

Electrical apparatus for use in the presence of combustible dust —

Part 17: Inspection and maintenance of electrical installations in hazardous areas (other than mines)

The European Standard EN 61241-17:2005 has the status of a
British Standard

ICS 29.260.20

National foreword

This British Standard is the official English language version of EN 61241-17:2005. It is identical with IEC 61241-17:2005. Together with BS EN 61241-14:2004, it partially supersedes BS EN 50281-1-2:1999, which will be withdrawn on 1 September 2007. Together with BS EN 61241-0, BS EN 61241-1:2004 and BS EN 61241-14:2004, it partially supersedes BS 6467-1:1985 and BS 6467-2:1998, which are being kept current until BS EN 61241-0 is published.

The UK participation in its preparation was entrusted by Technical Committee GEL/31, Electrical apparatus for explosive atmospheres, to Subcommittee GEL/31/20, Electrical apparatus for use in the presence of combustible dusts, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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English version

**Electrical apparatus for use in the presence of combustible dust
Part 17: Inspection and maintenance of electrical installations
in hazardous areas (other than mines)
(IEC 61241-17:2005)**

Matériels électriques pour utilisation
en présence de poussières combustibles
Partie 17: Inspection et maintenance
des installations électriques situées
en emplacements dangereux
(autres que les mines)
(CEI 61241-17:2005)

Elektrische Betriebsmittel zur Verwendung
in Bereichen mit brennbarem Staub
Teil 17: Prüfung und Instandhaltung
elektrischer Anlagen in
explosionsgefährdeten Bereichen
(ausgenommen Grubenbaue)
(IEC 61241-17:2005)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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Foreword

The text of document 31H/191/FDIS, future edition 1 of IEC 61241-17, prepared by SC 31H, Apparatus for use in the presence of combustible dust, of IEC TC 31, Electrical apparatus for explosive atmospheres, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61241-17 on 2005-04-01.

This European Standard, together with EN 61241-1-14:2004, supersedes EN 50281-1-2:1998 + corrigendum December 1999 + A1:2002.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2006-01-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2008-04-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61241-17:2005 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60079-0	NOTE	Harmonized as EN 60079-0:2004 (not modified).
IEC 60079-17	NOTE	Harmonized as EN 60079-17:2003 (not modified).
IEC 60204-1	NOTE	Harmonized as EN 60204-1:1997 (not modified).
IEC 61241-1	NOTE	Harmonized as EN 61241-1:2004 (not modified).
IEC 61241-18	NOTE	Harmonized as EN 61241-18:2004 (not modified).

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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; they therefore require initial inspection and either

- a) regular periodic inspections thereafter, or
- b) continuous supervision by skilled personnel

in accordance with this standard and, when necessary, maintenance.

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

ELECTRICAL APPARATUS FOR USE IN THE PRESENCE OF COMBUSTIBLE DUST –

Part 17: Inspection and maintenance of electrical installations in hazardous areas (other than mines)

1 Scope

This part of IEC 61241 is intended to be applied by users and covers factors directly related to the inspection and maintenance of electrical installations within hazardous areas only. It does not include conventional requirements for electrical installations, nor the testing and certification of electrical apparatus. This standard supplements the requirements laid down in IEC 60364-6-61.

NOTE The text is based on IEC 60079-17.

This standard assumes effective housekeeping based on a system of cleaning for the plant.

The principles of this standard can also be followed when combustible fibres or flyings may cause a hazard.

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

- underground mining areas,
- areas where a risk can arise due to the presence of hybrid mixtures,
- dusts of explosives that do not require atmospheric oxygen for combustion, or to
- pyrophoric substances.

2 Normative references

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

IEC 60079-14:2002, *Electrical apparatus for explosive gas atmospheres – Part 14: Electrical installations in hazardous areas (other than mines)*

IEC 60364-6-61: *Electrical installations of buildings – Part 6-61: Verification – Initial verification*

IEC 61241-4, *Electrical apparatus for use in the presence of combustible dust – Part 4: Type of protection “pD”*

IEC 61241-10, *Electrical apparatus for use in the presence of combustible dust – Part 10: Classification of areas where combustible dusts are or may be present*

IEC 61241-11, *Electrical apparatus for use in the presence of combustible dust – Part 11: Protection by intrinsic safety “iD”¹*

IEC 61241-14:2004, *Electrical apparatus for use in the presence of combustible dust – Part 14: Selection and installation*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

explosive atmosphere

mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour, mist or dust, in which after ignition, combustion spreads throughout the unconsumed mixture

3.2

explosive dust atmosphere

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

3.3

hazardous area

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

NOTE For the purposes of this standard, an area is a three-dimensional region or space.

3.4

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 apparatus

3.5

maintenance

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

3.6

inspection

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

3.6.1

visual inspection

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

¹ To be published.

3.6.2

close inspection

inspection which encompasses those aspects covered by a visual inspection and, in addition, identifies those defects, such as loose bolts, which will be apparent only by the use of access equipment, for example steps, (where necessary), and tools

NOTE Close inspections do not normally require the enclosure to be opened, or the equipment to be de-energized.

3.6.3

detailed inspection

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

3.6.4

initial inspection

inspection of all electrical apparatus, systems and installations before they are brought into service

3.6.5

periodic inspection

inspection of all electrical apparatus, systems and installations carried out on a routine basis

3.6.6

sample inspection

inspection of a proportion of the electrical apparatus, systems and installations

3.7

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

3.8

skilled personnel

people who meet the requirements for the qualification of personnel in accordance with 4.2

3.9

technical person with executive function

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

3.10

associated apparatus

electrical apparatus in which the circuits, or parts of circuits, are not all necessarily intrinsically safe but which contains circuits that can affect the safety of the intrinsically safe circuits associated with it

NOTE The associated apparatus is normally the interface between an intrinsically safe circuit and a non-intrinsically safe circuit and is frequently located in the non-hazardous area. The associated apparatus may be, for example, shunt diode safety barriers or galvanic isolators.

4 General requirements

4.1 Documentation

For the purposes of inspection and maintenance, up-to-date documentation of the following items shall be available:

- a) the classification of hazardous areas (see IEC 61241-10) including material characteristics as electrical resistivity, the minimum ignition temperature of the combustible dust cloud, minimum ignition temperature of the combustible dust layer and minimum ignition energy of the combustible dust cloud;
- b) apparatus characteristics e.g. temperature ratings, type of protection, IP rating, corrosion resistance;
- c) records sufficient to enable the explosion protected equipment to be maintained in accordance with its type of protection (see IEC 61241-14) (for example list and location of apparatus, spares, technical information).

4.2 Qualification of personnel

The inspection and maintenance of installations shall be carried out only by experienced personnel, whose training has included instruction on the various types of protection and installation practices, the relevant rules and regulations and on the general principles of area classification. Appropriate continuing education or training shall be undertaken by personnel on a regular basis. Evidence of the relevant experience and training claimed shall be available.

4.3 Inspections

4.3.1 General

Before plant or apparatus is brought into service, it shall be given an initial inspection. To ensure that the installations are maintained in a satisfactory condition for continued use within a hazardous area, either

- a) regular periodic inspections, or
- b) continuous supervision by skilled personnel,

and, where necessary, maintenance shall be carried out.

NOTE 1 Effective housekeeping is assumed.

Following any replacement, repair, modification or adjustment, the items concerned shall be inspected in accordance with the relevant items of the detailed column of Tables 1, 2 and 3.

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

If plant or apparatus 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, which includes removing any residual dust and replacing gaskets correctly.

NOTE 2 The major factors effecting the deterioration of apparatus 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, training and experience of personnel, likelihood of unauthorized modifications or adjustments and likelihood of inappropriate maintenance, for example that which is not in accordance with the manufacturer's recommendation.

4.3.2 Types of inspection

- a) Initial inspections are used to check that the selected type of protection and its installation are appropriate. They are to be detail inspection graded as shown in Tables 1, 2 and 3, as appropriate.

NOTE 1 A full initial inspection is not required if an equivalent inspection has been performed by the manufacturer, and it is unlikely that the installation process will have affected those items inspected by the manufacturer. For example, an initial detailed inspection of an Ex tD motor is not required; however, the terminal housing cover which would have been removed to facilitate connection of the field wiring should be inspected after installation.

- b) Periodic inspections may be visual or close as shown in Tables 1, 2 and 3, as appropriate.

A visual or close periodic inspection may lead to the need for a further detailed inspection. The grade of inspection and the interval between periodic inspections shall be determined taking account of the type of equipment, manufacturer's guidance if any, the factors governing its deterioration (see note 2 to 4.3.1), the zone of use and the results of previous inspections. Where inspection grades and intervals have been established for similar apparatus, plants and environments, this experience shall be used in determining the inspection strategy.

The interval between periodic inspections shall not exceed three years without seeking expert advice.

Movable electrical apparatus (hand-held, portable, and transportable) is particularly prone to damage or misuse and therefore the interval between periodic inspections may need to be reduced. Movable electrical apparatus shall be submitted to a close inspection at least every 12 months. Enclosures which are frequently opened (such as battery housings) shall be given a detailed inspection. In addition, the apparatus shall be visually checked by the user, before use, to ensure that the apparatus is not obviously damaged.

- c) Sample inspection may be visual, close or detailed. The size and composition of all samples shall be determined with regard to the purpose of the inspection.

NOTE 2 Sample inspection should not be expected to reveal faults of a random nature, such as loose connections, but should be used to monitor the effects of environmental conditions, vibration, inherent design weakness, etc.

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

The results of all initial, periodic and sample inspections shall be recorded. The recording requirements for continuous supervision by skilled personnel are detailed in 4.5.5.

4.3.3 Grades of inspection

The grade of inspection can be visual, close or detailed. Tables 1, 2 and 3 detail the specific checks required for these three grades of inspection.

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

4.4 Regular periodic inspections

Regular periodic inspection requires personnel who

- a) have a knowledge of area classification 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 apparatus used in those hazardous areas;
- c) understand the requirements of visual, close and detailed inspections as they relate to the installed apparatus.

Such personnel will need to be sufficiently independent of the demands of the maintenance activities so as not to prejudice their ability to reliably report the findings of the inspection.

NOTE It is not a requirement that such personnel are members of an external independent organisation.

To predict accurately an appropriate periodic inspection interval may not be easy, but it shall be fixed taking into account the expected deterioration (see 4.3.1).

Once an interval has been fixed, the installation shall be subjected to interim sample inspections to support or modify the proposed interval. Similarly, the grade of inspection will need to be determined, and here again sample inspection can be used to support or modify the proposed inspection grade. A regular review of the results of inspections will be required to justify the interval between, and grade of, inspections.

A typical inspection procedure is shown diagrammatically in Annex A.

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

4.5 Continuous supervision by skilled persons

4.5.1 Concept

Where an installation is visited on a regular basis, in the normal course of work, by skilled personnel who, in addition to satisfying the requirements of 4.4 a), b) and c), are

- a) aware of the process and environmental implications on the deterioration of the specific apparatus in the installation, and
- b) required to carry out visual and/or close inspections as part of their normal work schedule as well as detailed inspections as part of any replacement, repair, modification or adjustment in accordance with 4.3.1,

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

NOTE 1 The use of continuous supervision by skilled personnel does not remove the requirement for initial and sample inspections.

NOTE 2 Continuous supervision is not practicable for electrical apparatus for which this kind of attendance cannot be provided (e.g. in the case of movable apparatus). See also 4.5.4.

4.5.2 Objectives

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

4.5.3 Responsibilities

4.5.3.1 Technical persons with executive function

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 apparatus performance;
- d) ensure that the documentation referred to in 4.1 and 4.5.5 is made available;
- e) ensure that skilled personnel are familiar with
 - i) the concept of continuous supervision together with the needs for any reporting or analysis function;
 - ii) the installation they attend;
 - iii) the inventory of explosion protected apparatus;
- f) arrange for verification that
 - i) process of continuous supervision is being adhered to;
 - ii) skilled personnel are being given adequate time to carry out their inspections;
 - iii) skilled personnel are receiving appropriate training and refresher training;
 - iv) documentation is being completed correctly;
 - v) there is adequate technical support readily available to the skilled personnel;
 - vi) the state of the electrical installation is known.

4.5.3.2 Skilled personnel

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

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

4.5.4 Frequency of inspection

The frequency of the attendance and the inspections which support continuous supervision shall be determined having regard to the specific plant environment in relation to expected deterioration of the apparatus (see 4.3.1), use and experience.

NOTE 1 Unless experience indicates to the contrary, it may be considered that if a part of the plant having a significant inventory of explosion protected systems is not visited more frequently than once per week, then it would be inappropriate to include it as part of the continuous supervision concept.

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

NOTE 2 It also follows that the skilled personnel will be able to inspect less frequently those items of equipment that experience shows are not susceptible to change.

4.5.5 Documents

Documentation of the installation shall provide sufficient information to

- a) provide a history of maintenance activities with the reason for such activities, and
- b) verify the effectiveness of the continuous supervision approach.

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

NOTE 1 The documentation may be part of normal maintenance documentation; however, the interrogation arrangements for the system must then be suitable to achieve the above-mentioned concepts.

NOTE 2 The evidence that the skilled personnel are aware of the needs of the continuous supervision concept could be in the form of training programmes. Other evidence of this form of education is also possible.

4.5.6 Training

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

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

The knowledge requirements of the technical person with executive function shall include a full understanding of the provisions of IEC 61241-10 and IEC 61241-14 in relation to area classification and selection and installation of apparatus.

4.6 Maintenance requirements

4.6.1 Remedial measures and alterations to apparatus

The general condition of all apparatus 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 apparatus; this may require consultation with the manufacturer.

Replacement parts shall be in accordance with the safety documentation. Alterations to apparatus shall not be carried out without appropriate authorization where they adversely affect the safety of the apparatus as stated in the safety documentation.

NOTE 1 Care should be taken to avoid interfering with the means employed by the manufacturer to reduce the effects of static electricity.

NOTE 2 When replacing lamps in luminaires the correct rating and type should be used, or excessive temperatures may result.

NOTE 3 The etching, painting or screening of light transmitting parts or the incorrect positioning of the luminaires may lead to excessive temperatures.

4.6.2 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.

4.6.3 Withdrawal from service

If it is necessary for maintenance purposes to withdraw apparatus, etc. from service, the exposed conductors shall be

- a) correctly terminated in an appropriate enclosure,
- b) or isolated from all sources of power supply and insulated,
- c) or isolated from all sources of power supply and earthed.

If the apparatus is to be permanently withdrawn from service, the associated wiring, which shall be isolated from all sources of power supply, shall be removed, or, alternatively, correctly terminated in an appropriate enclosure.

4.6.4 Fastenings and tools

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

4.7 Environmental conditions

Electrical apparatus in a hazardous area can be adversely affected by the environmental conditions in which it is used. Some of the key elements to consider are corrosion, ambient temperature, ultraviolet radiation, ingress of water, accumulation of dust or sand, mechanical effects and chemical attack.

The corrosion of metal, or the influences of chemicals (particularly solvents) on plastic or elastomeric components, may affect the type and degree of protections of the apparatus. If the enclosure or component is severely corroded, the part shall be replaced. Plastic enclosures may exhibit surface cracking which can affect the integrity of the enclosure. Metallic enclosures of apparatus 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 electrical equipment is designed to withstand the highest and lowest ambient temperatures likely to be encountered.

NOTE If the marking of the explosion protected apparatus does not indicate a range of ambient temperatures, it should only be used over the range of $-20\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$, while if a range is indicated the equipment should only be used within this range.

All parts of installations should be kept clean and free from accumulations of dust and deleterious substances of such a nature as could cause excessive rise in temperature.

Care shall be taken to ensure that the weather protection of the apparatus 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 apparatus is subject to vibration, special care shall be taken to ensure that bolts and cable entries remain tight.

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

4.8 Isolation of apparatus

4.8.1 Installations other than intrinsically safe circuits

- a) Electrical apparatus containing live parts which are not intrinsically safe and which is located in a hazardous area shall not be opened (except as described in b) or c)) without isolating all incoming and (where necessary because of neutral voltage to earth) 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. The enclosure shall not be opened until sufficient time has been allowed to permit any surface temperature or stored electrical energy to decay to a level below which it is incapable of causing ignition.
- b) If, for the period of time needed for the proposed work, the absence of an explosive atmosphere can be guaranteed by those responsible for that area, and a written authorization has been issued to this effect, essential 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.
- c) Where relevant rules and regulations permit, a relaxation of the requirements under a) and b) is possible in zone 22 areas only. 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:
 - i) the proposed work on energized apparatus does not produce sparks capable of ignition;
 - ii) the circuits are of such a design as to preclude the production of such sparks;
 - iii) the apparatus and any associated circuits within the hazardous area do not include any hot surfaces capable of producing ignition.

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

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

- the form(s) which the proposed work on energized apparatus may take;

- the results of the assessment, including the results of any testing carried out during the assessment;
- any conditions in association with the maintenance of energized apparatus which the assessment has shown to be necessary.

The assessors of the equipment shall

- be familiar with the requirements of any relevant standards, the recommendations of any codes of practice, and any current interpretation;
- have access to all information necessary to carry out the assessment;
- where necessary, utilize similar test apparatus and test procedures to those used by national authorities.

4.8.2 Intrinsically safe installations

Maintenance work may be carried out on energized apparatus subject to the conditions detailed below.

a) Maintenance work in hazardous areas

Any maintenance work shall be restricted to the following:

- i) disconnection of, and removal or replacement of, items of electrical apparatus and cabling;
- ii) adjustment of any controls necessary for the calibration of the electrical apparatus or system;
- iii) removal and replacement of any plug-in components or assemblies;
- iv) 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;
- v) any other maintenance activity specifically permitted by the relevant documentation.

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

b) Maintenance work in non-hazardous areas

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

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

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.

4.9 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 B4 and B5; Table 2, items B6 and B7; and Table 3, items B3 and B4).

4.10 Conditions of use

Special conditions for safe use apply to any type of certified explosion protected apparatus where the certificate number has a suffix marking of "X" or other suffix. The certification documents shall be studied to ascertain the conditions of use.

4.11 Movable apparatus and its connections

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

NOTE Ordinary industrial movable apparatus, welding equipment, etc. should not be used in a hazardous area unless its use is undertaken under a controlled procedure and the specific location has been assessed to ensure that there is no hazardous atmosphere present.

4.12 Inspection schedules (Tables 1 to 3)

4.12.1 Apparatus is appropriate to area classification

See Clause 5, 6.2 and 6.4.1 of IEC 61241-14.

4.12.2 Apparatus maximum surface temperature is correct

See 6.3 of IEC 61241-14.

4.12.3 Apparatus circuit identification

The purpose of this requirement is to ensure that apparatus shall be correctly isolated whenever work is carried out. This can be achieved in a variety of ways, for example:

- a) apparatus is fitted with a permanent label which specifies the source of supply;
- b) apparatus is fitted with a tag number or the cable is fitted with a cable number adjacent to the apparatus. 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.

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

4.12.4 Cable entry devices

The check-tightening of cable entry devices under close inspection can be effected by hand without the need to remove weather-proofing tape or shrouds. Detailed inspections may necessitate that the cable entry devices are dismantled.

4.12.5 Type of cable is appropriate

See 10.1.1 of IEC 61241-14.

4.12.6 Sealing

The sealing of trunking, ducts, pipes and/or conduits is satisfactory. See Clause 10 of IEC 61241-14.

4.12.7 Fault loop impedance or earthing resistance

The integrity of the earthing shall be checked at the initial inspection by measurement of resistance. The measurement may be made using an intrinsically safe resistance measuring equipment (within the procedure specified by the manufacturer). Subsequent sample inspections may also be carried out using an intrinsically safe resistance measuring instrument.

Non-intrinsically safe measuring equipment may only be used if the locations where potentially incendive sparking could occur can be guaranteed to be free from an explosive atmosphere and dangerous dust layers by those responsible for the area.

4.12.8 Insulation resistance

The insulation resistance for apparatus and associated cabling up to 500 V (excluding SELV) shall be measured at 500 V d.c. The insulation resistance shall be at least 0,5 MΩ.

4.12.9 Overloads

See 8.4 of IEC 61241-14, concerning rotating electrical machines. It is necessary to check that

- the protective device is set to the rated current I_N (at initial and detailed inspections);
- the characteristics of the protective device are such that it will operate in 2 h or less at 1,20 times the set (rated) current, and will not operate within 2 h at 1,05 times the set (rated) current (at initial inspection).

5 Additional inspection schedule requirements

5.1 Type of protection "iD" – Intrinsic safety (see Table 2 and IEC 61241-11)

5.1.1 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.

5.1.2 Documentation

The documentation referred to in Table 2 shall, as a minimum, include details of

- a) circuit safety documents, where appropriate;
- b) manufacturer, apparatus type and certificate numbers, category and temperature class;
- c) where appropriate, electrical parameters such as capacitance and inductance, length, type and route of cables;
- d) special requirements of apparatus certificate and detailed methods by which such requirements are met in the particular installation;
- e) physical location of each item in the plant.

5.1.3 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 apparatus actually fitted is that specified.

5.1.4 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.

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

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

Associated apparatus should be inspected to ensure that they are 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 should be checked (see also 5.1.9).

5.1.6 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.

5.1.7 Cable screens

Installations shall be inspected 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.

5.1.8 Point-to-point connections

This check is only required at the initial inspection.

5.1.9 Earth continuity of non-galvanically isolated circuits

The resistance of the earth connection between intrinsically safe circuits and the earth point shall be measured on initial inspection.

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 apparatus 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 a combustible dust atmosphere.

A representative sample of connections, selected by the responsible person, shall be measured periodically to confirm the continuing integrity of the connections.

5.1.10 Earth connections to maintain the integrity of the intrinsic safety

The resistance of the earth connections necessary to maintain the integrity of the intrinsically safe system (such as transformer screen earth, barrier relay frame earth) shall be measured as in 5.1.9. There is no requirement to measure the earth loop impedance of mains powered apparatus 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 of intrinsically safe circuits.

5.1.11 Intrinsically safe circuit earthing and/or insulation

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

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

5.1.12 Separation between intrinsically safe and non-intrinsically safe circuits

Junction boxes and boxes containing associated apparatus shall be inspected to ensure that they contain only the wiring specified in the documentation appropriate to any system passing through them. See also 12.2 and 12.3 of IEC 60079-14.

5.2 Type of protection "pD" – Pressurized enclosure (see Table 3 and IEC 61241-4)

See Clause 13 of IEC 61241-14.

5.3 Apparatus used in zone 22

Explosion protected apparatus shall be inspected in accordance with the appropriate columns of Tables 1, 2 and 3.

5.4 Types of protection "mD" (encapsulation)

Tables have not been prepared to illustrate the inspection requirements for "mD" type of protection. Table 1 should be modified as appropriate incorporating specific inspection for the protective enclosure and contents for this type of protection.

6 Typical inspection schedules

Table 1 – Inspection schedule for Ex "tD" installations

Check that:		Grade of inspection		
		Detailed	Close	Visual
A	APPARATUS			
1	Apparatus is appropriate to area classification	*	*	*
2	IP grade of apparatus is appropriate to conductivity of dust	*	*	*
3	Apparatus maximum surface temperature is correct	*	*	
4	Apparatus circuit identification is correct	*		
5	Apparatus circuit identification is available	*	*	*
6	Enclosure, glasses and glass to metal sealing gaskets and/or compounds are satisfactory	*	*	*
7	There are no unauthorized modifications	*		
8	There are no visible unauthorized modifications		*	*
9	Bolts, cable entry devices and blanking elements are of the correct type and are complete and tight – physical check – visual check	*	*	*
10	Lamp rating, type and position are correct	*		
11	Electrical connections are tight	*		
12	Condition of enclosure gaskets is satisfactory	*		
13	Motor fans have sufficient clearance to enclosure and/or covers	*		
B	INSTALLATION			
1	The installation is such as to minimize the risk of dust accumulations	*	*	*
2	Sealing of trunking, ducts, pipes and/or conduits is satisfactory	*	*	*
3	Type of cable is appropriate	*		
4	There is no obvious damage to cables	*	*	*
5	Cables not in use are correctly terminated	*	*	
6	Earthing connections, including any supplementary earthing bonding connections are satisfactory – physical check – visual check	*	*	*
7	Earth loop impedance resistance is satisfactory	*		
8	Insulation resistance is satisfactory	*		
9	Automatic electrical protective devices operate within permitted limited	*		
10	Automatic electrical protective devices are set correctly	*		
11	Special conditions of use (if applicable) are compiled with	*		
C	ENVIRONMENT			
1	Apparatus is adequately protected against corrosion, weather, vibration and other adverse conditions	*	*	*
2	No undue accumulation of dust and dirt	*	*	*

Table 2 – Inspection schedule for Ex "iD" installations

Check that:		Grade of inspection		
		Detailed	Close	Visual
A	APPARATUS			
1	Circuit and/or apparatus documentation is appropriate to area classification	*	*	*
2	Apparatus installed is that specified in the documentation – Fixed apparatus only	*	*	
3	Circuit and/or apparatus category and group correct	*	*	
4	Apparatus temperature class is correct	*	*	
5	Installation is clearly labelled	*	*	
6	There are no unauthorized modifications	*		
7	There are no visible unauthorized modifications		*	*
8	Safety barrier units, relays and other energy limiting devices are of the approved type, installed in accordance with the certification requirements and securely earthed where required	*	*	*
9	Electrical connections are tight	*		
10	Printed circuit boards are clean and undamaged	*		
B	INSTALLATION			
1	Cables are installed in accordance with the documentation	*		
2	Cable screens are earthed in accordance with the documentation	*		
3	There is no obvious damage to cables	*	*	*
4	Sealing of trunking, ducts, pipes and/or conduits is satisfactory	*	*	*
5	Point-to-point connections are all correct	*		
6	Earth continuity is satisfactory (for example connections are tight and conductors are of sufficient cross-section)	*		
7	Earth connections maintain the integrity of the type of protection	*	*	*
8	The intrinsically safe circuit is isolated from earth or earthed at one point only (refer to documentation)	*		
9	Separation is maintained between intrinsically safe and non-intrinsically safe circuits in common distribution boxes or relay cubicles	*		
10	As applicable, short-circuit protection of the power supply is in accordance with the documentation	*		
11	Special conditions of use (if applicable) are complied with	*		
12	Cables not in use are correctly terminated	*	*	*
C	ENVIRONMENT			
1	Apparatus is adequately protected against corrosion, weather, vibration and other adverse factors	*	*	*
2	No undue external accumulation of dust and dirt	*	*	*

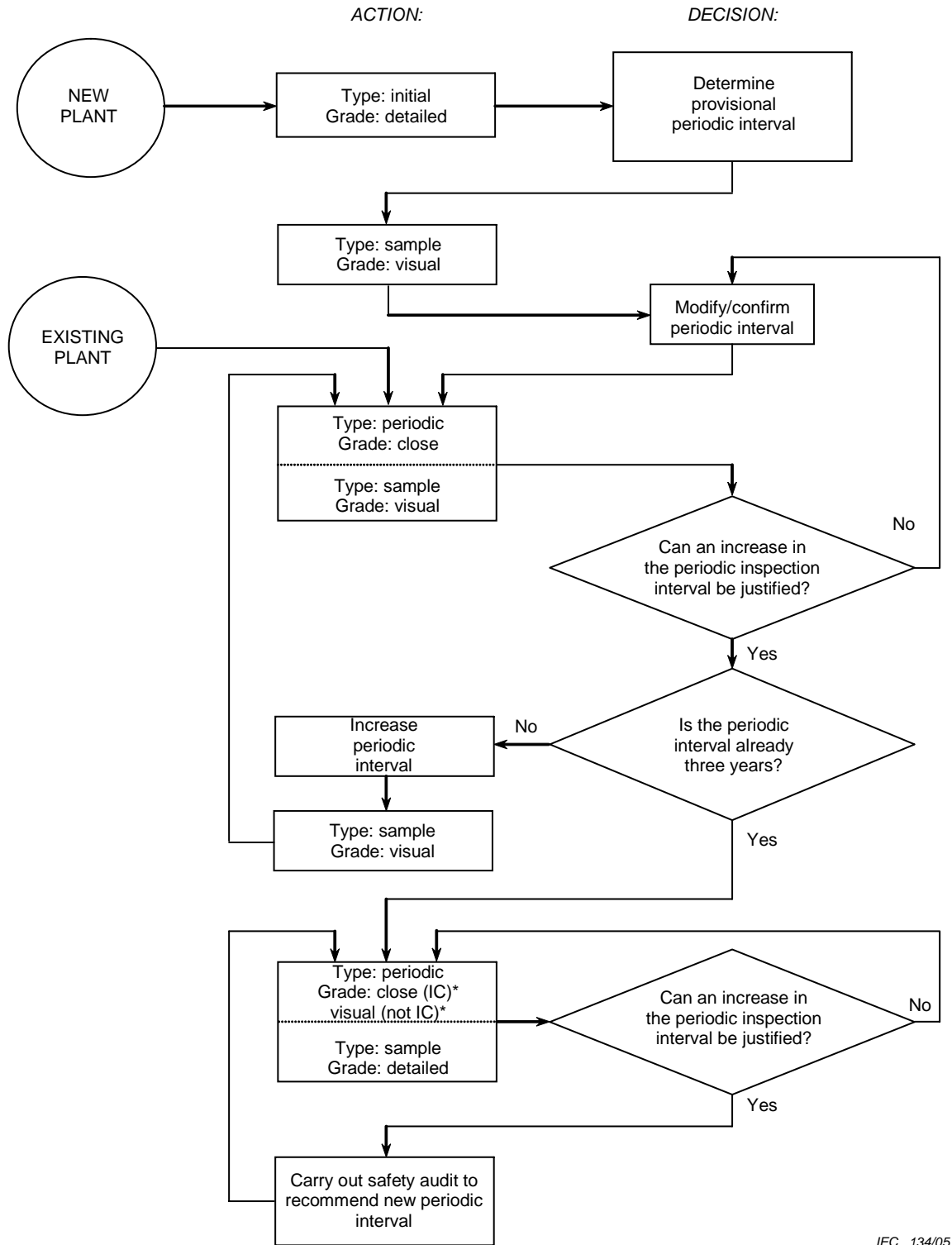
Table 3 – Inspection schedule for Ex "pD" installations

Check that:		Grade of inspection		
		Detailed	Close	Visual
A	APPARATUS			
1	Apparatus is appropriate to area classification	*	*	*
2	Apparatus surface temperature is correct	*	*	
3	Apparatus circuit identification is correct	*		
4	Apparatus circuit identification is available	*	*	*
5	Enclosure, glasses and glass-to-metal sealing gaskets and/or compounds are satisfactory	*	*	*
6	There are no unauthorized modifications	*		
7	There are no visible unauthorized modifications		*	*
8	Lamp rating, type and position are correct	*		
B	INSTALLATION			
1	Type of cable is appropriate	*		
2	There is no obvious damage to cables	*	*	*
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		*	*
4	Fault loop impedance (TN systems) or earthing resistance (IT systems) is satisfactory	*		
5	Automatic electrical protective devices operate within permitted limits	*		
6	Automatic electrical protective devices are set correctly	*		
7	Protective gas inlet temperature is below maximum specified	*		
8	Ducts, pipes and enclosures are in good condition	*	*	*
9	Protective gas is substantially free from contaminants	*	*	*
10	Protective gas pressure and/or flow is adequate	*	*	*
11	Pressure and/or flow indicators, alarms and interlocks function correctly	*		
12	Conditions of spark and particle barriers of ducts for exhausting the gas in hazardous area are satisfactory	*		
13	Special conditions of use (if applicable) are complied with	*		
C	ENVIRONMENT			
1	Apparatus is adequately protected against corrosion, weather, vibration and other adverse factors	*	*	*
2	No undue accumulation of dust and dirt	*	*	*

Annex A
(informative)

Typical inspection procedure for periodic inspections

(see 4.3)



IEC 134/05

* 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.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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

NOTE Where an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60079-14	2002	Electrical apparatus for explosive gas atmospheres Part 14: Electrical installations in hazardous areas (other than mines)	EN 60079-14	2003
IEC 60364-6-61	- ¹⁾	Electrical installations of buildings Part 6-61: Verification - Initial verification	-	-
IEC 61241-4	- ¹⁾	Electrical apparatus for use in the presence of combustible dust Part 4: Type of protection 'pD'	-	-
IEC 61241-10	- ¹⁾	Part 10: Classification of areas where combustible dusts are or may be present	EN 61241-10	2004 ²⁾
IEC 61241-11	- ³⁾	Part 11: Intrinsically safe apparatus 'iD'	-	-
IEC 61241-14	2004	Part 14: Selection and installation	EN 61241-14	2004

1) Undated reference.

2) Valid edition at date of issue.

3) At draft stage.

Bibliography

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

IEC 60079-17, *Electrical apparatus for explosive gas atmospheres – Part 17: Inspection and maintenance of electrical installations in hazardous areas (other than mines)*

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

IEC 61241-0, *Electrical apparatus for use in the presence of combustible dust – Part 0: General requirements* (formerly part of IEC 61241-1-1)

IEC 61241-1, *Electrical apparatus for use in the presence of combustible dust – Part 1: Protection by enclosures “tD”* (formerly part of IEC 61241-1-1)

IEC 61241-18, *Electrical apparatus for use in the presence of combustible dust – Part 18: Protection by encapsulation “mD”*.

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