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RAPID Ex

Barrier Glands Made Easy

The Fast Curing, Gas Blocking, Liquid Resin Seal

CMP PRODUCTS

Sealing cables in explosive atmospheres

Electrical power, control and instrument cables are manufactured to a host of different national and international construction standards. The matter of correctly sealing these cables as they enter hazardous area electrical equipment is an essential safety requirement the world over. Ensuring that the installed cable entry maintains the protection method of the associated equipment is a safety critical aspect of the installation which should not be treated lightly.

Sealing ring or barrier seal?

In some cases the sealing of cables may be achieved using a cable sealing ring applied to the extruded inner cable bedding, a method which is permitted in some hazardous area situations. However the cable to be used must be evaluated first to ensure it is suitable for the application of a cable entry with a sealing ring, otherwise a barrier seal may be necessary. Even when cables are deemed to be suitable for being sealed by a sealing ring other factors laid down in statutory installation standard requirements determine that this may not be a safe scenario. (see page 9 for further guidance)

When flameproof Type 'd' enclosures (also categorised Ex d) are encountered the cable entry selection is most critical, as this protection method relies upon the principal of 100% containment. Some Ex d equipment is manufactured utilising factory sealed cables, or barrier bushings that seal around individual cables used to interconnect between two hazardous area enclosures. However the vast majority of Ex d equipment is connected using cables that have been installed on site using suitably certified Ex d cable entry devices, these being either a cable gland with a sealing ring, a barrier gland, or cable sealing stopper box.

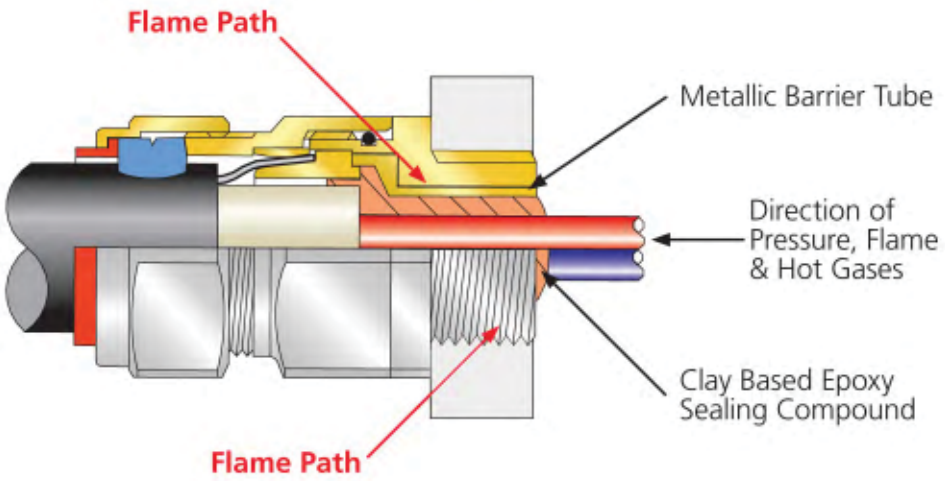
For Flameproof Type 'd' (Ex'd) enclosures a barrier seal provides the very best method of sealing cables as they enter the electrical equipment. In certain circumstances, if the wiring code in operation allows it, elastomeric sealing rings may be permitted to seal between the cable and the gland body, but only where specific restrictions on the cable construction are satisfied. If in doubt, barrier seal cable glands should be used.

Under NEC conditions an approved barrier seal must be used.

What is a Barrier Gland?

A barrier gland is an Explosion Protected (or explosion proof) cable gland incorporating a sealing chamber through which the individual insulated cable conductors are passed, and a barrier is formed around the conductors. This ensures that gas migration through the cable is prevented and also provides a flame barrier if an explosion occurs, thus maintaining the explosion protection integrity of the equipment to which it is connected. It is essential that the barrier seal is created correctly and this requires a higher level of competence than would normally be required for the installation of a hazardous area cable gland incorporating a sealing ring.

Typical Flameproof Type 'd' Compound Barrier Cable Gland mounted on SWA Cable



What issues exist with Barrier Gland installations?

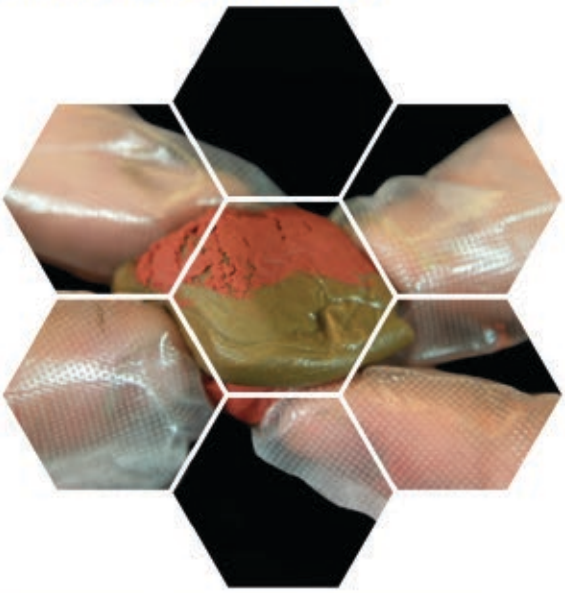
Traditional barrier type cable glands employing epoxy/clay based sealing compound have been used in hazardous areas for many years to provide effective explosion protection.

The barrier material is a two part formula that needs to be mixed thoroughly on site at each cable end before application. This is not only time consuming but requires extreme diligence. However a certain degree of risk is associated with this traditional installation process and this risk increases with the number of conductors in multi-core cables.

The standard technique involves the "packing" of the sealing compound between and around the individual cable conductors which is required to form a complete seal, and then leaving the assembled cable gland to cure, without disturbance, for several hours before connecting the cable to the equipment.

Failure to correctly perform the mix and / or application of the compound, or premature disturbance of the conductors may lead to critical failure of the barrier seal, or extensive rework being required, assuming that such an error can be detected.

One of the major challenges with the packing of compound is avoiding channels, voids or air gaps. 'Channels' in the barrier (caused by movement of the cores) are easy to identify but voids within the barrier are almost impossible to detect especially when multi conductor instrument and control cables are installed.



Examining the surface of the cured compound externally is no guarantee of the overall integrity of the barrier seal.

Regardless of which brand of barrier gland is selected, the difficulty of ensuring the integrity of the barrier seal is one of the key reasons why many clients remain sceptical over the reliability of the epoxy/clay based material.

Is there a more reliable solution?

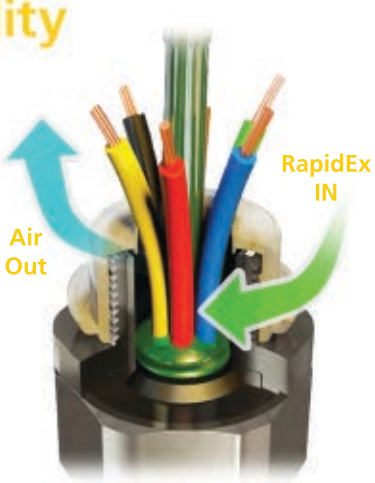
Considering the high volume of multi conductor control cables and multi-pair instrument cables installed in hazardous areas there needs to be a better solution that delivers more reliability to the installation, and gives the user more confidence in the method of application.

If risks can be reduced significantly by using a solution that is easier to work with and more likely to be right at the first time of asking, then this option should be pursued vigorously in the interests of enhanced safety.

Examples of typical multi-core cables

A revolutionary sealing solution for barrier glands that delivers increased reliability

RAPID Ex is a Liquid Pour, Fast Curing, Liquid Resin Seal that installs in seconds and cures in minutes. Its unique formula begins with a low viscosity liquid that flows into the cable interstices completely surrounding the cable conductors, driving out the air in the process. The viscosity then increases and completely cures in minutes, dependant on ambient temperature (see comparison graphs on page 5).



RapidEx benefits

RAPID Ex **is a revolutionary sealing system that gets right to the heart of the cable interstices and can be reliably installed in no time at all.**

- Simple cable preparation,
- Easy liquid pour RapidEx resin application,
- Cleaner, faster mixing process,
- High consistency of liquid pour fill,
- Fully compatible with IEC & CEC / NEC wiring code rules,
- Thermal endurance / age tested to the latest version of IEC 60079-0,
- Explosion pressure tested to IEC 60079-1:2007, CSA-C 22.2 and UL 2225,
- No need for repeated cable gland disassembly before connection to equipment,
- Faster RapidEx curing time, allowing earlier energizing of equipment,
- Enhanced accuracy, improved reliability.

Effective seal

During application the liquid resin flows between and around the cable conductors ensuring a complete and total seal with zero gaps.

In the process of curing the RapidEx resin adheres to both the cable conductors and the inside of the barrier tube creating a bond that is set for the life of the cable gland product.

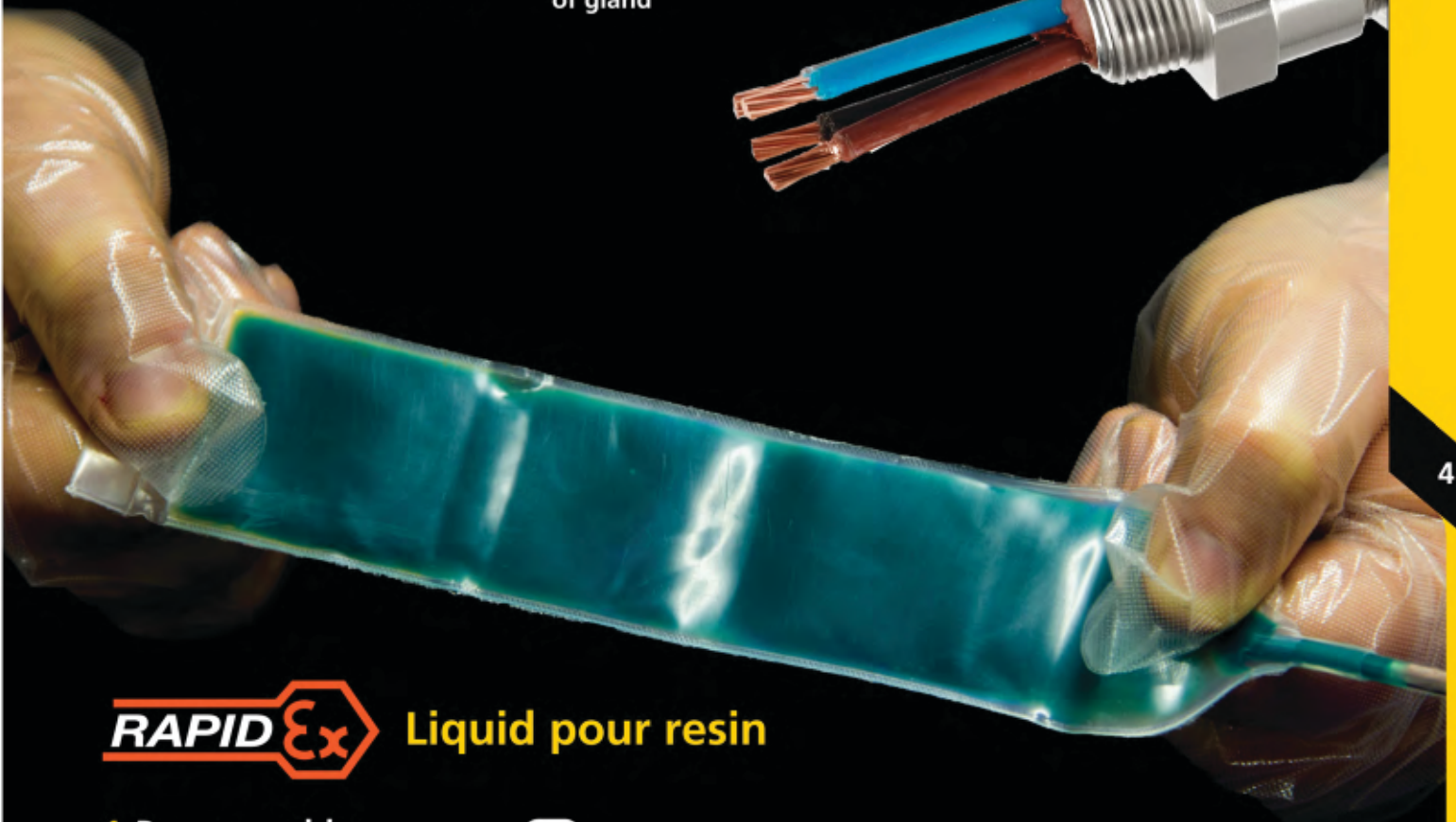
The RapidEx seal will never crack or shrink with changes in temperature.

Fewer steps in the installation process

Traditional epoxy/clay based compound

1 Prepare cable
2 Clamp armour
3 Mix compound
4 Pack cable crutch

5 Fill interstitial spaces
6 Pack around cores externally
7 Clean off excess compound
8 Pack front of gland



RAPID Ex Liquid pour resin

1 Prepare cable
2 Clamp armour
3 Mix liquid resin
4 Pour resin

The above comparison shows time taken when clay based epoxy compound and RapidEx liquid pour resin are applied to M20 (1/2") cable gland mounted on a typical 4 core armoured cable.

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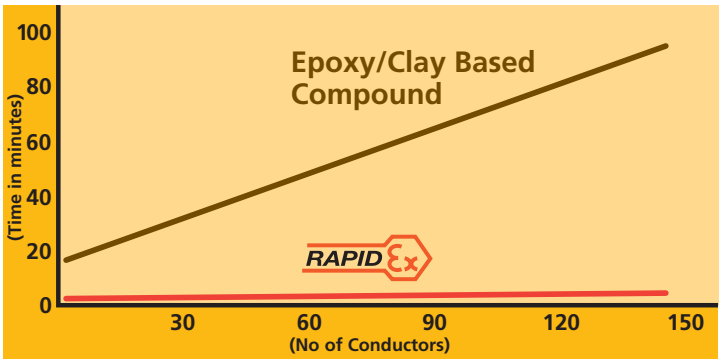
Easy application

This comparison shows the time required to mix and apply barrier materials on a range of multi conductor cables, using either Clay Based Epoxy Compound or RapidEx Liquid Pour Resin. This outlines the fact that the application of the RapidEx liquid pour resin is easier than traditional methods.

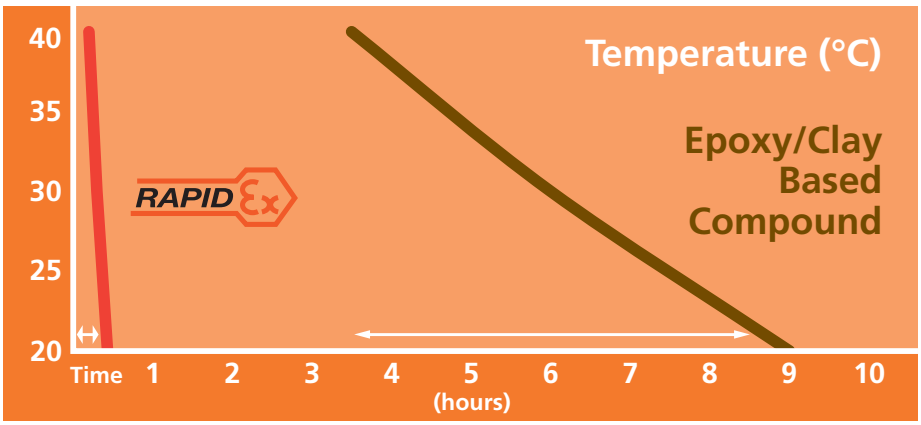


Faster curing

One of the many advantages of using the RapidEx liquid pour resin is the time saved in the completion of the cable installation, due to the fast curing formula.

This means that not only is the installation inherently more reliable, but an installation cost saving can also be made.

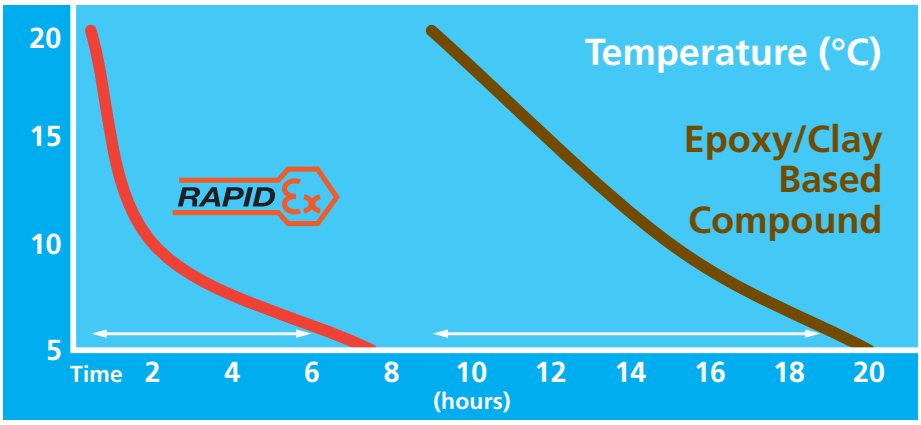
RAPID Ex **Cures more than 15 times faster than traditional epoxy/clay based compound at 40°C.**



40°C

In higher temperatures curing times are vastly reduced using RapidEx. At 40°C this can be as little as 15 minutes compared to over 3 hours for traditional epoxy/clay based compounds.

RAPID Ex **Cures more than 18 times faster than traditional epoxy/clay based compound at 20°C.**



20°C

Traditional epoxy/clay based compounds can take more than 9 hours to cure in temperatures below 20°C. Using RapidEx this can be reduced to as little as 30 minutes.

30 MINUTES

Cures more than 18 times faster than traditional epoxy/clay based compound at 20°C

15 MINUTES

Cures more than 15 times faster than traditional epoxy/clay based compound at 40°C

Do all Barrier Glands provide the same function?

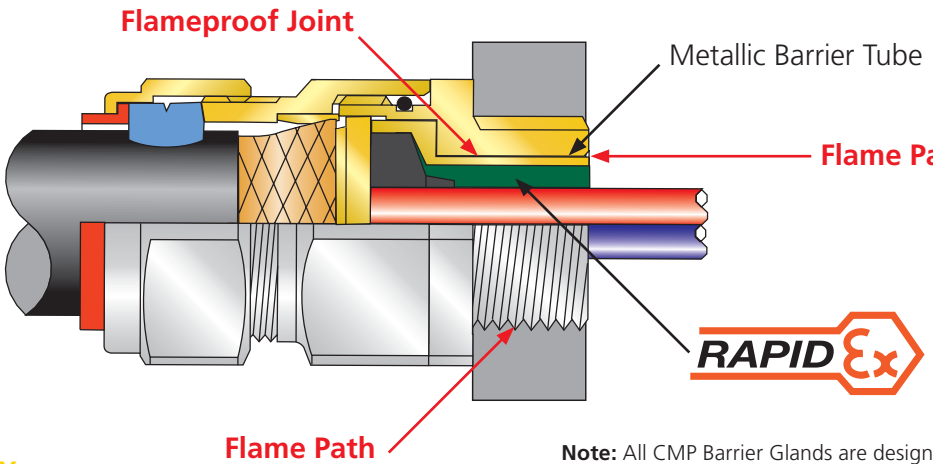
In theory the principal of a barrier gland is the same for all comparable products, in that the equipment form of protection is common (e.g. Ex d), given that the certification standards used are identical. However in practice not all barrier glands achieve the form of protection in the same subtle manner, even if the certification appears to have similarities.

When barrier glands first came on the market it was quickly identified that they needed to have an internal flameproof joint in order to allow the cable to be easily disconnected from the equipment. This part of the explosion protection concept is clearly understood by engineering professionals around the world who are involved in hazardous area decision making.

Today the concept of an internal flameproof joint has been abandoned by some product designs in favour of a 'stopper box' that relies on a completely different principal. With NO flameproof path incorporated into the internal joint, there is a greater emphasis on the installer to create a gap free, air tight joint, not only during installation, but following subsequent inspection and maintenance procedures. These requirements can potentially be more onerous than the conventional task of the installation itself.

This change in product to a 'stopper box' could lead to misinterpretation of the protection concept and all persons responsible for selection and specification are well advised to thoroughly review these products technically and evaluate what risks may exist.

Flameproof Type 'd' (Ex d) & Class I Div. 1 / Div. 2 Barrier Gland



PX2KX-REX

Note: All CMP Barrier Glands are designed and certified with a flameproof labyrinth joint, suitable for IEC & CEC / NEC installations.

Inspection requirements

As is the case with all cable glands intended for use in hazardous areas, barrier glands will be subjected to inspection from time to time. Inspection requirements may vary from site to site, or territory to territory, but the basis for inspection is usually determined by standards or client policy and procedures. In IEC 60079-17 "Electrical installations, inspection and maintenance" three grades of inspection exist, which are detailed as follows :-

V - Visual Inspection (External visual examination),

C - Close Inspection (Removal of shroud, if applicable, for external visual examination),

D - Detailed Inspection (Opening / Disassembly of cable gland for internal examination).

When periodic detailed inspections are carried out on Flameproof (Ex d) equipment, part of the inspection requirement is to check that the flange dimensions of flanged joint gaps are within maximum values permitted by IEC 60079-1. It is also necessary to check that joint surfaces are clean and undamaged.

This inspection standard also requires that stopping boxes and filling boxes are checked to ensure they are correctly filled. It would normally be possible to check that a cable sealing box or stopper box was correctly filled via a dedicated port that was provided with a removable flameproof plug. The existence of this "stopper plug" catered for subsequent inspections.

When it comes to barrier glands there are no specific checks that can be easily enacted on site that guarantees a compound barrier gland is filled correctly. The RapidEx liquid pour solution provided by CMP eliminates this risk and delivers a more reliable installation.

CMP Barrier Glands using RapidEx

Every barrier gland product supplied by CMP with RapidEx liquid pour resin, has an internal flameproof joint, enabling the cable to be easily disconnected and the assembly inspected. This arrangement is certified to both the IEC installation system (Ex d), in accordance with IEC 60079-1, and the CEC / NEC installation systems (Class I Division 1 and Division 2). The outcome of this is a range of products that can be selected for global applications without the need to specify or order different products for different situations.

RAPID Ex is available with the following CMP cable gland types

PX2K-REX	CMP PX2K RapidEx (PX2K-REX) cable gland for use with Single Wire Armour (SWA), Steel Tape Armour (STA), Pliable Wire Armour (PWA), Strip Armour (e.g. ASA), and Wire Braid cables, certified Ex d IIC Gb, Ex e IIC Gb, Ex nR IIC Gc, Ex ta IIIC Da IP6X, Ex d I Mb, Ex e I Mb (for Class I Div 1 braided cable use PX2KX-REX see below).
PX2KW-REX	CMP PX2KW RapidEx (PX2KW-REX) cable gland for use with Single Wire Armour (SWA) cables, certified Ex d IIC Gb, Ex e IIC Gb, Ex nR IIC Gc, Ex ta IIIC Da IP6X, Ex d I Mb, Ex e I Mb.
PX2KX-REX	CMP PX2KX RapidEx (PX2KX-REX) cable gland for use with Steel Tape Armour (STA), Pliable Wire Armour (PWA), Strip Armour (e.g. ASA), and Wire Braid cables, certified Ex d IIC Gb, Ex e IIC Gb, Ex nR IIC Gc, Ex ta IIIC Da IP6X, Ex d I Mb, Ex e I Mb.
PXSS2K-REX	CMP PXSS2K RapidEx (PXSS2K-REX) cable gland for use with Unarmoured cables, certified Ex d IIC Gb, Ex e IIC Gb, Ex nR IIC Gc, Ex ta IIIC Da IP6X, Ex d I Mb, Ex e I Mb.
PXRC-REX	CMP PXRC RapidEx (PXRC-REX) cable gland for use with Unarmoured cables or individual insulated cable conductors housed in conduit, certified Ex d IIC Gb, Ex e IIC Gb, Ex ta IIIC Da IP6X.
TMC2X	CMP TMC2X RapidEx cable gland for use with Corrugated Metal Clad cables, certified Ex d IIC Gb, Ex e IIC Gb, Ex ta IIIC Da, Class I Div 1 and 2, Groups A,B,C and D; Class II, Div 1 and 2 E,F and G; Class III, Div 1 and 2 Encl. Type 4X. Ex d IIC; Ex e II: Class I, Zone I, AEx d IIC; AEx e II; AEx ta IIC

*Cable types (SWA and Unarmored) are not permitted in Class I Div 1 locations, per the CEC / NEC, therefore certification restricted to Class I Div 2.

Other benefits

The CMP RapidEx Solution provides the following additional cable gland benefits :-

- Metal to metal armour clamping (when terminating armoured cables),
- Flameproof labyrinth joint maintained in dis-connectable barrier chamber,
- Inspectable flame path, with measurable dimensions to defined standards,
- Facility to inspect for earth continuity without disturbing the cable armour termination.

Typical engineering specification

Barrier glands shall be supplied complete with a fast curing liquid pour resin of type CMP RapidEx.

Fast curing liquid resin must be supplied as an integrated two part sachet with nozzle for easy mixing and application into the gland of type CMP RapidEx.

Barrier glands must have red identification marking to indicate a compound type gland of type CMP TMC2X series, PX2K-REX series, PXSS2K-REX series and PXRC-REX series.

Fast curing resin must cure in less than 30 minutes at temperatures above 20°C, and should be capable of energising the equipment after that time.

All barrier glands employing liquid type resin must have a built in resin dam to prevent liquid running through the gland and into the cable.
NOTE: Glass and cotton wool should not be used.

All barrier glands must be IEC Ex & ATEX certified with Ex d, Ex e and Ex nR forms of protection, backed up by certification to latest IEC Standards.

Barrier glands shall be of a type incorporating a metallic barrier tube with a flameproof path and must also allow for easy cable disconnection.

Selection process

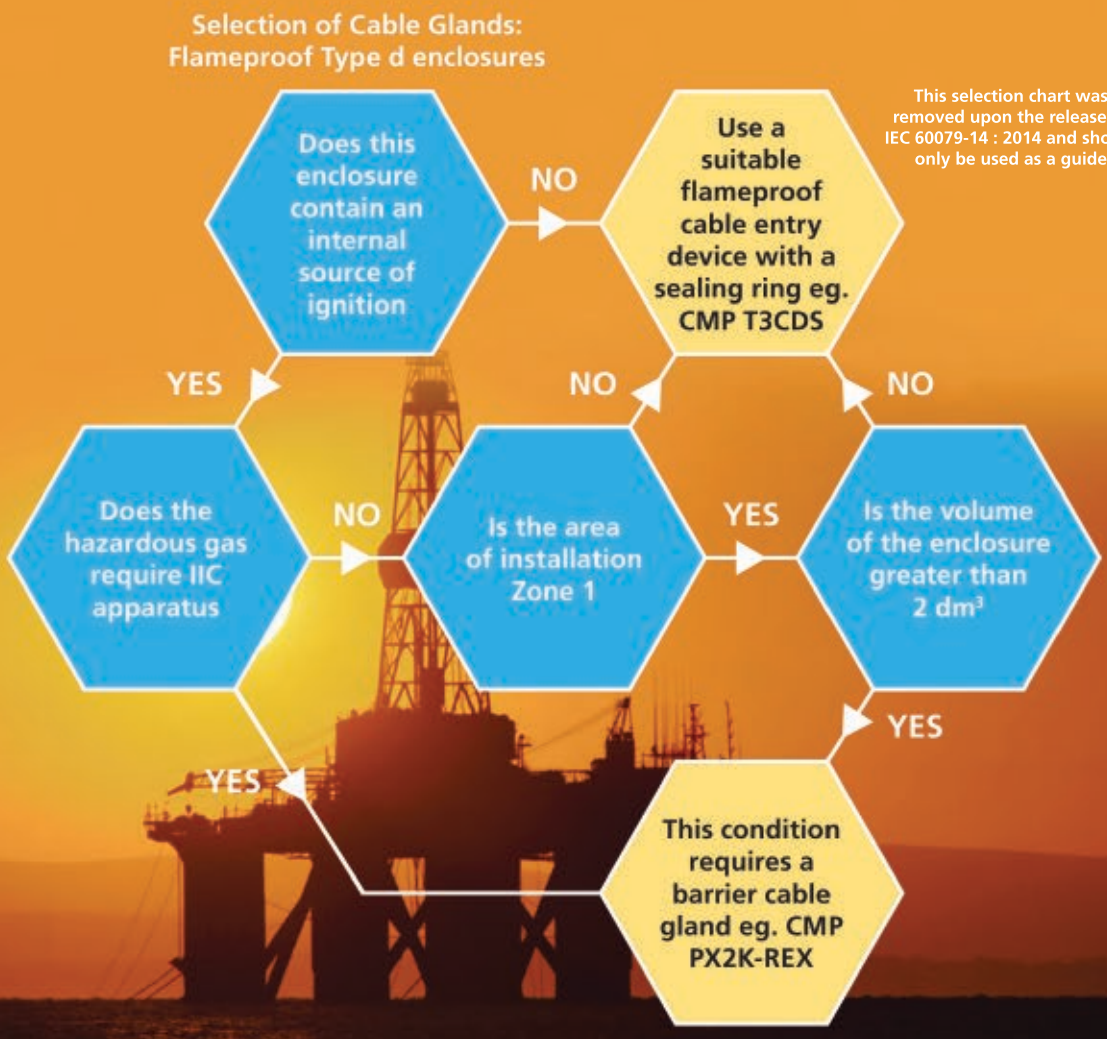
The need for barrier glands to be used in a given situation depends upon several factors, as stated in the prevailing installation standards, e.g. IEC 60079-14, which of course will be subject to change from time to time. Taking into account a diverse range of variables, such as equipment configuration, location, gas group etc, the one over-riding constant factor that must be considered in the selection process for hazardous area cable glands is the cable. When this has been properly assessed to ensure that it meets the essential criteria laid down (†), the other variables may pale into lesser significance, as far as this selection process is concerned, as a barrier gland may automatically be required.

Note † : IEC based standards, such as IEC 60079-14 generally require that cables used in hazardous areas are substantially compact and circular with extruded bedding and fillers, if present, which are non-hygroscopic. The implied intention of this requirement relates to the cable inner bedding or the part of the cable that enters the electrical enclosure. The National Electric Code (NEC) requires that cables are 'HL' listed for Hazardous Locations.

IEC Installations Requirements :

Here are the general requirements for selection of cable glands for Flameproof Type 'd' (Ex d) enclosures according to IEC based standards :-

Cables sheathed with thermoplastic, thermosetting, or elastomeric material shall be circular, compact, have extruded bedding and fillers, if any, shall be non-hygroscopic. Having satisfied this requirement engineers may follow the process below.



CEC / NEC Installations Requirements

Here are the general requirements for selection of cable glands for hazardous locations :-

These codes require that any cable for use in a Hazardous Location must firstly be permitted for use in that location, and secondly be tested and approved or listed for the application. Consequently cable glands intended for use in Hazardous Locations, must also be tested and approved or listed for use in a specified location, in conjunction with a specified and approved or listed cable type.

Cable Wiring Methods

The use of flexible cables in North America has provided industry with a wide choice of wiring methods. However, there are differences between the NEC and CEC for cables suitable for use in Hazardous areas and extreme care should be taken during the selection process. i.e. A cable type may be acceptable for use in Class I Division 1 in Canada, but not in the USA.

It is essential that the wiring method chosen is permitted for use within the area classification for the relevant code being utilized.

Cable Wiring Methods - Class I, Division 1 & Zone 1

Complete lists of suitable cable types for use in hazardous areas can be found by consulting the current NEC and CEC handbooks. Additional information for common cable types approved for offshore installations can be found by consulting section 43 of IEEE Standard 45 and API RPI 14F & 14FZ.

As a general rule, cables for use in Class I Division 1 and Zone 1 areas must be mechanically protected by armor. e.g. MC-HL and Wire Braid Armor (offshore) cables. In Canada, Interlocked armor can be also be used. e.g. Teck 90.

Cable Seals, Class I Division 1 & Zone 1

Where cables enter Class I Division 1 or Zone 1 AEx d enclosures, the cable must be sealed at the point of entry with an approved device to UL 2225 or CSA 22.2, Class I Division 1 or Zone 1 AEx d, where applicable. The sealing fitting or 'Barrier' gland must prevent the passage of gas or vapours through the gland by providing a compound barrier seal around each individual insulated conductor. e.g. CMP TMC2X or PX2KX-REX cable connectors.

NEC 2014

Article 501.15 (E) (1) Terminations. Cables entering enclosures that are required to be explosion proof shall be sealed at the point of entrance. The seal shall comply with 501.15(B)(1).

NEC 2014

Article 505.16 (C) (2) Cable Seals. (a) Explosion proof and Flameproof Enclosures. Cables entering enclosures required to be flameproof or explosion proof shall be sealed at the point of entrance. The seal shall comply with 505.16(D).

Cable Wiring Methods - Class I, Division 2 & Zone 2

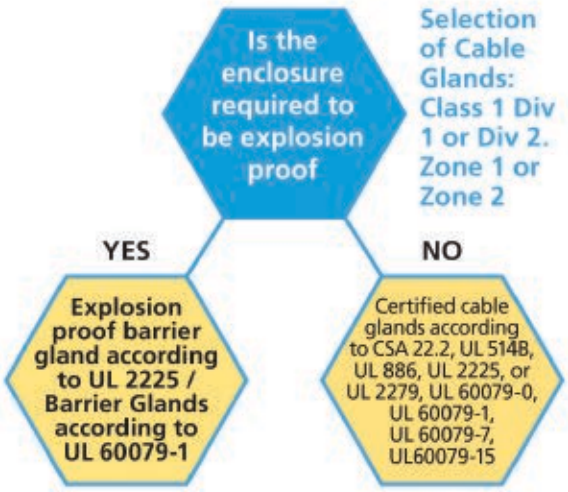
Complete lists of suitable cable types for use in hazardous areas can be found by consulting the current NEC and CEC handbooks. Additional information for common cable types approved for offshore installations can be found by consulting section 43 of IEEE Standard 45 and API RPI 14F & 14FZ.

As a general rule, cables permitted and listed for use in Class I Division 1 and Zone 1, and listed non-armored cables can be used in Class I Division 2 and Zone 2 hazardous locations. eg. Type TC (Tray Cable), Interlocked Armor cables

Cable Seals, Class I Division 2 & Zone 2

Where cables enter Class I Division 2 enclosures, the cable must be sealed if the enclosure contains any arcing or sparking devices or if the enclosure is explosion proof. In such cases a sealing fitting or Barrier gland to UL 2225 or CSA 22.2, Class I Division 1 or Division 2 must be used. Where the enclosure does not contain any arcing or sparking devices and the enclosure is NOT explosion proof, a cable is not required to be sealed at the point of entry. In such cases a listed cable gland or cable connector without compound sealing function may be used. e.g. TC, TMC2, T3CDS or C2KX cable connectors. Similarly for Class I Zone 1 & Zone 2 AEx e enclosures (Increased Safety), a non sealing fitting approved for use in this application can be used. e.g. TC, TMC2, T3CDS or C2KX cable glands.

Note: Non 'Sealing' type glands are restricted to Division 2 & Zone 2 equipment that does not contain an ignition source or to Zone 1 AEx e equipment. If the enclosure is required to be explosion proof under NEC conditions an approved barrier seal must be used.



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