Equipment Group II, as appropriate, both when inserted and at the moment of making or breaking of the electrical contact, or the electrical contact between the lampholder and the lamp cap shall be such that on insertion or removal of the lamp cap, the making or breaking of the current occurs only in a separate enclosure complying with the constructional and test requirements of Equipment Group I or Equipment Group II of IEC 60079-1, as appropriate.

Screw lampholders shall be designed to avoid self-loosening of the lamp after insertion. For lamp caps other than E10, this shall be shown by meeting the mechanical test of 6.3.3.

At the moment of contact separation during unscrewing of the lamp, at least two complete threads shall be engaged.

Screw lampholders and lamp caps provided as part of a luminaire need not conform to the requirements of 4.4.2 and 4.3 if they conform to the minimum requirements for creepage distances and clearances in Table 10.

NOTE The insulating material of the lamp cap typically conforms to material group I in Table 1.

Table 10 — Creepage distances and clearances for screw lampholder and lamp cap

Voltage, *U* V	**Creepage distance and clearance** mm
$U \leq 10$	1
$10 < U \leq 63$	2
$63 < U \leq 250$	3
When determining the required values for creepage and clearance, the voltage value in the table may be increased by a factor of 1,1 in order to recognize the range of rated voltages in common use. The creepage distance and clearance values shown are based on a maximum supply voltage tolerance of ±10 %. At 10 V and below, the value of CTI is not relevant and materials not meeting the requirement for material group I may be acceptable.	

5.3.5.2.3 Screw lampholders for screw lamp caps in Level of Protection “ec”

Screw lampholders specified for use in the luminaire shall be one of the non-switched types according to IEC 60238.

NOTE It is not a requirement of this standard that conformity to the lampholder type specification, according to IEC 60238, be verified.

Screw lampholders shall prevent self-loosening of the lamp after insertion. For lamp caps other than E10, this shall be shown by meeting the mechanical test of 6.3.3. The spring elements used shall ensure a contact force of at least 10 N between lamp cap and lampholder. Screw lampholders and screw lamp caps provided as part of a luminaire need not conform to the requirements of 4.4.2 and 4.3 if they conform to the minimum requirements for creepage distances and clearances in Table 10.

5.3.5.3 Lampholders for bi pin lamps

5.3.5.3.1 General

The maximum values for torque and/or force at each end of the lamp occurring when fitting or removing the lamp in the luminaire shall be, for Level of Protection “eb” not more than 50 % and for Level of Protection “ec” not more than 75 %, of the limit values for unused lamps that may be applied to the pins of the lamp specified in IEC 61195.

The mechanical dimensions and the mounting conditions in the luminaire shall take into account the mechanical values and the tolerances for the lamp specifications according to IEC 60061-1 and IEC 61195.

NOTE 1: It is not a requirement of this standard that conformity to the lamp specifications, according to IEC 60061-1 and IEC 61195 be verified.

Bipin lampholders specified for use in the luminaire shall be G5 or G13 according to IEC 60400.

NOTE 2: It is not a requirement of this standard that conformity to the lampholder type specification, according to IEC 60400, be verified.

5.3.5.3.2 Lampholders for bi-pin lamps in Level of Protection "eb"

Lampholders for bi-pin lamps shall conform to the following requirements when mounted in the luminaire.

a) The two pins on each lamp cap shall be connected in parallel, either within the lampholder, or directly adjacent within the luminaire wiring. The current-carrying capacity of each single pin connection shall be rated for the whole current of the lamp, to achieve redundancy.

b) The electrical contact system for each lamp pin shall be independent of the presence of the other pin.

c) The pins of the lamp shall be supported in a manner that minimizes distortion when they are subject to contact side pressure.

d) The electrical contact between each pin of the lamp and the lampholder shall be reliable even under corrosion and vibration conditions. The type tests are given in 6.3.5 and 6.3.6.

5.3.5.3.3 Lampholders for bi-pin lamps in Level of Protection "ec"

In addition to the general industrial requirements, they shall also be designed to make and maintain contact on the barrels of the lamp pins. Contact pressures shall be adequate and the pins of the lamp shall be supported to prevent distortion when they are subject to contact side pressure.

5.3.5.4 Other lampholders and lamp caps

5.3.5.4.1 Single pin lampholder and lamp caps in Level of Protection "eb"

The enclosure formed by the lampholder and the lamp cap, both when inserted and at the moment of making or breaking of the electrical contact, shall conform to the test requirements for non-transmission of an internal ignition of IEC 60079-1 for Equipment Group I or Equipment Group II, as appropriate.

Lampholders and lamp caps, which together after mounting provide a suitable type of protection are also permitted

Lampholders for these tubular fluorescent lamps shall be type Fa6 of IEC 60061-2.

NOTE It is not a requirement of this standard that conformity to the lampholder type specification, according to IEC 60061-2, be verified.

5.3.5.4.2 Bayonet lamp holders

Bayonet lampholders specified for use in the luminaire shall be of the type according to IEC 61184.

NOTE It is not a requirement of this standard that conformity to the lampholder type specification, according to IEC 61184, be verified.

Bayonet lampholders shall incorporate spring contacts so designed that the springs are not the principal means of carrying the current. The connecting wires and their insulation shall not be subject to damage

when the lamp is inserted or removed. The spring elements used shall ensure a contact force of at least 10 N between lamp cap and lampholder.

Bayonet lampholders in Level of Protection “eb” shall only be used for a rated voltage not greater than 12 V and a rated current not greater than 4 A.

5.3.5.5 Requirements for electrical contact between the lampholder and lamp cap in Level of Protection “eb”

The electrical contact to the lamp cap shall be:

a) in the case of screw caps:

   — to the bottom contact of the lamp cap through resilient or spring contact elements with a force of at least 15 N when tested in accordance with 6.4.4.1, and

   — to the lamp cap through at least two threads or through one or more spring elements with a minimum removal torque prescribed in Table 15 when tested in accordance with 6.4.4.2;

b) in the case of cylindrical pin caps through spring elements having a contact force of at least 10 N;

c) in the case of cylindrical plug-in caps, where the design shall not allow electrical sparking in or external to the joint between the cap and holder, through spring elements having a contact force of at least 10 N;

d) in the case of caps where, on removal from the respective lampholder, the circuit is interrupted in a separate flameproof enclosure (complying with IEC 60079-1) in such a way that the contact force exerted by the spring elements on the caps is not less than 7,5 N at the moment of circuit interruption;

e) in the case of bayonet lampholders, the spring elements used shall ensure a contact force of at least 10 N between lamp cap and lampholder.

The above minimum values prescribed for the contact force apply with the lamp fitted to the holder and ready for use.

5.3.6 Auxiliaries for Luminaires in Level of Protection “ec”

5.3.6.1 Glow-type starters

Glow-type starters shall be of the type in which the contacts are enclosed in a hermetically sealed envelope (for example, glass bottle inside a metal or plastic enclosure; the enclosure does not have to be hermetically sealed).

5.3.6.2 Electronic starters and ignitors

Electronic starters and ignitors shall have a starting pulse voltage not exceeding 5 kV and shall be tested in accordance with 6.3.9. Creepage and clearances shall meet the requirements of Table 9. If the case is made of metal, it shall be bonded to the earth terminal of the luminaire. Electronic starters and ignitors that are sealed, potted or moulded in a case shall additionally conform to the relevant requirements of Level of Protection ”mc”.

Circuits which include ignitors that subject internal wiring to high-voltage impulses shall be chosen so that the insulation is satisfactory for such impulses, shall meet the electric strength test of 6.3.7.

5.3.6.3 Starter holders

Contacts shall be resilient and shall provide adequate contact pressure. Compliance shall be checked by the test specified in 6.3.9.

5.3.6.4 Ballasts

Electromagnetic ballasts which are used with ignitors that have a working voltage above 1,5 kV shall not be of the type which can only be used with ignitors having a timed cut-out.

Electromagnetic ballasts subjected to only the 30 day voltage impulse type test shall only be used with timed cut-out ignitors.

If ignitors without timed cut-out are used, the 60 day voltage impulse test procedure based on product standard shall be used.

When conducting the tests to determine maximum surface temperature, the malfunctions to be considered are those defined as the "abnormal conditions" in the general industrial standards for electronic ballasts.

IEC 61347-1 permits certain exemptions to electrical spacings under conditions which are not acceptable for Level of Protection "ec" without further protection. If those reduced electrical spacings are employed, the ballast shall be protected by an internal over current device on the circuit board. However, the electrical spacings, within the ballast, on the supply side of the over current device shall be in line with 4.3 and 4.4. The over current device, if employed, shall have a rated voltage not less than that of the circuit and shall have a breaking capacity of at least 1,5 kA.

NOTE 1 The relevant industrial standard for electronic ballasts is IEC 61347-1.

NOTE 2 The rating of the fuse is normally selected based on the current of the ballast in normal operation, but is sometimes increased due to inrush impulses or transients due to EMC protection devices.

5.3.7 Surface temperatures

5.3.7.1 Luminaires

Under both normal, and in case of Level of Protection "eb", at expected malfunctions or in case of Level of Protection "ec" at regular expected occurrences, the surface temperature of any internal part of the luminaire, or the external surface of the luminaire, shall not exceed the marked temperature class when tested in accordance with 6.3.4.

5.3.7.2 Lamp

The maximum surface temperature of the lamp may exceed the temperature class if the small component exemptions of IEC 60079-0 are applied.

However, even for lamp surfaces with an area greater than 1 000 mm^2, the maximum surface temperature normally permitted based on the auto-ignition temperature of the specific gas atmosphere may be exceeded if the highest surface temperature of the lamp surface inside the luminaire is at least 50 K below the auto-ignition temperature of the specific explosive gas atmosphere for which the luminaire is intended. This shall be determined by tests made in the most easily ignitable concentration of the specific explosive gas atmosphere. No ignition of the surrounding atmosphere shall occur. This dispensation is only valid for the specific explosive gas atmospheres indicated in the marking.

NOTE Measurements on existing luminaires employing lamps with convex glass outer envelopes have established that the surface temperatures of the lamp at which ignition will occur inside the luminaires are considerably higher than the auto-ignition temperatures shown in IEC 60079-20-1 for the same gas.

5.3.7.3 LEDs

As the photon emissions can affect thermocouple readings, care should be taken when temperature measurements are made inside of the focused light emission region. Maximum surface temperature determination shall be done using one of the following methods:

a) an indirect method, by measuring the solder point and then calculating the junction temperature which is then used as the surface temperature of the LED;

b) thermocouple method involving [copper – constantan], no larger than 0.1 mm diameter, adhered with a small drop of silicone adhesive in accordance with the adhesive manufacturer's instructions for application and curing;

c) thermocouple method involving shielded [iron – constantan] or [chromel – alumel] thermocouples adhered with a small drop of silicone adhesive in accordance with the adhesive manufacturer's instructions for application and curing.

NOTE The effect of irradiation on thermocouples can result in temperature measurements that are higher than the actual temperature of the surface being measured if the thermocouples are not shielded from the direct effect of such irradiation.

5.3.7.4 Temperature of lamp caps for tungsten-filament and tungsten-halogen lamps

The temperature at the rim of the lamp cap and at the soldering point of the lamp cap shall not exceed the limiting temperature. The limiting temperature is the lesser of 195 °C or the value specified in 4.8.

5.3.8 Limiting temperatures

The limiting temperature of ballasts, lampholders and lamps shall not be exceeded even in the case of ageing lamps. The luminaire shall be subjected to the type test of 6.3.4. The stabilized temperature of the ballast, lampholder, and the lamp itself shall be less than the limiting temperature, or a cut-off device shall be used to switch off the power before the limiting temperature is exceeded. Resetting of the cut-off device shall only be possible manually (e.g. by switching off the power for resetting).

5.3.9 Luminaires for tubular fluorescent bi-pin lamps

5.3.9.1 General

Luminaires for tubular fluorescent bi-pin lam ps shall additionally conform to the following requirements.

5.3.9.2 Maximum ambient temperature

The maximum ambient temperature for a luminaire with tubular fluorescent bi-pin lamps employing electronic ballast shall not exceed 60 °C.

NOTE This limitation is to achieve a specific temperature class even under the end-of-life conditions for the lamp.

5.3.9.3 Temperature class

As the limiting temperature of a luminaire with tubular fluorescent bi-pin lamps employing an electronic ballast will exceed the temperatures appropriate for temperature classes T5 and T6, those temperature classes shall not be permitted. See 6.3.4.3.

5.3.9.4 Disconnection device

If a device which automatically disconnects all poles of the lampholder is provided in accordance with IEC 60079-0, it shall de-energize each lampholder when the protective cover is removed. When such a device is provided:

a) the device shall be specified as an isolator in accordance with IEC 60947-1 and IEC 60664-1, overvoltage category III, or the contact clearance in the neutral and/or the supply lines shall be at least 2,5 mm each for a maximum supply voltage of 300 V (d.c. or r.m.s.) to achieve the clearance of 2,5 mm, two separate clearances of at least 1,25 mm each may be added together;

b) the contacts shall open upon removal of the protective cover of the luminaire;

c) the device and its operation shall not be capable of being readily defeated without the use of a tool;

NOTE One solution might be IP2X protection according to IEC 60529 of the operating part of the device. Another solution might be that the device can only be closed (after operating) by means of a tool.

d) the device shall be protected using a suitable type of protection.

If a disconnection device is not provided, the luminaire shall be marked per item c) of Table 19 to indicate that the luminaire is not to be opened when energized.

5.3.9.5 Starting voltage for Level of Protection "eb" lamps

If an enhanced voltage is used to initiate discharge within the lamp (for example from an electronic starter/ignitor), the peak value of that voltage divided by $\sqrt{2}$ shall be used to determine the r.m.s. value used in Table 2. The metal ring of the lamp tube shall be assumed to be at the electrical potential of the pins.

If a device within the electronic ballast ensures that starting impulses will be stopped after a maximum time period of 5 s and that a reset is only possible after switching off the supply of the luminaire, then the factor $\sqrt{2}$ may be increased to 2,3.

5.3.9.6 Starting voltage for Level of Protection "ec" lamps

If an enhanced voltage is used to initiate discharge within the lamp (for example from an electronic starter/ignitor), the peak value of that voltage divided by 2 shall be used to determine the r.m.s. value used in Table 2. The metal ring of the lamp tube shall be assumed to be at the electrical potential of the pins.

If a device within the electronic ballast ensures that starting impulses will be stopped after a maximum time period of 5 s and that a reset is only possible after switching off the supply of the luminaire, then the factor 2 may be increased to 3. As the minimum the supply voltage is to be used.

5.3.10 Tests for resistance to impact

For all luminaires intended for fixed installation, the tests for resistance to impact of IEC 60079-0 apply.

For portable and transportable luminaires and handlights the tests for resistance to impact in IEC 60079-0 are modified as shown in 6.3.2.2.

5.4 Analog measuring instruments and instrument transformers

5.4.1 General

The requirements of 5.4.2 through 5.4.7 apply to analog measuring instruments and instrument transformers in Level of Protection "eb".

The requirements of 5.4.7 apply to analog measuring instruments and instrument transformers in Level of Protection "ec".

5.4.2 Limiting temperature

Analog measuring instruments and instrument transformers shall be able to withstand continuously 1,2 times their rated current and/or their rated voltage, as appropriate, without exceeding the limiting temperatures according to 4.8.

Terminals used in conjunction with measuring instruments and instrument transformers are evaluated based on 1,1 times their rated current and are not permitted to exceed the limiting temperature according to 4.8 at that current.

5.4.3 Short-circuit currents

Current transformers and the current-carrying parts of analog measuring instruments (excluding voltage circuits) shall be able to withstand thermal and dynamic stresses resulting from currents equal to at least the values stated in Table 11 for the periods as indicated in 6.4 with no reduction in their level of security against explosions.

Table 11 — Resistance to the effect of short-circuit currents

Current	Current transformer and current-carrying parts of analog measuring instruments
I_{th}	≥ 1,1 × I_{sc} (see 3.14 and Note 2)
I_{dyn}	≥ 1,25 × 2,5 I_{sc} (see Notes 1 and 2)
NOTE 1 2,5 I_{sc} is the maximum peak value of the short-circuit current. NOTE 2 Factors 1,1 and 1,25 are safety factors. It follows that the r.m.s. value of the permissible short-circuit current in service may not exceed I_{th}/1,1 and its peak value may not exceed I_{dyn}/1,25.	

5.4.4 Short time thermal current

The temperature attained during the passage of a current equal to the rated short-time thermal current I_{th} shall not exceed the limiting temperature specified in 4.8 and in no case shall it exceed 200 °C.

5.4.5 Measuring instruments supplied by current transformers

Where the current-carrying parts of analog measuring instruments are supplied by current transformers, the values of I_{th} and I_{dyn} need only equal the current flowing in the short-circuited secondary windings of the current transformer with its primary windings carrying the currents I_{th} and I_{dyn} applicable to them.

5.4.6 Moving coils

Analog measuring instruments with moving coils are not permitted.

5.4.7 External secondary circuits

If the secondary circuit of the current transformer extends outside the equipment, the certificate number shall include the "X" suffix in accordance with the marking requirements of IEC 60079-0 and the Specific Conditions of Use listed on the certificate shall detail the need to guard against the secondary circuit becoming open-circuited in service.

If current transformers are fitted, under open-circuit secondary conditions they can be capable of producing voltages which are significantly in excess of the voltage rating of the terminals employed in the current transformer circuit. Dependent upon the circumstances of a particular installation, it might

be appropriate to take precautions to ensure that dangerous voltages associated with open-circuits cannot occur.

For equipment having current transformers connected to matching transformers in the switchgear (for example a differential protection system), consideration should be given to the effect at the equipment of any possible disconnection of either set of transformers.

5.5 Transformers other than instrument transformers

Transformers other than instrument transformers for which the requirements are given in 5.4 shall be tested in accordance with 6.5.

5.6 Supplementary requirements for equipment incorporating cells and batteries

5.6.1 Type of cells and batteries

5.6.1.1 General

Cells and batteries are differentiated according to the construction and the likelihood of the evolution of electrolytic gases (for example, hydrogen and/or oxygen). This standard places restrictions on the use of cells and batteries according to their type, see Table 12.

Some cells and batteries are, by design, a specific type, i.e. sealed cells, valve-regulated cells or batteries, or vented cells or batteries. For cells and batteries that are valve-regulated by design, they may be able to be applied as if they were sealed in the end-application if abnormal conditions that could cause venting are avoided.

NOTE 1 Examples of such abnormal conditions to consider include:

1) Abnormal ambient conditions, including high ambient storage or use, and extreme low ambient charging.

2) Abnormal charging conditions, including excessive charging or overcharging rate, and extended overcharging.

3) Abnormal discharging conditions, including deep discharging.

4) Abnormal battery/charger combinations due to incompatible charging issues.

For cells and batteries that are vented by design, they cannot be considered any other type.

NOTE 2 In general, Nickel-cadmium and Nickel metal hydride cells and batteries are not, by design, always any one specific type

NOTE 3 IEC 60079-0 includes standard atmospheric conditions that may be exceeded unintentionally should cells or batteries, of any type, vent into a well-sealed enclosure resulting in an elevated pressure flammable mixture with elevated oxygen content. This can occur when the volume of the battery or cell represents a high percentage of the volume of the enclosure a situation commonly occurring in equipment such as hand-held torches. A pressure relief vent is often used to maintain the internal pressure within the limits of the standard atmospheric conditions of IEC 60079-0.

5.6.1.2 Sealed cells

This includes sealed primary cells and sealed secondary cells where the operating parameters are within the manufacturer's recommended limits and any required safety devices are either part of the equipment, or the requirements for them are defined in the equipment documentation in such a way as to give equivalent protection against abnormal conditions that could cause venting. The maximum capacity is 25 Ah.

These types of cells or batteries constructed from these cells may be used in Level of Protection "ec" equipment without additional precautions. The maximum capacity is 25 Ah for either cells or batteries.

The technical requirements and special precautions for Level of Protection “eb” are given in 5.6.2 and 5.6.4 and the verification and tests in 6.6.

5.6.1.3 Valve-regulated cells and batteries

When these valve-regulated cells are applied in Level of Protection “eb” equipment, the cell's limits and control system shall be fully specified.

When the cell’s recommended limits and the control system are not fully specified in accordance with the cell requirements, they may be used in Level of Protection "ec” equipment which does not contain parts which in normal operation produce arcs or sparks. It is, however, acceptable to incorporate these cells or batteries in such equipment provided that they are in a separate compartment in the equipment, vented directly to the atmosphere external to the enclosure. When using these cells or batteries special precautions shall be taken into account.

The technical requirements and special precautions are given in 5.6.2, 5.6.2.11, and 5.6.4 and the verification and tests are given in 6.6.

5.6.1.4 Vented cells and batteries

These types of cells and batteries shall be designed to avoid accumulation of gas in the compartments by venting them to the atmosphere external to the enclosure. The compartments shall contain no other electrical parts employing Type of Protection “e”, except those necessary to make the connections to the cells and batteries.

The technical requirements and special precautions are given in 5.6.2, 5.6.2.11, and 5.6.4 and the verification and tests are given in 6.6.

Table 12 — Types and use of cells and batteries

Type of cell or battery	Capacity of cell or battery	Permitted activity in hazardous area			Remarks
		Discharging	Charging of secondary cells	Additional equipment in the same compartment	
sealed	≤ 25 Ah	Yes	Yes	Yes	–
valve -regulated	No restriction	Yes	Noa	Yes Only “e” “m” with “e” connections “o” with “e” connections	Equipment with Type of Protection “d”, “í” or “q” shall be located in a separate compartment and their integral connections shall not be in same compartment as the battery
vented	No restriction	Yes	Noa	No	–
For charging in hazardous areas, special precautions are required.					

5.6.2 Requirements for cells and batteries ≤25 Ah

5.6.2.1 Encapsulation of cells or batteries

Where cells or batteries are subject to encapsulation, care shall be taken to ensure that any pressure relief facilities are not obstructed. The vent size shall be sufficiently large to prevent dangerous pressurization of the encapsulated assembly at the most onerous predictable release rate from the battery. A minimum of one vent for each cell is required.

If the encapsulation of cells or batteries is used to maintain the type of protection, the encapsulation shall allow for possible expansion of the cells during charging.

NOTE 1 For the purpose of this standard, the terms 'encapsulate' and 'encapsulation' do not imply conformity with IEC 60079-18.

NOTE 2 The physical characteristic of vents will depend upon the type and capacity of the battery arrangements. The effects of ageing on battery capacity can affect the rate of gas evolution from the battery.

5.6.2.2 Use of secondary cells or batteries

Secondary cells or batteries shall not be used in equipment designed for primary cells or batteries or vice versa unless the equipment is designed specifically for use with both.

5.6.2.3 Cell connection

Batteries for Level of Protection “eb” shall be made only of cells connected in series. Batteries for Level of Protection “ec” shall be made of cells connected in series except for the specific case where two cells are permitted to be connected in parallel with no further cells connected in series.

5.6.2.4 Discharge mode

5.6.2.4.1 General

5.6.2.4.1.1 Connecting cells in series

No more than three sealed cells or valve-regulated cells shall be connected in series, unless precautions are taken to prevent reverse charging.

NOTE The actual capacity of a cell might be reduced with time. If this occurs, cells of higher actual capacity can cause cells of lower capacity to reverse.

5.6.2.4.1.2 Deep discharge protection

If a deep discharge protection is installed to prevent reverse charging of cells, the minimum cut-off voltage shall conform to the cell manufacturer's specification. For Level of Protection “eb”, the current in amperes from the battery after switching off the load shall be less than 0,1 % of the rated capacity in Ah.

NOTE Generally, a maximum of six cells can be protected by one deep discharge protection circuit. If too many cells are connected in series, there might be no safe protection due to the tolerances of individual cell voltages and of the deep discharge protection circuit.

5.6.2.4.2 Discharge conditions for Level of Protection “eb”

Where a load current drawn from an Ex Component cell or battery can cause such damage to the battery as to invalidate the type of protection increased safety, the load or safety device shall be specified by the manufacturer. Where the type of protection increased safety is not invalidated, the load need not be specified or safety device provided.

NOTE 1 Specifying the permitted load is only practical for an Ex Component battery as a battery supplied as part of equipment will need to be capable of supplying the connected load of the equipment without invalidating the type of protection increased safety.

For verification and tests of the maximum surface temperature rating, the highest discharge current permitted by the maximum load specified by the manufacturer or by the protection device shall be taken into account, for example 1,7 × rating of the fuse, or at short-circuit if neither load nor protection device is specified.