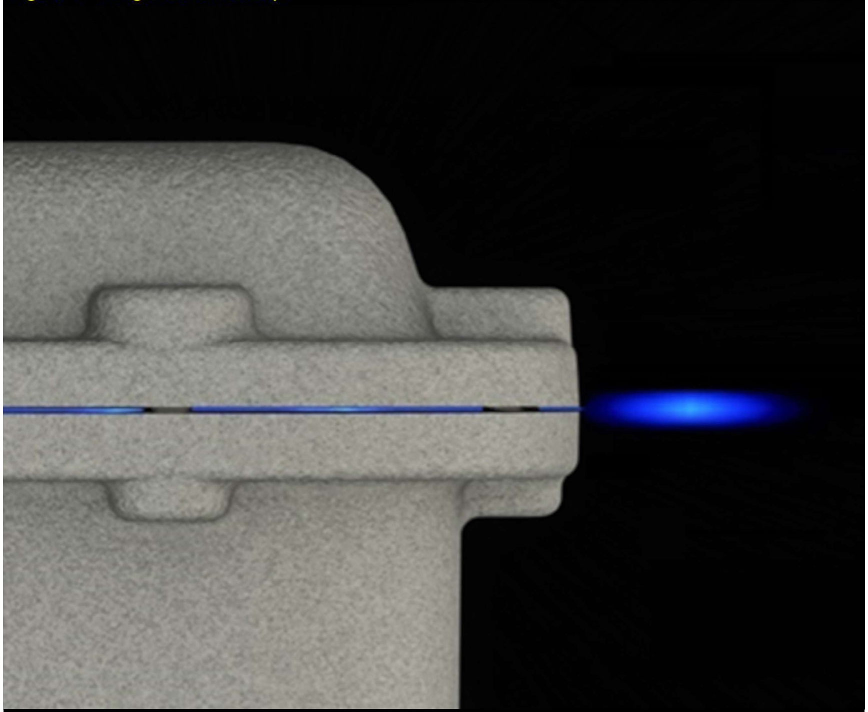
Figure 1 – Image: Cortem Group



Ex d protection: explosion-proof joints

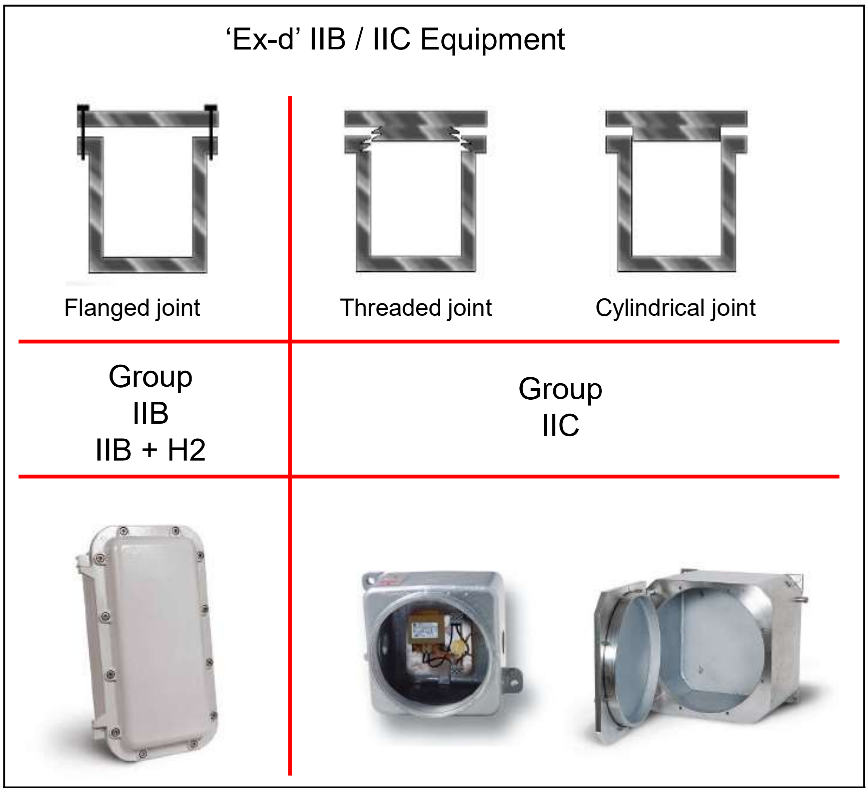


Figure 2 – Image: Cortem Group

Understanding the function of explosion-proof joints is a prerequisite for the correct use and the proper maintenance of all electrical devices that adopt this type of protection.

A typical feature of equipment with 'Ex d' protection is the presence of explosion-proof joints. The explosion-proof enclosures need to be opened, initially for the installation of the components inside and periodically for ordinary or extraordinary maintenance. They are therefore equipped with covers or doors. In other situations, there are moving parts that intersect the explosion-proof enclosure. We think of a shaft of an electric motor or of the levers/buttons that activate the opening and closing of the switches inside the panels. In both situations, the explosion-proof enclosure is made up of several components which, assembled, must guarantee the maintenance of the 'Ex d' type of protection.

The surfaces along which these components are in contact have a guaranteed and specific backlash. Through these interstices, in fact, it must be ensured that any explosion inside the explosion-proof enclosure is not able to ignite the external atmosphere.

Therefore, the corresponding contact surfaces of two parts of an enclosure are defined as an explosion-proof joint, through the interstices of which the propagation of an explosion inside the enclosure to the surrounding explosive atmosphere stops. Figure 1 shows an example of gas escaping from a flanged joint.

Most common types of explosion-proof joints and connection with the gas group of the equipment

The most popular explosion proof joints are cylindrical, threaded or flanged.[1] They are placed in the contact planes between bodies and covers, in the threads of threaded covers, in the cylindrical surfaces of the cylindrical joints. The flanged joints and the cylindrical ones are provided with fixing screws, while the threaded joints are fixed with the same thread that constitutes the joint. In the latter case there is a set screw with an anti-loosening function.

As can be seen from Figure 2 on the page opposite, there is a link between the type of explosion-proof joint and the gas group of the appliance. In fact, the flanged joint is threatened when it must hold back the passage of flame of gases such as hydrogen and, above all, acetylene. For this reason, a site with gases classified as IIC has always required equipment with threaded or cylindrical explosion-proof joints and, consequently, equipment contained in round or square enclosures. Only recently new types of joints obtained with special mechanical processing have allowed the creation of rectangular enclosures suitable for the gas group IIC.[2]

Figure 2 also shows how the enclosures with flanged flat joints can be certified for group IIB + H2. In this case, their use is extended to environments with the presence of hydrogen.

Principle of operation

The basic concept of the 'Ex d' type of protection is that an explosion inside the explosion-proof device can occur but is contained without triggering external gases. The function of the flame-proof joint is to ensure that the residual gases of the explosion are unable to ignite the atmosphere outside the flameproof enclosure.

As shown in Figure 5 on the following page, the explosion produces hot gases inside the explosion-proof enclosure. The resulting hot gas jets expand through the lamination joints and their temperature decreases considerably. During this passage, in fact, the energy released by the explosion is converted into the kinetic energy of the outgoing gases.[3]

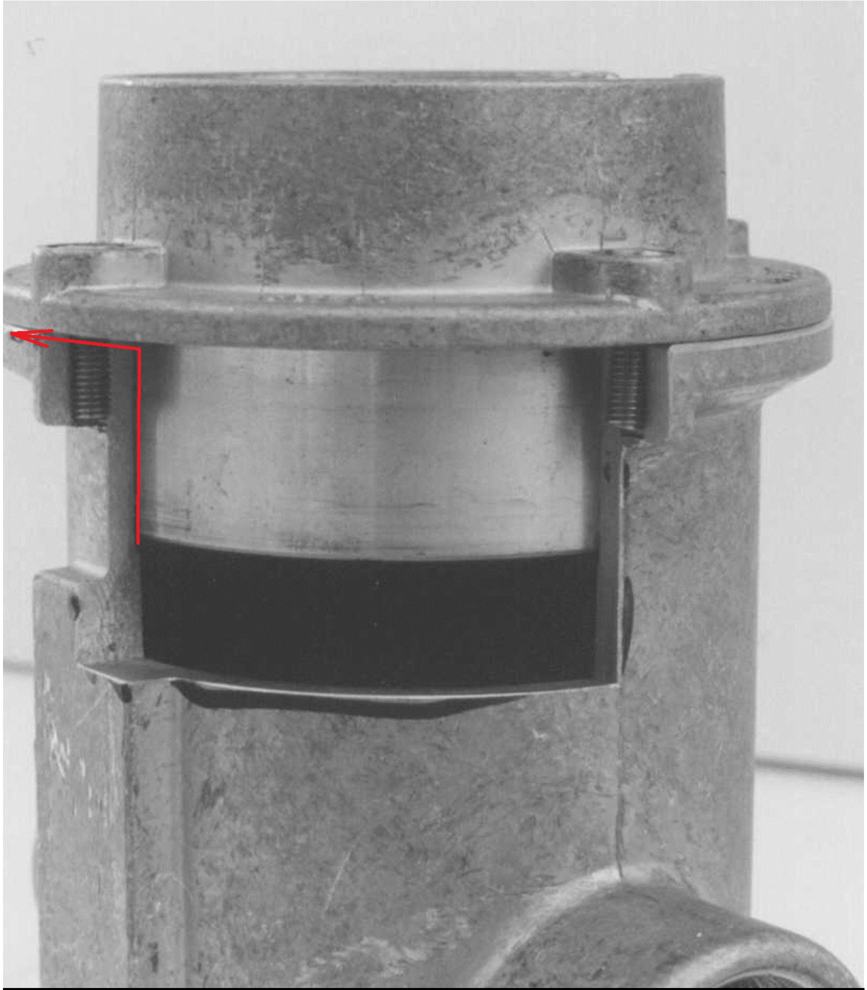


Figure 3 – Section of a housing with cover equipped with a cylindrical joint and the path followed by the escaping gases in red. Image: Cortem Group

GAS Group	Minimum distance mm
IIA	10
IIB	30
IIC	40

Table 1 – Minimum distance between flat joint and rigid obstacles according to the gas group.[4]

For this process to take place as intended, the lengths and tolerances of the joints must be well determined as well as the surface roughness. The IEC/EN 60079-1 standard reports specific tables for this purpose.

In flanged joints such as those in Figure 5, the flue gases escape for a certain distance from the flat surface of the flange, thus being able to meet rigid obstacles on their path such as support structures, walls, pipes, etc. This fact has been incorporated into the plant engineering legislation with the imposition of a minimum distance between a flat flanged joint and a rigid obstacle depending on the gas group present at the installation site (Table 1).

Another aspect that should not be underestimated is the tightening torque of the fixing screws of the flanged covers or cylindrical joints. These screws must be tightened with the correct torque indicated by the manufacturer in the use and maintenance manual. In fact, when the explosion occurs, the gases escape from all the paths or openings present and the interstices change because of the strong pressures that are exerted on the walls of the enclosure, increasing the passage opening through which the gases escape, as graphically represented in Figure 6.[5]

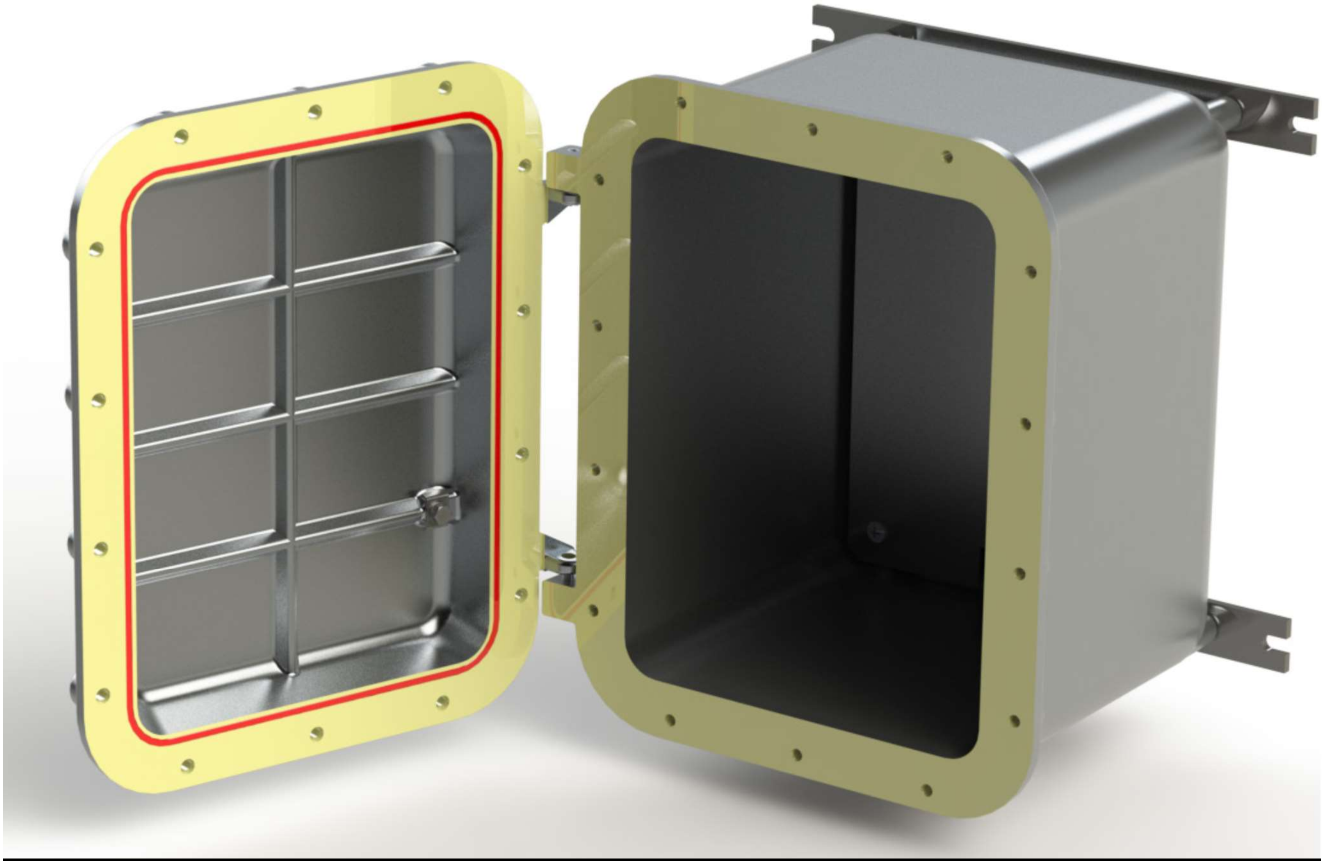


Figure 4 – Image: Cortem Group

On the other hand, when covers or elements with threaded lamination joints are present, the gas path develops in the spiral of their threading, in this case it is mandatory that the component is fully tightened ensuring at least five threads in contact.

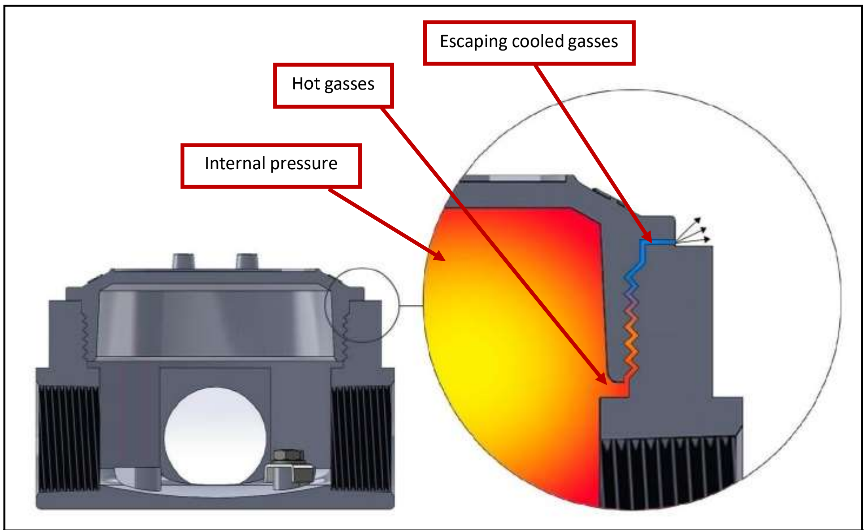


Figure 5 – Image: Cortem Group

The protection of lamination joints

During maintenance operations to clean the flanged flat joints, non-metallic brushes and non-corroding cleaning liquids must be used.[6]

The use of grease for various purposes is envisaged and encouraged by the legislation on the joints. The use of grease during the assembly phase can prevent seizure in the cylindrical joints and in the threaded joints, facilitating the coupling, as they are always made with tight gaps. During assembly or maintenance, petroleum jelly or soap thickened with mineral oils can be applied to the joint surfaces to protect against corrosion.

Usually, the manufacturer's documentation comes in handy when choosing the detergent and grease. If there are no indications in this regard, the grease, if applied, must be of a type that does not harden due to aging, free of evaporating solvents and non-corrosive of the joint faces.[7]

Conclusion

Explosion-proof joints are a basic aspect of the protection offered by an explosion-proof equipment or enclosure. For this reason, understanding their function is a prerequisite for correct use and proper maintenance of all electrical devices that adopt this type of protection. ■

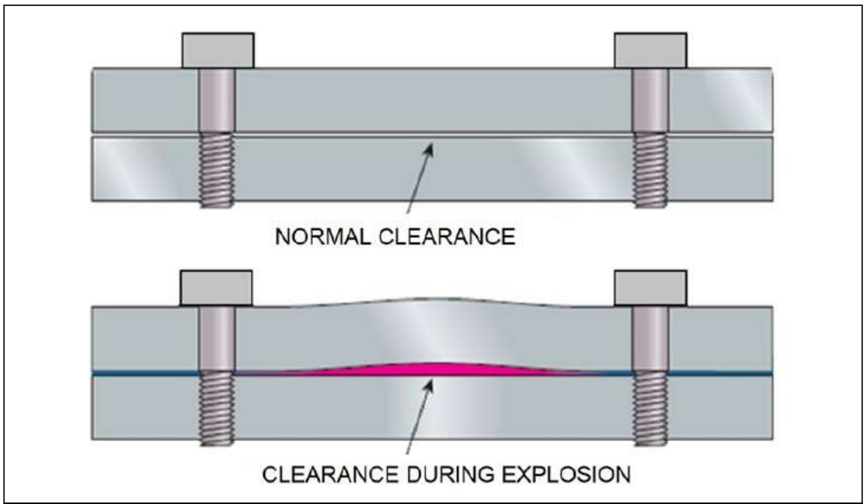


Figure 6 – Section of a housing with lid equipped with a cylindrical joint and the path followed by the flue gases in red. Image: Cortem Group

References

1 In addition to the three types of joints mentioned there are: conical joints, joints with partial cylindrical surfaces, labyrinth joints, serrated joints, and multi-section joints. In this article we consider those most used.

2 https://www.cortemgroup.com/en/news/the-evolution-of-the-ex-proof-flame-path

3 It has been observed that the type of material of the enclosure does not affect the decrease in the temperature of the outgoing gases, it is therefore wrong to think that the residual gases give heat to the enclosure. The decrease in temperature occurs due to phenomena like those of a rocket nozzle. Explosion protection - Heinrich Groh 2004 6.8.1 page 236

4 CEI EN 60079-14 - Table 13

5 NEC: National Electrical Code Handbook 501.3

6 CEI EN 60079-17: 2015-03 par. 5.1

7 CEI EN 60079-14: 2015-04 par. 14.3

About the author

Andrea Battauz is R&D Project Engineer at Cortem Group. After gaining a degree in mechanical engineering, he has been employed in the design of robotic machinery and automation. Since 2004, he has worked with the ATEX directive and the design of machines suitable for explosive atmospheres. In 2008 he joined Cortem Group where he has developed new explosion-proof products, specialising in signaling and lighting devices based on LED technology. He also carries out training activities on topics related to explosion protection. He has been a member of national committees CT 31 and SC 31J since 2010.

Although it may not be this futuristic yet, thanks to digitisation alarm management has undergone many changes. Image: Shutterstock

A changing perception to **alarm management**

For some operators and engineers, just the mention of 'alarm management' can send a chill down their spine. There can be significant pressure on the shoulders of someone charged with identifying and responding to critical alarms amongst a deluge of nuisance alarms and alarm floods. As a result, many opt to only interact with alarm management software when they must and, apart from outside of regular compliance requirements, only when there is a problem.

However, this should not be the norm and industry needs to reshape the way it thinks about alarm management in order to maximise the clear optimisation, efficiency, and productivity benefits that can be achieved.

Alistair Hookway, Editor of Hazardex, spoke with James Fox, Product Manager at ProcessVue, to discuss how a change of perception to alarm management could help expand its effectiveness and provide tangible benefits to operators.

For those unfamiliar with alarm management, it can be defined as a series of procedures, policies, and human factors used to manage alarm systems. The idea is to improve an alarm system's usability for an operator that is running a plant or process. Its traditional role is to act as a thin buffer of warning between normal operations and taking effective action to prevent a dangerous failure.

Alarm management challenges

It is estimated that poor alarm management costs the global industry an estimated $20 billion in lost production and productivity every year. It is important to remember that alarm management is not just a one-time activity that can be set up and forgotten – it is a continuous improvement process. If an operator chooses to ignore this process, pretty soon things will begin to fail and original problems will start again.

Operators face a number of challenges when it comes to alarm management. A major headache for many are alarm floods or alarm showers. These occur when a fault occurs in a process or plant that results in a large volume of alarms. For example, when a piece of equipment fails, a series of interconnected processes will also be impacted which creates a knock-on effect of alarms being generated. This leads to a flood or shower of alarms, inundating the operator with a sudden and sizable volume of warnings and alarms which stem from