Methods of Protection Flameproof (Exd)

EN IEC 60079-1 (EN IEC 60079-0 also applies)

Many types of industrial equipment can be certified using the flameproof concept. The external enclosure of flameproof equipment is designed to withstand an internal explosion. The enclosure joints permit the products of combustion, and the resulting expansion of gases, to be relieved through the joints and not to permit that explosion to transmit through to the external atmosphere.

Due to the nature of the protection method, it is usual for enclosures of any significant size to be manufactured from metal, rather than plastic.

Enclosures are purpose designed to meet the constructional requirements of the standard, however some manufacturers have certified component enclosures that can be utilised for a final design. When using a component enclosure, the final design must be presented to Sira for evaluation, to confirm that internal explosion pressure limits will not be exceeded.

Requirements Applicable to all Products

The principles of the flameproof protection concept are:

- No external hot surfaces above temperature class.
- Design of enclosure joints must comply with the requirements of the standard.
- Plastic and cemented parts contributing to the flameproof properties of the enclosure undergo high temperature and humidity testing.
- Parts fitted inside an enclosure may include sparking contacts, semi-conductor devices and batteries.
- Rotating parts (operating rods or motor shafts can also be permitted, subject to design restraints.
- Flexible enclosure walls or elements of enclosure walls are not permitted.

Specific Requirements

A vast range of electrical equipment can be protected by the flameproof method. Below are some additional notes for some specific types of equipment.

Motors

Motors must be specially designed to meet the stringent constructional and test requirements for flameproof devices. A motor complying with the requirements stated above will require a thermal test at manufacturer's rated full load to determine normal running temperatures. Reference pressure tests are conducted with the rotor stationary and rotating, to simulate conditions in use.

A range of standard motors can be covered on a certificate.

Motors to be used with an inverter (variable speed drive) require special consideration.

Luminaires

It is usual for a range of luminaries to be covered on a single certificate. Depending on lamp rating, not all types will require testing provided the client will accept the thermal test results from a luminaire having a higher rating. Emergency (battery back up with an inverter) luminaires may also be included on a certificate.

Junction boxes

A range of different size junction boxes can be covered on a single certificate. Control devices such as pushbuttons and switches may also be fitted to the enclosures.

Method

Assessment of the equipment is conducted to determine what tests are required to demonstrate compliance with the standard. A range of equipment sizes may not require tests on all sizes in the range.

Thermal test

Usually a thermal test is the first test to be conducted, to determine the maximum temperature of components and parts under maximum service conditions (i.e. using manufacturer's rating for the device, related to the maximum ambient temperature in service). An additional test at 0.9 to 1.1 times rated voltage may also be conducted at this time to determine maximum surface temperature. Again this is related to maximum ambient temperature in service.

Thermal endurance

Non-metallic enclosures and cemented joints contributing to the flameproof properties of the enclosure undergo thermal endurance (high humidity and high temperature) of non-metallic parts. This is followed by impact testing, unless the item is a component intended to be fitted inside another enclosure.

Reference pressure

A series of tests are conducted to determine maximum internal explosion pressure. The tests involve filling the enclosure with an explosive mixture of gas and igniting it. Special transducers fitted to the enclosure measure the resulting pressure. The internal arrangements of the equipment may be configured in various options determined by the manufacturer and additional tests carried out to measure the highest explosion (reference) pressure.

Depending on the arrangement of internal parts, some configurations may give rise to higher internal explosion pressure. This is because the complexity of the internal shapes may slow the speed at which the internal explosion occurs. When the explosion is slower, the rise in internal pressure compresses the unburned mixture before it is ignited. This is called 'pressure piling'.

Overpressure

Following these tests a hydrostatic overpressure test is conducted, to verify mechanical strength of the enclosure. Leakage of test fluid through flameproof joints is permitted.

Flame transmission

Following overpressure tests the test sample is also subjected to a series of flame transmission tests, using the same explosive mixture of gas as before. The sample is also placed in an explosive atmosphere. When the internal explosive mixture is ignited, it is not permitted for this to 'transmit' through the flameproof joints to the outer external atmosphere.

For equipment that has an ambient temperature range higher or lower than –20°C to +40°C the reference pressure overpressure and flame transmission tests may be conducted at the extremes of low and high ambient specified by the manufacturer.

For more information on Flameproof protection, please refer to general requirements tests EN IEC 60079-0.