IECEx OD 017

Edition 5

IECEx Operational Document

IEC System for Certification to Standards relating to Equipment for use in Explosive Atmospheres

Operational Document - Drawing and documentation Guidance for IEC Ex Certification – for use by Manufacturers and ExTLS

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IECEx OD 017

Edition 5

IECEx
OPERATIONAL DOCUMENT

IEC System for Certification to Standards relating to Equipment for use in Explosive Atmospheres (IECEx System)

IECEx Certified Equipment Scheme – Drawing and Documentation Guidance for IEC Ex Certification – for use by Manufacturers and ExTLS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Ex OD 017 Edition 5.0

Operational Document - Drawing and documentation Guidance for IEC Ex Certification – for use by Manufacturers and ExTLS

This Operational Document OD 017 has been prepared to assist manufacturers in the preparation of drawings and documentation to be submitted with an application for certification.

Document History

2004 07	**Original Issue (Version 1)**
2004 08	**Version 2 (minor editorial change)**
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DRAWING AND DOCUMENTATION GUIDANCE FOR IECEx CERTIFICATION – FOR USE BY MANUFACTURERS AND ExTLs

1 Scope

Certification drawings form part of the complete certification package. The content recommendation and purpose for certification drawings and other documentation that form the specification of the product is covered by this document.

A drawing/document should show the safety concept including which type of protection is applied for each part of the construction and which boundaries are involved.

This document has been prepared to assist manufacturers in the preparation of drawings and documentation to be submitted with an application for certification.

Because the equipment explosion protection standards are concept based and can be applied to a wide diversity of products, the information given in this document cannot be totally exhaustive nor cover every eventuality. IECEx Certification Bodies and Testing Laboratories are happy to advise on the needs in particular cases. They have a forum, the Ex Testing and Assessment Group (ExTAG), through which a common approach on this and other issues can be achieved throughout the world.

2 Purpose

The drawings and other documentation provided to demonstrate explosion protection conformity of the product are used by the certifying body for comparison with a prototype or sample and, in conjunction with an Ex test report, demonstrate conformity with the standard(s).

The drawings and other documentation that form the specification of the product used to demonstrate explosion protection conformity are a definitive specification of the product that has been certified.

The certificate holder/manufacturer uses the drawings and documents to record the controlled details (the elements of the design which provide the protection for the applicable explosion protection technique(s)). It is recommended that manufacturers prepare drawings specifically for the purpose of certification and do not necessarily provide every detail necessary to manufacture the product. The details provided in these drawings may only be modified by reference to the certifying body.

These drawings and documents are also used for audit and/or final inspection purposes. In particular, the certification body responsible for issuing the IECEx QAR will use the drawings and documents during audit against the requirements of ISO/IEC 80079-34.

The certification drawings and documents do not need to provide any information with regard to features not related to conformity with the standard(s). However in such cases the manufacturer should ensure an effective system for controlling manufacturing drawings derived from the certification drawings.

Changes to the certification drawings and documents are implemented only after the certification body has issued a revision to the certificate to incorporate the new drawings and documents.

In this operational document, it is assumed that the terms "drawings" and "documentation" refer to information that has an equal level of control within the manufacturer's documentation systems, though possibly held in different formats. In 4.2.3 of ISO/IEC 80079-34:2011, concerning control of manufacturing documents, both the drawings and documentation referred to in this operational document are referred to as "Schedule Drawings".

3 Drawing and documentation content

The manufacturer will often require the maximum degree of flexibility to cater for production changes and product variants while the certifying body will require a level of detail which demonstrates that every aspect of the certification process and the relevant standards have been clearly considered and that all details relevant to conformity have been defined unambiguously. The trade-off to be achieved relates to the work that the certifying body would need to carry out to ensure conformity over the whole range of the defined flexibility.

This document provides guidance regarding the detail required for each standard. It is not sufficient to include statements in drawings and other documentation that forms the specification of the product that simply replicate clauses from the applicable standard, e.g. ‘All fasteners require the use of a tool’ – the drawing should clearly show or make reference to a specific fastener.

IECEx rules (9.2 of IECEx02) require all principal information to be communicated in the English language. Where a drawing is created in a language other than English, an English translation of the important information should be added. This translation may be given directly on the drawing or on a separate document with reference to the drawing.

Where typical drawings are used, the drawing should specify of what it is typical. A drawing of an enclosure showing the typical position of a widget does not control the location of the widget unless boundaries of permitted positions are defined.

Where a generalised statement is used in a drawing it should be clear where it applies. For example, a general note stating “All gasket material to be 3 mm thick neoprene rubber” is only valid if the drawing clearly shows the position of every gasket critical to conformity.

Material specifications on drawings are generally to be taken as material purchasing specifications and should be adequate for that purpose. Any material bought against the specification should perform sufficiently like that used for the prototype sample to give confidence that the test results would be replicated. Where possible, materials should be specified against an IEC standard or an industry recognised specification.

Where a material is specified only by its performance, the manufacturer should be able to demonstrate during production audit (see ISO/IEC 80079-34) how this requirement is met in production. For example, material specified “epoxy glass resin with a CTI of greater than 175” would require proof of compliance with the CTI limit for each purchased batch. This can be achieved, for example, by an epoxy manufacturer’s declaration or by a third party.

4 Specific requirements

The drawing and documentation requirements for the various explosion protection techniques are as follows.

4.1 General requirement

4.1.1

All drawings should be identified by: drawing number, revision number, date of revision, title, name of the design authority in whose drawing record system the drawing is recorded (with relationship to the manufacturer if different).

4.1.2

All measurements given on drawings should be expressed in SI units.

4.1.3

All dimensions relevant to compliance with the standards should be toleranced unless not required by a specific standard.

4.1.4

A drawing/document should show details of marking, including all details required for compliance with the standards and all specific warning information required by the standards. The layout need not be identical to the layout intended on the final product but should be clear enough to ensure that the final marking is correct. The label material and method of marking and fixing should be provided.

4.1.5

Materials of parts relevant to the type of protection should be unambiguously identified. Where possible, this should be by reference to a material grade given in an IEC standard.

Where no relevant IEC standard is available, reference may be made to other nationally, regionally or industry recognised standards, but the applicant should be prepared to submit a copy of the standard if requested.

Where no standard is available, or where the standard does not control all relevant requirements, the material manufacturer's data sheet should be submitted.

4.1.6

The specification for all materials on which the type of protection depends should be provided in accordance with the requirements stated in the relevant standard

4.1.7

For earthing and bonding connections, the connecting method, the construction, parts, dimensions and material specifications including corrosion protection, should be identified.

4.1.8

For rotating machines, the drawing or document should identify all possible points where clearance of rotating parts is relevant, together with information to determine how the minimum clearances required by the standards are achieved on assembly.

4.1.9

Where applicable, details of mounting and guarding should be provided.

4.1.10

Where ingress protection is relevant, materials of gaskets (and 'O' rings) and the method of ensuring or controlling position, adhesion, and compression of the gaskets in service should be clear. Dimensions of gaskets and related features should be specified.

4.1.11

Correctly scaled and dimensioned general arrangement and enclosure drawings including layout should be supplied.

4.1.12

A circuit diagram (single line) including details of external connections should be provided.

4.1.13

Ratings of all protection devices should be specified.

4.1.14

Technical description of the equipment and its specification should be provided.

4.1.15

Identification of bearings including conditions of use should be supplied. Bearing data sheets should be provided detailing the working temperatures for the bearings.

4.1.16

The paint or coating applied to the equipment and the maximum thickness should be specified. If the material properties are relevant for static electricity, the paint or coating should be identified and a material data sheet indicating electrical conductivity and breakdown voltage should be provided.

4.1.17

Components which have IECEx component certificates should be identified in the parts list with their IECEx certificate number, or referenced from additional separate documents.

4.1.18

A description of all intended routine tests should be included in the drawings or documentation.

NOTE: Some details (such as pass criteria) may not be known at the time of submission for certification.

4.1.19

The documentation should specify the environmental conditions for which the equipment is suitable.

4.1.20

Enclosures with opening delay time marking based on surface temperature of enclosed hot components should have schematics/circuit diagrams provided which include component reference designations to correlate with the parts list. The parts list should define the surface temperature of hot components.

Enclosures with opening delay time marking based on charges of enclosed capacitors should have schematics/circuit diagrams provided which include component reference designations to correlate with the parts list. The parts list should define the charges (voltage and capacitances) of capacitors.

4.2 Flameproof enclosure “d”

4.2.1 The following dimensions/details should be shown in the drawings/documents for Ex “d” apparatus

Length of flamepath and maximum flamepath gap for each constructional gap/joint with maximum constructional tolerance.

4.2.2

Length, size and minimum yield strength or grade of fasteners. Fastener data and characteristics may be included in a table cross referenced to the applicable drawing(s)

4.2.3

Spacing of boltholes in covers.

4.2.4

Size and tolerance of clearance holes for fasteners. This may be included in a table cross referenced to the applicable drawing(s)

4.2.5

Depth of drilling and tapping. This may be included in a table cross referenced to the applicable drawing(s)

4.2.6

Minimum thickness of metal around holes. This may be included in a table cross referenced to the applicable drawing(s)

4.2.7

Maximum and minimum diameter of shafts and bores together with maximum “m” and minimum “k” radial clearances of rotating parts.

4.2.8

Location and details of threaded entries, including range of sizes and maximum number, pitch, class of fit, length of thread provided in enclosure (chamfers and undercuts taken into account)

4.2.9

Area in which cable entries, switch operators, windows, receptacles etc may be fitted to be shown.

4.2.10

Method of retaining a non threaded fitting e.g. a fitting having a spigot joint.

4.2.11

Hole spacing on face of enclosure where a certified component is to be fitted.

4.2.12

Values of ‘m’ and ‘k’.

4.2.13

Overall dimensions of the enclosure including minimum wall thickness.

4.2.14

Weld type and size.

4.2.15

Minimum thickness of window, material and method of mounting.

4.2.16

Normally, layout and heat dissipation of internal components showing location and approximate dimensions of each component, including clearances between components and the nearest sidewall. The purpose is to control:

- Location of sources of heat, for temperature classification purposes, for temperature withstand of plastic parts, window cement, other potting materials, cable entries, etc., and for confirming the local ambient for items such as IS safety barriers
- Dimensions relevant to pressure piling effects

Where the certificate is to cover variations in content: sufficient detail of the range so that the design limits for each variant are absolutely clear.

4.2.17

Surface roughness of flamepaths.

4.2.18

For cemented joints: specification of cement, manufacturer's data sheet, the shortest distance through the cemented joint.

Washer type and thickness.

4.2.19

Specification and data sheet for setting compounds used in stopping boxes etc..

4.2.20

Full specification for sintered metal components forming part of an enclosure or combustible sensor: material, max bubble pore size, minimum density, dimensions etc..

4.2.21

Comparative Tracking Index (CTI) for insulating material subject to electrical stress if the type of protection depends on it, e.g. through going bushings.

4.2.22

Gross and net internal volumes if not evident from general dimensions.

Installation precautions for cells and batteries.

4.2.23

Details and location of any internal thermal protective devices.

4.2.24

Length and diameters for press-fitted or interference fitted part.

4.2.25

Identification of grease if applied to the joints and specification data sheet with details on ageing process, solvent evaporation, corrosion, flash point.

4.2.26

Thickness of electroplating on flamepaths.

4.2.27

Details of safety devices for battery protection against excessive temperature, reverse polarity and exceeding the manufacturer charging specification

4.3 Increased safety "e"

The following dimensions/details should be shown in the drawings/documents for Ex "e" apparatus where applicable.

4.3.1

Minimum creepage and minimum clearance distances.

4.3.2

Comparative Tracking Index (CTI) including data sheet for the material to substantiate the repeatability of the characteristic.

4.3.3

Type and details of terminals used in junction boxes (e.g. type, material, rating).

4.3.4

Insulation on windings specified by manufacturer's data sheet, all relevant processes – e.g. for impregnation.

4.3.5

Details of all insulating materials and their data sheets where not defined by reference to an IEC standard.

4.3.6

Drawings for motors that identify the radial airgap and indicate how it is achieved during manufacture. For example, this may be by confirming that the gap is set and measured during manufacture, or by providing information to clearly show how a defined, but non-measurable gap, is achieved by considering the various tolerances and eccentricities that may contribute to the actual build

4.3.7

Warning label drawings including material and method of marking and fixing.

4.3.8

Specification of soft starters/frequency converters intended for use with motors.

4.3.9

Details of temperature limiting devices: identification and rating, specification of supplying voltage, mounting, wiring, insulation and termination.

4.3.10

Details of associated external protection devices (e.g. certified overload protection device for a motor) if a dedicated device is required, otherwise appropriate detail to allow a generic protection device to be correctly selected.

4.3.11

Details of electrical components of luminaires including lamps, lampholders, ballasts, terminals, starting circuits, fuses and batteries.

4.3.12

For rotating Machines: details of rotor bars as to method of location and achieving tightness within the slots, and the method of fixing/connection to shorting rings.

Internal as well as external fan clearances and method of achieving.

4.3.13

Data for gaskets including material, dimensions, placement and security.

4.3.14

Details of anti-condensation heaters: identification and rating, specification of supplying voltage, mounting, wiring, insulation and termination.

4.3.15

The minimum conductor dimension of wires used for winding

4.3.16

Specification for rolling bearing minimum radial or axial clearance between stationary and rotating parts for non-rubbing seals, specification of clearances for sleeve bearings.

4.3.17

Potential air gap sparking risk assessment for cage rotor ignition risk factors.

4.3.18

Potential stator winding discharge risk assessment for motors.

4.4 Intrinsic safety “i”

For equipment using intrinsic safety, the drawings and documentation should include the following where applicable.

4.4.1

For intrinsically safe apparatus: full schematics/circuit diagrams including component reference designations to correlate with parts list supplied.

For associated apparatus: schematics/circuit diagrams, including all component reference designations to correlate with the listing of safety relevant components necessary for intrinsic safety, including sufficient detail to verify the measures used to ensure intrinsic safety of the associated apparatus.

NOTE: In some cases it may be possible to reduce the amount of detailed information for circuits which are encapsulated. Advice should be sought from the relevant Certification Body.

4.4.2

Full listing of parts on which intrinsic safety depends, including for each component either:

- one or more specific manufacturer(s) and part number or range of part numbers, or
- sufficient specification required to maintain intrinsic safety.

NOTE: Maximum flexibility in manufacturing is achieved by minimising the details provided. For example, instead of providing nominal values and tolerance for resistors, it may be possible to supply only a minimum resistance (which is applicable having taken tolerance into account). For components on which intrinsic safety depends, sufficient information to demonstrate compliance with IEC 60079-11 Ed 6.0 clause 7 is required. For other non-energy storage components, it may be possible to provide no more than the component type and package.

4.4.3

Clear identification on the schematic drawings, for example by a dotted line, of the boundary between IS and non-IS circuit(s) in an associated apparatus requiring segregation.

4.4.4

Specific marking on the circuit diagram or in the parts list of electrical components on which the intrinsic safety depends.

A note explaining any identification symbol used (for example, “These components are safety components and may not be altered from the defined specification without approval of the Certification Body”) on the circuit diagram or on a separate document used as work instructions in production.

4.4.5

Correctly scaled PCB layout drawings or electronic Gerber (or alternative) files including:

- PCB material and thickness;

- distance between layers (if applicable);
- conductor material and thickness;
- minimum Comparative Tracking Index (CTI) (if applicable);

NOTE: IEC 60079-11 does not require the minimum Comparative Tracking Index (CTI) to be specified if the circuitry is rated for voltages of 10 V or less or if the circuitry (together with the PCB) is encapsulated in a casting compound or completely coated.

4.4.6

All safety distances in relation to the tracks on the wiring board.

4.4.7

All safety distances between components, terminals, or within safety components.

4.4.8

Minimum cross-sectional area, conductor type and insulation thickness of wires.

4.4.9

Minimum track width for temperature classification for IS apparatus and for tracks considered as infallible against open circuit failure.

4.4.10

Correctly scaled general mechanical arrangement drawings including details of any enclosure, and where relevant to intrinsic safety, the materials and surfaces used.

4.4.11

An interconnection diagram for equipment that includes internal interconnections, including identification of the boundaries where more than one protection concept is used within the equipment.

4.4.12

Assembly manufacturing drawings for custom components including specification of materials where relevant to safety and separation distances when required for safety.

4.4.13

Details of application and properties of insulating varnishes (conformal coatings).

4.4.14

If IEC 60079-11 Ed 6 Annex F has been used in determining separation, indication on the drawings or documentation where this has been applied and a statement of the ambient pollution degree and overvoltage category.

4.4.15

Details of any encapsulation materials used including generic name and type.

4.4.16

Statement of those entity parameters on which assessment is to be based. This usually includes one or more of U_m, U_i, I_i, P_i but may include limits to other parameters such as L_O/R, L_O, C_O etc. which are determined during the course of the assessment, if they are a requirement of the product specification.

4.4.17

A statement of any special requirements for installation, live maintenance and use as supplied in the instructions.

NOTE A control drawing is a recommended form of consolidating connection information and special requirements for installation and use.

4.4.18

Details of any special conditions which are assumed in determining the type of protection; for example that the voltage is to be supplied from a protective transformer or through a diode safety barrier.

4.5 Encapsulation “m”

The following dimensions/details should be shown in the drawings/documents for Ex “m” apparatus where applicable.

4.5.1

Details of the encapsulation compound(s) – see also 4.1.5.

4.5.2

Description of the production process of filling the equipment with compound, preferably a quality system work instruction or manufacturer’s recommended instruction.

4.5.3

A drawing showing the minimum distance from components within the encapsulation to the nearest surface of the compound. Dimensions showing the compound thickness between all components containing voids.

4.5.4

Maximum electrical input parameters specification.

4.5.5

Circuit diagram and physical layout of circuit boards.

4.5.6

Detail and location of any included protective device, e.g. thermal fuse.

4.5.7

Specification of any required external protective device, e.g. fuse.

4.6 Pressurisation “p”

The following dimensions/details should be shown in the drawings/documents for Ex “p” apparatus where applicable.

4.6.1

General arrangement of purged enclosure with dimensions including material and method of construction, and statement of gross free volume.

4.6.2

A schematic diagram showing the control circuit for purging and pressurisation, normal operation and shut down. Definition of settings and limits and a statement on safety integrity

that is compatible with the level of protection being claimed. Use of IEC 61508 is a preferred option.

4.6.3

Diagrams showing the purge and pressurisation ducting or pipework, components, pressure gauges etc..

4.6.4

Details of purging gas.

4.6.5

Statement of maximum, minimum and normal operating pressure.

4.6.6

Details of intake and outlet ducting and manifold distribution system.

4.6.7

Indicate details of certified components/equipment.

4.6.8

Detail windows and all other throughgoing devices e.g. pushbuttons, indicator lamps, etc

4.6.9

Layout of internal components and their thermal dissipation.

4.6.10

Details of how venting of any large enclosure volume is achieved.

4.6.11

Statement of presence of any cells/batteries and precautions taken.

4.7 Non-sparking “n”

The following dimensions/details should be shown in the drawings/documents for Ex “n” apparatus where applicable.

4.7.1

General arrangement of enclosure giving principal dimensions.

4.7.2

Ingress protection of sealing methods and seal details.

4.7.3

Details of connection facilities, showing how the conductor is secured to comply with the standard.

4.7.4

Details of connection methods for jointing internal wiring.

4.7.5

All Clearances and Creepage distances, showing actual paths. For connection facilities, this should take into account all potential positions of the moving parts, e.g. with terminals fully open and fully tightened.

4.7.6

Fixing of rotor bars to rotor and the method of connection to shorting rings, for rotating machines.

4.7.7

Specification of any required external protective device, e.g. fuse.

4.7.8

Details of frequency converters and their parameters for the motor to operate within its temperature class. As a minimum, the type of converter, the minimum set up information such as minimum carrier frequency and the acceptable speed ranges.

4.7.9

Details/specification of fuses if applicable.

4.7.10

Facilities (if applicable) to ensure plug and socket cannot vibrate loose.

4.7.11

Specification of lampholder, starter and starter holder types for luminaires.

4.7.12

Details of any warning labels.

4.7.13

Enclosed break devices and non-incendive components with specification of free internal volume of components.

4.7.14

Thermal stability parameters of any poured seals or encapsulating materials.

4.7.15

Specification of any free volume for sealed or encapsulated devices.

4.7.16

Details of temperature limiting and/or regulating devices (e.g. type of device such as themistor or thermostat. In the case of the thermostat, how the contacts are protected, e.g. by a sealed construction or by an enclosed-break construction, and in either case the limiting temperature): identification and rating, specification of supplying voltage, mounting, wiring, insulation and termination

4.7.17

Details of associated external protection devices (e.g. temperature control on heater).

4.7.18

Specification for rolling bearing minimum radial or axial clearance between stationary and rotating parts for non-rubbing seals. If relevant, specification of clearances for sleeve bearings

4.7.19

Potential air gap sparking risk assessment for cage rotor ignition risk factors.

4.7.20

Potential stator winding discharge risk assessment for motors.

4.7.21

Details of anti-condensation heaters: identification and rating, specification of supplying voltage, mounting, wiring, insulation and termination

4.8 Dust protection by enclosure “t”

The following dimensions/details should be shown in the drawings/documents for Ex “t” apparatus where applicable.

4.8.1

General arrangement of enclosure/equipment .

4.8.2

Sealing method/arrangement/shaft seals/bellows

4.8.3

Internal electrical equipment, general arrangement layout, power rating.

Normally, layout and heat dissipation of internal components showing location and approximate dimensions of each component, including clearances between components and the nearest sidewall. The purpose is to control location of sources of heat, for temperature classification purposes, for temperature withstand of plastic parts, window cement, other potting materials, cable entries, etc., and for confirming the local ambient temperature.

Where the certificate is to cover variations in content, sufficient detail of the range so that the design limits for each variant are absolutely clear.

4.8.4

Regarding sealing: construction details depending on the EPL.

4.8.5

Hole spacing for fasteners.

Specification of fastener type.

4.8.6

If required for joints: sizes, type, thread engagement, flange, spigot.

4.8.7

Details of warning labels.

4.8.8

Drawing that show all holes into enclosure, threaded entries, thread length.

4.8.9

Details of materials of enclosure, window material, thickness, sealing.

4.9 Oil-immersion “o”

The following dimensions/details should be shown in the drawings/documents for Ex “o” apparatus where applicable.

4.9.1

A general arrangement drawing showing enclosure details.

Bolt/screw hole spacing.

Enclosure material specification.

4.9.2

Pressure relief device and its release pressure for sealed devices.

4.9.3

Breathing device and drying agent details if enclosure is not sealed. A maintenance specification for the drying agent.

4.9.4

Means by which external and internal fasteners are secured from accidental loosening as well as details for securing devices such as liquid level indicators.

Fill and drain plugs.

4.9.5

Liquid level indicating devices with markings to show the minimum and maximum levels for the protective liquid for the temperature range for which the liquid will be subject to in service. Details of the level to which electrical equipment is filled.

4.9.6

Evidence demonstrating that transparent parts will retain their mechanical strength and optical properties when in contact with the protective liquid.

4.9.7

The dipstick and its sealing and guide hole details for non-sealed apparatus.

Details of warning label for replacement of dipstick after use.

Name, description, flashpoint etc. of protective liquid.

4.9.8

Specification of protective liquid including name, description, flashpoint, etc..

4.9.9

Method of sealing and securing devices for draining the liquid.

4.9.10

Oil expansion facility for non-sealed enclosures.

4.9.11

Details of means of interrupting the supply in the event that an internal fault produces evolution of gas

4.9.12

Details of electrical terminations and explosion protection technique applied.

4.10 Powder filling “q”

The following dimensions/details should be shown in the drawings/documents for Ex “q” apparatus where applicable.

4.10.1

General arrangement showing enclosure details, methods of securing the enclosure (e.g. cementing/riveting/welding cementing of screws/lead-seal safety-wiring of screws), material specification and thickness.

4.10.2

The specification of the particle material, the size range of the particles, as well as the filling process and the measures taken to ensure proper filling.

4.10.3

Statement of free volume of any electrical devices or components that have a cavity not filled with powder (e.g. relays).

4.10.4

Total capacitance with tolerance(s) of all capacitors and working voltage of each capacitor.

4.10.5

Cable entry and/or bushing sealing.

4.10.6

Sealing to achieve degree of protection.

4.10.7

Maximum width of gap.

4.10.8

PCB trackwork and component layouts (scaled), PCB coatings, component list with component values and tolerances, minimum distance through filling compound between electrically conductive materials and (i) insulated components and (ii) inner surface of enclosure.

4.10.9

Fuse current rating I_n.

4.10.10

Thermal protection device.

4.11 Cap lamps IEC 60079-35-1

The following dimensions/details should be shown in the drawings/documents for the apparatus where applicable.

4.11.1

Details of enclosure materials on which the type of protection depends – see also 4.1.5.

4.11.2

Segregation distances for all wiring connections and printed wiring boards that can affect the type of protection.

4.11.3

Over-current protection used in the cap light.

4.11.4

General arrangement and sealing details (gaskets, o-rings etc.) for both headpiece enclosure and battery container.

4.12 Electrical resistance trace heating Ex “e” or 60079-30-1

The following dimensions/details should be shown in the drawings/documents for the apparatus where applicable.

4.12.1

For recording the construction of the tested trace heater and cold lead samples: construction and dimensions of the trace heater including: dimension of the conductor(s) and heating element, thickness of primary insulation jacket or any other insulation layers, construction of any evenly-distributed electrically conductive covering, thickness of any over jacket or outer sheath.

4.12.2

For recording the construction of the tested samples of integral components: construction and dimensions of the integral component including: dimension and construction of the electrical connection, if applicable, dimension of the conductor(s), thickness of any insulation layer, construction of any evenly-distributed electrically conductive covering, thickness of any outer sheath.

4.12.3

Maximum withstand temperature.

4.12.4

Other temperature ratings such as: minimum installation temperature, maximum continuous exposure temperature (trace heater de-energized), maximum maintain temperature/maximum continuous operating temperature (trace heater energized), maximum intermittent exposure temperature (trace heater energized or de-energized).

4.12.5

Documentation of the specification of non-metallic materials on which the mechanical strength and the electrical insulation depend (between the heater and other conductive parts) including identification of the material type.

4.12.6

Minimum bending radius of the trace heater and cold lead as applicable as well as the intended area of use with regards to normal or low risk of mechanical damage.

4.12.7

Means of circuit protection of branch circuits to which electrical resistance trace heating is connected.

4.12.8

In the case where stabilized design is applied for the determination of the maximum sheath temperature: the predicted maximum pipe and maximum sheath temperatures, including the specification of applied heat transfer aids, design calculations, system parameters and methods for stabilized design.

4.12.9

In the case where controlled design is applied for the determination of the maximum sheath temperature: the predicted temperature difference between the temperature limiter's set point and the maximum sheath temperature of the trace heater, including the characteristics of the required temperature control device(s).

4.12.10

Electrical parameters such as: rated voltage and rated output or power density or resistance as applicable, maximum rated voltage, characteristic of power output with respect to temperature exposure if applicable, characteristic of start up-current with respect to time (0-300 s).

4.12.11

The intended area of use with regards to UV exposure.

4.12.12

Marking, required documentation and instruction manuals as specified in IEC 60079-30-1:2007 and IEC/IEEE 60079-30-1:2015 Ex 60079-30-1.