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Code of practice for

Selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres (other than mining applications or explosive processing and manufacture) —

Part 3: Installation and maintenance requirements for electrical apparatus with type of protection "d". Flameproof enclosure

UDC 696.6:621.3-7:614.83:621.3-213.34

Cooperating organizations

The General Electrotechnical Engineering Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Associated Offices Technical Committee*
British Approvals Service for Electric Cables; Ltd.;
British Electrical and Allied Manufacturers' Association (BEAMA)*
British Radio Equipment Manufacturers' Association
British Steel Corporation
Department of Energy (Electricity)
Electric Cable Makers' Confederation*
Electrical Contractors' Association*
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Telecommunication Engineering and Manufacturing Association (TEMA)

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Contents

Foreword

Many gases, vapours, mists and dusts encountered in industry are flammable. When ignited they may burn readily and with considerable explosive force if mixed with air in the appropriate proportions. It is often necessary to use electrical apparatus in locations where such flammable materials may be present, and appropriate precautions should therefore be taken to ensure that all such apparatus is adequately protected in order to reduce the likelihood of ignition of any external explosive atmosphere. When using electrical apparatus, potential ignition sources include electrical arcs and sparks, hot surfaces and, in certain circumstances, frictional sparks.

In general, electrical safety is ensured by implementing one of two procedures. Either the electrical apparatus should be located, whenever practicable, outside hazardous areas; or the electrical apparatus should be designed, installed and maintained in accordance with measures recommended for the area in which the apparatus is located.

Several techniques are available for the protection of electrical apparatus in hazardous areas. Some of these techniques (or "types of protection" as they are known) have been used for many years and have come to be regarded as traditional. Other types of protection have been introduced only recently.

This code of practice describes the basic safety features of these types of protection, full details of which are given in the relevant standards, and recommends the selection, installation and maintenance procedures that should be adopted to ensure the safe use of electrical apparatus in hazardous areas. This code therefore takes account of the significant developments that have taken place in area classification and in the design, manufacture and use of electrical apparatus for hazardous areas since the preparation of the earlier code of practice CP 1003.

It is important to note that this code of practice deals with *explosion* hazards due to the presence of flammable gas/air mixtures; it does not provide guidance on the extra precautions to be taken where such gases involve a *toxic* hazard.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

0 Introduction

This document is Part 3 of code of practice BS 5345. The code gives guidance in the selection, installation and maintenance of electrical apparatus for use in areas where flammable materials are generated, processed, handled or stored, and that are therefore potentially hazardous.

In common with the earlier code of practice for the use of electrical apparatus in hazardous areas (CP 1003-1:1964, CP 1003-2:1966 and CP 1003-3:1967), the present code is divided into a number of Parts. Each Part deals with the installation and maintenance requirements appropriate to one of the types or protection that may be used to achieve electrical safety, or with basic requirements and considerations that are fundamental to the use of electrical apparatus in hazardous areas, and that therefore provide the basis for the other Parts of the code.

The full list of Parts is as follows:

— *Part 1: Basic requirements for all Parts of the code;*

— *Part 2: Classification of hazardous areas*[1)]*;*

— *Part 3: Installation and maintenance requirements for electrical apparatus with type of protection "d". Flameproof enclosure;*

— *Part 4: Installation and maintenance requirements for electrical apparatus with type of protection "i". Intrinsically safe apparatus and systems;*

— *Part 5: Installation and maintenance requirements for electrical apparatus with type of protection "p". Pressurization and continuous dilution*[1)]*;*

— *Part 6: Installation and maintenance requirements for electrical apparatus with type of protection "e". Increased safety;*

— *Part 7: Installation and maintenance requirements for electrical apparatus with type of protection N;*

— *Part 8: Installation and maintenance requirements for electrical apparatus with type of protection "s". Special protection*[1)]*;*

— *Part 9: Installation and maintenance requirements for electrical apparatus with type of protection "o". Oil-immersed apparatus, and with type of protection "q". Sand-filled apparatus*[1)]*;*

— *Part 10: Installation and maintenance requirements for electrical apparatus for use with combustible dusts*[1)]*;*

— *Part 11: Specific industry applications*[1)]*;*

— *Part 12: The use of gas detectors*[1)].

This Part of the code should be read in conjunction with the other Parts, particularly Parts 1 and 2 which, taken together, describe the fundamental considerations that affect the selection, installation and maintenance of all electrical apparatus used in hazardous areas.

BS 5345 is based on the concept of area classification which recognizes the differing degrees of probability with which explosive (flammable) concentrations of flammable gas or vapour may arise in installations in terms of both the frequency of occurrence and the probable duration of existence on each occasion.

The detailed considerations that should be taken into account in deciding on an area classification are described in Part 2 of the code. For completeness, and for the convenience of readers, the definitions appropriate to area classification are repeated here. It should be noted that whereas, formerly, classified areas were known as Divisions, they are now called Zones. Three Zones are recognized, i.e.:

Zone 0 In which an explosive gas/air mixture is continuously present or present for long periods.

Zone 1 In which an explosive gas/air mixture is likely to occur in normal operation.

Zone 3 In which an explosive gas/air mixture is not likely to occur in normal operation, and if it occurs it will only exist for a short time.

It should be noted that this concept of area classification deals only with risks due to flammable gases and vapours and, by implication, mists. It does not deal with flammable dusts, which may lie quiescent for long periods of time until disturbed into suspension by a suitable mechanism. An area classification concept is being developed for dusts.

By implication, an area that is not classified as Zone 0, 1 or 2 is deemed to be a non-hazardous or safe area. If doubt exists as to the classification of an area that is judged to be hazardous or potentially hazardous, guidance should be sought at an early stage from the authority having jurisdiction in the industry or area concerned. (See Parts 1 and 2 of the code.)

Electrical apparatus used in each of the classified Zones should be suitably protected by design and manufacture and should also be installed and maintained in a manner to ensure its safe use.

[1)] In course of preparation

BS 5345, in offering guidance in the selection, installation and maintenance of suitably protected apparatus, replaces CP 1003 and should be used for all new installations. It should also be used for changes to existing installations, though it is recognized that minor changes only to certain existing installations may need to be made in accordance with the recommendations of the earlier code. It is intended, however, that CP 1003-1, CP 1003-2 and CP 1003-3 will eventually be withdrawn from use.

Notwithstanding application of the installation recommendations of this code to existing installations, the recommendations for maintenance should be applied to all electrical apparatus and installations, irrespective of age and date of installation. It should also be noted that the installation and maintenance recommendations given in the code are supplementary to, and not alternative to, requirements that would apply to general industrial installations (see also Part 1 of the code).

Section 1. General principles

1 Scope

This Part of BS 5345 describes the concept of ensuring electrical safety in hazardous areas by means of type of protection "d": flameproof enclosure, and gives guidance on the selection, installation and maintenance of this type of electrical apparatus.

This code does not apply to the underground mining industry, where other precautions are necessary, though it is recognized that the code may be applied to the surface installations of mines.

Apparatus with type of protection "d": flameproof enclosure is designed for use in areas with flammable gas and vapour risks. Combustible dusts are excluded from this Part and are dealt with in Part 10.

2 References

The titles of the standards publications referred to in this code are listed on the inside back cover.

3 Definitions and explanations of terms

The definitions and terms generally applicable to hazardous areas and electrical apparatus used therein are included in Part 1 of the code, to which reference should be made. The definitions and terms that are particularly relevant to individual types of protection are given in the appropriate Parts of the code. For the purposes of this Part, the following definitions and terms apply.

NOTE The following definitions are derived from BS 4683-2 and BS 229. Other very similar definitions may be found in IEC Publication 79-1 and BS 5501-5.

3.1
type of protection "d": flameproof enclosure

a method of protection where enclosures for electrical apparatus will withstand an internal explosure of the flammable gas or vapour which may enter it, without suffering damage and without communicating the internal flammation to the external flammable gas or vapour for which it is designed, through any joints or structural openings in the enclosure

3.2
gap (diametral clearance)

the distance between the corresponding surfaces at a joint, measured normally to the surfaces. For cylindrical surfaces, the gap is the difference between the two diameters and is usually referred to as the diametral clearance

3.3
gap (maximum experimental safe)

the maximum gap which has been found to prevent ignition of the most easily ignited external mixture when the most incendive mixture of the same flammable material is exploded inside the test vessel

3.4
joint

the place where corresponding surfaces of the different parts of an enclosure come together and where flame paths from inside to the outside of the enclosure occur

3.5
length of flame path (width of joint)

the shortest distance, measured along the flame path from the inside to the outside of the flameproof enclosure

4 Description of technique

Electrical apparatus complying with the requirements for type of protection "d" is so designed and constructed that it is not capable, under practical conditions of operation within the rating of the apparatus (and recognized overloads and defined fault conditions, if any, associated therewith), of igniting a surrounding explosive atmosphere.

This is achieved by:

a) completely surrounding the electrical apparatus with an enclosure, including flamepaths as necessary, of sufficient strength and integrity of manufacture to withstand internal explosions without suffering damage and without communicating the internal flammation to the external flammable gas or vapour for which it is designed through any joints or structural openings in the enclosure;

b) restricting the maximum external surface temperature to below the ignition temperature of the gas or vapour which presents the explosion risk.

NOTE The maximum surface temperature should take into account possible restrictions of air circulation, extreme environmental conditions and heat from adjacent plant. See also Part 1 of the code.

5 Relevant specifications

The specifications currently available for apparatus with type of protection "d": flameproof enclosure are as follows:

a) IEC Publication 79-1 "Electrical apparatus for explosive gas atmospheres" published by the International Electrotechnical Commission.

b) EN 50018 "*Electrical apparatus for potentially explosive atmospheres — Flameproof enclosure "d"*" prepared by the European Committee for Electrotechnical Standardization (CENELEC), the English language version being BS 5501 "*Electrical apparatus for potentially explosive atmospheres*" Part 5 "*Flameproof enclosure "d"*".

c) BS 4683 "*Electrical apparatus for explosive atmospheres*" Part 2 "*The construction and testing of flameproof enclosures of electrical apparatus*".

d) BS 229 "*Flameproof enclosure of electrical apparatus*".

NOTE 1 BS 5501-5 (EN 50018) and BS 4683-2 are used for all new certification applications and for all new designs of flameproof enclosures.

NOTE 2 Although superseded by BS 5501-5 and BS 4683-2, BS 229 remains valid for the manufacture of existing certified equipment. Equipment certified to editions of BS 229 prior to 1946 should not be newly installed without consultation with the authority having jurisdiction in the industry or area concerned. It is intended that BS 229 will eventually be withdrawn.

e) IEC Publication 79-8 "Classification of maximum surface temperatures".

f) BS 4683 "*Electrical apparatus for explosive atmospheres*" Part 1 "*Classification of maximum surface temperatures*".

g) EN 50014 "*Electrical apparatus for potentially explosive atmospheres — General requirements*", the English language version being BS 5501 "*Electrical apparatus for potentially explosive atmospheres*" Part 1 "*General requirements*".

h) BS 6121 "*Mechanical cable glands for elastomer and plastics insulated cables*".

i) BS 889 "*Flameproof electric light fittings*". This standard refers to BS 229 for flameproof requirements [see d) above].

Section 2. Selection of apparatus

6 General

The general factors affecting the selection of electrical apparatus and systems for hazardous areas are described in detail in section 2 of Part 1 of this code. The specific factors that need to be taken into account when selecting electrical apparatus and systems with type of protection "d" are described in the remaining clauses of this section.

7 Permissible Zones of use

Electrical apparatus with type of protection "d" is primarily intended for use in Zone 1 areas, and is also applicable for use in Zone 2 areas for apparatus that could cause arcs and sparks in normal operation, together with other suitable protection concepts (see Part 1 of the code).

NOTE For information on the exceptional use of portable apparatus in Zone 0 areas see note 1 to **26.1** of Part 1:1976 of the code.

8 Temperature classification

8.1 Apparatus with type of protection "d" should be selected according to its temperature classification (see Part 1 of the code). The maximum surface temperature appropriate to the temperature class should not exceed the ignition temperature of the flammable gas or vapour expected to be present in the hazardous area, or the lowest value of ignition temperature if more than one flammable gas or vapour may be present.

NOTE 1 For type of protection "d" apparatus the surface to be considered is the external surface.

NOTE 2 The temperature class of apparatus is determined according to the results of temperature measurements made under normal operating conditions and with recognized overloads, if any. The validity of temperature classification may be dependent upon operation within recognized tolerances of supply voltage variation; in cases of doubt the manufacturer should be consulted.

NOTE 3 In the UK temperature class T ratings apply only to apparatus complying with the requirements of BS 4683-2 or BS 5501-5 (EN 50018) the rating being marked on the certification label. When apparatus complying with the requirements of BS 229 is employed, reference should be made to the manufacturer if critical temperature levels are involved.

8.2 Generally, an ambient temperature of 40 °C is assumed in the rating of electrical apparatus for use in hazardous areas. Higher temperatures should be, and in exceptional cases lower temperatures may be, taken into account in determining the rating of apparatus. In that event, the value of the peak ambient temperature will be clearly marked on the apparatus, it should be noted that the certification will be invalidated if the apparatus is used at an ambient temperature higher than that for which the certification applies.

9 Apparatus subgrouping

9.1 In the new groupings, agreed internationally by the International Electrotechnical Commission (IEC), Group I is reserved for apparatus for mining use only and will not be considered further in this code. Apparatus for use with gases and vapours encountered in the surface industries is, where appropriate, grouped in one of three subgroups of Group II, namely IIA, IIB and IIC.

9.2 Apparatus may be used only with compounds allocated to the appropriate apparatus subgroup, as indicated in Part 1 of the code, whose ignition temperatures are not less than the maximum temperature of the temperature class certified for the apparatus. Apparatus certified for a particular subgroup may also be used with compounds allocated to a lower subgroup, e.g. apparatus certified for Group IIC is also suitable for Groups IIA and IIB, subject to consideration of temperature classification.

9.3 It will sometimes be found necessary to use electrical equipment in applications where compounds may be present which have not yet been allocated to a subgroup. In these circumstances, expert advice should be obtained on the subgrouping allocation and temperature class of apparatus for the compounds in question.

NOTE The relationship between apparatus subgroup and former apparatus group according to the requirements specified in BS 229 is shown in Part 1 of the code.

10 Environmental conditions

When selecting apparatus, special care should be taken to ensure that the apparatus and its component parts are so constructed as to guard against electrical and mechanical failure in the intended conditions of use.

Particular attention should be given to the need for protection against the weather, the ingress of liquids and particulate matter, corrosion, the effect of solvents and the effect of heat from adjacent plant (see Part 1 of the code).

11 Requirements for certification of apparatus

See Part 1 of the code.

Section 3. Installation requirements

12 General

Electrical apparatus complying with the requirements of type of protection “d” should be installed in accordance with the general installation requirements given in Part 1 of the code.

The specific factors that need to be taken into account when installing electrical apparatus with type of protection “d” are described in the remaining clauses in this section.

13 Solid obstruction effects

13.1 Tests have shown that solid obstructions or obstacles, which are not part of the apparatus, near the edges of flanged joints or openings, may impair the efficient operation of a flameproof enclosure. The effect is most noticeable for Group IIC enclosures with decreasing severity for Groups IIB and IIA.

13.2 When installing apparatus, care should be exercised to prevent any external solid obstacle which is not part of the apparatus, such as steelwork, walls, weatherguards, mounting brackets, pipes or other electrical equipment, approaching nearer than the distance recommended in Table 2 from the outer edge of the enclosure flange or opening.

14 Weather protection

14.1 Where flameproof/weatherproof type of equipment is not available, the gaps should be protected against ingress of moisture. The use of gaskets is only permissible when certified as part of the equipment.

14.2 It has been established that the ability of enclosures to withstand the maximum explosion pressure is not impaired if the gaps are reduced or sealed by suitable methods. It is therefore permissible to seal a joint, e.g. for weather protection.

14.3 Suitable sealing methods for joints are: the application of non-setting greases, or approved anticorrosive agents. Silicone based greases are often suitable for this purpose but see note below concerning use with gas detectors, it cannot be too strongly emphasized that extreme care should be exercised in the selection and application of these substances to ensure the retention of the non-setting characteristics, and subsequent separation of the joint surfaces.

NOTE The use of silicone based compounds for the sealing of gas detector heads and associated fittings is not recommended because of the poisoning effect of silicones on most detector elements. The manufacturer of the gas detector units should be consulted for advice on suitable sealing compounds.

14.4 Joints should not be treated with substances which harden in use.

14.5 For any Group II apparatus, non-hardening tape should be employed only where such apparatus is used in conjunction with gases allocated to Group IIA (see Tables 3 and 5 of Part 1 of the code).

Unless expert advice is sought, non-hardening tape should not be employed where Group II B or II C apparatus is used in conjunction with gases allocated to Group II B.

Non-hardening tape should not be employed where group II C apparatus is used in conjunction with gases allocated to Group II C.

14.6 Weatherseals for entry devices may be by means of purpose designed sealing washers or a suitable thread sealant (see **14.3**). However the minimum number of threads engaged should still be in accordance with the flamepath requirements for the apparatus group concerned and the earth continuity should be maintained through the entry device to the enclosure.

15 Wiring systems

The general recommendations and requirements for wiring systems for electrical apparatus installed in hazardous areas are considered in Part 1 of the code. The specific factors that need to be taken into account when installing electrical apparatus with type of protection "d" are described below.

The choice of wiring systems should take account of the requirements of the electrical apparatus and the nature of the environment, including mechanical, thermal, chemical corrosive and solvent agencies.

15.1 General. It is essential that the entry system complies with all the requirements referred to in the appropriate apparatus standard and that the entry device is appropriate to the type of wiring employed.

15.2 Entry tappings

15.2.1 BS 4683-2 does not specify thread forms and apparatus certified to this standard should be available with any thread form that the manufacturer originally specified, including ISO metric threads, as given in BS 31 and BS 4568.

15.2.2 BS 229 refers to tappings having thread forms as specified in BS 31, BS 1387 or, for metric thread forms, BS 4568 (the latter being incorporated in BS 229 by amendment in July 1974). To accommodate the change to ISO metric threads, the Certifying Authority, on application by manufacturers, issue "Endorsements" to existing certificates covering thread forms other than those specified in BS 31 or BS 1387 providing the apparatus is otherwise suitable.

15.2.3 Where entry thread forms, other than those specified in BS 31 or BS 4568 are involved, reference should be made to the manufacturer to confirm that the certification of apparatus in accordance with the requirements of BS 4683-2 and the "Endorsement" for apparatus in accordance with the requirements of BS 229, cover these thread forms.

15.3 Conduit systems

15.3.1 Conduit systems should be installed in accordance with the recommendations of Part 1 of the code. It is recommended that the use of conduit in outdoor locations is kept to an absolute minimum.

15.3.2 Stopper boxes or other approved sealing devices should be fitted at each point of connection with flameproof apparatus. The exception to this is where a sealing device forms an integral part of the apparatus and is certified as such.

15.3.3 Stopper boxes or other approved sealing devices should be fitted to all enclosures accommodating cable joints and/or terminals and conduit fittings containing terminals, e.g. conduit junction boxes with terminals including earth terminals.

15.3.4 Where every item of flameproof apparatus connected to a conduit system has a sealing device fitted to each point of entry, it is permissible to use conduit and fittings complying with the requirements of BS 31 or BS 4568 provided that there is no discontinuity in the conductors or their insulation. Where terminals or terminations are required they should be protected by a flameproof enclosure.

15.3.5 Where it is necessary to employ a joint other than a screwed coupler, suitable unions approved for the purpose should be used. Running couplers are not permitted.

15.3.6 All screwed joints should be pulled up tight and should in addition, for parallel threaded components, be provided with locknut.

15.3.7 All conduit and conduit fittings should be checked before assembly to remove all sharp edges and burrs which could cause damage to cables when being pulled in.

15.4 Cable systems and terminations

15.4.1 Cables and cable entries (e.g. cable glands) should maintain the respective method of protection and be in accordance with Part 1 of the code. For the direct entry of cables into flameproof enclosures the cable system should comply with Figure 1 and may be achieved by one of the systems described in **15.4.2** to **15.4.4**.

NOTE Attention is drawn to the importance of efficient earthing and bonding in an installation. See Part 1 of the code.

For indirect entry of the site wiring into flameproof enclosures, the apparatus will generally have been certified with flameproof bushings through the wall of the enclosure and the parts of the bushings outside the flameproof enclosure will be protected in accordance with one of the types of protection listed in Table 1 of Part 1 of the code. Normally the exposed part of the bushings will be within a terminal box which will either be another flameproof enclosure or will be protected by type of protection "e". Where the Ex e indirect entry method is used, the cable entry and terminations should be in accordance with Part 6 of the code.

15.4.2 Thermoplastic, thermosetting or elastomeric cables having extruded bedding and which are substantially compact and circular may enter a flameproof enclosure by any of the following methods:

a) cable termination box with cable entry devices certified as part of the apparatus when tested with a sample of the particular type of cable;

b) plugs, complete with suitable cable gland, which engage with sockets which are certified as part of the apparatus;

c) certified flameproof cable glands selected in accordance with Figure 1;

d) other certified means which maintain the integrity of the flameproof enclosure.

NOTE Cables complying with BS 5308, BS 5467, BS 6116, BS 6346 or BS 6883 will be suitable provided that the recommendations of this subclause are met. Other cables meeting these recommendations may also be suitable but attention is drawn to the recommendations of **19.2.1** of Part 1 of the code.

Any fillers should be non-hygroscopic.

15.4.3 Mineral insulated cables with or without plastic outer covering with appropriate certified flameproof cable glands may also be used.

15.4.4 For other cables where the method of termination and/or the construction is such that it would not maintain the method of protection, the cable should enter a flameproof enclosure by one of the following methods:

a) a certified sealing device, e.g. a stopper box or sealing chamber, certified as part of the apparatus or having component approval and employing cable glands appropriate to the cables used;

b) certified cable glands incorporating compound filled seals or other equivalent sealing arrangements and having component certification;

c) plugs, complete with suitable cable glands, which engage with sockets which are certified as part of the apparatus;

d) other certified means which maintain the integrity of the flameproof enclosure.

NOTE 1 The sealing devices such as stopper boxes or sealing chambers referred to above should incorporate compound or other appropriate seals which permit stopping around individual cores. Sealing devices should be fitted at the points of entry of cables to the apparatus.

NOTE 2 Where a factory-made termination of the encapsulated type is used, no attempt should be made to interfere with the connection to the apparatus or to replace the cable. The apparatus should be returned to the manufacturer for repair.

16 Unused cable entries

If cable entries provided on the equipment are not employed for installation purposes, either because full information was not available at the time of ordering or by reason of site changes, entries should be closed by an approved method in order to maintain the integrity of the enclosure.

Section 4. Inspection, maintenance and testing

17 General

The safe and satisfactory operation of electrical apparatus with type of protection "d" is dependent on a high standard of inspection, maintenance and testing by trained and competent personnel.

General recommendations for inspection, maintenance and testing are given in Part 1 of the code and apply equally to this Part. The following requirements apply particularly to type of protection "d" flameproof enclosures.

18 Initial and periodic inspections

All electrical apparatus, systems and installations should be inspected prior to commissioning and after replacement in accordance with the "Initial" column of inspection schedule (see Table 1).

Following any repair, adjustment or modification, those parts of the installation that have been disturbed should be checked in accordance with the relevant items in the "Initial" column of the inspection schedule.

All apparatus, systems and installations should be inspected regularly in accordance with the "Periodic" column of the inspection schedule.

If, at any time, there is a change in the area classification, or in the characteristics of the flammable material used in the area, or if the apparatus is moved from one location to another, a check should be made to ensure that the apparatus concerned has the correct apparatus subgroup and temperature class, and that it complies with the relevant area classification.

A system should be established to record the results of all inspections and the action taken to correct defects.

19 Maintenance

19.1 No alteration that might invalidate the certificate or other document relating to the safety of the apparatus should be made to apparatus with type of protection "d" without appropriate approval.

If replacement components such as cable glands, conduit or conduit accessories, are available only with thread forms which differ from those provided on the apparatus, suitable adaptors having "Component Approval" should be employed. This situation is most likely to occur when apparatus manufactured in accordance with BS 229 is being resited or reused. See also **15.2**.

19.2 Checks should be made for obstructions around flanges of equipment. The dimensions of the gaps at flameproof joints should be checked periodically during maintenance to see that they do not exceed the maximum figure specified in BS 229, BS 4683-2 or BS 5501-5 as applicable. At such intervals as experience may prove desirable the flanged joints should be separated and the faces examined for possible defects resulting from corrosion, erosion, or other causes. If flanges are to be sealed then new non-setting grease or tape should be used on reassembly. See **14.3** and **14.5**.

19.3 Care should be taken to avoid paint or any other coating entering the gap. See clause **14**.

19.4 Equipment enclosures and fittings should be examined to see that all stopping plugs (see clause **16**) and bolts are in position and tight. Locking and sealing devices should be checked to confirm that they are secured in the prescribed manner. Replacement cover securing fasteners, nuts, studs or bolts should be types specified by the manufacturer for the particular apparatus.

19.5 No attempt should be made to replace or repair a glass in a flameproof enclosure, e.g. in a luminaire or other enclosures, except by the complete assembly or part obtainable from the manufacturer, and complying with the flameproof certificate.

19.6 Repairs and refurbishing of apparatus with type of protection "d" should be performed only by the original manufacturer, his authorized agents or a repairer who is conversant with the construction standards for flameproof equipment and demonstrates the ability to understand certification restraints.

Table 1 — Inspection schedule; apparatus with type of protection "d": flameproof enclosure

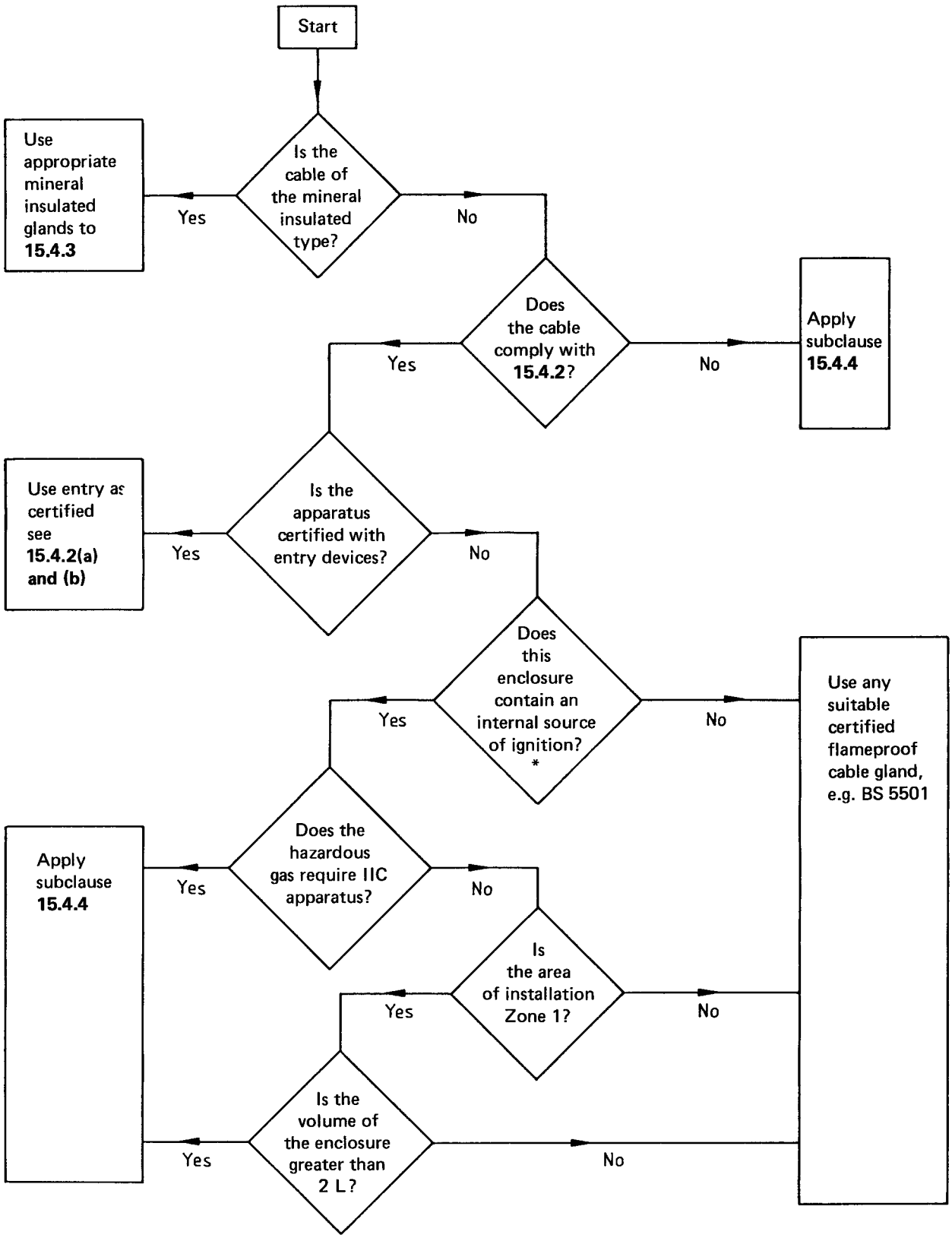
Check that	Inspection category[a]		Notes
	Initial	Periodic	
Apparatus is appropriate to area classification	A	B	
Surface temperature class is correct	A	B	
Apparatus subgroup is correct	A	B	
Apparatus carries the correct circuit identification	A	B	Apparatus should be positively identified with its circuit to ensure that correct isolation can be carried out.
Obstructions do not conflict with clause **13**	A	A	
Enclosures, glasses and glass/metal seals are satisfactory	A	A	
Gaps are free from corrosion, dirt and paint	A	B	
Dimensions of gaps are correct	A	B	
There are no unauthorized modifications	A	A	
Bolts, glands and stoppers are complete and tight	A	A	
There is no undue accumulation of dust or dirt	B	B	Accumulation of dust or dirt can interfere with heat dissipation and result in surface temperatures higher than those permitted in the hazardous area.
All conduit runs and fittings are tight and free from corrosion	A	B	
Earthing is satisfactory	A	A	
Condition of enclosure gaskets is satisfactory	A	B	
Electrical connections are tight	A	B	
Motor fans and couplings are not rubbing on cowls/guards	A	A	
Lamp rating and type are correct	A	B	An "initial" inspection is necessary after relamping.
Electrical protection is satisfactory	A	A	
Stopper boxes and cable boxes are correctly filled	A	B	
There is no leakage of compound from stopper or cable boxes	B	B	
There is no obvious damage to cables, cable sheaths or cable glands	A	A	Particular attention should be paid to flexible cables used with portable apparatus.
Apparatus is adequately protected against corrosion, the weather, vibration and other adverse factors	A	A	
Guards, where used, are present and correctly located	A	B	

[a] Category A inspections should be carried out in all cases and, where "periodic", at intervals not exceeding two years. More frequent and/or more detailed inspection will be necessary where there is a corrosive or other adverse atmosphere, a high risk of mechanical damage or vibration, or where there are other onerous circumstances. The need for more frequent inspection may also be determined by operating experience.
The need for, the method, and the frequency of category B inspections is at the discretion of the engineer responsible, it is not intended that periodic inspections should incur undue disturbances of apparatus, unless considered necessary by the engineer responsible.

Table 2 Minimum distance of obstruction from flange or opening

Apparatus subgroup[a]	Minimum distance
	mm
IIA	10
IIB	30
IIC	40

[a] Apparatus designed for a particular subgroup but used in a gas for which another lower subgroup would normally be applicable [see **7.4.2** c) of Part 1 of the code] may alternatively observe the clearances for the gas in question, e.g. for Group IIC apparatus used in a Group IIA atmosphere the 10 mm distance may apply instead of 40 mm.



*Internal sources of ignition include sparks or equipment temperatures occurring in normal service which can cause ignition. An enclosure containing terminals only or an indirect entry enclosure is considered not to constitute an internal source of ignition.

Figure 1 — Selection chart for direct entry of cables into flameproof enclosures

Publications referred to

BS 31, *Steel conduit and fittings for electrical wiring.*

BS 229, *Flameproof enclosure of electrical apparatus.*

BS 889, *Flameproof electric lighting fittings.*

BS 1387, *Steel tubes and tubulars suitable for screwing to BS 21 pipe threads.*

BS 4568, *Steel conduit and fittings with metric threads of ISO form for electrical installations.*

BS 4683, *Electrical apparatus for explosive atmospheres.*

BS 4683-1, *Classification of maximum surface temperature.*

BS 4683-2, *The construction and testing of flameproof enclosures of electrical apparatus.*

BS 5467, *Specification for armoured cables with thermosetting insulation for electricity supply.*

BS 5501, *Electrical apparatus for potentially explosive atmospheres.*

BS 5501-1, *(EN 50014) General requirements.*

BS 5501-5, *(EN 50018) Flameproof enclosure "d".*

BS 6116, *Elastomer-insulated flexible trailing cables for quarries and miscellaneous mines.*

BS 6121, *Mechanical cable glands for elastomer and plastics insulated cables.*

BS 6346, *PVC-insulated cables for electricity supply.*

CP 1003, *Electrical apparatus and associated equipment for use in explosive atmospheres of gas or vapour other than mining applications.*

CP 1003-1, *Choice, installation and maintenance of flameproof and intrinsically-safe equipment.*

CP 1003-2, *Methods of meeting the explosion hazard other than by the use of flameproof or intrinsically-safe equipment.*

CP 1003-3, *Division 2 areas.*

IEC 79, *Electrical apparatus for explosive gas atmospheres.*

IEC 79-1, *Construction and test of flameproof enclosures of electrical apparatus.*

IEC 79-8, *Classification of maximum surface temperatures.*

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