MODULE IV

Installation

IEC 60079-14 Explosive Atmospheres –
Electrical Installations Design, Selection and Erection.

- **Qualification of personnel**
- **Types of cable**
- **Cable gland**
- **Earthing**
- **Lightning**

MODULE IV
Qualification of Personnel

It is essential for all workers to understand the basic requirements for working in a hazardous area.

The Installation (60079-14) standard defines three levels of personnel involved in the installation and erection of equipment in hazardous areas.

- **Responsible persons**
- **Operatives/technicians (selection and erection)**
- **Designers (design and selection)**

But in general we will concentrate in Maintenance (60079-17) standard:

- **Responsible persons and technical persons with executive function**
- **Operative/technician (inspection and maintenance)**

MODULE IV
Qualification of Personnel

Knowledge and skills

Responsible persons and technical persons with executive function

- general understanding in electrical engineering;
- explosion protection principles and techniques;
- engineering drawings;
- working knowledge and understanding of relevant standards in explosion protection,
- basic knowledge of quality assurance, including the principles of auditing, documentation, traceability of measurement and instrument calibration.

Operative/technician (inspection and maintenance)

- understanding of explosion protection principles;
- types of protection and marking;
- aspects of equipment design which affect the protection concept;
- understanding of certification and 60079-17
- importance of permit to work systems and safe isolation
- familiarity with the particular techniques to be employed in the inspection and
- maintenance of equipment
- comprehensive understanding of the selection and erection requirements of IEC 60079-14;
- repair and reclamation requirements of IEC 60079-19. (in general)

MODULE IV
Qualification of Personnel

Competencies

Competencies shall apply to each of the explosion protection techniques for which the person is involved.

Responsible persons and technical persons with executive function

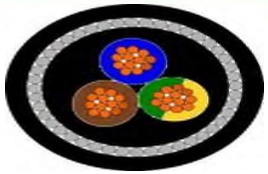
- shall be able to demonstrate their competency and provide evidence of attaining the knowledge and skill requirements relevant to the types of protection and/or types of equipment involved.

Operative/technician (inspection and maintenance)

- shall be able to demonstrate their competency and provide evidence of attaining the knowledge and skill requirements relevant to the types of protection and/or types of equipment involved.
- practical skills necessary for the inspection and maintenance
- Able to use DOSIER documentation

MODULE IV
Types of cable

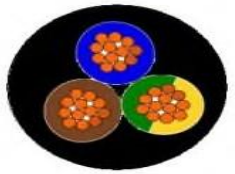
Steel Wire Armour (SWA)



Wire braid armour

Steel tape armour

Unarmoured

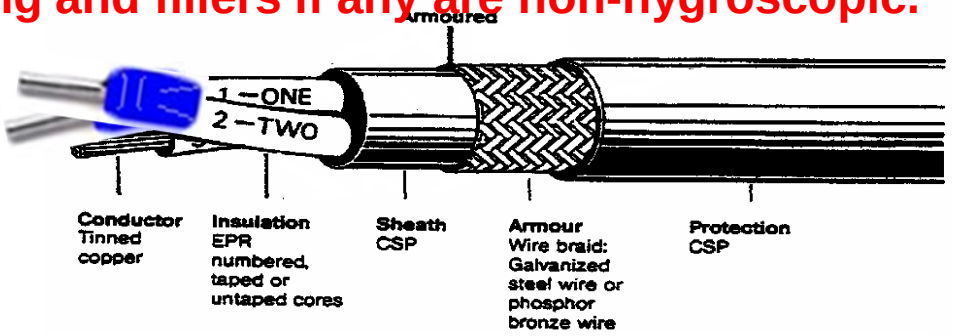


Suitable cables are manufactured from thermoplastic, thermosetting or elastomeric materials, typically EPR/CSP) or mineral insulated metal sheathed (MICC/MIMS) and appropriate for the ambient conditions in service.

MODULE IV
Elastomeric cables

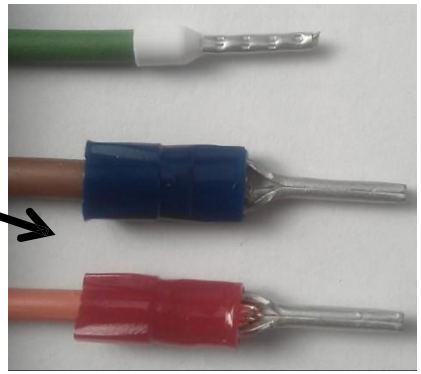
Circular, Compact extruded bedding and fillers if any are non-hygroscopic.

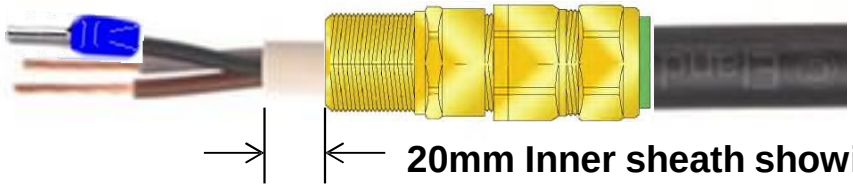
If cables with multi-stranded or fine – stranded conductors are used the ends shall be protected against separation by cable lugs or core end sleeves but not by soldering alone.



Good Lug Joints

Bad Lug Joints





20mm Inner sheath showing out of the gland.

Terminal Crimps or Cable Lugs

For Stranded conductors

Bootlace Crimps or core end sleeves

For flexible stranded conductors only

MODULE IV
Joint of cable conductors

- Ideally, cable runs through hazardous areas should be continuous and without interruption.
- Joints should be mechanically, electrically and environmentally effective.
- Connection may be either:

1. Compression connectors;
2. Secured screw connectors;
3. Welding or brazing;
4. Soldering - (only if conductors are mechanically held together during soldering).

- The unused cores of cables can be terminated in a hazardous area by following documentation or ,

a) IS circuits: adequately insulated from earth & from each other at both ends by the use of suitable terminations or, terminated at an IS earth connection used to terminate earth connections of other circuits in the same cable but must be adequately insulated from earth and from each other by the use of suitable terminations at the other end.

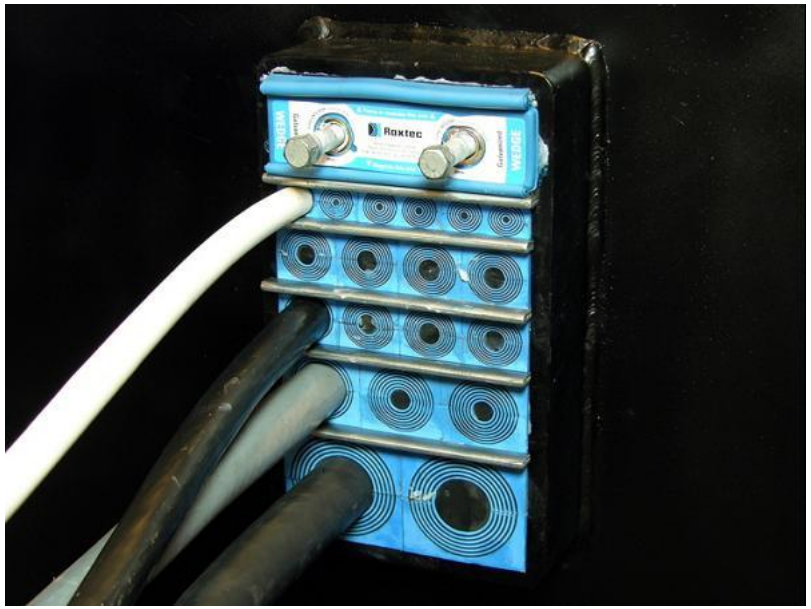
b) Other circuits: Hazardous area end of each unused core to be connected to earth or be adequately insulated by means of terminations suitable for the type of protection. Insulation by tape alone is not permitted.

- If aluminium conductors are used, suitable connections shall be used and, with the exception of I.S. Installations, they shall have a minimum c.s.a of 16mm².

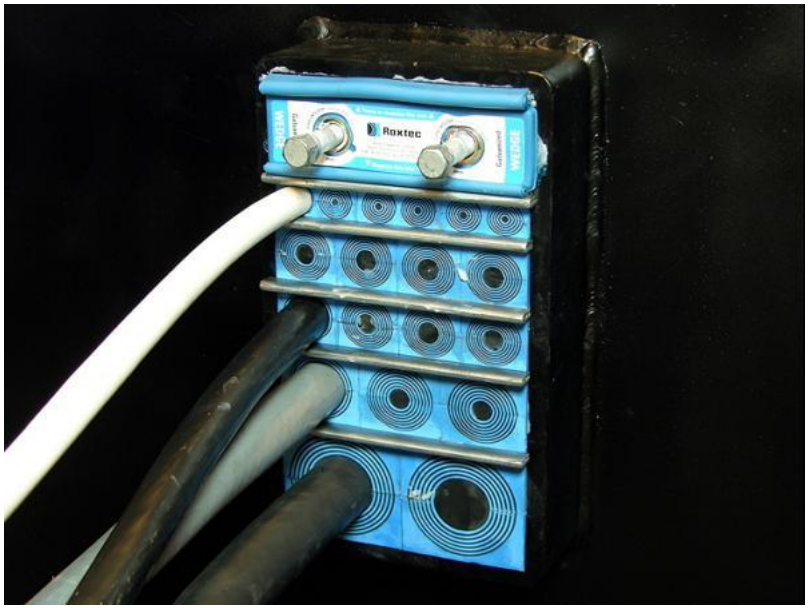
MODULE IV
Types of cable seal

Cable gland

Multi cable transits frame /blocks (MCT's)



MCT designed to seal the cable passages through structures as well as cable entries into the equipment.



MODULE IV
Cable gland

Equipment for the cable sealing when it is entered into the apparatus frame or shell. It solves the following important tasks:

- Protection against environments;
- Mechanical mounting (protection from pulling out);
- Providing the necessary level of explosion protection;

The SWA may supplement the effectiveness of the CPC but is not to be relied upon. Metallic cable coverings e.g. SWA, braiding etc. (exposed conductive parts) to be effectively connected to the equipotential bonding system unless stated in the design documentation. Accordance IEC 60079-14, it important for avoiding sparks in the hazardous area.

MODULE IV
Selection of cable glands

Definition:

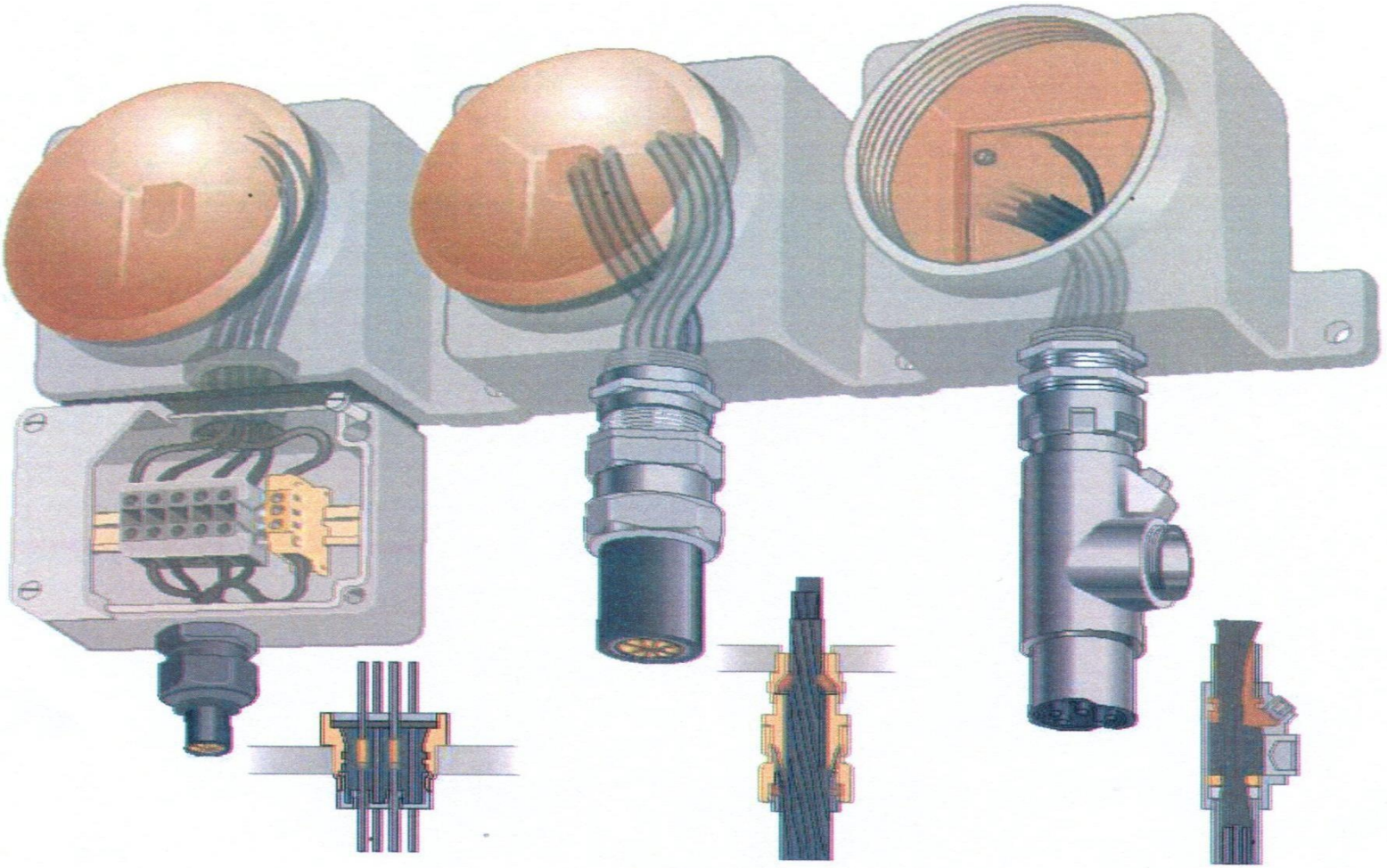
A device designed to permit the entry of a cable into electrical equipment and which provides sealing and retention. It may also provide other functions such as earthing (or grounding), bonding, insulation, strain relief or a combination of these.

Considerations are:

1. **A cable gland should maintain of the Ex type of protection of the equipment into which it is to be fitted;**
2. **Ingress protection (IP) rating of apparatus (IP washers are required to achieve IP65/66 in addition to just the cable gland.)**
3. **Cable susceptible to 'cold flow';**
4. **Electrolytic action.**

Additional considerations for flameproof apparatus are:
Is the Ex d enclosure an "Indirect entry "? – Fit a suitable sealed flameproof gland.
If a "Direct entry" refer to flowchart in IEC 60079-14

MODULE IV
Selection of cable glands



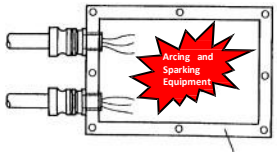
MODULE IV
Flameproof cable gland selection

Latest Standard requirements

Protection technique for the equipment	Glands, adapters and blanking element protection technique			
	Ex "d" see 10.6	**Ex "e"** see 10.4	**Ex "n"** see 10.4	**Ex "t"** see 10.7
Ex "d"	X			
Ex "e"	X	X		
Ex "i" and Ex "nL" – Group II[a]	X	X	X – see 16.5	
Ex "i" – Group III [a]				X – see 16.5
Ex "m"	Ex "m" would not normally be applied to wiring connections. The protection technique for connections shall suit the wiring system used.			
Ex "n" except Ex "nL" For Ex "nR" see also 10.8	X	X	X	
Ex "o"	Ex "o" would not normally be applied to wiring connections. The protection technique for connections shall suit the wiring system used			
Ex "p", all types	X	X	X [b]	

Compound barrier gland or universal flameproof?

MODULE IV
Flameproof cable gland selection



Direct Entry

Ex d Direct Entry (importance to use)

MICC cable?

Yes → Use Exd MICC gland

No → Elastomeric or Thermoplastic or Thermosetting cable with extruded bedding?

No → Use either: Barrier Gland, Stopper Box or Sealing Chamber

Yes → Circular non-hygroscopic filled cable?

No → Use either: Barrier Gland, Stopper Box or Sealing Chamber

Yes → Internal source of ignition?

No → Use a suitable flameproof cable entry device with a sealing ring

Yes → Gas Group IIC hazard?

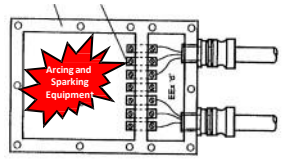
Yes → Use either: Barrier Gland, Stopper Box or Sealing Chamber

No → Zone 1 area?

Yes → Volume greater than 2 litres?

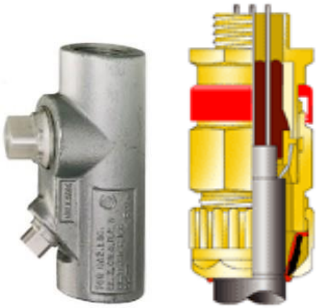
Yes → Use either: Barrier Gland, Stopper Box or Sealing Chamber

No → Use a suitable flameproof cable entry device with a sealing ring

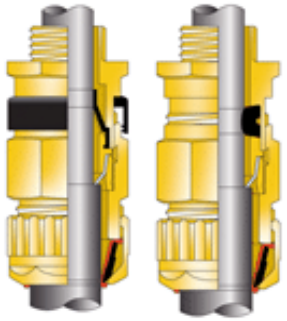


Indirect Entry

Compound sealed Flameproof Barrier Gland



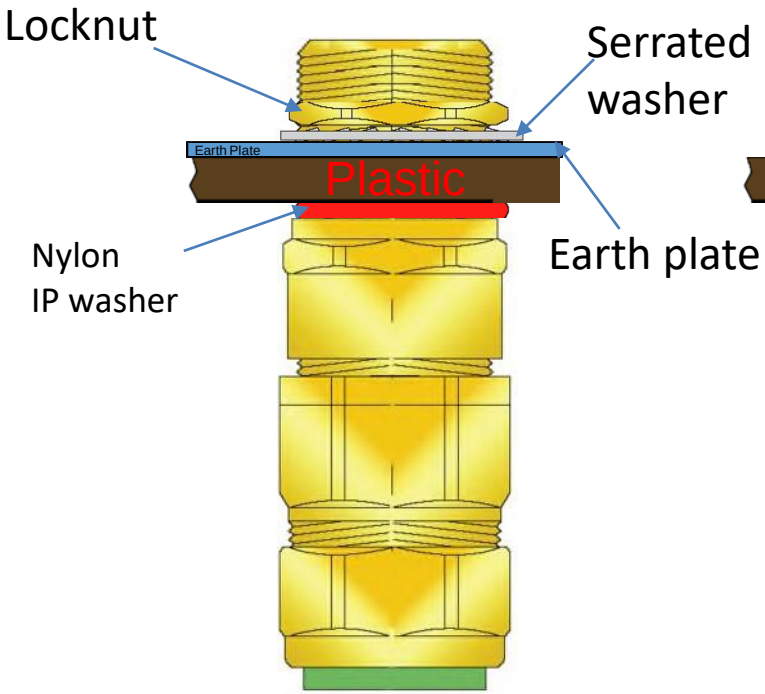
Suitable sealed Flameproof Universal Gland



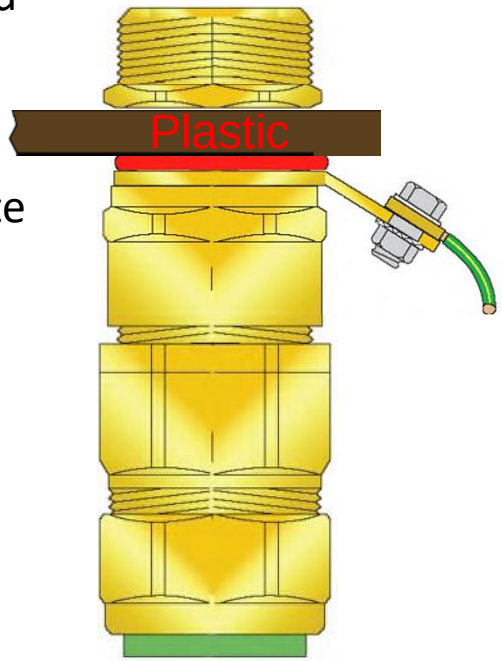
MODULE IV
Glanding

General Rules – Minimum accessories with plastic enclosure.

Ex e, Internal Earth Plate, Less than 6mm thread



Ex e, Less than 6mm thread



Ex e, Internal Earth Plate, Greater than =6mm thread

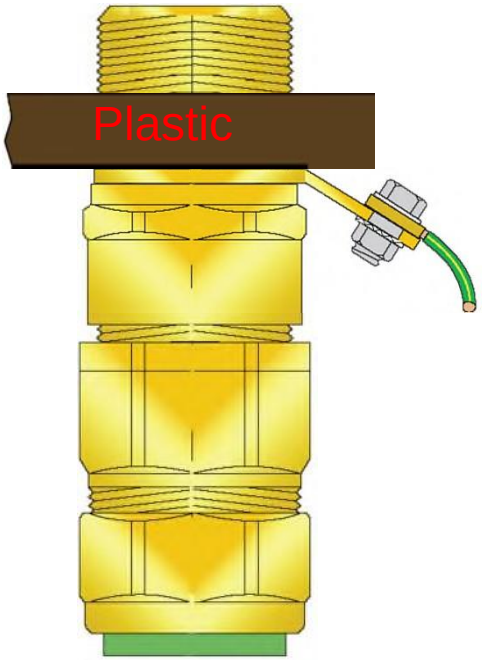
To maintain the minimum IP 54

Earth plate dimples may not need serrated washer.

MODULE IV
Glanding

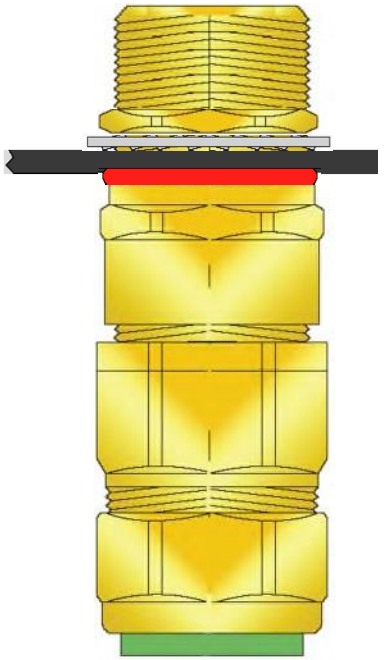
General Rules – Minimum accessories for Ex e enclosures.

Ex e,
Greater than =6mm thread



Ex e,
Clearance Hole

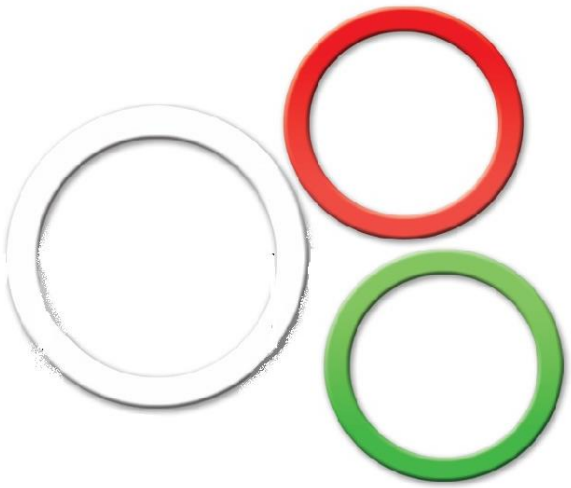
Ex e, Metal
Less than =6mm



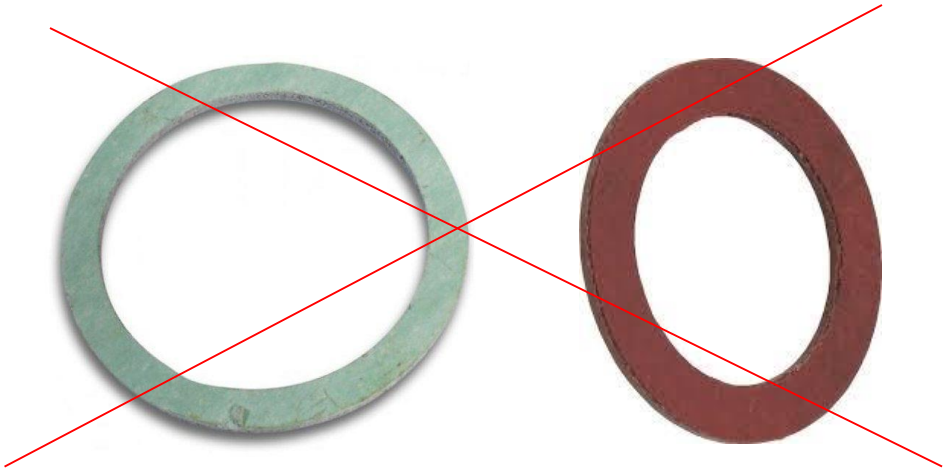
To maintain the minimum IP 54

MODULE IV
Glanding

To maintain IP 65/66 FGP used Nylon IP washers only



Nylon



Fiber

MODULE IV
Adapters

MODULE IV
Plugs

Blanking plugs are used to provide temporary or permanent closure of unused cable accessory entries allowing the safe use of equipment.

All plugs shall be certified in accordance with EACEx, even temporary variants must hold the correct certification.

Please look at certified and not certified blanking plugs

MODULE IV
Gland marking

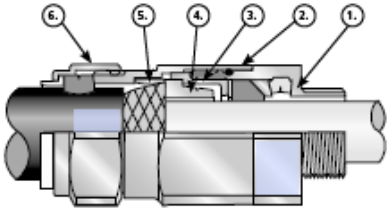
1. Manufacturer
2. Type
3. Protection concept
4. Size
5. Marking in accordance with EACEx (ATEX for EU, IECEx– Internationally)
6. IP rating
7. Certificate number

X - if special conditions are available

MODULE IV
Gland installation

INSTALLATION INSTRUCTIONS FOR CMP CABLE GLAND T3CDS & T3CDSPB

1. Entry Item
2. Body
3. Compensating Sleeve
4. Reversible Armour Cone
5. AnyWay Clamping Ring
6. Outer Seal Nut

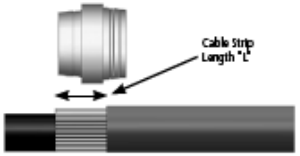


PLEASE READ ALL INSTRUCTIONS CAREFULLY BEFORE BEGINNING THE INSTALLATION

CABLE GLAND COMPONENTS - It is not necessary to dismantle the cable gland any further than illustrated below

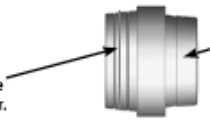
1. Separate the gland into two sub-assemblies, A and B, by unscrewing the body (2) from the entry item (1). Note that items (4) and (5) are loose items.

2. Prepare the cable by stripping back the cable outer sheath and armour to suit the equipment geometry. Expose the armour by stripping back the outer sheath further using the table below as a guide.



CABLE GLAND SIZE	20(5/16, 20)5, 20	25(5, 25, 32, 40	50(5, 50, 63(5 63	75(5, 75, 90,100,115,130
CABLE STRIP LENGTH "L"	12 mm (0.472 inches)	15 mm (0.591 inches)	18 mm (0.709 inches)	20 mm (0.787inches)

3. Secure the entry components (sub-assembly A) into the equipment. (Not for remote installation)
When installing entry items that have an integrated o ring face seal via clearance/through holes, please refrain from rotating the entry item where possible. Hold the entry item stationary with the appropriate tool and tighten the locknut inside the enclosure to secure the gland.

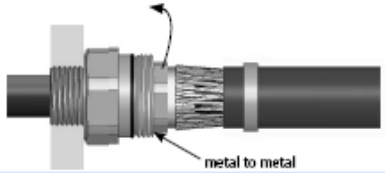


Grooved side of cone outwards - to terminate braid, strip armour, pliable wire or tape armour.

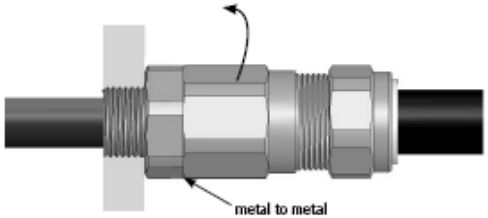
Stepped side of cone outwards - to terminate SWA cable.

4. Pass the cable through sub-assembly A, spacing the armour or braid evenly around the cone. Whilst continuing to push the cable forward to keep the cable braid or armour in contact with the cone, tighten the compensating sleeve (3) into the entry component (1) until all the threads are used. (Note that the internal compensator will prevent the cable gland inner seal from being overtightened onto the cable inner sheath.)

The inner sheath of the T3CDSPB gland contains a device to automatically make an electrical contact with the lead sheath on the cable as the cable is installed.



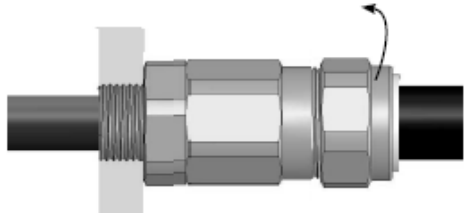
5. Terminate the cable by tightening the body (2) onto the entry component (1) using a spanner on each part. Tighten the body until the body and entry components are metal to metal and cannot be tightened further.



6. Only using finger pressure, tighten the outer seal nut assembly (8) until light resistance to tightening is met.

Then either use the outer seal tightening guide tape or table on the rear of the page to determine how much further to tighten the seal using a spanner (using the outer seal tightening guide is recomended).

Wrap the outer seal tightening guide tape around the cable to show the amount of spanner turns needed (as shown here). Make sure the correct side of the outer seal tightening guide tape is used depending on the cable gland size.



HORIZON

MODULE IV
Corrosion

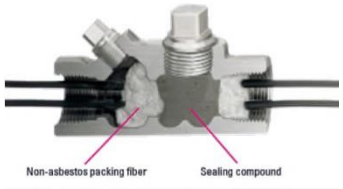
MODULE IV
Selection conduit

Conduit for use with flameproof apparatus is required to be

a) **screwed heavy duty steel, solid drawn or seam welded conduit Seam welded; or**
b) **flexible conduit of metal or composite material construction**

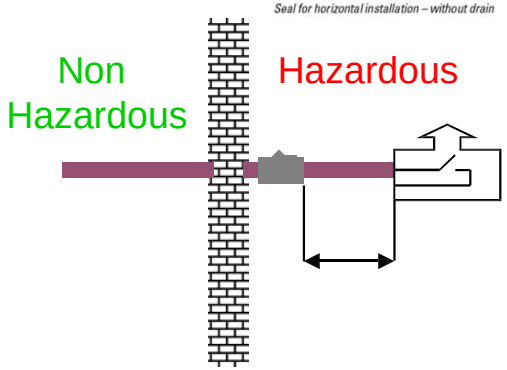
Conduit entering flameproof enclosures is required to be engaged by at least 5 full threads.

Sealing Of Conduit

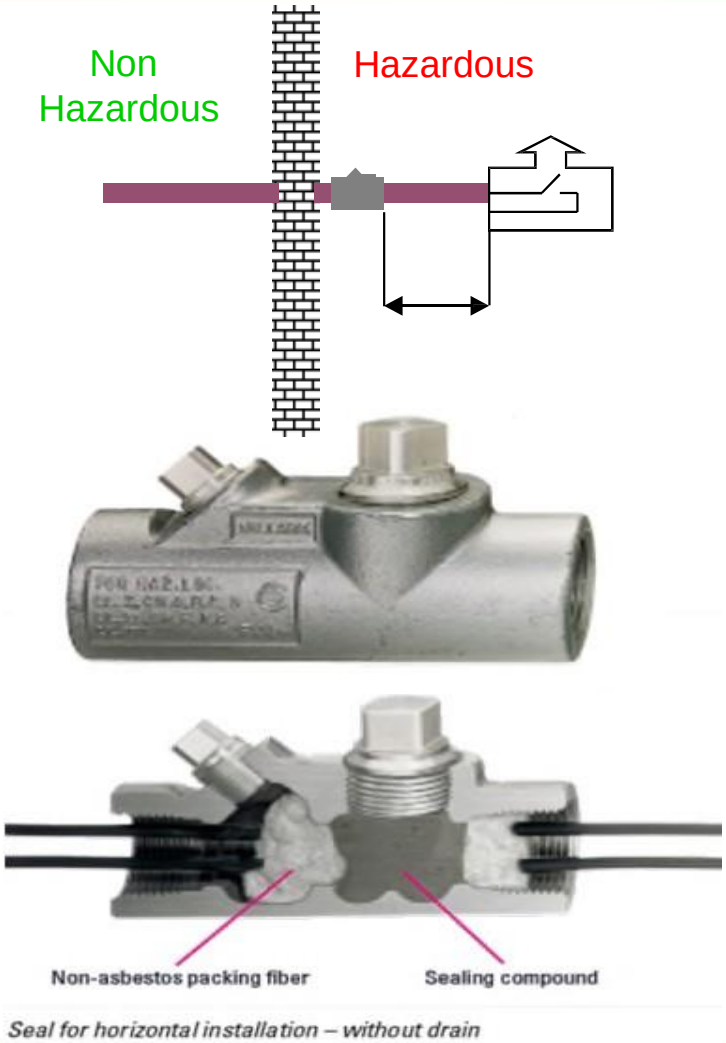


Conduit seals (Stopper boxes) are required to be fitted:

a) **Where conduit leaves or enters a hazardous area;**
b) **Either as part of the flameproof enclosure or immediately or as close as practical to the entry to the flameproof enclosure using a minimum number of fittings.**



MODULE IV
Selection conduit



Seal for horizontal installation – without drain

The distance from the face of the seal closest to the enclosure (or intended end-use enclosure), and the outside wall of the enclosure (or intended end-use enclosure) shall be as small as practical, but in no case more than the size of the conduit or 50 mm, whichever is the lesser.

The conduit shall be wrench tight at all of the threaded connections.

Non-sheathed insulated single or multicore cables may be used in the conduits.
When the conduit contains three or more cables, the total cross-sectional area of the cables, including insulation, shall be not more than 40 % of the cross-sectional area of the conduit.

In the event that the conduit is installed in a corrosive area, the conduit material shall either be corrosion resistant or the conduit shall be adequately protected against corrosion.
Combinations of metals that can lead to galvanic corrosion shall be avoided.

There shall be no union, coupling or other fittings between the sealing device and the hazardous area's boundary.

Long runs of conduits shall be provided with suitable draining devices. In addition, cable insulation shall have suitable water resistance

Conduit entries are permitted only for electrical equipment of Group II.