropriate to its Type of Protection, equipment group, and maximum surface temperature. Where it is possible for movable equipment to be used in a location for which it is not suitable, additional precautions should be implemented to limit the likelihood of this.

NOTE Additional precautions could include the restriction of equipment permitted on site to only equipment which is suitable for all areas accessed by personnel, or specific signage at areas with more onerous requirements.

Ordinary industrial movable equipment should not be used in a hazardous area unless its use is managed under a safe work procedure (according to IEC 60079-14).

EXAMPLES Welding equipment, power tools, computers, data recorders.

4.13 Inspection schedules ~~(Tables 1 to 3)~~

4.13.1 General

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

The inspection schedules are shown in Table 1, Table 2, Table 3, and Table 4.

~~Items identified in the Tables 1 to 3 and 4.12.2 to 4.12.11 detail only key items related to hazardous area integrity.~~ Checks identified in Table 1, Table 2, Table 3, and Table 4 detail only the minimum items related to the integrity of equipment and installations in hazardous areas. Other ~~items~~ checks 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.

Inspection schedules should be modified accordingly to suit the specific equipment and installation requirements.

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

4.13.2 Equipment is appropriate to the EPL/Zone requirements of the location

Equipment meets or exceeds the requirements for the EPL/Zone of use.

4.13.3 Equipment group

Equipment group shall ~~be correct~~ meet or exceed the requirements of the location.

4.13.4 Equipment maximum surface temperature

Equipment maximum surface temperature shall ~~be correct~~ meet or exceed the requirements of the location.

4.13.5 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.

4.13.6 Ex Cable Glands

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

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

The check-tightening of Ex Cable Glands under close inspection may be carried out by hand without the need to remove weather-proofing tape or shrouds. Detailed inspections will require removal of weather-proofing tape or shrouds to verify certification details and could necessitate that the Ex Cable Glands are dismantled.

4.13.7 Type of cable

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

4.13.8 Sealing

The sealing of trunking, ducts, pipes, conduits etc., is in accordance with the site documentation and IEC 60079-14.

NOTE The sealing is for prevention of transmission of vapours or process fluids and is not part of Ex protection of equipment.

4.13.9 Test and measuring equipment

Test equipment shall only be used if precautions have been taken to prevent electrical discharges in the hazardous area.

NOTE 1 The connection of test equipment outside the hazardous area could result in electrical discharges in the hazardous area.

NOTE 2 Even when using meters which are Ex Equipment, the interconnection of the test leads to the circuit to be tested could result in electrical discharges in the hazardous area.

4.13.10 Fault loop impedance or earthing resistance

The integrity of the earthing shall be checked. The measurement may be made using an intrinsically safe resistance measuring instrument (according to the procedure specified by the manufacturer). Detailed sample inspections may be carried out and the results checked against those obtained from the initial inspection.

Non-intrinsically safe measuring equipment may be used if a safe work procedure (according to IEC 60079-14) has been conducted and if the locations where potentially incendive sparking could occur can be guaranteed to be free from an explosive atmosphere by those responsible for the area.

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

4.13.11 Insulation resistance

~~The insulation resistance for intrinsically safe apparatus and associated cabling shall be measured at 500 V a.c. or 700V d.c.~~

Testing of insulation resistance may be performed if a safe work procedure (according to IEC 60079-14) has been conducted and if the locations where potentially incendive sparking could occur can be guaranteed to be free from an explosive atmosphere by those responsible for the area.

During test it might be necessary to perform disconnection to avoid damage to the Ex Equipment connected to the cable or to the device under test.

The testing of insulation resistance on intrinsically safe apparatus, and associated cabling, shall be performed at 500V DC or twice the I.S. circuit voltage, whichever is the greater.

The insulation resistance measured 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.

4.13.12 Overload protection

~~See IEC 60079-14, concerning~~ 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 as required by IEC 60079-14.

4.13.13 Lamps and luminaires

Lamps for luminaires shall be checked for conditions that ~~may~~ can 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 EOL 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 1 and IEC 60079-1)~~

For guidance on the inspection of Type of Protection "d" Ex Equipment see Table 1.

When reassembling flameproof enclosures, all joints shall be thoroughly cleaned and 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 1 should be applied when a visual examination of flanged joint surfaces suggests that dimensions may be exceeded.~~

The diametric clearance of spigot, shaft, spindle and threaded joints may not be checked, unless there is evidence of wear, distortion, corrosion or other damage in that occurrence procedure equivalent to the one applied to flanged joint gaps check shall be used.

Flanged joint gaps shall be within the following as applicable:

a) the limits in accordance with manufacturer’s documentation;

b) maximum values permitted by relevant equipment standards at the time of manufacture, if not documented by the manufacture; or

c) the maximum values permitted by the site documentation if the equipment has been repaired (see IEC 60079-19).

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

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

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

5.2.1 Level of Protection "eb"

Level of Protection "eb" is equivalent to the historical "e" marking without an Equipment Protection Level.

For guidance on the inspection of Type of Protection "e" Ex Equipment see Table 1.

The windings of Ex "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 selected such that the tripping time from cold, taken from the 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 the protective device setting ~~should be~~ checked (see IEC 60079-19).

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

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

5.2.2 Level of Protection "ec"

From IEC 60079-7:2015 (edition 5) and IEC 60079-15:2017 (edition 5), Type of Protection "nA" has been changed to Level of Protection "ec". These should be considered technically equivalent for the purposes of this document.

NOTE This marking is also equivalent to the Type of Protection "n" marking with no additional symbol from IEC 60079-15:1987 (edition 1) and similar national standards from the same era.

For guidance on the inspection of Level of Protection "ec" and Type of Protection "nA" Ex Equipment, see the "n" column of Table 1.

5.3 Type of Protection "i" – Intrinsic safety ~~(see Table 2 and IEC 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

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.

For guidance on the inspection of Type of Protection "i" Ex Equipment see Table 2.

5.3.2 Documentation

The documentation referred to in Table 2, as a minimum, includes ~~details~~ all of the following:

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

b) manufacturer, equipment type and certificate numbers, Level of Protection ~~and, in case of gases~~, equipment group, and temperature class ~~and, in case of dust, equipment group and the~~ or maximum surface temperature as applicable;

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 such requirements are met in the particular installation;~~

d) Specific Conditions of Use and any actions taken to satisfy them; and

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 being conducted.

It may be possible to utilize the fact that the soldering associated with most repairs~~/~~ or 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

Associated apparatus shall be inspected to ensure that it is of the correct type and rating in accordance with the descriptive system document. 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

Installations shall be inspected to ensure that the cables used comply with the documentation. Particular care shall be taken when utilizing spare cores 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 in the same pipe, duct or cable tray.

5.3.7 Cable screens

Installations shall be inspected and tested to ensure that cable screens are earthed in accordance with the appropriate documentation. Particular attention shall be paid to installations utilizing multicore cables which contain more than one intrinsically safe ~~system~~ circuit.

5.3.8 Point-to-point connections

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

5.3.9 Earth continuity of non-galvanically isolated circuits

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

The resistance of the earth conductors between the intrinsically safe high integrity earth point and the main power system earth shall be checked during the initial inspection and periodic inspections and be documented. For a TN-S system the value should not exceed 1 ohm. Values for other systems may be different.

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.

Where connections show evidence of degradation 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, diode safety 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~~ is 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.

Where, in order to carry out these tests, the common earth connection to a group of diode safety barriers is disconnected, the tests can only be made if either the plant is free from hazard, 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

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

5.4 Type of Protection "p" and "pD" – Pressurized enclosure ~~(see Table 3, IEC 60079-2 and IEC 61241-4)~~

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

For guidance on the inspection of Type of Protection "p" or "pD" Ex Equipment see Table 3.

5.5 Type of Protection "n" ~~(see Table 1 or 2 and IEC 60079-15)~~

5.5.1 General

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

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

For guidance on the inspection of Type of Protection "n", "nC" and "nR" Ex Equipment see the "n" column of Table 1.

For guidance on the inspection of Type of Protection "'nL" Ex Equipment see Table 2 as equivalent to Level of Protection "ic" (see 5.3).

NOTE "nL" and "nA" from previous editions of IEC 60079-15 have been re-designated as "ic" and "ec" respectively in more recent editions of the IEC 60079 series. One type of "nC", enclosed break device, has similarly been redesignated as "dc".

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 1 and IEC 60079-31 and IEC 61241-1)~~

~~Explosion protected equipment type "t" and "tD" shall be inspected in accordance with Table 1.~~

For guidance on inspection of Type of Protection "t" and "tD" Ex Equipment see Table 1.

5.7 Types of Protection "o" (liquid immersion)

For guidance on inspection of Type of Protection "o" Ex Equipment see Table 4.

Type of Protection "o" electrical equipment designed to be opened shall be re-filled to within the required level range with the protective liquid required and re-sealed in accordance with the manufacturer's instructions.

5.8 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 "m", "mD", ~~"o",~~ "op" and "q" types of protection. Table 1 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.~~

6 Inspection tables

The following tables are not intended to be applied exactly as presented. Checks within the tables may be deleted, if not relevant to the type of equipment being inspected, or be added to according to the nature of the site.

Table 1 – Inspection schedule for Ex "d", Ex "e", Ex "n" and Ex "t/tD" installations

Check that: X = required for all types, n = type "n" only, t = type "t" and "tD" only		Ex "d"			Ex "e"			Ex "n" Ex"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 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							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 – visual check	X	X	X	X	X	X	X	X	X

	Check that: X = required for all types, n = type "n" only, t = type "t" and "tD" only	Ex "d"			Ex "e"			Ex "n" Ex"t/tD"		
		Grade of inspection								
		D	C	V	D	C	V	D	C	V
12	Threaded covers on enclosures are of the correct type, are tight and secured – physical check – visual check	X	X	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: – 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	X								
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			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 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 is appropriate	X			X			X		
2	There is no obvious damage to cables	X	X	X	X	X	X	X	X	X
3	Sealing of trunking, ducts, pipes ~~and/or~~, conduits and cables is satisfactory	X	X	X	X	X	X	X	X	X
4	Stopping boxes and cable boxes are correctly filled	X								
5	Integrity of conduit system and interface with mixed 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 (for example, connections are tight and conductors are of sufficient cross-section) – visual check	X	X	X	X	X	X	X	X	X
7	Fault loop impedance (TN systems) or earthing resistance (IT systems) is satisfactory	X			X			X		

Check that: X = required for all types, n = type "n" only, t = type "t" and "tD" only		Ex "d"			Ex "e"			Ex "n" Ex"t/tD"		
		Grade of inspection								
		D	C	V	D	C	V	D	C	V
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	X	X	X						
13	Variable voltage/frequency installation complies with documentation	X	X		X	X		X	X	
	INSTALLATION – 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									
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 2 – Inspection schedule for Ex "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 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~~ X	~~X~~ X
11	There is no damage or 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		
17	The maximum voltage U_m of the associated apparatus is not exceeded	X	X	
B	**INSTALLATION**			
1	Cables are installed in accordance with the documentation	X		
2	Cable screens are earthed in accordance with the documentation	X		
3	There is no obvious damage to cables	X	X	X
4	Sealing of trunking, ducts, pipes ~~and/or~~, conduits and cables is satisfactory	X	X	X
5	Point-to-point connections are all correct (initial inspection only)	X		
6	Earth continuity is satisfactory (for example, connections are tight, conductors are of sufficient cross-section) for non-galvanically isolated circuits	X		
7	Earth connections maintain the integrity of the Type of Protection	X		
8	Intrinsically safe circuit earthing is satisfactory	X		
9	Insulation resistance is satisfactory	X		
10	Separation is maintained between intrinsically safe and non-intrinsically safe circuits in common distribution boxes or relay cubicles	X		
11	Short-circuit protection of the power supply is in accordance with the documentation	X		
12	Specific Conditions of Use (if applicable) are complied with	X		
13	Cables not in use are correctly terminated	X		
C	**ENVIRONMENT**			
1	Equipment is adequately protected against corrosion, weather, vibration and other adverse factors	X	X	X
2	No undue external accumulation of dust and dirt	X	X	X
(D = detailed, C = close, V = visual)				

Table 3 – Inspection schedule for Ex "p" and "pD" installations

Check that: X = required		Grade of inspection		
		D	C	V
A	**EQUIPMENT**			
1	Equipment is appropriate to the EPL/Zone requirements of the location	X	X	X
2	Equipment group is correct	X	X	
3	Equipment temperature class or surface temperature is correct	X	X	
4	Equipment circuit identification is correct	X		
5	Equipment circuit identification is available	X	X	X
6	Enclosure, glasses and glass-to-metal sealing gaskets and ~~/or~~ compounds are satisfactory	X	X	X
7	There is no damage or unauthorized modifications	X		
8	There is no evidence of unauthorized modifications		X	X
9	Lamp type, rating, and position are correct	X		
B	**INSTALLATION**			
1	Type of cable is appropriate	X		
2	There is no obvious damage to cables	X	X	X
3	Earthing connections, including any supplementary earthing bonding connections, are satisfactory~~, for example connections are tight and conductors are of sufficient cross-section~~ ~~– physical check~~ ~~– visual check~~ – physical check for example, connections are tight and conductors are of sufficient cross-section – visual check	~~X~~ X 	~~X~~ X	~~X~~ X
4	Fault loop impedance (TN systems) or earthing resistance (IT systems) is satisfactory	X		
5	Automatic electrical protective devices operate within permitted limits	X		
6	Automatic electrical protective devices are set correctly	X		
7	Protective gas inlet temperature is below maximum specified	X		
8	Ducts, pipes and enclosures are in good condition	X	X	X
9	Protective gas is substantially free from contaminants	X	X	X
10	Protective gas pressure and/or flow is adequate	X	X	X
11	Pressure and/or flow indicators, alarms and interlocks function correctly	X		
12	Conditions of spark and particle barriers of ducts for exhausting the gas in hazardous area are satisfactory	X		
13	Specific Conditions of Use (if applicable) are complied with	X		
C	**ENVIRONMENT**			
1	Equipment is adequately protected against corrosion, weather, vibration, and other adverse factors	X	X	X
2	No undue accumulation of dust and dirt	X	X	X
(D = detailed, C = close, V = visual)				

Table 4 – Inspection schedule for Ex "o" installations

Check that: X = required		Grade of inspection		
		D	C	V
A	**EQUIPMENT**			
1	Equipment is appropriate to the EPL/Zone requirements of the location	X	X	X
2	Equipment group is correct	X	X	
3	Equipment temperature class is correct	X	X	
4	Equipment circuit identification is correct	X		
5	Equipment circuit identification is available	X	X	X
6	Enclosure, glass parts and glass-to-metal sealing gaskets and/or compounds are satisfactory	X	X	X
7	There are no unauthorized modifications	X		
8	There are no visible unauthorized modifications		X	X
9	Bolts, cable entry devices (indirect) and Blanking Elements are of the correct type and are complete and tight – physical check – visual check	X	X	X
10	Electrical connections are tight	X		
11	Condition of enclosure gaskets is satisfactory	X		
12	Breathing and draining devices are satisfactory. The manufacturer's schedule for maintenance requirements for the drying agent are documented to have been followed	X		
13	Sealed enclosure pressure-relief devices are satisfactory	X		
14	Enclosures marked Permanently Sealed have no visible evidence that the enclosure has been opened	X	X	X
15	**maximum/minimum criteria of the protective liquid** a) level of the protective liquid shall be at or below the maximum and above the minimum permitted level; b) the maximum working angle to the horizontal of the equipment shall be satisfactory	X X	X	X
16	**Enclosures intended to be opened** The level of the protective liquid is correct.	X		
17	When a dipstick is provided, the dipstick is secured in its measurement position and its seal is satisfactory	X	X	
18	remote-indicating protective liquid level indicating device operation is satisfactory	X	X	X
19	switching device schedule for cleaning/filtering/replacement of the protective liquid following a given number of normal switching operations or interruption of fault currents is documented	X	X	X

	Check that: X = required	Grade of inspection		
		D	C	V
B	**INSTALLATION – GENERAL**			
1	Type of cable is appropriate	X		
2	There is no obvious damage to cables	X	X	X
3	Sealing of trunking, ducts, pipes, conduits, and Cable Glands is satisfactory	X	X	X
4	Stopping boxes, cable boxes and Cable Glands are correctly filled	X		
5	Integrity of conduit system and interface with mixed system maintained	X		
6	Earthing connections, including any supplementary earthing bonding connections are satisfactory – physical check (for example connections are tight and conductors are of sufficient cross-section) – visual check	X	X	X
7	Fault loop impedance (TN systems) or earthing resistance (IT systems) is satisfactory	X		
8	Automatic electrical protective devices are set correctly (auto-reset not possible)	X		
9	Automatic electrical protective devices operate within permitted limits	X		
10	Specific Conditions of Use (if applicable) are complied with	X		
11	Cables not in use are correctly terminated	X		
12	Variable voltage/frequency installation complies with documentation	X	X	
	INSTALLATION – HEATING SYSTEMS			
13	Temperature sensors function according to manufacturer's documents	X		
14	Safety cut off devices function according to manufacturer's documents	X		
15	The setting of the safety cut off is sealed	X	X	
16	Reset of a heating system safety cut off possible with tool only	X	X	
17	Auto-reset is not possible	X	X	
18	Reset of a safety cut off under fault conditions is prevented	X		
19	Safety cut off independent from control system	X		
20	Level switch is installed and correctly set, if required	X		
21	Flow switch is installed and correctly set, if required	X		
C	**ENVIRONMENT**			
1	Equipment is adequately protected against corrosion, weather, vibration, and other adverse factors	X	X	X
2	No undue accumulation of dust and dirt	X	X	X
3	Electrical insulation is clean and dry			X
(D = detailed, C = close, V = visual)				

Annex A
(informative)

Typical inspection procedure for periodic inspections

Figure A.1 shows a typical inspection procedure for periodic inspections.

NOTE See 4.4.

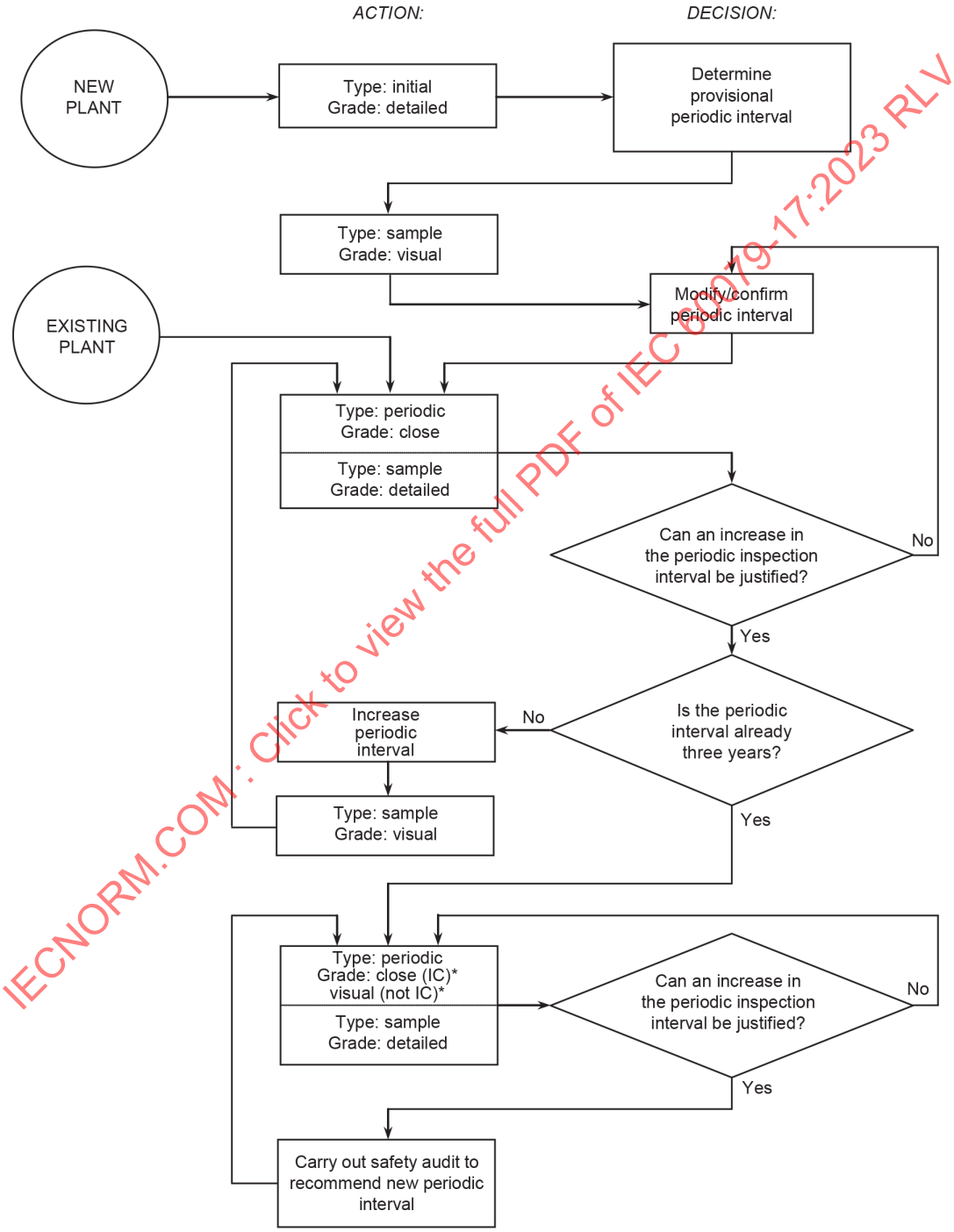

Figure A.1 – Typical inspection procedure for periodic inspections

Annex B
(normative)

Knowledge, skills and competencies of ~~responsible persons,~~ Technical Persons with Executive Function and ~~operatives~~ Skilled Personnel

B.1 ~~Scope~~ General

This annex specifies the knowledge, skills and competencies of Technical Persons with Executive Function and Skilled Personnel referred to in this document.

B.2 Knowledge and skills

B.2.1 ~~Responsible persons and~~ Technical Persons with Executive Function

~~Responsible persons and~~ Technical Persons with Executive Function who are responsible for the processes involved in the inspection and maintenance of explosion protected equipment shall possess, at least, all of the following:

a) general understanding of relevant electrical engineering,

b) practical understanding of explosion protection principles and techniques,

c) understanding and ability to read and assess engineering drawings,

d) working knowledge and understanding of relevant standards in explosion protection, particularly IEC 60079-10-1, IEC 60079-10-2, IEC 60079-14 and IEC 60079-19, and,

e) basic knowledge of quality assurance, including the principles of auditing, documentation, traceability of measurement and instrument calibration.

Such persons shall confine their involvement to the management of Skilled Personnel ~~and competent operatives,~~ conducting inspection and maintenance duties and not engage themselves directly in the work without ensuring their practical skills at least meet the requirements given in B.2.2.

B.2.2 ~~Operative/technician~~ Skilled Personnel (inspection and maintenance)

~~Operatives/technicians~~ Skilled Personnel shall possess, to the extent necessary to perform their tasks, all of the following:

a) understanding of the general principles of area classification or EPL and explosion protection,

b) understanding of the general principles of types of protection and marking,

c) understanding of those aspects of equipment design which affect the protection concept,

d) understanding of certification and relevant parts of this document,

e) understanding of the additional importance of permit to work systems and safe isolation in relation to explosion protection,

f) familiarity with the particular techniques to be employed in the inspection and maintenance of equipment referred to in this document,

g) comprehensive understanding of the selection and erection requirements of IEC 60079-14, and,

h) general understanding of the repair and reclamation requirements of IEC 60079-19.

Additionally, for those involved in Continuous Supervision:

i) awareness of process and environmental implications on the deterioration of the specific equipment in the installation, and

j) familiarity with the concept of continuous supervision together with reporting and analysis functions.

B.3 Competencies

B.3.1 General

Competencies shall apply to each of the explosion protection techniques for which the person is involved. For example: it is possible for a person to be competent in the field of inspection and maintenance of Ex "i" equipment only and not be fully competent in the inspection and maintenance of Ex "d" switchgear or Ex "e" motors. In such cases, ~~that person's management shall define this in their documentation system~~ the specific competency limitation shall be documented.

B.3.2 ~~Responsible persons and~~ Technical Persons with Executive Function

~~Responsible persons and~~ Technical Persons with Executive Function shall be able to demonstrate their competency and provide evidence of attaining the knowledge and skill requirements specified in B.2.1 relevant to the Types of Protection and~~/or~~ types of equipment involved.

B.3.3 ~~Operative/technician~~ Skilled Personnel

~~Operatives/technicians~~ Skilled Personnel shall be able to demonstrate their competency and provide evidence of attaining the knowledge and skill requirements specified in B.2.2 relevant to the types of protection and/or types of equipment involved.

They shall also be able to demonstrate their competency with documentary evidence in the:

- use of documentation specified in 4.1;
- practical skills necessary for the inspection and maintenance of relevant concepts of protection.

B.4 Assessment

The competency of ~~responsible persons,~~ Technical Persons with Executive Function and ~~operatives~~ Skilled Personnel shall be verified and attributed, at intervals not exceeding 5 years on the basis of sufficient evidence that the person:

a) has the necessary skills required for the scope of work, and,

b) can act competently across the specified range of activities; and,

c) has the relevant knowledge and understanding underpinning the competency.

Annex C
(informative)

Fitness-for-purpose assessment

C.1 Background

Where no certificate of conformity is available (or the origin of a certificate cannot be verified), a fitness-for-purpose assessment should be undertaken. Usually this will require a full audit and assessment of the equipment, generation of a design specification including all necessary calculations, measurements, equipment and cable parameters and the like, and making decisions and statements that the equipment is fit for its purpose and safe to use. Where tests are required, they should be carried out by competent personnel using the necessary calibrated test equipment. The fitness-for-purpose assessment may not be allowed in some countries, in this case the relevant National Rules should be applied.

C.2 Need for a fitness-for-purpose assessment

In order to establish evidence enabling a risk assessment to demonstrate an equivalent level of safety within an existing installation, the need for a fitness-for-purpose assessment report may be determined on the basis that insufficient information is available to comply with ~~4.3~~ certification requirements of IEC 60079-14~~:—~~, or with the requirements of the installation standard applicable at the time of the original installation.

C.3 Approach

In preparing a fitness-for-purpose assessment it should be based on the assessment to standards that are relative to the avoidance of ignition sources for the equipment to be used in hazardous areas.

C.4 Ignition sources

The assessment of the equipment should take into account any likely ignition sources, whether they be arcs, sparks or hot surfaces, and take into account whether they are likely to occur in normal circumstances or only under fault or abnormal conditions. Attention is drawn to the possibility of ignition from high energy light sources (lasers), static electricity, friction heating, ionising radiation etc., as well as the contact sparking and/or heating from electrical equipment. Where requirements for protective devices as a form of control are used, they should also be included in the assessment.

C.5 Contents of the fitness-for-purpose assessment

C.5.1 General

The following items are recommended for all fitness-for-purpose assessment reports before they are considered for acceptance.

C.5.2 Scope of the assessment report

The assessment report clearly indicates the extent of work undertaken, incorporating a list of those aspects included in the report and any considerations, which may reasonably have been expected, that have been excluded.

Details of the explosion protection methods, Types of Protection and other characteristics are stated together with details of each individual standard used for the assessment.

C.5.3 Equipment and its application

The equipment, its application, function and location should be fully defined.

C.5.4 Description

The description will adequately define the equipment by type and model, including any special variations or additions that establish the unique identity of the item being assessed. It should include characteristics relating to appearance, materials etc., which may be by description and/or photographs.

C.5.5 Function of the product including the location

The purpose and use of the equipment, its location, environmental conditions and full details of the hazardous area parameters should be provided.

C.5.6 Specification

The manufacturer's electrical performance specification for the equipment is required for the assessment. This is preferably appended to the report rather than supplied separately, thus ensuring a complete record is maintained for the equipment.

Any hazardous area specification (or claim of suitability for the hazardous area) made by the manufacturer should be included with the assessment if provided. This is also preferably appended to the report rather than supplied separately, thus ensuring a complete record is maintained for the equipment.

Drawings of the equipment that clearly identify the aspects of the equipment that affect the assessment are included in the report. These drawings may be provided by the manufacturer or by the assessor preparing the fitness-for-purpose assessment report and can be in the form of a sketch if necessary. ~~Guidance on requirements for drawings can be obtained from IECEx OD 017.~~

A material schedule is to be included, where possible, identifying the materials used for the major components relating to the Type of Protection. Ideally the description will be supported by photographs.

C.5.7 Standards compliance

All assessments should be carried out according to IEC standards. The equipment is assessed and/or tested to ensure that all requirements of the identified IEC standards have been met and secondly that the assessor has demonstrated and documented that compliance with the standards has been achieved.

A reference list of standards to which the item has been assessed and cross referenced will be included in the fitness-for-purpose assessment report.

Where a fitness-for-purpose assessment report is based on standards other than IEC, the report should contain full justification and information of any applicable variation to that given in the IEC standards relating to the installation and use of the product including any inspection, maintenance, overhaul or repair variations. Every endeavour should be taken in obtaining full manufacturer's documentation according to IEC 60079-0 and this should be included with the report.

Assessment and testing is conducted according to the standards identified as being applicable to the equipment being assessed. Each relevant clause of the standard is considered and reported in an assessment and test report which should form part of the fitness-for-purpose assessment report.

Each clause that has not been established as compliant is assigned a risk ranking by the Assessor, using a risk assessment (for example, methodologies such as those outlined in IS0 31000 or other recognized principles and procedures).

C.5.8 Documents

The documents provided by the manufacturer, or those developed by the assessor, used as evidence for the assessment, are listed and appended to the fitness-for-purpose assessment. As a minimum the documents should include the assessor's assessment and test report, manufacturer's specifications supplemented by any additional information the assessor provides to complete the specification, drawings and photographs, label information etc. Each document should be verified as authentic by either the organization that has issued it or by the assessor.

C.5.9 Product sample

Care is to be taken that the equipment sample being evaluated is not damaged or altered in any way that would impair its explosion protection integrity in the act of assessing or testing. If a test is not conducted based on the possibility of causing damage, this information is included in the test report. If multiple items of equipment of the same type are installed a single item may be assessed and/or tested provided it can be established all such items are identical, otherwise an individual assessment or part assessment should be undertaken.

C.5.10 Equipment label

The assessor should provide full details of the identification in the form of a permanent label for attachment to the equipment, to clearly identify that the equipment has been assessed and a full report is included in the verification dossier. The information on this label should NOT misrepresent the equipment as having a certificate of conformity or otherwise infer that it has a certificate of conformity.

The preferred method of marking is according to the requirements for marking in IEC 60079-0, except that the name or mark of the certificate issuer and the certificate reference should be replaced with 'Fitness-for-purpose assessment report no. YY.xxxx'.

The assessor may also add an X to the report number and label if Specific Conditions of Use apply to the equipment. Full details of any such conditions should be included in the report.

~~Typical label~~

A.B. ACHUTZ A.G. TYPE 5 CD
Assessed as: Ex de IIB T3
'Other relevant identifiers'
Fitness-for-purpose assessment Report No. 07.0000X

Typical label

ABC limited TYPE 5 CD
Assessed as: Ex de IIB T3
'Other relevant identifiers'
Fitness-for-purpose assessment Report No. 07.0000X

C.5.11 Training of personnel

Any equipment specific requirements for training of personnel working with this equipment are included in the fitness-for-purpose assessment report. These requirements take into account the safe use of the equipment including requirements for installation, inspection, and maintenance including spare parts, overhaul and repair.

C.5.12 Elements of the report

In addition to the items above, each fitness-for-purpose assessment report should include all of the following:

a) Executive summary

A summary, normally given at the beginning of the report, providing an overview of the complete assessment and also providing guidance on whether a full review of the fitness-for-purpose assessment is warranted.

b) Restriction of application

A statement highlighting any restrictions regarding the application or other aspects that would not normally be evident in the selection process.

c) Fitness-for-purpose assessment

A formal fitness-for-purpose assessment statement by the Assessor, stating the assigned level of risk and detailing any special requirements that might be observed.

d) Conclusion

A clear summary of the level of conformity established by the assessment and whether or not it is sufficient to be used to apply a risk assessment approach for the acceptance of the equipment for use.

e) Authorization of report

A statement by the Assessor to indicate they have assessed and/or tested the equipment and obtained the necessary documentation, and that they have personally undertaken the review.

f) Assessment and test report

Tabulated results of the clause-by-clause assessment and testing according to the appropriate standards should be appended to the fitness-for-purpose assessment report.

C.5.13 Assessor requirements

All Assessors should have demonstrated competency to assess the fitness-for-purpose of explosion-protected equipment.

C.5.14 Typical assessment and test report

Table C.1 shows an example of a typical assessment and test report that details the results for each clause of the standards used for equipment to comply with the explosive atmosphere requirements for Ex db IIB T4 Gb IP54 against IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements* and IEC 60079-1, *Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures "d"*.

Table C.1 shows an example of a typical assessment and test report against IEC 60079-0.

Table C.1 – Example of a typical assessment and test report

IEC 60079.0:2012			
Clause	**Assessed/tested**	**Result**	**Comments/action required**
4.1	Assessed	Complied	Group I does not apply
4.2	Assessed	Complied	Group IIB assigned
4.3	N/A		Does not apply to this equipment
5.1.1	Assessed	Complied	Ambient Temperature -20 °C to +50 °C applies
5.3.2.2	Tested	Complied	Temperature measured and corrected for ambient temperature = 92 °C Temperature Class assigned T5
26.4.2	Substitute test	Not verified	The test equipment specified in the standard for the impact test was not available. An alternate similar test was conducted by using a ball peen hammer of 2 kg and swinging through an arc of 0.5 m to simulate an approximate impact of 7 joules. The equipment was subject to this test at 4 different locations selected as 'worst case' and at the conclusion was observed not to have suffered any damage that would indicate the explosion protection or IP characteristics would be impaired.
26.8	Not tested	Not verified	The thermal endurance to heat is not reasonably able to be conducted. As this test is designed to determine the ageing properties of non-metallic materials and this equipment is manufactured from cast aluminium it is not essential to conduct the test. For non-metallic parts such as the gasket there will need to be an increased frequency cycle to monitor any deterioration.

Annex D
(informative)

Example of motor checks

The documents provided by the motor manufacturer ~~may~~ can detail requirements for regular ~~inspection~~ checks. The following examples are given to supplement any manufacturer's requirements to avoid motor faults becoming a source of ignition ~~to the surrounding explosive atmosphere~~.

Examples of checks:

- Motor runs smoothly and makes no abnormal noises.
- Lubricant level and condition of sleeve bearings are satisfactory.
- Lubrication of the bearings or oil flow to bearing housings is satisfactory.
- ~~Check~~ The permissible bearing temperatures are not exceeded.
- For sleeve bearing, check insulation of the NDE bearing and the spherical surfaces of the seat of the bearing shell on the frame is satisfactory.
- ~~Check~~ Protective and control equipment is installed and operational.
- All covers are in place and properly secured.
- Inspection of stator winding, rotor winding, core, brushless exciter, brushless and collector rings (for machines supplied with this equipment) is satisfactory.
- All motor bolts are re-tightened to the correct torque following cleaning or repainting.
- Condensate drain holes are free from corrosion.
- There are no signs of heat dissipation by external devices (for example hot pumps).
- Bearings noise and vibration levels are satisfactory.
- Checks on the condition of the bearing insulation and bearing's inner and outer race fluting (for motors fed by frequency converter) are satisfactory.
- The earth connection for converter fed motors terminal box is satisfactory.
- Record measurements of monitoring devices, such as bearing, winding and frame vibration and temperatures.
- Air, oil and water filters for any heating, cooling and lubrication systems are clean.
- Tubes of air/air or air/water heat exchanger of motor cooling or lubricating auxiliary systems have been cleaned.

Annex E
(informative)

Adverse service conditions

Where equipment is exposed to adverse service conditions, additional periodic checks or maintenance should be conducted in order to maintain the effectiveness of explosion protection under such conditions.

The following should be considered:

- More frequent inspections should be made to ensure proper operation of items such as heaters, bearing lubrication and machine serviceability.
- Because many sealing materials become harder at temperatures below -20 °C, maintenance and inspections should not be performed at low temperatures to prevent damage to the seals or other parts.
- The torque of fasteners, and the sealing they create, should be checked.
- Manufacturers' instructions should include the requirements for maintenance, use of special tools, lubricants and spare parts.
- The temperature of oil-cooled bearings before start up should be maintained as recommended by the manufacturer.
- Periodic checks of insulation systems could be required (using a high-resistance ohmmeter).
- Corrosion prevention of the equipment should be checked.
- Sealing ring should be checked.
- Moisture entry or condensation should be checked.

Bibliography

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at http://www.electropedia.org)

IEC 60079-5, *Explosive atmospheres – Part 5: Equipment protection by powder filling "q"*

IEC 60079-6, *Explosive atmospheres – Part 6: Equipment protection by ~~oil immersion~~ powder filling "o"*

IEC 60079-7:2015, *Explosive atmospheres – Part 7: Equipment protection by powder filling "e"*

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

IEC 60079-13, *Explosive atmospheres – Part 13: Equipment protection by pressurized room "p" and artificially ventilated room "v"*

IEC 60079-18, *Explosive atmospheres – Part 18: Equipment protection by encapsulation "m"*

IEC 60079-26, *Explosive atmospheres – Part 26: Equipment with ~~equipment protection level (EPL) Ga~~ Separation Elements or combined Levels of Protection*

IEC 60079-28, *Explosive atmospheres – Part 28: Protection of equipment and transmission systems using optical radiation*

IEC 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 61892-7, *Mobile and fixed offshore units – Electrical installations – Part 7: Hazardous areas*

IMO MODU – *Code for the construction and equipment of mobile offshore – Drilling units – Chapter 6 – Machinery and electrical installations in hazardous areas for all types of units*, 2009

IS0 31000, *Risk management – Principles and guidelines*

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IEC 60079-17

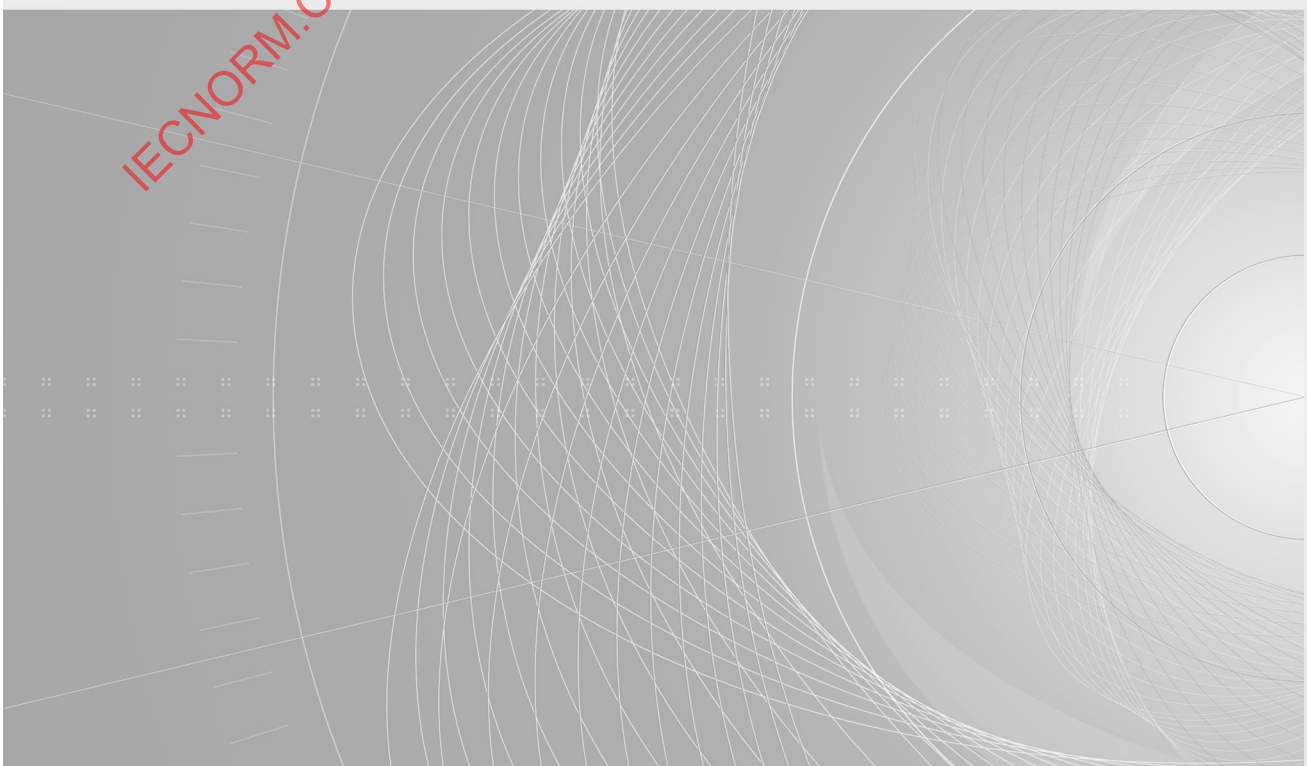
Edition 6.0 2023-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Explosive atmospheres –
Part 17: Electrical installations inspection and maintenance

Atmosphères explosives –
Partie 17 : Inspection et maintenance des installations électriques



IEC 60079-17:2023-12(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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EXPLOSIVE ATMOSPHERES –

Part 17: Electrical installations inspection and maintenance

FOREWORD

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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. It is an International Standard.

This sixth edition cancels and replaces the fifth edition published in 2013. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

		Type		
Changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
Simplifying description of explosive gas and dust atmospheres in the Scope and uses of these terms throughout document	1	X		
Clarifies the exclusion of ventilated rooms in the Scope	1	X		
Aligns maintenance terms and definitions in 3.7 and 3.8 with IEV & 60079.	3	X		
Introducing new clause 4.4.1.2. **Manufacturer's documentation** for cross referencing in text without repetition	4	X		
Further guidance added into Note 4 regarding factors contributing to the deterioration of Ex Equipment.	4.4.1.1.		X	
Clarifies the change in terminology from previously used **Special Condition of Safe Use** to current terminology **Specific Conditions of Use**.	4.11		X	
Further requirements added regarding Type of Protection "o".	5.7			C1
Clarification added regarding use of inspection tables	6		X	
Minor editorial changes and correction made to Tables 1 to 4 but with no change to item numbering or content	Tables 1 to 4	X		
Modified reference in this standard to align all types of inspection with Continuous Supervision terms for example; Skilled Personnel and Technical Persons with Executive Function.	Annex B			C2
A typical assessment and test report is shown in C.5.14.	Annex C	X		
Introducing new items in the Bibliography	Bibliography	X		
NOTE The technical changes referred to include the significance of technical changes in the revised IEC Standard, but they do not form an exhaustive list of all modifications from the previous version.				

Explanations:

A Definitions

Minor and editorial changes

– clarification

– decrease of technical requirements

– minor technical change

– editorial corrections

These are changes which modify requirements in an editorial or a minor technical way. They include changes of the wording to clarify technical requirements without any technical change, or a reduction in level of existing requirement.

Extension

– addition of technical options

These are changes which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements from the previous standard.

Major technical changes

– addition of technical requirements

– increase of technical requirements

These are changes to technical requirements (addition, increase of the level or removal) made in a way that an overhaul or repair of product to the preceding edition will not always be able to fulfil the requirements given in the later edition. For these changes additional information is provided in clause B) below.

NOTE These changes represent current technological knowledge. However, these changes do not normally have an influence on equipment already placed on the market.

B Information about the background of 'major technical changes'

C1 Sub-clause 5.7 and Table 4 has been inserted based on text submitted by MT60079-6 *Explosive atmospheres – Part 6: Equipment protection by liquid immersion "o".*

C2 The previous reference to Responsible Person in Annex B usually reflects the roles and the responsibilities of a person rather than the technical knowledge, skills and competencies required to manage the activity of periodic inspection and maintenance of Ex equipment. The term used within the Continuous Supervision clauses of Technical Person With Executive Function provides clarity and harmonises the clauses within the document.

The text of this International Standard is based on the following documents:

Draft	Report on voting
31J/345/FDIS	31J/351/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

This International Standard is intended 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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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 document provides the details for initial inspection and on-going inspections as either:

a) regular periodic inspections thereafter, or,

b) continuous supervision

by Skilled Personnel.

Where necessary, maintenance might also be needed.

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

EXPLOSIVE ATMOSPHERES –

Part 17: Electrical installations inspection and maintenance

1 Scope

This part of IEC 60079 applies to users and covers only those factors directly related to the inspection and maintenance of electrical installations specifically designed for hazardous areas, where the hazard is caused by explosive atmospheres.

It does not include:

- other fundamental installation and inspection requirements for electrical installations;
- the verification of electrical equipment;
- protection or ventilation of rooms;
- gas detection systems;
- the repair, overhaul and reclamation of explosion protected equipment (see IEC 60079-19).

While this document does not include inspection of safety devices such as used in ventilated rooms (see IEC 60079-13), it does include the requirements for inspection and maintenance of individual items of equipment that will be part of such systems, for example motors or sensors.

This document supplements the requirements for inspection and testing in non-hazardous areas in IEC 60364-6. This document is intended to be applied where there is a risk due to the potential 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,
- pyrophoric substances.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

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 – Explosive dust atmospheres*

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

3 Terms and definitions

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

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
close inspection
inspection that 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, for 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 that 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 can 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: IEC 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*, gives a classification of hazardous areas containing explosive gas atmospheres (see IEC 60050-426:2020, 426-03-03, 426-03-04 and 426-03-05).

Note 2 to entry: IEC 60079-10-2, *Explosive atmospheres – Part 10-2: Classification of areas – Explosive dust atmospheres*, gives a classification of hazardous areas containing explosive dust atmospheres (see IEC 60050-426:2020, 426-03-23, 426-03-24, and 426-03-25).

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

3.6
inspection
<for explosive atmospheres> 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
live maintenance

maintenance activities carried out while the associated apparatus, intrinsically safe apparatus, and circuits are energized

[SOURCE: IEC 60050-426: 2020, 426-11-51]

3.8
maintenance
<for explosive atmospheres> combination of routine actions taken to preserve the fully serviceable condition of the installed apparatus

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

3.10
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
people who meet specific requirements for the qualification of personnel

Note 1 to entry: The specific requirements for the qualification of personnel with respect to installation and maintenance are specified in Annex B.

3.13
Technical Persons with Executive Function
persons providing technical management of the Skilled Personnel, having adequate knowledge in the field of explosion protection, familiar with the local conditions, familiar 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 that identifies, without the use of access equipment or tools, those defects, such as missing bolts, which will be apparent to the eye

4 General requirements

4.1 Documentation

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) hazardous area classification and, if included, the Equipment Protection Level (EPL) required for each location (see IEC 60079-10-1 and IEC 60079-10-2);

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

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

d) equipment characteristics for example ambient temperature range, Type of Protection, IP rating, corrosion resistance;

e) records sufficient to enable the Ex Equipment to be maintained in accordance with its Type of Protection (see IEC 60079-14) (for example list and location of equipment, spares, certificates, technical information); and

f) copies of previous inspection records, including initial inspection as detailed in IEC 60079-14.

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

4.2 Competence of personnel

The inspection and maintenance of installations covered by this document shall be carried out only by skilled personnel. The knowledge, skills, and competencies of Technical Persons with Executive Function and Skilled Personnel are given in Annex B.

Appropriate continuing education or training shall be undertaken by all personnel on a regular basis with all evidence documented and available for regular review.

4.3 Integrated systems

Integrated systems which provide protection in relation to the hazardous area installation, for example ventilation or pressurisation of rooms or gas detection systems, shall be inspected and maintained to ensure correct functioning in accordance with the requirements of the relevant standards.

NOTE The requirements for pressurised and ventilated rooms are given in IEC 60079-13.

4.4 Inspections

4.4.1 General

4.4.1.1 Basic principles

The inspection program should be sufficient to confirm ongoing suitability of the equipment for use in hazardous areas.

Before a new installation of plant or equipment is commissioned, it shall be given an initial inspection. Requirements for initial inspection are provided in IEC 60079-14, along with other guidance for the plant commissioning and start up procedures.

To ensure that the installations are maintained in a satisfactory condition for continued use within a hazardous area, and where necessary relevant maintenance is performed, they shall be subject to either:

a) regular periodic inspections by personnel with competence according to 4.2 and Annex B; or

b) continuous supervision by Skilled Personnel (see 4.6).

NOTE 1 In the case of dust hazardous area, housekeeping can influence the inspection and maintenance requirements.

Inspections on existing installations shall be carried out in accordance with this document. However, for older installations the details for the equipment and installation requirements could be referenced to the standards that applied at the date of the installation.

NOTE 2 Standards applied at the date of installation might not have been IEC standards.

In cases where Ex Equipment is located outside of a hazardous area, for example due to changes on site, it should be maintained in accordance with its Type of Protection.

Following any adjustment, maintenance, repair, overhaul, modification or replacement, the equipment or relevant parts of equipment concerned shall be given a detailed inspection.

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

NOTE 3 It is not a requirement of this document that inspection personnel are 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, maximum surface temperature for dusts, including any consideration of dust layers, and temperature class for gases, 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.

EXAMPLE 1 Removing any residual dust.

EXAMPLE 2 Correctly reinstating gaskets.

NOTE 4 Factors affecting the deterioration of Ex Equipment or installation can include accumulation of dust, water ingress, excessive ambient temperature, exposure to chemicals, susceptibility to corrosion, undue vibration or mechanical damage. Service factors affecting Ex Equipment or installation can include inappropriate maintenance, lack of training, experience or competency of personnel and the resulting unauthorised modifications or adjustments or inappropriate maintenance, for example that which is not in accordance with the manufacturer's requirements.

4.4.1.2 Manufacturer's documentation

Manufacturer's information can have additional requirements or recommendations for inspection and maintenance for example, types of grease that should be used, frequency of inspection under specific climatic conditions or torque that should be applied by fasteners.

The manufacturer's requirements or guidance take precedence over this document in the event of conflict, for example for testing frequency.

4.4.1.3 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; reference to the installation databases; etc. The method of attaching or fixing the labelling shall not reduce the integrity of the equipment.

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

4.4.1.4 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 should be followed.

NOTE This assessment is intended to apply to items in an installation that predate any requirement for the use of certified electrical equipment in hazardous areas.

4.4.2 Grades of inspection

4.4.2.1 General

Grades of inspection are visual, close and detailed. Table 1, Table 2, Table 3, and Table 4 detail the checks 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 (for example Ex "de" equipment) shall be a combination of the relevant columns from Table 1, Table 2, Table 3, and Table 4.

4.4.2.2 Use of inspection tables

The inspection Table 1, Table 2, Table 3, and Table 4 provides indicative checks that should be conducted as part of any inspection. The tables are not intended to be applied exactly as presented.

The inspection checks:

a) may be combined if suited to the final methodology for recording inspections

b) may be deleted if not relevant to the type of equipment being inspected

c) should be added to as appropriate

EXAMPLE Any other detail that might be needed to confirm ongoing service condition or compliance of the installation according to the nature of the site for motors is covered in Annex D.

Additional guidance for adverse service conditions is provided in Annex E.

4.4.3 Types of inspection

Types of inspections include:

a) Initial inspections as required by IEC 60079-14

A reduced inspection may be completed if an inspection equivalent to a detailed grade has been performed by the manufacturer. However, relevant detailed grade inspection checks from part B Installation, and C Environment, of Table 1, Table 2, Table 3, and Table 4 will still need to be carried out to ensure that the installation conforms to the requirements.

EXAMPLE 1 An initial detailed inspection of internal flamepaths of a flameproof motor or the internal joints of an Ex t motor is not required; however, the terminal housing cover, which would have been removed to facilitate connection of the field wiring as part of the installation process, should be inspected after. These requirements are also covered in IEC 60079-14.

EXAMPLE 2 An equipment assembly has had an initial inspection at a detailed grade by the assembly manufacturer, and a visual inspection is conducted at the final point of installation to verify that no damage has occurred in transport.

b) Periodic inspections which may be visual, close or detailed or a combination of types in accordance with 4.5.

c) Sample inspections which may be visual, close or detailed or a combination of types. 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. The size and composition of the samples selected shall be based on assessment of the installation (for example, Zones, Types of Protection, age, location, exposure, risk of damage and other factors).

d) Continuous supervision utilizing Skilled Personnel to carry out regular inspection and monitoring, equivalent to visual or close grades of inspection, in accordance with 4.6.

The results of all inspections shall be recorded, retained and reviewed to consider if further action is necessary.

4.5 Periodic inspections

4.5.1 Personnel

Regular periodic inspection requires personnel who are both competent for the inspection required and the competency requirements as defined in clause 4.2 and Annex B, and who:

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;

A Technical Person with Executive Function shall be identified for each installation with overall responsibility and control of the inspection systems for the electrical equipment within the hazardous areas.

4.5.2 Fixed installations

The grade of inspection and the interval between periodic inspections shall be determined considering: the type of equipment, the manufacturer's guidance, if any, the factors governing its deterioration (see 4.4.1.1, Note 4), the area classification or the EPL requirements and the results of previous inspections. The grade and frequency of inspection may be varied for different items of equipment at a site according to the individual factors for each item of equipment, for example the frequency of inspection might need to be increased in corrosive parts of a site but need not be applied across the entire site. Where the grade and frequency of inspections is varied from the minimum requirements of this document the inspection program should be documented.

Where inspection grades and intervals have been established for similar equipment, installations and environments, this experience should be used in determining the inspection program.

The interval between periodic inspections shall not exceed three years without conducting and documenting a risk assessment based on equipment type, location, environment and previous inspection history. This risk assessment shall be conducted by an independent expert.

NOTE ‘independent’ does not necessarily imply an ‘external body’ or person to the user organisation.

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.

The results of inspections will be subjected to ongoing review 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, periodic inspections may be carried out 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.

4.5.3 Transportable, personal and portable equipment

Transportable, personal and portable electrical equipment are particularly prone to damage or misuse and therefore the interval between periodic inspections is reduced.

The interval between periodic inspections shall not exceed the following without seeking advice from the manufacturer and Technical Person with Executive Function:

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

b) all personal, portable, and transportable equipment shall be submitted to a close inspection at least every 12 months; and

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

4.6 Continuous supervision

4.6.1 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 4.5.1 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 or close inspections as part of their normal work schedule as well as identify any need for detailed inspections as part of any replacement, or adjustment in accordance with 4.4.1.1,

then it might 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.

If the Skilled Personnel have the adequate competency, then those personnel may also carry out the detailed inspection.

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 (for example in the case of Transportable, personal and portable equipment), and in such cases the equipment shall be subject to periodic inspection. See 4.6.4.

4.6.2 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 (for example 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.

4.6.3 Responsibilities

4.6.3.1 Technical Persons with Executive Function

A Technical Person with Executive Function shall be identified for each installation and shall 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 Ex Equipment compliance;

d) ensure that the documentation referred to in 4.1 and 4.6.5 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; and

   3) the inventory of Ex 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; and

   6) the state of the electrical installation is known.

4.6.3.2 Skilled Personnel

The Skilled Personnel shall be in addition familiar with the concept of continuous supervision together with any reporting or analysis functions which comprise the method of continuous supervision applicable to the specific installation.

In undertaking continuous supervision of plant and equipment the Skilled Personnel should take account of the conditions of the installation and any changes which occur.

4.6.4 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 and expected deterioration of the equipment (see 4.4.1.1), use and experience.

Unless experience indicates to the contrary, if a part of the installation with a significant inventory of Ex Equipment is not visited routinely for example weekly, then it should not be included as part of the continuous supervision concept.

Where the Skilled Personnel have noted a condition change of the environment (for example invasion of solvent or increased vibration) those items of explosion protected equipment which could be sensitive to the change shall be checked more frequently.

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.

4.6.5 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 if a) and b) above can be achieved by the documentation system.

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.

4.6.6 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. When the process or installation is changed, training on the changes shall be provided.

Training in the concepts of continuous supervision shall be provided together with refresher or reinforcement seminars.

The knowledge requirements of the Technical Persons with Executive Function shall include a full understanding of the provisions of IEC 60079-10-1, IEC 60079-10-2, IEC 60079-14, this document, and IEC 60079-19 in relation to area classification or EPLs and electrical installations design, selection, erection and inspection, equipment repair, overhaul and reclamation.

4.7 Maintenance requirements

4.7.1 Remedial measures and modifications to equipment

Appropriate remedial measures shall be taken where necessary. The integrity of the Type of Protection shall be maintained which can require consultation with the manufacturer.

Replacement parts shall be in accordance with the manufacturer's instructions or other applicable documentation. Modifications to equipment shall not be carried out without appropriate authorization where they adversely affect the safety of the equipment as stated in the manufacturer's instructions or other applicable documentation.

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

The means employed by the manufacturer to reduce the effects of static electricity should not be interfered with.

When replacing lamps in luminaires the correct rating and type shall be used, otherwise excessive temperatures can result.

Lamps in increased safety luminaires should be replaced periodically to avoid any temperature rise that can occur at end-of-life.

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

4.7.2 Maintenance of flexible cables

Flexible 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.

4.7.3 Withdrawal from service

Where equipment is temporarily withdrawn from service, the exposed conductors shall be:

a) correctly terminated in an appropriate enclosure;

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

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

Where equipment is permanently removed, the associated wiring shall be:

1) removed; or

2) correctly terminated in an appropriate enclosure; or

3) earthed at the supply end and, at the other end of the cable, the conductors shall be bonded together and then insulated by a secure means (for example epoxy pot-end).

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

4.7.4 Fastenings and tools

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

4.8 External influences

Ex Equipment can be adversely affected by the environmental conditions in which it is used. The inspection interval, type and grade as well as the specific requirements of the inspection should be adjusted to suit anywhere adverse conditions could 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, can affect the degree of protection (IP) of the equipment. If the enclosure or component is severely corroded, the part shall be replaced. Plastic enclosures can 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 installation of the electrical equipment is acceptable for use in the environment likely to be encountered.

If the marking of the Ex Equipment does not indicate a range of ambient temperatures for which the equipment is designed, it shall be used within the range of –20 °C to +40 °C. If a range is indicated for which the equipment is designed it shall be used within this range. If the ambient temperature is outside the temperature range, or if there is a temperature influence from other factors, for example the process temperature or exposure to solar radiation, the application shall be checked with the documented assessment (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, additional precautions should be taken to ensure that bolts and cable entries remain tight.

EXAMPLE The use of locknuts or threads which are resistant to vibration.

The cleaning of non-conductive electrical equipment shall use methods that avoid the generation of static electricity.

EXAMPLE Cleaning with a damp cloth.

4.9 Isolation of equipment

4.9.1 Installations other than intrinsically safe circuits

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

a) 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, under a safe work procedure (see IEC 60079-14).

   This might require isolation 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.

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

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

b) A relaxation of the requirements for increased safety "e" equipment which also contains intrinsically safe apparatus is permitted, if all bare live parts not protected by the Type of Protection "i" have a separate internal cover providing at least the degree of protection IP30 when the enclosure of the apparatus is open.

   This equipment will 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 are 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. The recording shall contain:

- the form(s) which the proposed work on energized equipment could take;
- the results of the assessment, including the results of any testing carried out during the assessment; and
- any additional controls 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; and
- have access to all information necessary to carry out the assessment.

4.9.2 Live maintenance on Intrinsically safe installations

4.9.2.1 General

Maintenance work may be carried out on energized intrinsically safe equipment subject to manufacturer's recommendations (see 4.4.1.2) and the following subclauses.

Where equipment contains more than one intrinsically safe circuit, any maintenance shall ensure that separation between the circuits is not compromised.

4.9.2.2 Maintenance work in hazardous areas

Any maintenance work shall be restricted to:

a) disconnection of, and removal or replacement of, items of electrical equipment and cabling;
b) adjustment of any controls necessary for the calibration of the electrical equipment or system;
c) removal and replacement of any plug-in components or assemblies;
d) any other maintenance activity specifically permitted by the relevant documentation; and
e) 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.

4.9.2.3 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 4.9.2.2 a) whilst such electrical apparatus or parts of circuits remain interconnected with parts of intrinsically safe systems located in hazardous areas.

Diode 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.

Other maintenance work on associated apparatus or parts of an intrinsically safe circuit mounted 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.

4.10 Earthing and equipotential bonding

Earthing and equipotential bonding provisions in hazardous areas shall be maintained in good condition (see Table 1, checks B6 and B7; Table 2, checks B6 and B7; Table 3, checks B3 and B4; and Table 4 checks B6 and B7).

4.11 Specific Conditions of Use

Specific Conditions of Use apply to any Ex Equipment marked with the symbol "X", usually as a suffix to the certificate number. Any Specific Conditions of Use contained within the certificate and manufacturer's instructions shall be complied with.

NOTE Prior to 2007, Specific Conditions of Use were referred to as "special conditions for safe use".

4.12 Movable equipment and its connections

Movable electrical equipment (transportable, personal and portable) shall only be used in locations appropriate to its Type of Protection, equipment group, and maximum surface temperature. Where it is possible for movable equipment to be used in a location for which it is not suitable, additional precautions should be implemented to limit the likelihood of this.

NOTE Additional precautions could include the restriction of equipment permitted on site to only equipment which is suitable for all areas accessed by personnel, or specific signage at areas with more onerous requirements.

Ordinary industrial movable equipment should not be used in a hazardous area unless its use is managed under a safe work procedure (according to IEC 60079-14).

EXAMPLES Welding equipment, power tools, computers, data recorders.

4.13 Inspection schedules

4.13.1 General

The inspection schedules are shown in Table 1, Table 2, Table 3, and Table 4.

Checks identified in Table 1, Table 2, Table 3, and Table 4 detail only the minimum items related to the integrity of equipment and installations in hazardous areas. Other checks 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.

Inspection schedules should be modified accordingly to suit the specific equipment and installation requirements.

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

4.13.2 Equipment is appropriate to the EPL/Zone requirements of the location

Equipment meets or exceeds the requirements for the EPL/Zone of use.

4.13.3 Equipment group

Equipment group shall meet or exceed the requirements of the location.

4.13.4 Equipment maximum surface temperature

Equipment maximum surface temperature shall meet or exceed the requirements of the location.

4.13.5 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 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.

4.13.6 Ex Cable Glands

The check-tightening of Ex Cable Glands under close inspection may be carried out by hand without the need to remove weather-proofing tape or shrouds. Detailed inspections will require removal of weather-proofing tape or shrouds to verify certification details and could necessitate that the Ex Cable Glands are dismantled.

4.13.7 Type of cable

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

4.13.8 Sealing

The sealing of trunking, ducts, pipes, conduits etc., is in accordance with the site documentation and IEC 60079-14.

NOTE The sealing is for prevention of transmission of vapours or process fluids and is not part of Ex protection of equipment.

4.13.9 Test and measuring equipment

Test equipment shall only be used if precautions have been taken to prevent electrical discharges in the hazardous area.

NOTE 1 The connection of test equipment outside the hazardous area could result in electrical discharges in the hazardous area.

NOTE 2 Even when using meters which are Ex Equipment, the interconnection of the test leads to the circuit to be tested could result in electrical discharges in the hazardous area.

4.13.10 Fault loop impedance or earthing resistance

The integrity of the earthing shall be checked. The measurement may be made using an intrinsically safe resistance measuring instrument (according to the procedure specified by the manufacturer). Detailed sample inspections may be carried out and the results checked against those obtained from the initial inspection.

Non-intrinsically safe measuring equipment may be used if a safe work procedure (according to IEC 60079-14) has been conducted and if the locations where potentially incendive sparking could occur can be guaranteed to be free from an explosive atmosphere by those responsible for the area.

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

4.13.11 Insulation resistance

Testing of insulation resistance may be performed if a safe work procedure (according to IEC 60079-14) has been conducted and if the locations where potentially incendive sparking could occur can be guaranteed to be free from an explosive atmosphere by those responsible for the area.

During test it might be necessary to perform disconnection to avoid damage to the Ex Equipment connected to the cable or to the device under test.

The testing of insulation resistance on intrinsically safe apparatus, and associated cabling, shall be performed at 500V DC or twice the I.S. circuit voltage, whichever is the greater.

The insulation resistance measured 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.

4.13.12 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 as required by IEC 60079-14.

4.13.13 Lamps and luminaires

Lamps for luminaires shall be checked for conditions that can 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 EOL 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

For guidance on the inspection of Type of Protection "d" Ex Equipment see Table 1.

When reassembling flameproof enclosures, all joints shall be thoroughly cleaned and 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).

The diametric clearance of spigot, shaft, spindle and threaded joints may not be checked, unless there is evidence of wear, distortion, corrosion or other damage in that occurrence procedure equivalent to the one applied to flanged joint gaps check shall be used.

Flanged joint gaps shall be within the following as applicable:

a) the limits in accordance with manufacturer's documentation;

b) maximum values permitted by relevant equipment standards at the time of manufacture, if not documented by the manufacture; or

c) the maximum values permitted by the site documentation if the equipment has been repaired (see IEC 60079-19).

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

Bolts, screws and similar parts, upon which the Type of Protection depends, shall only be replaced by equivalent parts in accordance with the manufacturer's design.

5.2 Type of Protection "e" – Increased safety

5.2.1 Level of Protection "eb"

Level of Protection "eb" is equivalent to the historical "e" marking without an Equipment Protection Level.

For guidance on the inspection of Type of Protection "e" Ex Equipment see Table 1.

The windings of Ex "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 selected such that the tripping time from cold, taken from the 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 could be reduced and the protective device setting checked (see IEC 60079-19).

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

NOTE It might or might not be necessary to measure the tripping times at the periodic inspection.

5.2.2 Level of Protection "ec"

From IEC 60079-7:2015 (edition 5) and IEC 60079-15:2017 (edition 5), Type of Protection "nA" has been changed to Level of Protection "ec". These should be considered technically equivalent for the purposes of this document.

NOTE This marking is also equivalent to the Type of Protection "n" marking with no additional symbol from IEC 60079-15:1987 (edition 1) and similar national standards from the same era.

For guidance on the inspection of Level of Protection "ec" and Type of Protection "nA" Ex Equipment, see the "n" column of Table 1.

5.3 Type of Protection "i" – Intrinsic safety

5.3.1 General

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.

For guidance on the inspection of Type of Protection "i" Ex Equipment see Table 2.

5.3.2 Documentation

The documentation referred to in Table 2, as a minimum, includes all of the following:

a) descriptive system documents, where appropriate;

b) manufacturer, equipment type and certificate numbers, Level of Protection, equipment group, and temperature class or maximum surface temperature as applicable;

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

d) Specific Conditions of Use and any actions taken to satisfy them; and

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 some unauthorized modification being conducted.

It may be possible to utilize the fact that the soldering associated with most repairs or 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

Associated apparatus shall be inspected to ensure that it is of the correct type and rating in accordance with the descriptive system document. Where the associated apparatus is a 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

Installations shall be inspected to ensure that the cables used comply with the documentation. Particular care shall be taken when utilizing spare cores 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 in the same pipe, duct or cable tray.

5.3.7 Cable screens

Installations shall be inspected and tested to ensure that cable screens are earthed in accordance with the appropriate documentation. Particular attention shall be paid to installations utilizing multicore cables which contain more than one intrinsically safe circuit.

5.3.8 Point-to-point connections

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

5.3.9 Earth continuity of non-galvanically isolated circuits

The resistance of the earth conductors between the intrinsically safe high integrity earth point and the main power system earth shall be checked during the initial inspection and periodic inspections and be documented. For a TN-S system the value should not exceed 1 ohm. Values for other systems may be different.

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.

Where connections show evidence of degradation 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, diode safety barrier 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 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 is 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.

Where, in order to carry out these tests, the common earth connection to a group of diode safety barriers is disconnected, the tests can only be made if either the plant is free from hazard, 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

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

5.4 Type of Protection "p" and "pD" – Pressurized enclosure

For guidance on the inspection of Type of Protection "p" or "pD" Ex Equipment see Table 3.

5.5 Type of Protection "n"

5.5.1 General

For guidance on the inspection of Type of Protection "n", "nC" and "nR" Ex Equipment see the "n" column of Table 1.

For guidance on the inspection of Type of Protection "'nL" Ex Equipment see Table 2 as equivalent to Level of Protection "ic" (see 5.3).

NOTE "nL" and "nA" from previous editions of IEC 60079-15 have been re-designated as "ic" and "ec" respectively in more recent editions of the IEC 60079 series. One type of "nC", enclosed break device, has similarly been redesignated as "dc".

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

For guidance on inspection of Type of Protection "t" and "tD" Ex Equipment see Table 1.

5.7 Types of Protection "o" (liquid immersion)

For guidance on inspection of Type of Protection "o" Ex Equipment see Table 4.

Type of Protection "o" electrical equipment designed to be opened shall be re-filled to within the required level range with the protective liquid required and re-sealed in accordance with the manufacturer's instructions.

5.8 Types of Protection "m" and "mD" (encapsulation), "op" (optical radiation) and "q" (powder-filling)

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

6 Inspection tables

The following tables are not intended to be applied exactly as presented. Checks within the tables may be deleted, if not relevant to the type of equipment being inspected, or be added to according to the nature of the site.

Table 1 – Inspection schedule for Ex "d", Ex "e", Ex "n" and Ex "t/tD" installations

	Check that: X = required for all types, n = type "n" only, t = type "t" and "tD" only	Ex "d"			Ex "e"			Ex "n" Ex"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 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							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 – visual check	X	X	 X	X	X	 X	X	X	 X
12	Threaded covers on enclosures are of the correct type, are tight and secured – physical check – visual check	X	X	 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: – 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	X								
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			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)							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		

Check that: X = required for all types, n = type "n" only, t = type "t" and "tD" only		Ex "d"			Ex "e"			Ex "n" Ex"t/tD"		
		Grade of inspection								
		D	C	V	D	C	V	D	C	V
	EQUIPMENT SPECIFIC (MOTORS)									
29	Motor fans have sufficient clearance to the enclosure and/or covers, cooling systems are undamaged, motor foundations 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 is appropriate	X			X			X		
2	There is no obvious damage to cables	X	X	X	X	X	X	X	X	X
3	Sealing of trunking, ducts, pipes, conduits and cables is satisfactory	X	X	X	X	X	X	X	X	X
4	Stopping boxes and cable boxes are correctly filled	X								
5	Integrity of conduit system and interface with mixed system maintained	X			X			X		
6	Earthing connections, including any supplementary earthing bonding connections are satisfactory – physical check (for example, connections are tight and conductors are of sufficient cross-section) – visual check	X	X	X	X	X	X	X	X	X
7	Fault loop impedance (TN systems) or earthing resistance (IT 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	X	X	X						
13	Variable voltage/frequency installation complies with documentation	X	X		X	X		X	X	
	INSTALLATION – 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									
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 2 – Inspection schedule for Ex "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 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 is no damage or 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		
17	The maximum voltage U_m of the associated apparatus is not exceeded	X	X	
B	**INSTALLATION**			
1	Cables are installed in accordance with the documentation	X		
2	Cable screens are earthed in accordance with the documentation	X		
3	There is no obvious damage to cables	X	X	X
4	Sealing of trunking, ducts, pipes, conduits and cables is satisfactory	X	X	X
5	Point-to-point connections are all correct (initial inspection only)	X		
6	Earth continuity is satisfactory (for example, connections are tight, conductors are of sufficient cross-section) for non-galvanically isolated circuits	X		
7	Earth connections maintain the integrity of the Type of Protection	X		
8	Intrinsically safe circuit earthing is satisfactory	X		
9	Insulation resistance is satisfactory	X		
10	Separation is maintained between intrinsically safe and non-intrinsically safe circuits in common distribution boxes or relay cubicles	X		
11	Short-circuit protection of the power supply is in accordance with the documentation	X		
12	Specific Conditions of Use (if applicable) are complied with	X		
13	Cables not in use are correctly terminated	X		
C	**ENVIRONMENT**			
1	Equipment is adequately protected against corrosion, weather, vibration and other adverse factors	X	X	X
2	No undue external accumulation of dust and dirt	X	X	X
(D = detailed, C = close, V = visual)				

Table 3 – Inspection schedule for Ex "p" and "pD" installations

	Check that: X = required	Grade of inspection		
		D	C	V
A	**EQUIPMENT**			
1	Equipment is appropriate to the EPL/Zone requirements of the location	X	X	X
2	Equipment group is correct	X	X	
3	Equipment temperature class or surface temperature is correct	X	X	
4	Equipment circuit identification is correct	X		
5	Equipment circuit identification is available	X	X	X
6	Enclosure, glasses and glass-to-metal sealing gaskets and compounds are satisfactory	X	X	X
7	There is no damage or unauthorized modifications	X		
8	There is no evidence of unauthorized modifications		X	X
9	Lamp type, rating, and position are correct	X		
B	**INSTALLATION**			
1	Type of cable is appropriate	X		
2	There is no obvious damage to cables	X	X	X
3	Earthing connections, including any supplementary earthing bonding connections, are satisfactory – physical check for example, connections are tight and conductors are of sufficient cross-section – visual check	X	X	X
4	Fault loop impedance (TN systems) or earthing resistance (IT systems) is satisfactory	X		
5	Automatic electrical protective devices operate within permitted limits	X		
6	Automatic electrical protective devices are set correctly	X		
7	Protective gas inlet temperature is below maximum specified	X		
8	Ducts, pipes and enclosures are in good condition	X	X	X
9	Protective gas is substantially free from contaminants	X	X	X
10	Protective gas pressure and/or flow is adequate	X	X	X
11	Pressure and/or flow indicators, alarms and interlocks function correctly	X		
12	Conditions of spark and particle barriers of ducts for exhausting the gas in hazardous area are satisfactory	X		
13	Specific Conditions of Use (if applicable) are complied with	X		
C	**ENVIRONMENT**			
1	Equipment is adequately protected against corrosion, weather, vibration, and other adverse factors	X	X	X
2	No undue accumulation of dust and dirt	X	X	X
(D = detailed, C = close, V = visual)				

Table 4 – Inspection schedule for Ex "o" installations

	Check that: X = required	Grade of inspection		
		D	C	V
A	**EQUIPMENT**			
1	Equipment is appropriate to the EPL/Zone requirements of the location	X	X	X
2	Equipment group is correct	X	X	
3	Equipment temperature class is correct	X	X	
4	Equipment circuit identification is correct	X		
5	Equipment circuit identification is available	X	X	X
6	Enclosure, glass parts and glass-to-metal sealing gaskets and/or compounds are satisfactory	X	X	X
7	There are no unauthorized modifications	X		
8	There are no visible unauthorized modifications		X	X
9	Bolts, cable entry devices (indirect) and Blanking Elements are of the correct type and are complete and tight – physical check – visual check	 X	 X	 X
10	Electrical connections are tight	X		
11	Condition of enclosure gaskets is satisfactory	X		
12	Breathing and draining devices are satisfactory. The manufacturer's schedule for maintenance requirements for the drying agent are documented to have been followed	X		
13	Sealed enclosure pressure-relief devices are satisfactory	X		
14	Enclosures marked Permanently Sealed have no visible evidence that the enclosure has been opened	X	X	X
15	**maximum/minimum criteria of the protective liquid** a) level of the protective liquid shall be at or below the maximum and above the minimum permitted level; b) the maximum working angle to the horizontal of the equipment shall be satisfactory	 X X	 X	 X
16	**Enclosures intended to be opened** The level of the protective liquid is correct.	 X		
17	When a dipstick is provided, the dipstick is secured in its measurement position and its seal is satisfactory	X	X	
18	remote-indicating protective liquid level indicating device operation is satisfactory	X	X	X
19	switching device schedule for cleaning/filtering/replacement of the protective liquid following a given number of normal switching operations or interruption of fault currents is documented	X	X	X

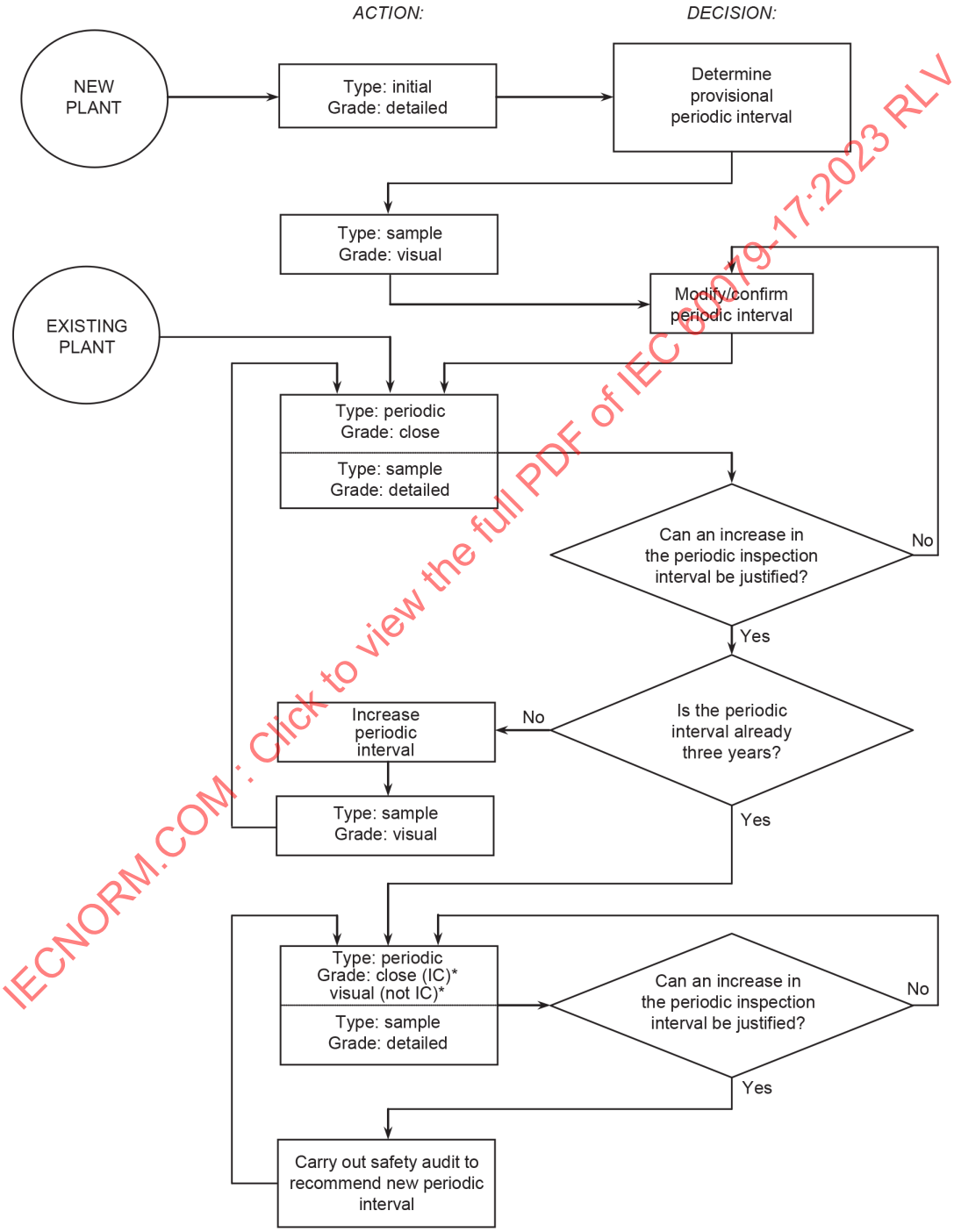
Check that: X = required		Grade of inspection		
		D	C	V
B	**INSTALLATION – GENERAL**			
1	Type of cable is appropriate	X		
2	There is no obvious damage to cables	X	X	X
3	Sealing of trunking, ducts, pipes, conduits, and Cable Glands is satisfactory	X	X	X
4	Stopping boxes, cable boxes and Cable Glands are correctly filled	X		
5	Integrity of conduit system and interface with mixed system maintained	X		
6	Earthing connections, including any supplementary earthing bonding connections are satisfactory – physical check (for example connections are tight and conductors are of sufficient cross-section) – visual check	X	X	X
7	Fault loop impedance (TN systems) or earthing resistance (IT systems) is satisfactory	X		
8	Automatic electrical protective devices are set correctly (auto-reset not possible)	X		
9	Automatic electrical protective devices operate within permitted limits	X		
10	Specific Conditions of Use (if applicable) are complied with	X		
11	Cables not in use are correctly terminated	X		
12	Variable voltage/frequency installation complies with documentation	X	X	
	INSTALLATION – HEATING SYSTEMS			
13	Temperature sensors function according to manufacturer's documents	X		
14	Safety cut off devices function according to manufacturer's documents	X		
15	The setting of the safety cut off is sealed	X	X	
16	Reset of a heating system safety cut off possible with tool only	X	X	
17	Auto-reset is not possible	X	X	
18	Reset of a safety cut off under fault conditions is prevented	X		
19	Safety cut off independent from control system	X		
20	Level switch is installed and correctly set, if required	X		
21	Flow switch is installed and correctly set, if required	X		
C	**ENVIRONMENT**			
1	Equipment is adequately protected against corrosion, weather, vibration, and other adverse factors	X	X	X
2	No undue accumulation of dust and dirt	X	X	X
3	Electrical insulation is clean and dry			X
(D = detailed, C = close, V = visual)				

Annex A
(informative)

Typical inspection procedure for periodic inspections

Figure A.1 shows a typical inspection procedure for periodic inspections.

NOTE See 4.4.



* IC Ignition capable in normal operation. i.e. where the internal components of the apparatus produce in normal operation, arcs, sparks or surface temperature capable of causing ignition.

IEC

Figure A.1 – Typical inspection procedure for periodic inspections

Annex B
(normative)

Knowledge, skills and competencies of Technical Persons with Executive Function and Skilled Personnel

B.1 General

This annex specifies the knowledge, skills and competencies of Technical Persons with Executive Function and Skilled Personnel referred to in this document.

B.2 Knowledge and skills

B.2.1 Technical Persons with Executive Function

Technical Persons with Executive Function who are responsible for the processes involved in the inspection and maintenance of explosion protected equipment shall possess, at least, all of the following:

a) general understanding of relevant electrical engineering,

b) practical understanding of explosion protection principles and techniques,

c) understanding and ability to read and assess engineering drawings,

d) working knowledge and understanding of relevant standards in explosion protection, particularly IEC 60079-10-1, IEC 60079-10-2, IEC 60079-14 and IEC 60079-19, and,

e) basic knowledge of quality assurance, including the principles of auditing, documentation, traceability of measurement and instrument calibration.

Such persons shall confine their involvement to the management of Skilled Personnel conducting inspection and maintenance duties and not engage themselves directly in the work without ensuring their practical skills at least meet the requirements given in B.2.2.

B.2.2 Skilled Personnel (inspection and maintenance)

Skilled Personnel shall possess, to the extent necessary to perform their tasks, all of the following:

a) understanding of the general principles of area classification or EPL and explosion protection,

b) understanding of the general principles of types of protection and marking,

c) understanding of those aspects of equipment design which affect the protection concept,

d) understanding of certification and relevant parts of this document,

e) understanding of the additional importance of permit to work systems and safe isolation in relation to explosion protection,

f) familiarity with the particular techniques to be employed in the inspection and maintenance of equipment referred to in this document,

g) comprehensive understanding of the selection and erection requirements of IEC 60079-14, and,

h) general understanding of the repair and reclamation requirements of IEC 60079-19.

Additionally, for those involved in Continuous Supervision:

i) awareness of process and environmental implications on the deterioration of the specific equipment in the installation, and

j) familiarity with the concept of continuous supervision together with reporting and analysis functions.

B.3 Competencies

B.3.1 General

Competencies shall apply to each of the explosion protection techniques for which the person is involved. For example: it is possible for a person to be competent in the field of inspection and maintenance of Ex "i" equipment only and not be fully competent in the inspection and maintenance of Ex "d" switchgear or Ex "e" motors. In such cases, the specific competency limitation shall be documented.

B.3.2 Technical Persons with Executive Function

Technical Persons with Executive Function shall be able to demonstrate their competency and provide evidence of attaining the knowledge and skill requirements specified in B.2.1 relevant to the Types of Protection and types of equipment involved.

B.3.3 Skilled Personnel

Skilled Personnel shall be able to demonstrate their competency and provide evidence of attaining the knowledge and skill requirements specified in B.2.2 relevant to the types of protection and/or types of equipment involved.

They shall also be able to demonstrate their competency with documentary evidence in the:

- use of documentation specified in 4.1;
- practical skills necessary for the inspection and maintenance of relevant concepts of protection.

B.4 Assessment

The competency of Technical Persons with Executive Function and Skilled Personnel shall be verified and attributed, at intervals not exceeding 5 years on the basis of sufficient evidence that the person:

a) has the necessary skills required for the scope of work, and,

b) can act competently across the specified range of activities; and,

c) has the relevant knowledge and understanding underpinning the competency.

Annex C
(informative)

Fitness-for-purpose assessment

C.1 Background

Where no certificate of conformity is available (or the origin of a certificate cannot be verified), a fitness-for-purpose assessment should be undertaken. Usually this will require a full audit and assessment of the equipment, generation of a design specification including all necessary calculations, measurements, equipment and cable parameters and the like, and making decisions and statements that the equipment is fit for its purpose and safe to use. Where tests are required, they should be carried out by competent personnel using the necessary calibrated test equipment. The fitness-for-purpose assessment may not be allowed in some countries, in this case the relevant National Rules should be applied.

C.2 Need for a fitness-for-purpose assessment

In order to establish evidence enabling a risk assessment to demonstrate an equivalent level of safety within an existing installation, the need for a fitness-for-purpose assessment report may be determined on the basis that insufficient information is available to comply with certification requirements of IEC 60079-14, or with the requirements of the installation standard applicable at the time of the original installation.

C.3 Approach

In preparing a fitness-for-purpose assessment it should be based on the assessment to standards that are relative to the avoidance of ignition sources for the equipment to be used in hazardous areas.

C.4 Ignition sources

The assessment of the equipment should take into account any likely ignition sources, whether they be arcs, sparks or hot surfaces, and take into account whether they are likely to occur in normal circumstances or only under fault or abnormal conditions. Attention is drawn to the possibility of ignition from high energy light sources (lasers), static electricity, friction heating, ionising radiation etc., as well as the contact sparking and/or heating from electrical equipment. Where requirements for protective devices as a form of control are used, they should also be included in the assessment.

C.5 Contents of the fitness-for-purpose assessment

C.5.1 General

The following items are recommended for all fitness-for-purpose assessment reports before they are considered for acceptance.

C.5.2 Scope of the assessment report

The assessment report clearly indicates the extent of work undertaken, incorporating a list of those aspects included in the report and any considerations, which may reasonably have been expected, that have been excluded.

Details of the explosion protection methods, Types of Protection and other characteristics are stated together with details of each individual standard used for the assessment.

C.5.3 Equipment and its application

The equipment, its application, function and location should be fully defined.

C.5.4 Description

The description will adequately define the equipment by type and model, including any special variations or additions that establish the unique identity of the item being assessed. It should include characteristics relating to appearance, materials etc., which may be by description and/or photographs.

C.5.5 Function of the product including the location

The purpose and use of the equipment, its location, environmental conditions and full details of the hazardous area parameters should be provided.

C.5.6 Specification

The manufacturer's electrical performance specification for the equipment is required for the assessment. This is preferably appended to the report rather than supplied separately, thus ensuring a complete record is maintained for the equipment.

Any hazardous area specification (or claim of suitability for the hazardous area) made by the manufacturer should be included with the assessment if provided. This is also preferably appended to the report rather than supplied separately, thus ensuring a complete record is maintained for the equipment.

Drawings of the equipment that clearly identify the aspects of the equipment that affect the assessment are included in the report. These drawings may be provided by the manufacturer or by the assessor preparing the fitness-for-purpose assessment report and can be in the form of a sketch if necessary.

A material schedule is to be included, where possible, identifying the materials used for the major components relating to the Type of Protection. Ideally the description will be supported by photographs.

C.5.7 Standards compliance

All assessments should be carried out according to IEC standards. The equipment is assessed and/or tested to ensure that all requirements of the identified IEC standards have been met and secondly that the assessor has demonstrated and documented that compliance with the standards has been achieved.

A reference list of standards to which the item has been assessed and cross referenced will be included in the fitness-for-purpose assessment report.

Where a fitness-for-purpose assessment report is based on standards other than IEC, the report should contain full justification and information of any applicable variation to that given in the IEC standards relating to the installation and use of the product including any inspection, maintenance, overhaul or repair variations. Every endeavour should be taken in obtaining full manufacturer's documentation according to IEC 60079-0 and this should be included with the report.

Assessment and testing is conducted according to the standards identified as being applicable to the equipment being assessed. Each relevant clause of the standard is considered and reported in an assessment and test report which should form part of the fitness-for-purpose assessment report.

Each clause that has not been established as compliant is assigned a risk ranking by the Assessor, using a risk assessment (for example, methodologies such as those outlined in IS0 31000 or other recognized principles and procedures).

C.5.8 Documents

The documents provided by the manufacturer, or those developed by the assessor, used as evidence for the assessment, are listed and appended to the fitness-for-purpose assessment. As a minimum the documents should include the assessor's assessment and test report, manufacturer's specifications supplemented by any additional information the assessor provides to complete the specification, drawings and photographs, label information etc. Each document should be verified as authentic by either the organization that has issued it or by the assessor.

C.5.9 Product sample

Care is to be taken that the equipment sample being evaluated is not damaged or altered in any way that would impair its explosion protection integrity in the act of assessing or testing. If a test is not conducted based on the possibility of causing damage, this information is included in the test report. If multiple items of equipment of the same type are installed a single item may be assessed and/or tested provided it can be established all such items are identical, otherwise an individual assessment or part assessment should be undertaken.

C.5.10 Equipment label

The assessor should provide full details of the identification in the form of a permanent label for attachment to the equipment, to clearly identify that the equipment has been assessed and a full report is included in the verification dossier. The information on this label should NOT misrepresent the equipment as having a certificate of conformity or otherwise infer that it has a certificate of conformity.

The preferred method of marking is according to the requirements for marking in IEC 60079-0, except that the name or mark of the certificate issuer and the certificate reference should be replaced with 'Fitness-for-purpose assessment report no. YY.xxxx'.

The assessor may also add an X to the report number and label if Specific Conditions of Use apply to the equipment. Full details of any such conditions should be included in the report.

Typical label

ABC limited TYPE 5 CD
Assessed as: Ex de IIB T3
'Other relevant identifiers'
Fitness-for-purpose assessment Report No. 07.0000X

C.5.11 Training of personnel

Any equipment specific requirements for training of personnel working with this equipment are included in the fitness-for-purpose assessment report. These requirements take into account the safe use of the equipment including requirements for installation, inspection, and maintenance including spare parts, overhaul and repair.

C.5.12 Elements of the report

In addition to the items above, each fitness-for-purpose assessment report should include all of the following:

a) Executive summary

A summary, normally given at the beginning of the report, providing an overview of the complete assessment and also providing guidance on whether a full review of the fitness-for-purpose assessment is warranted.

b) Restriction of application

A statement highlighting any restrictions regarding the application or other aspects that would not normally be evident in the selection process.

c) Fitness-for-purpose assessment

A formal fitness-for-purpose assessment statement by the Assessor, stating the assigned level of risk and detailing any special requirements that might be observed.

d) Conclusion

A clear summary of the level of conformity established by the assessment and whether or not it is sufficient to be used to apply a risk assessment approach for the acceptance of the equipment for use.

e) Authorization of report

A statement by the Assessor to indicate they have assessed and/or tested the equipment and obtained the necessary documentation, and that they have personally undertaken the review.

f) Assessment and test report

Tabulated results of the clause-by-clause assessment and testing according to the appropriate standards should be appended to the fitness-for-purpose assessment report.

C.5.13 Assessor requirements

All Assessors should have demonstrated competency to assess the fitness-for-purpose of explosion-protected equipment.

C.5.14 Typical assessment and test report

Table C.1 shows an example of a typical assessment and test report that details the results for each clause of the standards used for equipment to comply with the explosive atmosphere requirements for Ex db IIB T4 Gb IP54 against IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements* and IEC 60079-1, *Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures "d"*.

Table C.1 shows an example of a typical assessment and test report against IEC 60079-0.

Table C.1 – Example of a typical assessment and test report

IEC 60079.0:2012			
Clause	**Assessed/tested**	**Result**	**Comments/action required**
4.1	Assessed	Complied	Group I does not apply
4.2	Assessed	Complied	Group IIB assigned
4.3	N/A		Does not apply to this equipment
5.1.1	Assessed	Complied	Ambient Temperature -20 °C to +50 °C applies
5.3.2.2	Tested	Complied	Temperature measured and corrected for ambient temperature = 92 °C Temperature Class assigned T5
26.4.2	Substitute test	Not verified	The test equipment specified in the standard for the impact test was not available. An alternate similar test was conducted by using a ball peen hammer of 2 kg and swinging through an arc of 0.5 m to simulate an approximate impact of 7 joules. The equipment was subject to this test at 4 different locations selected as 'worst case' and at the conclusion was observed not to have suffered any damage that would indicate the explosion protection or IP characteristics would be impaired.
26.8	Not tested	Not verified	The thermal endurance to heat is not reasonably able to be conducted. As this test is designed to determine the ageing properties of non-metallic materials and this equipment is manufactured from cast aluminium it is not essential to conduct the test. For non-metallic parts such as the gasket there will need to be an increased frequency cycle to monitor any deterioration.

Annex D
(informative)

Example of motor checks

The documents provided by the motor manufacturer can detail requirements for regular checks. The following examples are given to supplement any manufacturer's requirements to avoid motor faults becoming a source of ignition.

Examples of checks:

- Motor runs smoothly and makes no abnormal noises.
- Lubricant level and condition of sleeve bearings are satisfactory.
- Lubrication of the bearings or oil flow to bearing housings is satisfactory.
- The permissible bearing temperatures are not exceeded.
- For sleeve bearing, check insulation of the NDE bearing and the spherical surfaces of the seat of the bearing shell on the frame is satisfactory.
- Protective and control equipment is installed and operational.
- All covers are in place and properly secured.
- Inspection of stator winding, rotor winding, core, brushless exciter, brushless and collector rings (for machines supplied with this equipment) is satisfactory.
- All motor bolts are re-tightened to the correct torque following cleaning or repainting.
- Condensate drain holes are free from corrosion.
- There are no signs of heat dissipation by external devices (for example hot pumps).
- Bearings noise and vibration levels are satisfactory.
- Checks on the condition of the bearing insulation and bearing's inner and outer race fluting (for motors fed by frequency converter) are satisfactory.
- The earth connection for converter fed motors terminal box is satisfactory.
- Record measurements of monitoring devices, such as bearing, winding and frame vibration and temperatures.
- Air, oil and water filters for any heating, cooling and lubrication systems are clean.
- Tubes of air/air or air/water heat exchanger of motor cooling or lubricating auxiliary systems have been cleaned.

Annex E
(informative)

Adverse service conditions

Where equipment is exposed to adverse service conditions, additional periodic checks or maintenance should be conducted in order to maintain the effectiveness of explosion protection under such conditions.

The following should be considered:

- More frequent inspections should be made to ensure proper operation of items such as heaters, bearing lubrication and machine serviceability.
- Because many sealing materials become harder at temperatures below -20 °C, maintenance and inspections should not be performed at low temperatures to prevent damage to the seals or other parts.
- The torque of fasteners, and the sealing they create, should be checked.
- Manufacturers' instructions should include the requirements for maintenance, use of special tools, lubricants and spare parts.
- The temperature of oil-cooled bearings before start up should be maintained as recommended by the manufacturer.
- Periodic checks of insulation systems could be required (using a high-resistance ohmmeter).
- Corrosion prevention of the equipment should be checked.
- Sealing ring should be checked.
- Moisture entry or condensation should be checked.

Bibliography

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at http://www.electropedia.org)

IEC 60079-5, *Explosive atmospheres – Part 5: Equipment protection by powder filling "q"*

IEC 60079-6, *Explosive atmospheres – Part 6: Equipment protection by powder filling "o"*

IEC 60079-7:2015, *Explosive atmospheres – Part 7: Equipment protection by powder filling "e"*

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

IEC 60079-13, *Explosive atmospheres – Part 13: Equipment protection by pressurized room "p" and artificially ventilated room "v"*

IEC 60079-18, *Explosive atmospheres – Part 18: Equipment protection by encapsulation "m"*

IEC 60079-26, *Explosive atmospheres – Part 26: Equipment with Separation Elements or combined Levels of Protection*

IEC 60079-28, *Explosive atmospheres – Part 28: Protection of equipment and transmission systems using optical radiation*

IEC 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 61892-7, *Mobile and fixed offshore units – Electrical installations – Part 7: Hazardous areas*

IMO MODU – *Code for the construction and equipment of mobile offshore – Drilling units – Chapter 6 – Machinery and electrical installations in hazardous areas for all types of units*, 2009

IS0 31000, *Risk management – Principles and guidelines*

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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ATMOSPHÈRES EXPLOSIVES –

Partie 17: Inspection et maintenance des installations électriques

AVANT-PROPOS

1) La Commission Électrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
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8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
9) L'IEC attire l'attention sur le fait que la mise en application du présent document peut entraîner l'utilisation d'un ou de plusieurs brevets. L'IEC ne prend pas position quant à la preuve, à la validité et à l'applicabilité de tout droit de propriété revendiqué à cet égard. À la date de publication du présent document, l'IEC n'avait pas reçu notification qu'un ou plusieurs brevets pouvaient être nécessaires à sa mise en application. Toutefois, il y a lieu d'avertir les responsables de la mise en application du présent document que des informations plus récentes sont susceptibles de figurer dans la base de données de brevets, disponible à l'adresse https://patents.iec.ch. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets.

L'IEC 60079-17 a été établie par le sous-comité 31J: Classification des emplacements dangereux et exigences d'installation, du comité d'études 31 de l'IEC: Équipements pour atmosphères explosives. Il s'agit d'une Norme internationale.

Cette sixième édition annule et remplace la cinquième édition parue en 2013. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

		Type		
Modifications	**Paragraphe**	**Modifications mineures ou rédactionnelles**	**Extension**	**Modifications techniques majeures**
Simplification de la description des atmosphères explosives de gaz et de poussières dans le domaine d'application et utilisation de ces termes dans l'ensemble du document	1	X		
Clarification de l'exclusion des salles ventilées dans le domaine d'application	1	X		
Alignement des termes et définitions de maintenance en 3.7 et 3.8 sur l'IEV et la série IEC 60079	3	X		
Ajout du nouveau paragraphe 4.4.1.2. **Documentation du fabricant** pour les références croisées dans le texte sans répétition	4	X		
Ajout de recommandations supplémentaires dans la Note 4 concernant les facteurs contribuant à la détérioration des appareils Ex	4.4.1.1.		X	
Clarification de la modification de la terminologie utilisée précédemment **Conditions particulières d'utilisation en toute sécurité** à la terminologie actuelle **Conditions particulières d'utilisation**	4.11		X	
Ajout d'exigences supplémentaires concernant le mode de protection "o"	5.7			C1
Ajout d'une clarification concernant l'utilisation des tableaux d'inspection	6		X	
Modifications rédactionnelles mineures et correction des Tableaux 1 à 4, mais sans modification de la numérotation ou du contenu des articles	Tableaux 1 à 4	X		
Modification de la référence dans la présente norme pour aligner tous les types d'inspections sur les termes relatifs à la surveillance continue, c'est-à-dire personnes qualifiées et personne avec qualification technique ayant une fonction d'encadrement	Annexe B			C2
Un exemple de rapport d'évaluation et d'essai type est fourni en C.5.14.	Annexe C	X		
Ajout de nouveaux éléments dans la Bibliographie	Bibliographie	X		
NOTE Les modifications techniques mentionnées incluent l'importance des modifications techniques apportées dans la version révisée de la norme IEC, mais il ne s'agit pas d'une liste exhaustive de toutes les modifications apportées à la version précédente.				

Explications:

A Définitions

Modifications mineures ou rédactionnelles:

– Clarification;
– réduction des exigences techniques;
– modification technique mineure;
– corrections rédactionnelles.

Ces modifications portent sur les exigences et sont de nature rédactionnelle ou technique mineure. Elles comprennent des modifications de formulation destinées à clarifier les exigences techniques sans apporter de modification technique ni réduire le niveau actuel de l'exigence.

Extension:

– ajout d'options techniques.

Ces modifications ajoutent de nouvelles exigences techniques ou modifient les exigences techniques existantes, de façon à fournir de nouvelles options, mais sans augmenter les niveaux d'exigences de la norme précédente.

Modifications techniques majeures:

– ajout d'exigences techniques;
– augmentation des exigences techniques.

Ces modifications sont apportées aux exigences techniques (ajout, augmentation du niveau ou suppression) de telle manière qu'une révision ou une réparation de produit conforme à l'édition précédente ne pourra pas toujours satisfaire aux exigences indiquées dans la dernière édition. Des informations supplémentaires relatives à ces modifications sont données à l'Article B) ci-dessous.

NOTE Ces modifications représentent les connaissances technologiques actuelles. Toutefois, elles n'ont normalement aucune influence sur les appareils déjà présents sur le marché.

B Informations sur l'origine des "modifications techniques majeures"

C1 Le paragraphe 5.7 et le Tableau 4 ont été insérés sur la base du texte soumis par la MT 60079-6 *Atmosphères explosives – Partie 6: Protection du matériel par immersion dans le liquide "o"*.

C2 La référence précédente à la personne responsable dans l'Annexe B reflète généralement les rôles et les responsabilités d'une personne plutôt que les connaissances techniques, les aptitudes et les compétences exigées pour gérer l'activité d'inspection et de maintenance périodiques de l'appareil Ex. Le terme utilisé dans les articles relatifs à la surveillance continue, à savoir Personne avec qualification technique ayant une fonction d'encadrement. est plus clair et harmonise les articles du document.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
31J/345/FDIS	31J/351/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

La présente Norme internationale est destinée à être utilisée conjointement avec l'IEC 60364-6.

Une liste de toutes les parties de la série IEC 60079, publiées sous le titre général *Atmosphères explosives*, se trouve sur le site web de l'IEC.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site Web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera:

- reconduit,
- supprimé, ou
- révisé.

INTRODUCTION

Les installations électriques dans les emplacements dangereux possèdent des caractéristiques spécialement conçues pour être aptes au fonctionnement dans de telles atmosphères. Il est essentiel, pour des raisons de sécurité dans ces emplacements, que l'intégrité de ces caractéristiques soit maintenue tout au long de la vie de telles installations. Le présent document fournit les informations détaillées pour une inspection initiale et par la suite:

a) soit des inspections périodiques régulières;

b) soit une surveillance continue

par un personnel qualifié.

Si nécessaire, la maintenance peut également être nécessaire.

Le fonctionnement correct des installations dans les emplacements dangereux ne signifie pas que l'intégrité des caractéristiques spéciales auxquelles il est fait référence ci-dessus est préservée et le présent document n'est pas à interpréter en ce sens.

ATMOSPHÈRES EXPLOSIVES –

Partie 17: Inspection et maintenance des installations électriques

1 Domaine d'application

La présente partie de l'IEC 60079 s'applique aux utilisateurs et couvre uniquement les facteurs directement liés à l'inspection et à la maintenance des installations électriques spécialement conçues pour les emplacements dangereux, où le danger provient des atmosphères explosives.

Elle ne comprend pas:

- les autres exigences fondamentales relatives à l'installation et à l'inspection pour les installations électriques;
- la vérification des appareils électriques;
- la protection ou la ventilation des salles;
- les systèmes de détection de gaz;
- les réparations, les révisions et la remise en état des appareils protégés contre l'explosion (voir IEC 60079-19).

Bien que le présent document n'inclue pas l'inspection des dispositifs de sécurité tels que ceux utilisés dans les salles ventilées (voir IEC 60079-13), il inclut les exigences relatives à l'inspection et à la maintenance de chacun des éléments des appareils qui font partie de ces systèmes, par exemple les moteurs ou les capteurs.

Le présent document constitue un complément pour les exigences relatives aux inspections et aux essais de l'IEC 60364-6 effectués dans des emplacements non dangereux. Le présent document est destiné à être appliqué s'il existe un risque dû à la présence potentielle de gaz explosifs, de mélanges de poussières dans l'air ou de couches de poussières combustibles dans des conditions atmosphériques normales. Il ne s'applique pas:

- aux parties souterraines des mines;
- aux poussières d'explosifs;
- aux substances pyrophoriques.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60079-0, *Atmosphères explosives – Partie 0: Matériel – Exigences générales*

IEC 60079-10-1, *Atmosphères explosives – Partie 10-1: Classification des emplacements – Atmosphères explosives gazeuses*

IEC 60079-10-2, *Atmosphères explosives – Partie 10-2: Classification des emplacements – Atmosphères explosives poussiéreuses*

IEC 60079-14, *Atmosphères explosives – Partie 14: Conception, sélection et construction des installations électriques*

IEC 60079-15, *Atmosphères explosives – Partie 15: Protection du matériel par mode de protection "n"*

IEC 60079-19, *Atmosphères explosives – Partie 19: Réparation, révision et remise en état de l'appareil*

IEC 60364-6, *Installations électriques à basse tension – Partie 6: Vérification*

3 Termes et définitions

Pour les besoins du présent document, les termes et les définitions de l'IEC 60079-0, ainsi que les suivants, s'appliquent.

NOTE Des définitions supplémentaires applicables aux atmosphères explosives se trouvent dans l'IEC 60050-426.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1
inspection de près
inspection qui comporte les aspects couverts par une inspection visuelle et, de plus, détecte les défauts tels que des boulons desserrés, qui ne peuvent être mis en évidence que par l'utilisation d'un matériel d'accès, par exemple des échelles (si cela est nécessaire) et des outils

Note 1 à l'article: L'inspection de près n'exige normalement pas d'ouvrir l'enveloppe ni de mettre l'appareil hors tension.

3.2
surveillance continue
présence, inspection, service, maintenance et maintenance fréquents des installations électriques par un personnel qualifié ayant une bonne expérience de cette installation particulière et de son environnement afin de maintenir dans un état satisfaisant les dispositifs de protection contre l'explosion de cette installation

3.3
inspection détaillée
inspection qui comporte les aspects couverts par une inspection de près et qui, de plus, détecte les défauts, tels que des connexions desserrées, qui ne sont détectables qu'après ouverture de l'enveloppe et/ou en utilisant, si cela est nécessaire, des outils et du matériel d'essai

3.4
emplacement dangereux
emplacement dans lequel une atmosphère explosive gazeuse est présente ou dont il peut être prévu qu'elle est présente, en quantités suffisantes pour exiger des précautions particulières pour la construction, l'installation et l'utilisation d'appareils

Note 1 à l'article: L'IEC 60079-10-1, *Atmosphères explosives – Partie 10-1: Classification des emplacements – Atmosphères explosives gazeuses*, fournit une classification des emplacements dangereux qui contiennent des atmosphères explosives gazeuses (voir IEC 60050-426:2020, 426-03-03, 426-03-04 et 426-03-05).

Note 2 à l'article: L'IEC 60079-10-2, *Atmosphères explosives – Partie 10-2: Classification des emplacements – Atmosphères explosives poussiéreuses*, fournit une classification des emplacements dangereux qui contiennent des atmosphères explosives poussiéreuses (voir IEC 60050-426:2020, 426-03-23, 426-03-24 et 426-03-25).

3.5
inspection initiale
inspection de tous les appareils, systèmes et installations électriques avant leur mise en service

3.6
inspection
<pour atmosphères explosives> action comportant un examen minutieux d'un élément de l'installation exécuté soit sans démontage, soit, en plus, avec le démontage partiel exigé, complété par des moyens tels que des mesures, afin d'aboutir à une conclusion digne de confiance sur l'état de cet élément

3.7
maintenance sous tension
opérations de maintenance effectuées lorsque l'appareil associé, l'appareil à sécurité intrinsèque et les circuits sont sous tension

[SOURCE: IEC 60050-426: 2020, 426-11-51]

3.8
maintenance
<pour atmosphères explosives> combinaison d'actions de routine prises pour préserver la condition de bon fonctionnement de l'appareil installé

3.9
emplacement non dangereux
emplacement dans lequel une atmosphère explosive n'est pas prévisible en quantité telle que des précautions spéciales sont exigées pour la construction, l'installation et l'utilisation d'appareils

3.10
inspection périodique
inspection de tous les appareils, systèmes et installations électriques effectuée de façon systématique

3.11
inspection par sondage
inspection portant sur une fraction représentative des appareils, systèmes et installations électriques

3.12
personnel qualifié
personnes qui satisfont à des exigences spécifiques relatives à la qualification du personnel

Note 1 à l'article: Les exigences spécifiques relatives à la qualification du personnel en ce qui concerne l'installation et la maintenance sont spécifiées à l'Annexe B.

3.13
personnes avec qualification technique ayant une fonction d'encadrement
personnes assurant la gestion technique du personnel qualifié, qui ont des connaissances suffisantes dans le domaine de la protection contre l'explosion, familiarisées avec les conditions locales et avec l'installation, et à laquelle ont été confiées la responsabilité générale et la maîtrise des systèmes d'inspection pour les appareils électriques dans les emplacements dangereux

3.14
inspection visuelle
inspection qui permet de détecter, sans l'utilisation d'un matériel d'accès ou d'outils, les défauts visibles à l'œil nu, tels que des boulons manquants

4 Exigences générales

4.1 Documentation

En vue de l'inspection et de la maintenance, les documents ci-après, mis à jour (y compris toutes modifications d'enregistrement) doivent être disponibles:

a) classification de zone dangereuse et, si inclus, niveau de protection de l'appareil (EPL – Equipment Protection Level) exigé pour chaque emplacement (voir IEC 60079-10-1 et IEC 60079-10-2);

b) pour les gaz: exigences pour le groupe d'appareils (IIA, IIB ou IIC) et la classe de température;

c) pour les poussières: exigences pour le groupe d'appareils (IIIA, IIIB ou IIIC) et la température de surface maximale;

d) caractéristiques des appareils, par exemple plage de températures ambiantes, mode de protection, degré IP, résistance à la corrosion;

e) enregistrements suffisants pour permettre à l'appareil Ex d'être maintenu en conformité avec son mode de protection (voir IEC 60079-14) (par exemple liste et emplacement des appareils, pièces de rechange, certificats, informations techniques); et

f) copies des enregistrements des inspections précédentes, y compris l'inspection initiale, comme indiqué en détail dans l'IEC 60079-14.

D'autres exigences de documentation peuvent s'avérer nécessaires et sont fournies dans l'IEC 60079-14 et l'IEC 60079-19.

4.2 Compétence du personnel

L'inspection et la maintenance des installations couvertes par le présent document doivent être effectuées uniquement par un personnel qualifié. Les connaissances, qualifications et compétences des personnes avec qualification technique ayant une fonction d'encadrement et des personnes qualifiées sont données à l'Annexe B.

L'ensemble du personnel doit suivre régulièrement une instruction ou une formation continue appropriée, toutes les preuves étant documentées et disponibles pour être examinées régulièrement.

4.3 Systèmes intégrés

Les systèmes intégrés qui assurent une protection par rapport à l'installation dans les emplacements dangereux, par exemple la ventilation ou la pressurisation des salles ou encore les systèmes de détection de gaz, doivent faire l'objet d'inspection et de maintenance pour s'assurer d'un fonctionnement correct conformément aux exigences des normes applicables.

NOTE Les exigences relatives aux salles sous pression et ventilées sont données dans l'IEC 60079-13.

4.4 Inspections

4.4.1 Généralités

4.4.1.1 Principes de base

Il convient que le programme d'inspection soit suffisant pour confirmer que les appareils sont toujours aptes pour une utilisation dans des emplacements dangereux.

Avant la mise en service d'une nouvelle installation ou de nouveaux appareils, il doit être procédé à une inspection initiale. L'IEC 60079-14 fournit les exigences relatives à l'inspection initiale, ainsi que d'autres recommandations pour la mise en service de l'installation et les procédures de démarrage.

Pour s'assurer que les installations sont maintenues dans des conditions satisfaisantes permettant de fonctionner en continu dans un emplacement dangereux, et lorsque la maintenance nécessaire est effectuée, celles-ci doivent être soumises:

a) soit à des inspections périodiques régulières par des personnes qui ont des compétences conformes à 4.2 et à l'Annexe B;

b) soit à une surveillance continue par un personnel qualifié (voir 4.6).

NOTE 1 Dans le cas d'emplacements dangereux poussiéreux, le niveau de l'entretien courant peut avoir une influence sur les exigences de maintenance et d'inspection.

Les inspections des installations existantes doivent être effectuées conformément au présent document. Cependant, pour les installations plus anciennes, les informations détaillées relatives aux exigences applicables aux appareils et aux installations peuvent faire référence aux normes appliquées à la date d'installation.

NOTE 2 Les normes appliquées à la date d'installation peuvent ne pas avoir été des normes IEC.

Dans les cas où l'appareil Ex est situé en dehors d'un emplacement dangereux, par exemple en raison de changements sur le site, il convient de le soumettre à une maintenance conformément à son mode de protection.

À la suite de tout réglage, maintenance, réparation, révision, modification ou remplacement, les appareils ou parties concernées des appareils considérés doivent faire l'objet d'une inspection détaillée.

L'inspection doit être suffisamment indépendante des demandes immédiates de maintenance ou d'autres activités afin de ne pas être influencée dans son aptitude à présenter des conclusions fiables.

NOTE 3 Le présent document n'exige pas que le personnel d'inspection fasse partie d'un organisme extérieur indépendant.

Si, à un moment donné, la classification de l'emplacement ou les exigences du niveau de protection de l'appareil sont modifiées ou si un appareil est déplacé d'un emplacement à un autre, une vérification doit être effectuée pour s'assurer que le mode de protection, le groupe, la température de surface maximale pour la poussière, y compris toute considération sur les couches de poussières, et la classe de température pour les gaz, le cas échéant, sont aptes aux conditions modifiées.

Si l'installation ou l'appareil est démonté pendant l'inspection, des précautions doivent être prises lors du remontage pour s'assurer que l'intégrité du mode de protection n'est pas compromise.

EXEMPLE 1 Élimination de toute poussière résiduelle.

EXEMPLE 2 Remise en place correcte des joints.

NOTE 4 Les facteurs ayant une influence sur la détérioration de l'appareil ou de l'installation Ex peuvent inclure l'accumulation de poussière, la pénétration d'eau, des températures ambiantes excessives, l'exposition à des produits chimiques, la susceptibilité à la corrosion, des vibrations anormales ou une détérioration mécanique. Les facteurs de service affectant l'appareil ou l'installation Ex peuvent inclure une maintenance inappropriée, un manque de formation, d'expérience ou de compétences du personnel et les modifications ou ajustements non autorisés qui en résultent ou une maintenance inappropriée, par exemple celle qui n'est pas conforme aux exigences du fabricant.

4.4.1.2 Documentation du fabricant

Les informations du fabricant peuvent comporter des exigences ou des recommandations supplémentaires relatives à l'inspection et à la maintenance, par exemple types de graisses qu'il convient d'utiliser, fréquence des inspections dans des conditions climatiques particulières ou couple qu'il convient d'appliquer aux fermetures.

Les exigences ou les recommandations du fabricant prévalent sur le présent document en cas de contradiction, par exemple concernant la fréquence d'essai.

4.4.1.3 Vérification d'appareil non marqué

En l'absence de marquages ou de plaques de certification sur l'appareil protégé contre l'explosion ou s'ils sont illisibles, des méthodes alternatives peuvent être utilisées pour déterminer la traçabilité des détails de la certification de l'appareil spécifique. La méthode utilisée peut inclure des étiquettes d'identification supplémentaires qui comportent les numéros d'identification uniques, les numéros de série, les références aux bases de données d'installation. etc. La méthode qui consiste à attacher ou fixer l'étiquetage ne doit pas réduire l'intégrité de l'appareil.

L'inventaire et l'identification de la méthode d'étiquetage pour la gestion de l'appareil protégé contre l'explosion doivent permettre de suivre la réparation de l'appareil ou son remplacement par un appareil qui peut avoir des marquages et informations détaillées de certification différents de l'appareil d'origine.

4.4.1.4 Acceptation des appareils dans les anciennes installations

Pour un appareil existant ne pouvant être identifié comme étant certifié pour l'utilisation dans un emplacement dangereux, il est nécessaire d'établir que l'appareil est apte à une utilisation continue. Afin de pouvoir faire fonctionner et entretenir correctement l'appareil, il est nécessaire de procéder à une évaluation permettant de vérifier la spécification de l'appareil, déterminer son aptitude à l'emploi dans l'emplacement considéré et pouvoir définir les exigences appropriées en matière d'inspection et de maintenance. Dans ce cas, il convient de suivre la procédure donnée dans l'Annexe C.

NOTE Cette évaluation est destinée à s'appliquer aux installations qui peuvent être antérieures à toute exigence applicable à l'usage de l'appareil électrique certifié dans des emplacements dangereux.

4.4.2 Niveaux d'inspection

4.4.2.1 Généralités

Les niveaux d'inspection sont: visuelle, de près et détaillée. Le Tableau 1, le Tableau 2, le Tableau 3 et le Tableau 4 précisent les vérifications spécifiques pour ces trois niveaux d'inspection applicables aux éléments d'ordre général et particulier de l'appareil électrique.

Les inspections visuelles et de près peuvent être effectuées avec les appareils sous tension. Généralement, les inspections détaillées exigent que les appareils soient déconnectés des sources d'énergie.

Le niveau d'inspection choisi pour l'appareil utilisant plusieurs modes de protection (par exemple un appareil Ex "d e") doit être une combinaison des colonnes correspondantes des Tableau 1, Tableau 2, Tableau 3, et Tableau 4.

4.4.2.2 Utilisation des tableaux d'inspection

Les Tableau 1, Tableau 2, Tableau 3, et Tableau 4 d'inspection fournissent des vérifications indicatives qu'il convient d'effectuer dans le cadre de toute inspection. Les tableaux ne sont pas destinés à être appliqués exactement comme ils sont présentés.

Pour les vérifications de l'inspection:

a) elles peuvent être combinées si elles sont adaptées à la méthodologie finale d'enregistrement des inspections;

b) elles peuvent être supprimées si elles ne sont pas pertinentes pour le type d'appareils inspecté;

c) il convient qu'elles soient ajoutées, suivant le cas.

EXEMPLE Tout autre détail qui peut être nécessaire pour confirmer la condition de service permanent ou la conformité de l'installation en fonction de la nature du site pour les moteurs est couvert à l'Annexe D.

Des recommandations supplémentaires concernant les conditions de service défavorables sont fournies à l'Annexe E.

4.4.3 Types d'inspections

Les types d'inspections comprennent:

a) Les inspections initiales exigées par l'IEC 60079-14.

Une inspection réduite peut être effectuée si une inspection détaillée équivalente a été effectuée par le fabricant. Toutefois, il est toujours nécessaire d'effectuer des vérifications pertinentes de l'inspection détaillée de la partie B, Installation, et C, Environnement, du Tableau 1, du Tableau 2, du Tableau 3 et du Tableau 4 pour s'assurer que l'installation est conforme aux exigences.

EXEMPLE 1 Une inspection détaillée initiale des passages de flamme internes d'un moteur antidéflagrant ou des joints internes d'un moteur Ex t n'est pas exigée; il convient cependant d'inspecter ensuite le couvercle de la boîte à bornes qui a été retiré pour faciliter le raccordement du câblage sur site dans le cadre du processus d'installation. Ces exigences sont traitées également dans l'IEC 60079-14.

EXEMPLE 2 Un assemblage d'appareils a fait l'objet d'une inspection initiale détaillée par le constructeur d'assemblages, et une inspection visuelle est effectuée au point final de l'installation pour vérifier qu'aucun dommage ne s'est produit pendant le transport.

b) Les inspections périodiques qui peuvent être visuelles, de près ou détaillées ou une combinaison de types conformément à 4.5.

c) Les inspections par sondage qui peuvent être visuelles, de près ou détaillées ou une combinaison de types.

Il convient de ne pas s'attendre à ce que les inspections par sondage mettent en évidence des défauts de nature aléatoire, par exemple des connexions desserrées, mais il convient de les mettre en œuvre pour surveiller les effets des conditions d'environnement, des vibrations, des faiblesses à la conception, etc. Le nombre et la composition des échantillons sélectionnés doivent être basés sur l'évaluation de l'installation (par exemple zones, modes de protection, âge, emplacement, exposition, risque d'endommagement et autres facteurs).

d) Surveillance continue par un personnel qualifié pour effectuer des inspections régulières et une surveillance, équivalente à des niveaux d'inspection visuelle ou de près, conformément à 4.6.

Les résultats de toutes les inspections doivent être enregistrés, conservés et examinés afin de déterminer si des mesures supplémentaires sont nécessaires.

4.5 Inspections périodiques

4.5.1 Personnel

Une inspection périodique régulière exige du personnel à la fois compétent pour l'inspection exigée et satisfaisant aux exigences de compétences définies en 4.2 et à l'Annexe B, et qui:

a) possède de bonnes connaissances de la classification des emplacements/niveau de protection de l'appareil, ainsi qu'une connaissance technique suffisante pour comprendre ses implications dans la localisation envisagée;

b) possède de bonnes connaissances techniques et une bonne compréhension des exigences théoriques et pratiques relatives aux appareils et installations électriques utilisés dans de tels emplacements dangereux;

c) comprenne les exigences des inspections visuelles, de près et détaillées relatives aux appareils installés et aux installations.

Une personne avec qualification technique ayant une fonction d'encadrement doit être identifiée pour chaque installation avec la responsabilité générale et la maîtrise des systèmes d'inspection pour les appareils électriques dans les emplacements dangereux.

4.5.2 Installations fixes

Le niveau d'inspection et l'intervalle entre les inspections périodiques doivent être déterminés en tenant compte du type d'appareils, des indications du fabricant, si elles existent, des facteurs ayant une influence sur sa détérioration (voir 4.4.1.1, Note 4), de la classification des emplacements ou des exigences du niveau de protection de l'appareil et des résultats des inspections précédentes. Le niveau et la fréquence d'inspection peuvent varier pour différents appareils sur un site en fonction des facteurs individuels de chaque appareil, par exemple il peut être nécessaire d'augmenter la fréquence d'inspection pour les parties corrosives d'un site, mais pas nécessairement pour l'ensemble du site. Si le niveau et la fréquence des inspections varient par rapport aux exigences minimales du présent document, il convient de documenter le programme d'inspection.

Lorsque des niveaux et des intervalles d'inspection ont été établis pour des appareils, installations et environnement similaires, il convient que cette expérience soit utilisée pour déterminer le programme d'inspection.

L'intervalle entre les inspections périodiques ne doit pas dépasser trois ans sans réaliser ou documenter une évaluation des risques basée sur le type d'appareil, l'emplacement, l'environnement et l'historique de l'entretien. Cette évaluation des risques doit être réalisée par un expert indépendant.

NOTE Le terme "indépendant" n'implique pas nécessairement un organisme ou une personne "externe" à l'organisation de l'utilisateur.

Une fois que l'intervalle a été défini, il convient de soumettre l'installation à des inspections par sondage provisoires supplémentaires pour confirmer ou infirmer l'intervalle proposé et le niveau d'inspection.

Les résultats des inspections sont soumis à un examen permanent afin de justifier l'intervalle entre les inspections, ainsi que leur niveau.

Une procédure typique d'inspection est donnée sous forme de diagramme à l'Annexe A.

Lorsqu'un grand nombre d'éléments similaires tels que luminaires, boîtes de jonction, etc. sont installés dans un environnement analogue, des inspections périodiques peuvent être réalisées sur la base de sondages à condition que le nombre d'échantillons, en plus de la fréquence des inspections, soit sujet à révision. Il est toutefois recommandé de soumettre tous les éléments à une inspection visuelle au moins.

4.5.3 Appareils transportables, personnels et portables

Les appareils électriques transportables, personnels et portables sont particulièrement sujets à des défaillances ou à de mauvais emplois, et par conséquent il peut se révéler nécessaire de réduire l'intervalle entre les inspections périodiques.

L'intervalle entre les inspections périodiques ne doit pas dépasser les durées ou indications ci-dessous sans requérir l'avis du fabricant et de la personne avec qualification technique ayant une fonction d'encadrement:

a) les appareils personnels et portables doivent, avant chaque utilisation, être contrôlés visuellement par l'utilisateur pour s'assurer qu'ils ne présentent pas de dommages apparents;

b) tous les appareils personnels, portables et transportables doivent être soumis à une inspection de près au moins tous les 12 mois; et

c) les enveloppes qui sont fréquemment ouvertes (par exemple des boîtiers de piles ou d'accumulateurs) doivent faire l'objet d'une inspection détaillée au moins tous les 6 mois.

4.6 Surveillance continue

4.6.1 Concept

Lorsqu'une installation est contrôlée de façon régulière au cours normal du travail par un personnel qualifié qui, en plus de satisfaire aux exigences de 4.5.1 a), b) et c), est:

a) conscient des conséquences de la détérioration d'un appareil particulier dans l'installation sur le processus et sur l'environnement; et

b) tenu de faire des inspections visuelles ou de près au cours du programme normal de travail et d'identifier les inspections détaillées nécessaires à la suite de tout remplacement ou réglage conformément à 4.4.1.1.

il est alors être possible de se passer d'une inspection périodique régulière et de profiter de la présence plus fréquente du personnel qualifié pour assurer l'intégrité continue de l'appareil.

Si la personne qualifiée a des compétences suffisantes, elle peut également effectuer l'inspection détaillée.

La surveillance continue par un personnel qualifié n'exonère pas de l'exigence d'une inspection initiale et d'inspections par sondage.

La surveillance continue n'est pas réalisable pour les appareils électriques pour lesquels ce genre d'assistance ne peut être fourni (par exemple dans le cas d'appareils transportables, personnels et portables), et dans de tels cas, les appareils doivent être soumis à une inspection périodique. Voir 4.6.4.

4.6.2 Objectifs

L'objectif de la surveillance continue est de permettre la détection précoce des défauts qui surviennent et la réparation qui s'impose. Elle fait appel à un personnel qualifié présent dans l'installation au cours de son travail normal (par exemple montage, modifications, inspections, travaux de maintenance, recherche de défauts, travaux de nettoyage, opérations de régulation, opérations de commutation, branchement et débranchement des bornes, travaux de réglage et d'ajustement, essais de fonctionnement, mesures) et qui, par sa qualification, peut détecter précocement les défauts et modifications.

4.6.3 Responsabilités

4.6.3.1 Personnes avec qualification technique ayant une fonction d'encadrement

Une personne avec qualification technique ayant une fonction d'encadrement doit être désignée pour chaque installation et doit effectuer les opérations suivantes:

a) évaluer la viabilité du concept de surveillance continue au regard des compétences, qualifications et disponibilités du personnel et de son expérience relative à cette installation;

b) définir le domaine des appareils à prendre en considération dans la surveillance continue en tenant compte des conditions d'environnement, la fréquence de la présence humaine, les connaissances spéciales, le déroulement du travail et l'emplacement des appareils;

c) définir la fréquence de l'inspection, le niveau de l'inspection et le contenu du rapport de manière à permettre une analyse significative de la conformité des appareils Ex;

d) s'assurer de la disponibilité de la documentation prévue en 4.1 et 4.6.5;

e) s'assurer que le personnel qualifié connaît bien:

   1) le concept de la surveillance continue, ainsi que la nécessité de rapports et fonctions d'analyse;

   2) l'installation dont il s'occupe; et

   3) l'inventaire des appareils Ex relevant de leur responsabilité.

f) faire le nécessaire pour vérifier que:

1) la surveillance continue est bien exécutée;
2) le personnel qualifié dispose d'un temps suffisant pour faire ses inspections;
3) le personnel qualifié est convenablement formé avec mise à niveau si nécessaire;
4) la documentation est complète;
5) il existe un support technique approprié pour le personnel qualifié; et
6) l'état de l'installation électrique est connu.

4.6.3.2 Personnel qualifié

Le personnel qualifié doit être en outre familiarisé avec le concept de surveillance continue, ainsi qu'avec toute fonction d'élaboration de rapports et d'analyses qui comprennent la méthode de surveillance continue applicable à l'installation particulière.

En effectuant la surveillance continue de l'installation et des appareils, il convient que le personnel qualifié prenne en compte l'état des installations et toutes les modifications qui se produisent.

4.6.4 Fréquence des inspections

La fréquence de la présence humaine et des inspections qui sont à la base de la surveillance continue doit être définie en fonction de l'environnement particulier de l'installation et des détériorations prévisibles des appareils (voir 4.4.1.1), de l'usage et de l'expérience.

À moins que l'expérience ne démontre le contraire, si une partie de l'installation comprenant de nombreux appareils Ex n'est pas contrôlée plus fréquemment qu'une fois par semaine, par exemple, il convient qu'elle ne soit pas incluse dans le concept de la surveillance continue.

Si le personnel qualifié a constaté une modification dans l'état de l'environnement (par exemple augmentation de la présence de solvant ou vibrations plus fortes), les appareils protégés contre l'explosion susceptibles d'être affectés par cette modification doivent être vérifiés plus souvent.

NOTE Il en résulte que le personnel qualifié peut inspecter moins souvent les appareils dont l'expérience a démontré qu'ils ne sont pas sensibles aux modifications.

4.6.5 Documents

La documentation relative à l'installation doit présenter des renseignements suffisants pour:

a) fournir un historique des activités de maintenance avec la justification de ces activités; et
b) vérifier l'efficacité de l'approche de surveillance continue.

Les enregistrements concernant les défauts trouvés et les réparations effectuées doivent être conservés.

La documentation peut faire partie du manuel d'entretien, si a) et b) ci-dessus peuvent être obtenus par le système de documentation.

NOTE Les programmes de formation peuvent constituer une preuve que le personnel qualifié connaît bien les besoins du concept de la surveillance continue. Une autre preuve de ce type de formation est également possible.

4.6.6 Formation

En plus des exigences de 4.2, le personnel qualifié doit bénéficier d'une formation suffisante afin d'être familiarisé avec les installations dont il s'occupe. Cette formation doit comprendre toute l'installation, les appareils, l'état de fonctionnement ou d'environnement nécessaires à la compréhension des besoins des appareils relatifs à la protection contre l'explosion. Lors d'une modification apportée au procédé ou à l'installation, une formation concernant les modifications doit être assurée.

Une formation dans le domaine de la surveillance continue doit être assurée, ainsi que des séminaires de mise à niveau ou de renfort.

Les exigences relatives aux connaissances de la personne avec qualification technique ayant une fonction d'encadrement doivent inclure la compréhension totale des dispositions de l'IEC 60079-10-1, de l'IEC 60079-10-2, de l'IEC 60079-14, du présent document et de l'IEC 60079-19 en ce qui concerne la classification des emplacements ou des niveaux de protection des appareils et la conception, la sélection, la construction des installations électriques et l'inspection, la réparation, la révision et la remise en état des appareils.

4.7 Exigences relatives à la maintenance

4.7.1 Remise en état de service et modifications des appareils

Les appareils doivent être remis en état de service si cela est nécessaire. L'intégrité du mode de protection doit être maintenue, ce qui peut exiger l'avis du fabricant.

Les pièces de rechange doivent être conformes aux instructions du fabricant ou à toute autre documentation applicable. Les modifications apportées aux appareils ne doivent pas être exécutées sans autorisation appropriée, s'il résulte des instructions du fabricant, ou de toute autre documentation applicable, qu'elles peuvent conduire à une diminution de la sécurité des appareils.

Les réparations, les révisions et la remise en état des appareils doivent être effectuées conformément à l'IEC 60079-19.

Il convient de veiller à éviter d'interférer avec les moyens utilisés par le fabricant pour réduire les effets de l'électricité statique.

Lors du remplacement des lampes d'un luminaire, des lampes d'un type et de caractéristiques assignées corrects doivent être utilisées, sinon des températures excessives peuvent en résulter.

Il convient de remplacer périodiquement les lampes pour une sécurité renforcée des luminaires afin d'éviter tout échauffement qui peut se produire en fin de vie.

NOTE La gravure, la peinture ou l'interposition d'écrans de protection sur les parties translucides ou une position incorrecte du luminaire peuvent conduire à des températures excessives.

4.7.2 Maintenance des câbles souples

Les câbles et conduits souples et leurs extrémités sont particulièrement sujets à avarie. Ils doivent être inspectés à intervalles réguliers et doivent être remplacés s'ils sont endommagés ou défectueux.

4.7.3 Mise hors service

Si un appareil est retiré temporairement du service, les conducteurs exposés doivent être:

a) correctement interrompu dans une enveloppe appropriée;

b) isolés de toutes les sources d'énergie et isolés; ou

c) isolés de toutes les sources d'énergie et mis à la terre.

Si un appareil est retiré définitivement, le câblage associé doit être:

1) retiré; ou

2) correctement interrompu dans une enveloppe appropriée; ou

3) mis à la terre à l'extrémité d'alimentation et, à l'autre extrémité du câble, les conducteurs doivent être fixés ensemble, puis isolés par un moyen sûr (par exemple embout de câble en époxy).

NOTE L'utilisation d'une bande autoadhésive seulement n'est pas considérée comme un moyen sûr d'isolation.

4.7.4 Fermetures et outils

Lorsque des boulons et d'autres fermetures ou des outils spéciaux sont exigés, ils doivent être disponibles et utilisés.

4.8 Influences externes

Les appareils Ex peuvent subir une influence défavorable de l'environnement dans lequel ils sont utilisés. Il convient d'ajuster l'intervalle entre les inspections, le type et le niveau de celles-ci, ainsi que les exigences spécifiques relatives à l'inspection au cours de laquelle des conditions défavorables peuvent être observées. Quelques éléments essentiels à prendre en considération sont:

– des températures extrêmement faibles ou élevées;
– les conditions de pression;
– une atmosphère corrosive;
– des vibrations, des chocs mécaniques, le frottement ou l'abrasion;
– le vent;
– les processus de mise en peinture;
– le rayonnement solaire;
– les produits chimiques;
– l'eau et l'humidité;
– la poussière ou la saleté;
– les végétaux, les animaux et les insectes.

La corrosion du métal, ou l'influence des produits chimiques (particulièrement les solvants) sur les composants plastiques ou les élastomères, peuvent affecter le mode et le degré de protection (IP) de l'appareil. Si l'enveloppe ou le composant est gravement corrodé, la partie concernée doit être remplacée. Les enveloppes en matière plastique peuvent présenter des craquelures de surface qui peuvent compromettre l'intégrité de l'enveloppe. Les enveloppes métalliques doivent, lorsque c'est nécessaire, être traitées avec un revêtement de protection approprié comme précaution contre la corrosion, la fréquence et la nature d'un tel traitement étant déterminées par les conditions d'environnement.

Il doit être vérifié que l'installation de l'appareil électrique est acceptable pour un usage dans l'environnement susceptible d'être rencontré.

Si le marquage d'un appareil Ex n'indique pas de plage de températures ambiantes pour laquelle l'appareil est conçu, il doit être utilisé dans la plage de –20 °C à +40 °C. Si la plage pour laquelle l'appareil est conçu est indiquée, il doit être utilisé à l'intérieur de cette plage. Si la température ambiante se situe hors de la plage de températures ou s'il y a une influence de température provenant d'autres facteurs, par exemple la température du processus ou l'exposition au rayonnement solaire, l'application doit être vérifiée à l'aide de l'évaluation documentée (voir IEC 60079-14).

Toutes les parties des installations doivent être maintenues propres et sans d'accumulation de poussières et de substances nuisibles qui pourraient entraîner une élévation excessive de la température.

Il faut s'assurer que la protection de l'appareil contre les intempéries est maintenue. Les garnitures endommagées doivent être remplacées.

Les dispositifs anticondensation, tels que les éléments de respiration, de drainage ou de chauffage, doivent être vérifiés pour assurer un fonctionnement correct.

Si l'appareil est soumis à des vibrations, il convient de prendre des précautions supplémentaires pour s'assurer que les boulons et les entrées de câbles ne se desserrent pas.

EXEMPLE L'utilisation d'écrou à encoches ou de filets résistants aux vibrations.

Le nettoyage des appareils électriques non conducteurs doit mettre en œuvre des méthodes qui évitent la production d'électricité statique.

EXEMPLE Nettoyage à l'aide d'un chiffon humide.

4.9 Isolation de l'appareil

4.9.1 Installations autres que les circuits de sécurité intrinsèque

Un appareil électrique contenant des parties sous tension, situées dans un emplacement dangereux, ne doit pas être ouvert, sauf dans les conditions décrites en a), b) ou c).

a) Lorsque des travaux nécessitent l'exposition des parties sous tension, ils peuvent être effectués selon les précautions applicables à un emplacement non dangereux et en appliquant une procédure de travail en toute sécurité (voir IEC 60079-14).

   Elle peut exiger l'isolation de toutes les connexions d'entrée et de sortie, y compris le conducteur neutre. Dans le présent contexte, "isolation" signifie l'extraction des fusibles ou des éléments de remplacement ou l'ouverture d'un isolateur ou d'un interrupteur.

   Il convient d'attendre un temps suffisant pour que toutes les températures de surface ou l'énergie électrique emmagasinée aient pu décroître jusqu'à un niveau en dessous duquel il est impossible de provoquer l'inflammation.

   NOTE 1 Les capacités de protection d'une enveloppe Ex "d" sont toujours compromises à l'ouverture de l'enveloppe alors que cela peut être de moindre importance à l'ouverture des enveloppes Ex "e" et Ex "n" lorsque la pénétration d'humidité est peu probable.

b) Un assouplissement des exigences applicables à l'appareil à sécurité augmentée "e" comportant également des matériels de sécurité intrinsèque est autorisé si toutes les parties sous tension nues non protégées par le mode de protection "i" ont un couvercle intérieur séparé assurant au moins le degré de protection IP30 lorsque l'enveloppe du matériel est ouverte.

   Cet appareil est fourni avec une étiquette extérieure portant la mention suivante:

   "AVERTISSEMENT – NE PAS OUVRIR LORSQUE LES CIRCUITS DE NON-SÉCURITÉ INTRINSÈQUE SONT SOUS TENSION". Un texte techniquement équivalent peut être utilisé et plusieurs avertissements peuvent être combinés.

   NOTE 2 Lorsqu'il est installé, le couvercle intérieur assure un degré minimal acceptable de protection contre l'accès à des circuits qui ne sont pas à sécurité intrinsèque et sous tension lorsque l'enveloppe est ouverte pendant de courtes périodes à des fins de maintenance sous tension de circuits de sécurité intrinsèque. Le couvercle n'est pas destiné à assurer une protection contre les chocs électriques.