

January 2017

The use of the sealing fittings in explosion-proof electrical equipment

(Ex d IIB, Ex d IIB + H2 and Ex d IIC)

In electrical equipment in which it's necessary to have a physical separation for the limitation of the flame passage, such as petrochemical, oil and gas, chemical industrial plants and, generally, in places with a potentially explosive atmosphere and the possible presence of gas and dust, must be used specific limitation devices such as sealed cable glands or sealing fittings.

During the inspection operations of facilities, the sealing fittings have been found too many times not installed as indicated by the manufacturer or not filled with the specific sealant material provided with the sealing fittings or even missing between two adjacent boxes. This is due to the superficiality of the operators in charge of assembly operations, safety supervision and testing.

This carelessness and failure to comply with the manufacturer's requirements will invalidate every product guarantee (and this would be the lesser of evils), involving a huge risk to the safety and functionality of the system, with possible health risks and damage to operators. Furthermore, it can cause economic damage for the loss of production in case of functional failure and out of order of the equipment.

The difference between the functions of "Designer", "Installer", " Safety supervisor " and "Maintenance Technician" is:

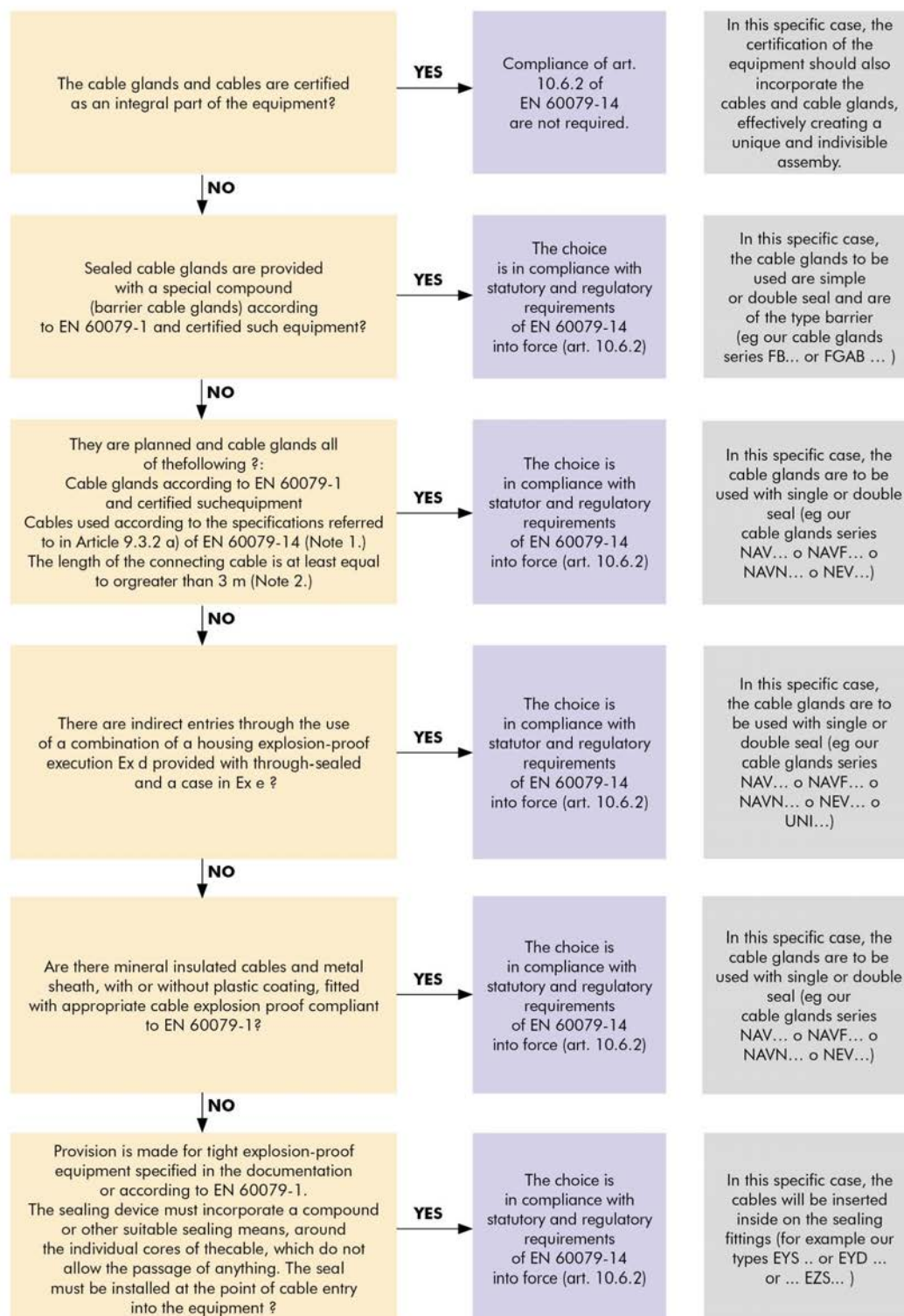
- The designer has the task of size properly the sealing fittings, evaluating, in addition to all the primary variables such as the size of the cable for current flow, voltage drop, type of cable, temperature class commensurate to enclosure or end user temperatures, even the correct filling of the sealing fittings, respecting the provisions of EN 60079-14 IEC 60079-14 Standards in paragraph 9.4, taking care to "fill" the joint up to a maximum of 40% of its section (if included 3 or more conductors in the same fitting).
- The installer must perform in the best way, and respecting all the provisions in the plant according to EN 60079-14 and IEC 60079-14 Standards, as designed and planned by the designer.
- The security supervisor has the task of checking that the installer has performed all the provisions of the project in the best way and in compliance with the relevant Standards. Furthermore, he has to check the overall functionality of the system and the correct mounting and sealing of the sealing fittings.
- The mechanical maintenance technician has the task of keeping operating all the electrical equipment, that can be the cause of physical or material damage due to lack of controls over time, routine cleanings and compliance to all the instructions given by the manufacturer in the owner's handbook.

The Standards EN 60079-14 and IEC 60079-14, at paragraph 10.6.2, specify the choosing of the entry system, as shown in the following diagram.

TECHNICAL NEWS



To be sure to be safe.



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.

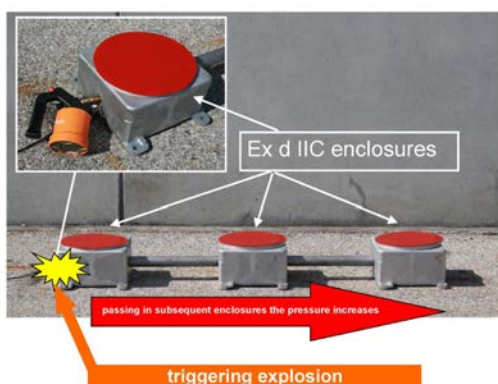
Note 2. The minimum cable length is defined in order to limit the potential danger due to the transmission of flame through the cable. For the test procedures of restricted breathing cable (Appendix E, extracted from EN 60079-14), you have to take a piece of cable with a length of 0.5 m should be tried, once installed in a sealed 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 millimeters of water column) is equal to or greater 5 s.

One of the possible solutions, as mentioned above, is the use of sealing fittings, which are subdivided into types such as:

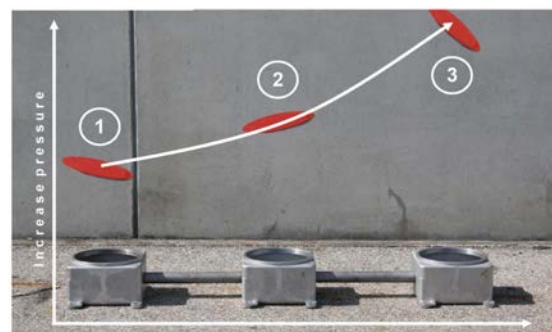
- ✓ Sealing fittings for vertical installation only, divided into two types such as:
 - EYS series for direct coupling to the equipment, with or without interposition of tube (length not greater than the nominal diameter of the joint);
 - EYD series for piping coupling downstream with the appropriate drainage device for any condensation developed in the piping for temperature variation.
- ✓ Sealed joints for installation both horizontal and vertical, divided into two types such as:
 - EZS series for direct coupling to the equipment, with or without interposition of piping/curves.
 - EZD series for piping coupling downstream with appropriate drainage device for any condensation developed in the piping for temperature variation.

The most important thing for a proper functionality of the equipment and to avoid the spread of fire/explosion is the correct installation of sealing devices next to the equipment to be protected, as clearly indicated in paragraph 13.5.3 of EN 60079-1 / IEC 60079-1, where it is written that *"the distance from the nearest surface of the sealing to the housing (or the housing provided for final use) and the outer wall of the housing (or the housing provided for final use) must be as small as possible but in no case be greater than the size of conduit or 50 mm, whichever is the smaller of the two values"*, whereas the same standard defines that *"a sealing device is considered to be inserted immediately on entry of the explosion-proof housing when the device is fixed to the same directly or by means of a coupling accessory"*.

The consequence of non-compliance with the provisions of the above rules, the non-use of sealing devices, such as the sealing fitting, involves the propagation of the flame and consequently the explosion inside the box and to the boxes directly related to the system, with increased pressure, as shown in the pictures below.



Ignition and explosion propagation to coupled enclosures



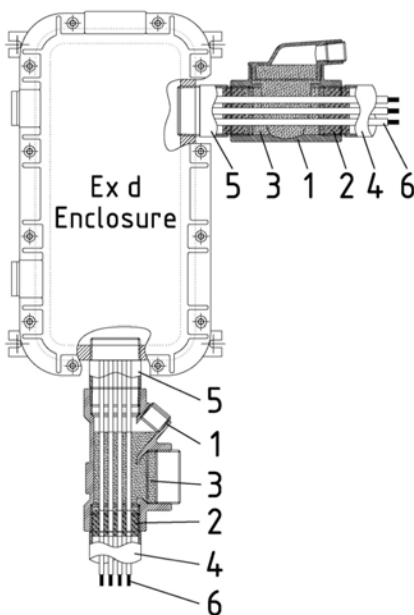
In this picture you can note the increase of pressure between an enclosure and the subsequent, determined by the absence of the sealing fittings between the enclosures

In phase 1 the first explosion occurs and spreads to the following enclosures, due to the lack of sealing fittings. During the phase 2 the pressure increases, causing a second burst of greater power. This explosion spreads in the following enclosure, phase 3, causing a subsequent burst with further increase of the explosive power.

It's evident that without appropriate sealing devices will probably occurs serious damage to people and property.

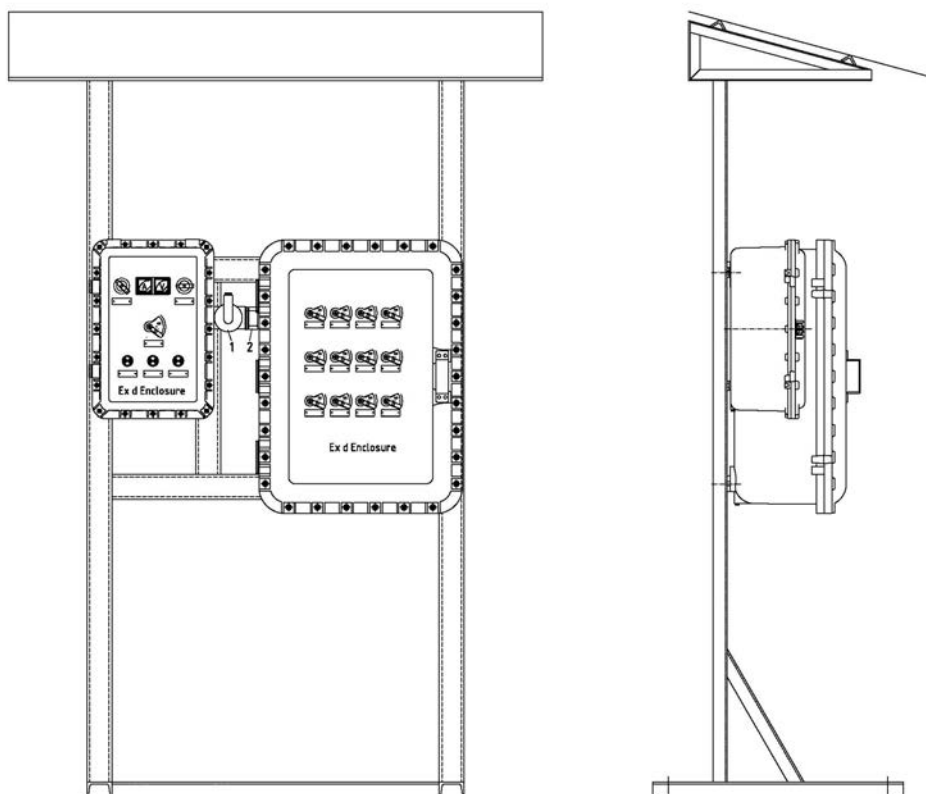
Obviously, in order that the sealing device (sealing fitting) performs their specific protection function to not propagate the flame between an enclosure and the other, must be installed respecting all the requirements of use and maintenance provided by the manufacturer, mandatory to ensure the functionality.

The correct assembly, as illustrated in the diagram below, is to install EYS sealing fittings vertically, while EZS horizontally, although this type of coupling can also be installed horizontally, thanks to its design that allows to rotate the filling inlet, in order to bring it on the verticality and thus facilitating the filling with the specific sealant.



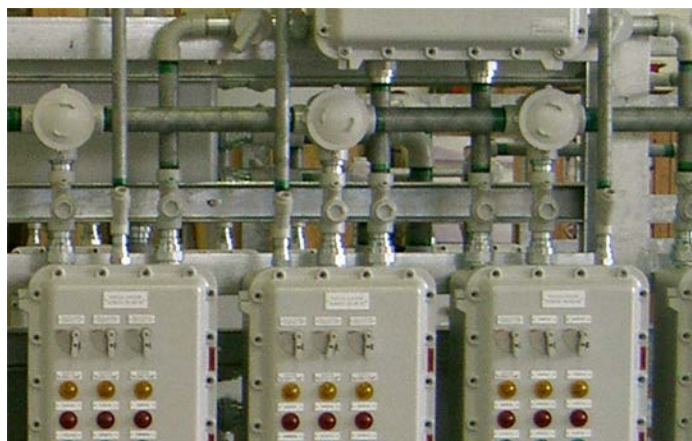
1. Sealing fitting
2. Filling with synthetic or natural fiber
3. Sealant
4. Conduit
5. Coupling nipple
6. Feeder cable or single core conductors with double sheath

In the case of joints installed on a set of equipment supplied complete and assembled, the manufacturer must install and fill the sealing fittings after testing and before being shipped to the plant, in accordance with the provisions of standard EN 60079-14 IEC 60079-14, paragraph 9.4.



1. Sealing fittings
2. Three pieces union plus coupling nipple

The installer is not allowed to proceed with the assembly, in accordance with the provisions of IECEx OD 203 (IECEx OPERATIONAL DOCUMENT), as *"Guidance on the definition of 'manufacturer' in relation to trade agents"* and *"local assemblers"*. This is why they are part of an indivisible integrated system and, therefore, assembled only and exclusively by the original manufacturer or qualified assembler recognized by the original manufacturer.



In the case of sealing fittings to be fulfilled in the field, for example near local control stations, motors or lighting fixtures, the installer is in charge for their installation and sealing, strictly complying with all the requirements of installation instructions issued by the manufacturer and using only and exclusively the compound provided by the manufacturer of the sealing fitting. It's not allowed the use of other types of compound respect to the one supplied with the sealed joint because the guarantee shall be invalid.

During the filling operations of the sealing fittings, the installer must make a careful choice of the type of joint, vertical or horizontal, and must be very careful in determining the size of the coupling, whereas the "filling" must be done respecting the manufacturer's instructions, and if with the insertion of more cables, in accordance with the provisions of EN 60079-14, IEC 60079-14 Standards, paragraph 9.4.

In conclusion, the foregoing is intended to be a guide and, at the same time, a warning for designers, installers, security supervisors and maintenance operators to consider a particular product such as the sealing fitting, apparently insignificant in the context of a major plant such as a refinery or other, an object of vital importance to be installed in a proper way.