Choosing a Method of Explosion Protection

Making the right choice of protection concept for your equipment can make a big difference in terms of cost, timescale and the cost of modifications to the product. To assist you, Sira has prepared a brief outline of a few of the most common types of protection, with an explanation of the advantages and disadvantages of each.

In some cases 'component' certified products are mentioned in the following sections. A component is a product that does not form a complete explosion safety device but is able to be incorporated into a finished design. An example would be flameproof switches that must be fitted to a flameproof housing. A large number of manufacturers offer component certified devices for sale and these can be used to provide part of the explosion safety solution. The final assembly would still require assessment, testing and certification, but testing on the component certified parts is usually not required.

Flameproof (Ex d) – EN 60079-1

Above: an enclosure that did not meet Flameproof requirements

The heart of the Flameproof concept is in providing a strong and closely fitting enclosure to protect its contents. The enclosure must be capable of containing an explosion.

The contents are not really that important, although there are some restrictions for fluids and batteries. As long as there is plenty of internal free space most contents will be OK.

Flameproof protection lends itself to utilising off-the-shelf parts for the contents, for example electronic control boards. The enclosure can either be purpose designed or you could take advantage of a range of component certified versions. Using an already component certified Flameproof enclosure removes any uncertainty about its integrity.

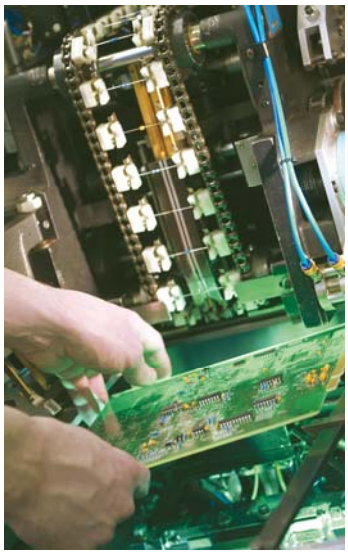
If operator control is required, several manufacturers offer pushbuttons etc that are component certified and can be fitted to an enclosure.

Generally flameproof enclosures are made of cast iron or aluminium, making them quite heavy. They are generally small to medium size because the casting process is more expensive as the size increases and the subsequent weight makes installation a specialist task.

Plastic enclosures can be designed to meet the construction and strength requirements. Usually plastic enclosures are quite small because they have to have thicker wall sections, compared to a metal counterpart, to withstand the explosion pressure. A metal enclosure is usually cheaper to manufacture.

Intrinsic Safety (Ex i) – EN 60079-11

Intrinsic Safety relies upon the equipment supplies being of low voltage and power and is suited to electronic devices. The operating current of the circuitry should be low enough not to be affected by series resistance, which may be required to limit energy. The circuitry should contain low values of inductance and capacitance.



Supply values exceeding 30V and 1.3W are possible though increasingly more difficult to certify.

A detailed analysis of the circuit design will be undertaken. In short your circuit design will probably need to be modified to achieve certification, so this protection concept is not suited to circuit boards that cannot be modified. The strength and shape of the enclosure is not so important as full control and knowledge of the circuit design.

Increased Safety (Ex e) – EN 60079-7

The most common equipment protected by increased safety are transformers, motors, luminaires, cells, batteries, terminals and wires. It is not appropriate for electronic components or sparking devices such as switches. Increased Safety relies upon a dust/water tight enclosure to avoid tracking across live circuits. A large number of manufacturers produce increased safety enclosures, terminals and junction boxes.

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Serious About Safety

Non sparking (Ex n) – EN 60079-15

This type of protection is only suitable for Zone 2 or 22 hazardous areas, but can apply to a large range of equipment. Generally any electrical device that does not have potentially sparking contacts, such as potentiometers, relays or switches and where a water/ dust tight enclosure is present, can be accommodated easily. Creepage and clearance distances are not appropriate where supplies don't exceed 60 V ac. or 70 V dc., provided over-voltage protection exists for the supply and the enclosure is dust/water tight.

Specific requirements apply to certain recognised types of equipment, such as motors, luminaires and batteries.

Equipment with potentially sparking contacts can be protected in a number of ways:

Encapsulation

Suited to higher power circuits or where creepage and clearance distances on a circuit board are below the required minimum.

Sealed

The sparking device is sealed in an enclosure so the flammable atmosphere cannot gain access.

Restricted breathing

The enclosure may contain either hot components but no sparking components, or sparking components but with low internal air temperature rise. This method relies on a tight gasket seal on the enclosure joints.

Energy limited

Similar to intrinsic safety, the energy available at potentially sparking parts is limited to prevent an ignition occurring. Suitable for circuit designs where detailed knowledge of the design is available and modifications can be accommodated.

Simplified pressurisation

Similar to purging and pressurising, uses a control system to flush clean air through and enclosure and keep it pressurised to prevent a flammable atmosphere from entering.

Enclosed break

Applies to small enclosures where the design of the enclosure joints prevents an internal ignition from transmitting to the flammable atmosphere outside. Similar to Ex d but without flamepath design requirements.

Encapsulation (Ex m) – EN 60079-18

Encapsulation works simply by enclosing equipment in potting compound so keeping the potentially explosive atmosphere away from the source of ignition. There are however, several drawbacks with this type of protection. The testing part of the certification process takes at least five weeks and the outcome is by no means certain.

The encapsulated product is subjected to high temperature conditioning for four weeks and, with the differences of thermal expansion of internal parts, can lead to cracking and splitting of the encapsulant.

Accessibility and serviceability of the product is sacrificed, since the potting should cover all parts of the circuit. On the plus side however there is not much restriction to the design of the circuit, although some modification may be needed because a single fault has to be applied to the circuit without damaging the potting. Thermal fuses can provide this protection either built in or as a 'piggy back' board.

Pressurisation (Ex p) – EN 60079-2

This has the benefits of Flameproof but does not require a specialised enclosure, generally a standard industrial enclosure is suitable. The only drawback of Pressurisation is that it requires a supply of protective gas, usually air, to purge the enclosure and keep it pressurised.

The supply of purging and pressurising air is managed by a special control unit. Usually this is easier to purchase as a component certified item. There is a choice of several units on the market but a special application may make designing your own unit worthwhile.

One advantage of purging and pressurising is that this protection concept also accommodates possible internal releases of flammable gas, vapour or liquid. This is relevant for analysers or other equipment that have a flammable liquid or gases passing through it.

More Information

For more information, or to discuss a particular approval project, please contact Sira.

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