Is IEC 60079-28 applicable for LED luminaires ?

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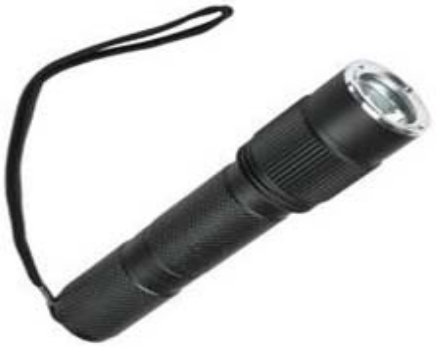
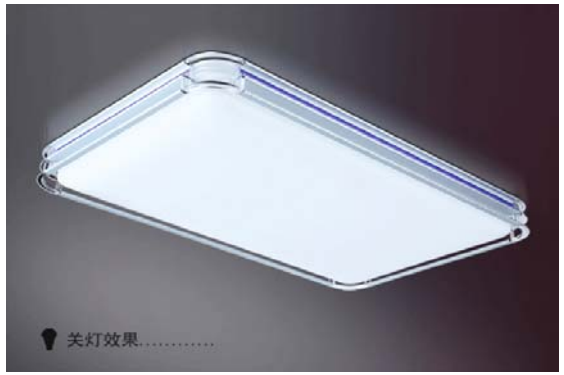
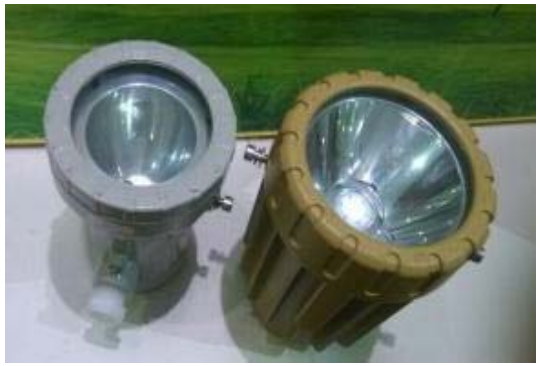
Contents

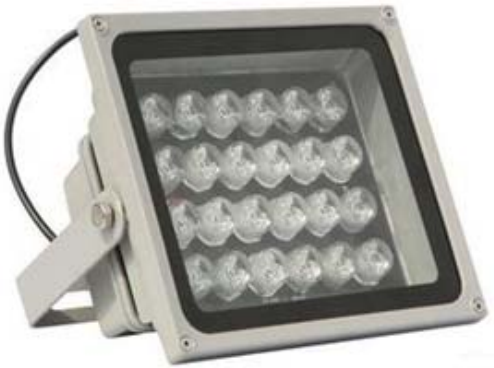
An overview of LED luminaires

- As a new “green” light source (lower consumption & longer life), LED is popular to be used in various luminaires (LED luminaires/ equipment), for example:
  - Strip lighting
  - Emergency lighting
  - Indicator
  - Exit lighting
  - Floodlight
  - Flashlight
  - Torch
  - Caplights
  - ……









- Lights (optical radiation) can propagate from inside to outside of the enclosure of LED equipment.

An overview of LED luminaires (con't)

- There are 13 **possible ignition sources** resulting in ignition hazard according to ISO/IEC 80079-36 :
  - Hot surfaces
  - Flames and hot gases (incl. hot particles)
  - Mechanically generated sparks
  - Electrical ignition sources
  - Stray electric currents, cathodic correction protection
  - Static electricity
  - lightning
  - RF electromagnetic waives ($10^4 \sim 3*10^{12}$ Hz)
  - Electromagnetic waives ($3*10^{12} \sim 3*10^{15}$Hz), including optical radiation
  - Ionizing radiation (mainly generated from LED, laser and etc)
  - Ultrasonics
  - Adiabatic compression and shock waves
  - Exothermic reactions, incl. self-ignition of dusts
- Optical radiation from LEDs might be able to ignite the surrounding explosive atmosphere.

An overview of LED luminaires (con't)

- Due to inconsistent practice of IEC60079-28 btw ExCBs, a FAQ comes, whether we need to consider the possible optical ignition source for LED luminaires.
- In fact, that is similar to the question "what LED light sources are excluded from the scope of IEC 60079-28", which was originally raised by UL LLC, towards generating an ExTAG decision sheet in June 2015.
- Although majority of members consider the FAQ has been clearly answered in IEC 60079-28, ExTAG did not reach consensus until now.

ExTAG/373/CD
June 2015

COLLECTION OF IECEx / ExTAG DECISION

Standard: IEC 60079-28:2015 (Edition 2.0) IEC 60079-28:2006 (First Edition), including I-SH 01	**Clause:** 1 1	
Subject: Scope exception regarding LED light sources **Status of document:** Draft	**Key words:** - Optical radiation - Light-emitting diode - LED - Luminaire	**Date: 2015 06 22** **Originator of proposal:** UL LLC **TC/SC involved:** IEC/TC 31 MT 60079-28

Question
Are all LED light sources included within the scope of IEC 60079-28?

Answer
No. Regarding continuous LED light sources for EPLs Ga, Gb, Da and/or Db, these are included within the scope of IEC 60079-28. However, continuous LED light sources for EPLs Gc and Dc are not included within the scope.

Regarding pulsed LED light sources for all EPLs, these are also included within the scope of IEC 60079-28.

In accordance with Item 2) under the paragraph that details Scope exceptions, all LED light sources are included within the scope of IEC 60079-28 except for continuous divergent LED light sources in EPL Gc or Dc applications.

The Note under this Scope exception provides informative content regarding the reasoning for this limited Scope exception at this time regarding LED light sources.

Consideration should also be given to the other Scope exceptions when determining if a given application of an LED light source is covered under the Scope of IEC 60079-28.

Interpretations to IEC 60079-28

- Existing IEC 60079-28:

  - IEC 60079-28:2006 Ed. 1.0 *Explosive atmospheres – Part 28: Protection of equipment and transmission systems using optical radiation* (covering Group II only, noting IEC 60079-0:2007 supplements the limits for Groups I & III)

  - I-SH01(2014) of IEC 60079-28:2006 Ed.1.0 (covering Groups I and II only)

  - IEC 60079-28:2015 Ed. 2.0 *Explosive atmospheres – Part 28: Protection of equipment and transmission systems using optical radiation* (covering Groups I, II and III and EPLs Ga, Gb, Gc, Da, Db, Dc, Ma and Mb)

- Points of the standards:

  - The scope of existing standards covers all the Groups and EPLs.

  - There are three types of protection “op is”, “op pr” and “op sh” to prevent the ignition source of optical radiation, safe limits and test methods are given.

  - The latest IEC 60079-28 clearly indicates that *optical fibre equipment and optical equipment including LED and laser equipment* is in the scope, except those listed in Chapter 1 scope exception .

Interpretations to IEC 60079-28 (con't)

- Scope exception of IEC 60079-28:

Exclusion 1) is LED related, and excludes LEDs, due to the low radiation & divergent LEDs used.

1) Non-array divergent LEDs used for example to show equipment status or backlight function.

2) All luminaires (fixed, portable or transportable), hand lights and caplights; intended to be supplied by mains (with or without galvanic isolation) or powered by batteries:

   – with continuous divergent light sources (for all EPLs),

   – with LED light sources (for EPL Gc or Dc only).

This is just for luminaire with light sources other than LED light sources. It is not relevant to LED luminaires.

This is LED related, and should be read as the exclusion of LED light sources for EPL Gc and Dc.

It means all the LED luminaires (other than for Gc and Dc) are within the scope of IEC 60079-28.

N… …or other than EPL Gc or Dc are not excluded from the sta… …oncerns regarding high irradiance.

3) Op… …or Gc and Db or Dc applications which comply wi… …60825-1.

? Are those Gc, Dc luminaires with LED source exceeding those safe limits, safe in hazardous are?

NO… …hat involve emission limits below 15 mW measured at a dis… …rdance with IEC 60825-1, with this measured distance ref…

4) Single or multiple optical fibre cables not part of optical fibre equipment if the cables:

Interpretations to IEC 60079-28 (con't)

Exclusion 5) is not relevant to LED luminaires. The enclosures should be considered as enclosed enclosures without any release of optical radiation.

– g with additional protective means, Db, Mb, Gc or Dc),

– L Gc or Dc).

5) Enclosed equipment involving an enclosure that fully contains the optical radiation and that complies with a suitable type of protection as required by the involved EPL, with the enclosure complying with one of the following conditions:

– An enclosure for which an ignition due to optical radiation in combination with absorbers inside the enclosure would be acceptable such as flameproof "d" enclosures (IEC 60079-1), or

– An enclosure for which protection regarding ingress of an explosive gas atmosphere is provided, such as pressurized "p" enclosures (IEC 60079-2), restricted breathing "nR" enclosure (IEC 60079-15), or

– An enclosure for which protection regarding ing s provided, such as dust protection "t" enclosure

? How to verify the potential absorbers left during production, daily maintenance and repair.

– An enclosure for which protection regarding ingress of absorbers is provided (such as IP 6X enclosures) and where no internal absorbers are to be expected.

NOTE 4 For these scope exclusions based on enclosure constructions, it is anticipated that the enclosures are not opened in the explosive atmosphere, so that ingress is protected.

Interpretations to IEC 60079-28 (con't)

- Different interpretations on the scope exception of IEC 60079-28 lead to the inconsistencies btw ExCBs. The following are **opinions** from experts in China:

- the optical radiation as possible ignition sources can exist both **inside** and **outside** the enclosure of the LED equipment.

- No supplemental protection needed for the optical radiation **inside** of Ex d, m, t, p, nR or nC enclosures.

- The optical radiation on the surface or **outside** of those enclosure could be protected by type of protection "op is" , which shall be verified by testing and assessment according to IEC 60079-28 (required EPL and fault conditions).

- Industry needs an ExCoC based on Entity Explosion Protection - eliminating all the possible ignition sources.

Survey on use of IEC 60079-28

- In 55 accepted ExCBs, 30 ExCBs having the scope of IEC60079-28.
- In 59 accepted ExTLs, 28 ExTLs having the scope of IEC60079-28.
- Certificates Statistics (as of 22 July 2016):

  There are 1000 certificates issued to luminaires using LED light sources, as registered in IECEx website. Majority of them are Ga, Gb, Da and Db equipment, in which:

  - only 94 certificates refer to the standard IEC 60079-28
  - only 64 certificates indicate with “op is” in Ex marking
- The statistics indicates the understanding to the standard are different among ExCBs/ExTLs .
- Those LED luminaires IECEx certified against IEC 60079-28, there are inconsistencies existed obviously.
- This has attracted attentions of manufacturers and product-users.

Survey on use of IEC 60079-28 (con't)

- Example 1 of incons… … Luminaires (with similar power ratings and equipment structure)

ExCB	Listed S…	Ex marking	
ExCB-1	IEC 60079-0:20…, IEC 60079-28:2006, IEC 60079-3… IEC 60079-7:2006	Ex e mb op is IIC T5 Gb Ex tb op is IIIC T85°C Db	
	…0079-0:2011, IEC 60079-18:201… …079-28:2015, IEC 60079-31:201… …079-7:2015	Ex eb mb op is IIC T5 Gb Ex tb op is IIIC T100°C Db	March 2016
	…079-0:2011, IEC 60079-1:2007 …079-28:2006, IEC 60079-31:2013 …0079-7:2006	Ex d e op is IIB T4 Gb Ex tb IIIC T100°C Db	March 2015
ExCB-3	IEC 60079-0:2011, IEC 60079-1:2007 IEC 60079-31:2013	Ex d IIB T4 Gb Ex tb IIIC T130°C Db	April 2016

? The markings for dust is different btw ExCB-1&2.

Note: Ed.1 & its I-SH01 apply to Group I and II only, and Ed.2 covers all Groups and EPLs.

Except the certificate issued by ExCB-3, the markings with "op is" for gas are consistent.

? No optical radiation assessment information available, is the product certified by ExCB-3 in accordance with IEC 60079-28? Is the certified luminary safe against optical radiation?

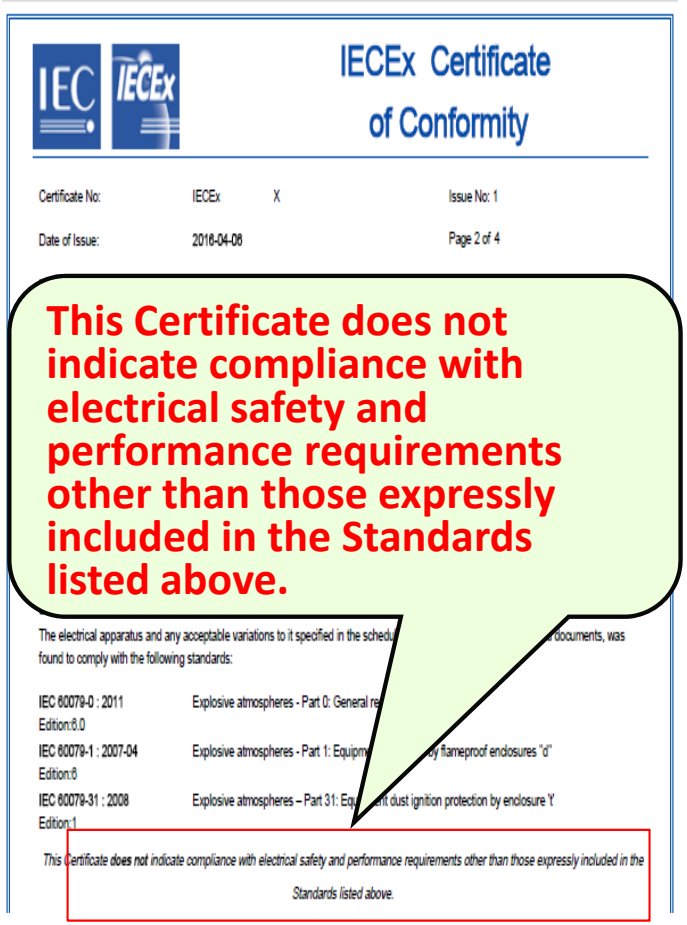
- ExCB-1&2 tested and assessed the luminaires against IEC 60079-28, but ExCB-3 did not.

Survey on use of IEC 60079-28 (con't)

- Industry feedback: Application-based certification is not a good practice. End-user needs an ExCoC based on Entity Explosion Protection - eliminating all the possible ignition sources.

  - When an applicant applies for an ExCoC against limited standards (e.g. exclusion of IEC 60079-28), or an ExCB doesn't have the scope of the specific STD, ExCB can certify it as the scenery. But the ExCB has to identify all the possible ignition sources and indicates as Conditions of Certification in IECEx CoC.

- Industry feedback: When ExCB doesn't identify an existing ignition source, which is out of the listed standards in CoC, the current statement as a safe measure in CoC is not sufficient.


IECEx Certificate of Conformity

Certificate No: IECEx X Issue No: 1

Date of Issue: 2016-04-08 Page 2 of 4

This Certificate does not indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.

The electrical apparatus and any acceptable variations to it specified in the schedu documents, was found to comply with the following standards:

IEC 60079-0 : 2011 Explosive atmospheres - Part 0: General re
Edition:6.0

IEC 60079-1 : 2007-04 Explosive atmospheres - Part 1: Equipm by flameproof enclosures "d"
Edition:6

IEC 60079-31 : 2008 Explosive atmospheres – Part 31: Eq t dust ignition protection by enclosure 't'
Edition:1

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

Survey on use of IEC 60079-28 (con't)

- Example 2: for LED floodlight **(with similar power ratings and equipment structure)**

There are similar inconsistencies as listed in Example 1.

Furthermore…

	Listed Standards in CoC	Ex marking	Issued date
	IEC 60079-0:2011, IEC 60079-1:2007 IEC 60079-31:2013, IEC 60079-7:2006	Ex d e IIC T4 Gb Ex tb IIIC T135°C Db	
ExCB-B	IEC 60079-0:2011, IEC 60079-1:2007 IEC 60079-28:2015, IEC 60079-31:2013 IEC 60079-7:2006	Ex db eb op is IIB T4 Ex tb IIIC T80°C Db	
ExCB-C	IEC 60079-0:2011, IEC 60079-1:2007 IEC 60079-31:2013, IEC 60079-7:2006	Ex d e IIB T6 Gb Ex tb IIIC T85°C Db	January 2014
ExCB-D	IEC 60079-0:2011, IEC 60079-1:2007 IEC 60079-28:2006, IEC 60079-7:2015	Ex d e op is IIB+H_2 T4 Gb	January 2015
ExCB-E	IEC 60079-0:2011, IEC 60079-1:2007 IEC 60079-18:2009, IEC 60079-31:2013 IEC 60079-7:2006	Ex d e mb IIC T6 Gb Ex tb IIIC T82°C Db	July 2016
ExCB-F	IEC 60079-0:2011, IEC 60079-11:2011 IEC 60079-28:2006	Ex ib op is IIC T4 Gb	January 2016
ExCB-G	IEC 60079-0:2011, IEC 60079-11:2 IEC 60079-26:2006		June 2015
ExCB-D	IEC 60079-0:2011, IEC 60079-15:2010 IEC 60079-28:2006, IEC 60079-31:2008	Ex nR op is IIC T6…T5 Gc Ex tb IIIC T80°C …T95°C Db	June 2015

? The marking for dust didn't indicate the symbol "op is"

Note: Ed.2 applies to Group III.

? Does IEC60079-28 apply to EPL Gc

Conclusions

- Optical power /optical irradiance is a possible ignition source, and may ignite surrounding explosive atmospheres.
- IEC 60079-28 does apply to all the luminaires with LED light sources (other than for EPLs for Gc and Dc).
- The CoC of the certified equipment against IEC 60079-28 shall contain the information of standards and Ex marking properly.
- So-called application-based certification is not a good practice. Industry needs certificates based on Entity Explosion Protection. In case a CoC did not cover risk assessment on optical radiation, a statement is required.
- A DS or OD is expected to harmonize the application of IEC 60079-28 within IECEx based on cooperation with relevant MTs.

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Many thanks for your attention!

For further information, please visit:

www.nepsi.org.cn or www.sitiias.com.cn