TECHNICAL NEWS

CORTEM GROUP
To be sure to be safe.

May 2020

The barrier cable gland: moldable sealant (two-component filler) vs auto-forming sealant (two-component resin)

1. Preface: the selection of the cable gland

In the plant concept it has always been of primary importance the physical separation between safe area and classified area. This concept was applied in the electric energy transport systems by means of cables buried in sand bed and then derived to the user (an electric motor or a junction box or an end user) with the use of a conduit tube suitable for the insertion of electrical cables (Freez-Moon) free from internal ridges and terminated on the end user through a physical separation made with explosion-proof sealing device (for example a sealing fitting).

With the advent of the IEC/EN 61241-0 and IEC/EN 60079-0 standards, as well as the IEC/EN 60079-1 standard, changed the concept of cable entry in electrical and electronic equipment suitable for areas with danger of explosion, allowing to have the cable entry with appropriate sealing cable gland. Lately, the IEC 60079-14:2013-1/EN 60079-14: 2014-03 standards, which describes the design, selection and installation of electrical systems in explosive atmospheres, introduced, in the paragraph 10.6.2, the selection criterion of cable glands to be used for cable entry into electrical and electronic equipment suitable for installation in such atmospheres. This means that substantial changes have occurred over time. The effect of regulatory unification, both in Europe and internationally, changed the concepts of classification from a "Rigid" system, a system that provided unique dimensional parameters, to a "Calculation" system according to the type of gas, the concentration, the aeration capacity of the classified area and other process parameters that have become a prerogative of the process engineer.

For a greater clarity and to give a precise description of this conceptual variation, in the graphs below we show the differences between the previous version of the standard IEC 60079-14: 2007-12/EN 60079-14: 2008-10 and the version currently in force of the IEC 60079-14:2013-11/EN 60079-14:2014-03, *fully reporting what is described in these standards*.

In the previous version, in the paragraph 10.4.2, it is described as follows:

Note: the versions of the mentioned standards within this description must obviously be those aligned with the date of issue of these rules.

"10.4.2 Selection of cable glands"

The cable entry system shall comply with one of the following:

a) cable glands in compliance with IEC 60079-1 standard and certified as part of the equipment when tested with a sample of the particular type of cable;

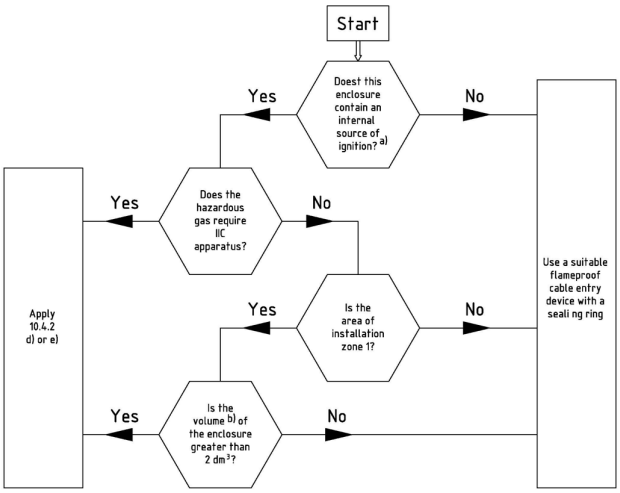
b) when a cable, in compliance with 9.3.1 (a) (from 9.3.1 a) *"with a sheath in thermoplastic, thermosetting or elastomeric material. They must be circular, compact, have the extruded insulation and any filler must be non-hygroscopic")* is substantially compact, a flameproof cable gland, in compliance with IEC 60079-1, may be used if it incorporates a sealing ring and it is selected in accordance with Figure 2.
The compliance with the fig. 2 is not required if the cable gland complies with the 60079-1 standard and if a sample of the specific cable has been subjected to repeated ignition tests of the flammable gas inside of a junction box and no ignition occurs outside the box.

c) mineral-insulated cable with metal-sheathed cable with or without plastic outer with an appropriate flameproof cable gland complying with IEC 60079-1;

d) flameproof sealing device (for example a sealing chamber) specified in the equipment documentation or complying with IEC 60079-1 standard and using a cable gland suitable for the cable used. The sealing device shall incorporate compound or other appropriate seals which permit the sealing around individual cores. The sealing device shall be placed at the point of entry of cables into the equipment;

e) flameproof cable gland, specified in the equipment documentation or complying with IEC 60079-1, filled with compound seals or elastomeric seals that seal around the individual cores or other equivalent sealing arrangements.

Figure 2



a) internal sources of ignition include sparks or equivalent temperatures occurring in normal operation which can cause ignition. An enclosure containing terminals only or an indirect entry enclosure (see 10.4.1 of IEC 60079-14) is not considered an internal source of ignition.

b) The term “volume” is defined in IEC 60079-1 standard.

In the current version, in paragraph 10.6.2, it is described as follows:

Note: the versions of the mentioned standards, within this description, must obviously be those aligned with the date of issue of these rules.

"10.6.2 Selection of cable glands"

The cable entry system shall comply with one of the following:

a) Sealed cable glands provided with a special compound (barrier cable glands) according to IEC 60079-1 and certified such equipment;

b) Cables and cable glands that meet all of the following:
   - Cable glands according to IEC 60079-1 and certified as equipment
   - Cables used according to the specifications of Article 9.3.2 a) of IEC 60079-14 (Note 1)
   - The length of the cable is at least equal to 3 m (Note 2)

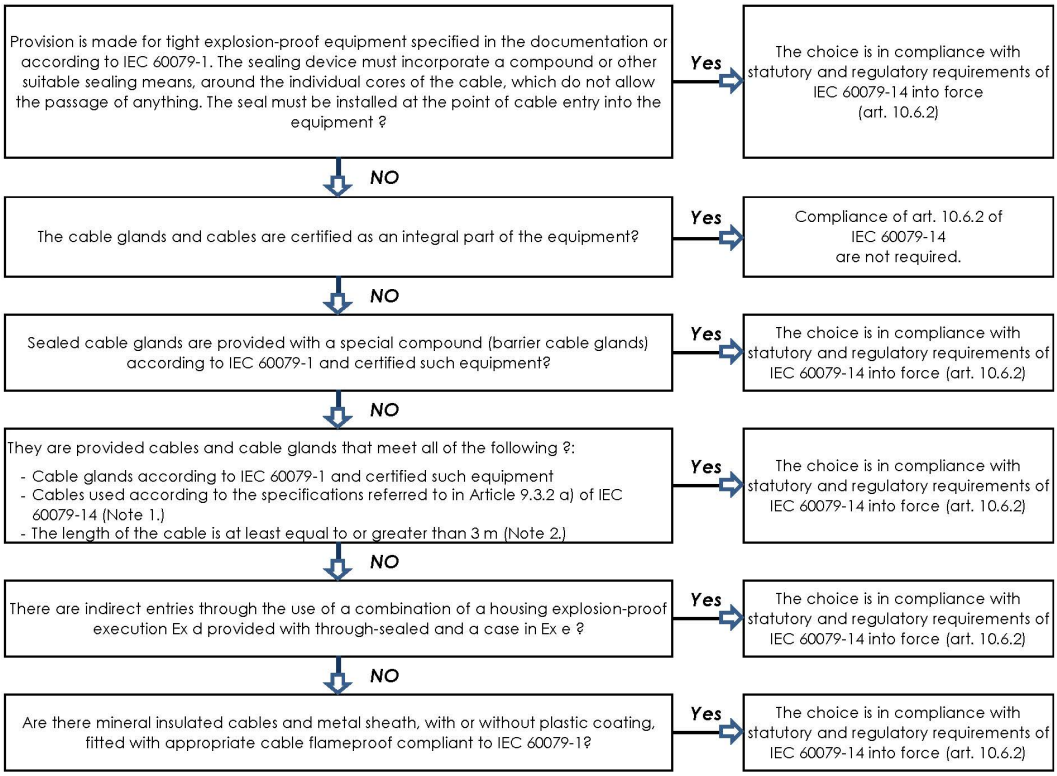
c) indirect entries through the use of a combination of an ‘Ex d’ explosion-proof junction box provided with sealing bushing and a ‘Ex e’ junction box

d) mineral insulated cables and metal sheath, with or without plastic coating, fitted with appropriate flameproof cable gland compliant to EN 60079-1

e) explosion-proof equipment specified in the documentation or according to IEC 60079-1. The sealing device must incorporate a compound or other suitable sealing means, around the individual cores of the cable, which do not allow the passage of anything. The seal must be installed at the point of cable entry into the equipment.

Note 1 The minimum cable length is specified to limit the potential hazard due to flame transmission through the cable (see also Annex E of the same standard)

Note 2 If the cable gland and the cables in use are certified as a part of the equipment (enclosures), the compliance to 10.6.2 paragraph is not necessary.



Note 1 With a sheath in thermoplastic material, thermosetting or elastomeric. They must be circular and compact. Any padding or sheathing must be extruded. Any fillers must be non-hygroscopic.

Note 2 The minimum cable length is defined in order to limit the potential danger due to the transmission of flame through the cable. For the test procedures of restricted breathing cable (Appendix E, extracted from EN 60079-14), you have to use a piece of cable with a length of 0.5 m to be tested, once installed in a sealed junction box of 5 liters (± 0.2 liters), in conditions of constant temperature. The cable is considered acceptable if the interval of time required to bring down to 0.15 kPa (15 mm of water column) an internal overpressure of 0.3 kPa (30 millimetres of water column) is equal to or greater 5 s.

It is therefore evident that, following the entry into force of the new version of the IEC 60079-14 standard, the scenario has changed, and the use of barrier-type cable glands results of primary importance.

2. The methods of sealing of the barrier-type cable glands

What kind of sealant should be used to achieve a perfect flameproof protection on barrier-type cable glands?

There are two different methods to be used for the realization of the "Barrier".

One, which uses as a sealant the semi-solid type with two components, the other that uses a resin, also two-component, but in the liquid state.

The first system uses the semi-solid sealant and must be performed the following operations:

- mixing the two semi-solid components, thus causing a chemical reaction of unification
- inserting a minimum part of this compound inside the cable cores and, subsequently, covering all the surrounding parts
- inserting the whole into the housing provided in the cable gland.

This operation, after hardening, does not allow a complete filling (presence of air pockets). Moreover, during the polymerization phase of the compound, the cables must not be touched at all, to avoid the formation of air interstices between the cable sheath and the compound.

The second system uses the bi-component resin and must be performed the following operations:

- preparing the "cable head", inserting the special pre-drilled cap for the effective diameter of each individual core
- filling with the bi-component resin prepared previously or from the single package supplied with the barrier cable gland. This operation must be carried out directly inside the housing designed for this function.

This second system, being the resin of the liquid type, guarantees a perfect penetration between the individual cores and outside them, guaranteeing in fact a correct finishing in full compliance with the reference standard.

Cortem Group, always attentive to plant requirements, after a careful analysis on installation problems, has favoured the second system that allows the installer to carry out a correct system and, at the same time, verify that it corresponds to the installation instructions given along with the cable glands.

We conclude by recalling that all activities aimed at sizing and selection are the prerogative of the designer who must always refer to the specific mandatory regulations and that he is entirely responsible for the analyses, calculations and the consequent executive project, certifying the compliance with the regulations.

Cortem Group barrier cable glands NAVB, NEVB series for non-armoured and armoured cables