

9

Technical

SX Range

1

BPG Range

2

BPGA Range

3

ZAG Range

4

High Voltage

5

Fire Rated

6

ZP Range

7

Others

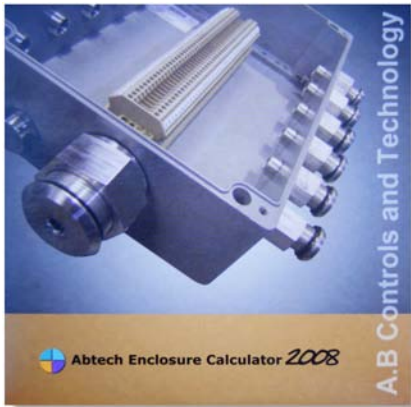
8

Technical

9

Selecting the Correct Enclosure

It is vital that the enclosure selected is suitable for the required application. The enclosure should be mechanically robust enough to contain cables and cable glands which will be fitted and the IP rating of the enclosure should be adequate to deal with the environmental conditions likely to be encountered. The enclosure should also be large enough to accommodate the terminals or components fitted and it should be considered at this stage whether or not future expansion will be necessary and to allow room for this. The ABTECH *Enclosure Calculator Software* can be used to select the correct enclosure by quickly calculating if the required terminals will fit.



Cable entry points must also be considered i.e. how many and where are they to be placed. If all the cable entry points are to be on the bottom face, for instance, this may necessitate a larger enclosure than would be necessary just to accommodate the terminals.

Terminal Selection

Any type or make can be fitted inside ABTECH enclosures except in the case of enclosures intended for use in hazardous areas. The terminal should be matched to the type and size of cable being used and attention should be paid to the current and voltage ratings of both the terminal and cable. Any manufacturer's instructions in relation to the fitment and necessary clearance required around the terminal should be strictly adhered to. Modular terminals can be fitted to DIN

standard terminal rails and these can be fitted directly to the inside of the enclosure using the fixing points which are a standard feature of ABTECH enclosures or by mounting onto a component mounting plate which is available as an option for all enclosure types and sizes.

Cable Glands

Cable glands should be selected according to the cable type, screen or armour earthing requirements and the IP rating required. Using the ABTECH *Enclosure Calculator Software* will quickly let you see whether your chosen enclosure can accommodate the required number of cable glands and provide a drawing automatically. Designers should always allow enough clearance around multiple gland entries to allow for fixing nuts etc. Please refer to the drawing at the end of this section which shows ABTECH's suggested clearance dimensions for common entry sizes. Cable glands are a specialised field and the cable gland manufacturers should be contacted for technical information and help regarding the correct selection of these items.

ABTECH can supply and fit cable glands if required or we can machine the enclosure or gland plates for fitting on site. We can provide a number of different thread forms e.g. metric, NPT, PG etc. or clearance holes.

Hazardous Areas

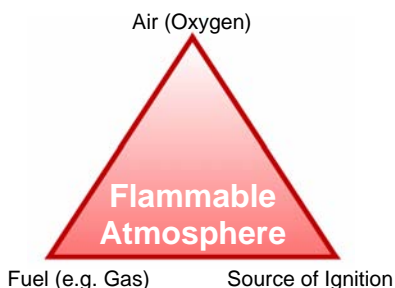
ABTECH specialises in the design and production of junction boxes and enclosures for use in potentially hazardous areas. The SX, BPG and ZAG enclosure ranges are all certified for use in Zone 1 and Zone 2 hazardous areas. We also specialise in high voltage junction boxes for up to 11kV in Zone 1 and 35KV in Zone 2 areas. The following gives a brief guide to the protection methods used for electrical equipment in hazardous areas.

Definition

A Hazardous Area is defined as "An Area containing a potentially explosive atmosphere, which, if ignited, could give rise to damage of property or injury to persons". Hazardous areas can be found in almost every industry and even in daily life, the best example being a petrol station or a gas station.

Protection

How do we protect hazardous areas? i.e., how do we stop a potentially explosive atmosphere from igniting and destroying the installation? In order to prevent an explosion we must first understand the conditions required to cause an explosion. There are three conditions which must co-exist in order to create an explosion, fuel, air and an ignition source. This is normally known as the Ignition Triangle.



With this knowledge, it is possible to protect the equipment from one of the three elements required to cause an explosion i.e. in the case of increased safety (EEx'e') the ignition source is removed by ensuring that there are no hot surfaces or sparking components which could ignite a fuel and oxygen mixture which may enter the enclosure.

Zone Classification

Codes of practise exist for the classification of areas according to the probability or likelihood of the existence of a flammable atmosphere. This is known as Area Classification and in accordance with EN 60079-14 is typically as follows:-

Zone 0

Where a Flammable Atmosphere is continuously present or present for long periods. Permitted forms of protection: Ex 'ia', Ex 's' (for Zone 0)

Zone 1

Where a Flammable Atmosphere is likely to occur during normal operation. Permitted forms of protection; any type of protection suitable for Zone 0 and Ex 'd', Ex 'ib', Ex 'p', Ex 'e', Ex 's', Ex 'm', Ex 'q'.

Zone 2

Where a Flammable Atmosphere is not likely to occur during normal operation and if it does will only exist for a short period of time. Typically less than 10 hours per year and is often referred to as the "Remotely Hazardous Area" Permitted forms of protection: Any type of protection suitable for Zone 0 and 1 and Ex 'nA', Ex 'nR', Ex 'o'

Zone 20

A place in which an explosive atmosphere, in the form of a cloud of combustible dust in air, is present continuously, or for long periods or frequently for short periods.

Zone 21

A place in which an explosive atmosphere, in the form of a cloud of combustible dust in air, is likely to occur occasionally in normal operation.

Zone 22

A place in which an explosive atmosphere, in the form of a cloud of combustible dust in air, is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

For all dust hazard areas the permitted forms of protection include: mD (encapsulation), iaD (intrinsically safe), pD (purged), tD (protection by enclosure). Where protection type tD is selected a plastics enclosure should only be used if the material has anti-static properties.

Types Of Protection

Intrinsically Safe – Ex 'ia' (EN 50020)

This type of protection is afforded by the electrical circuit or components having insufficient energy to ignite a flammable atmosphere. Ex 'ia' equipment is safe under two fault conditions and permissible for use in Zone 0 areas. Intrinsically safe components or circuitry is normally housed in an enclosure having Ex 'e' protection although this is not always necessary. In this case it is important that the integrity of the enclosure is adequate for the area of use.

Intrinsically Safe – Ex 'ib' (EN 50020)

As above, except Ex 'ib' equipment is safe under one fault condition permissible in Zone 1 areas.

SX Range

1

BPG Range

2

BPGA Range

3

ZAG Range

4

High Voltage

5

Fire Rated

6

ZP Range

7

Others

8

Technical

9

Flameproof – Ex ‘d’ (EN 50018)

Equipment may include arching and sparking (or incensive) devices and flammable mixtures may enter the enclosure. The enclosure construction is designed to contain an internal explosion and prevent transmission of sufficient energy to ignite a potentially flammable atmosphere outside the enclosure.

Increased Safety Ex ‘e’ (EN 50019)

Explosive mixtures may enter the equipment but the likelihood of a fault condition, which could result in ignition of this mixture, is significantly reduced.

The components used in the apparatus shall not produce arcs or sparks or temperatures above that of ignition temperature of the surrounding atmosphere in normal working conditions. Creepage and clearance distances for electrical insulation are increased over that of industrial equipment and insulation material must be reliable over long periods of time. A minimum ingress protection of IP54 must be provided by any enclosure containing increased safety equipment and it must also be capable of withstanding a 7Nm impact.

Pressurised – Ex ‘p’ (EN 50016)

Pressurised or purged apparatus Type ‘p’ rely on a combination of a positive static pressure applied inside the enclosure and a continuous flow of air or inert gas to expel any explosive mixture which may have entered. A monitoring system is an important part of the apparatus to ensure correct operation.

Encapsulation – Ex ‘m’ (EN 50028)

Encapsulation of arching and sparking components or apparatus to ensure no exposure to explosive mixtures which may be present. The surface temperature is also controlled under normal and fault conditions, thus preventing ignition from occurring.

Powder Filled – Ex ‘g’ (EN 50017)

Powder or sand filled enclosures housing arching and sparking devices. Often used to contain the energy released from the failure of electrical or electronic components such as the breaking of a fuse.

Non Sparking – Ex ‘nA’ (EN 50021)

This protection method is very similar to that of Ex ‘e’ and although to a higher level than industrial standards, it is less than that of Ex ‘e’. Can only be used in Zone 2 areas but allows the use of fuses, disconnect terminals and other components not allowed in Ex ‘e’.

Restricted Breathing – Ex ‘nR’ (EN 50021)

In this concept, protection is afforded by the sealing properties of the enclosure in which either hot or sparking equipment may be fitted. It is assumed that the likelihood of a flammable atmosphere being present whilst the enclosure is breathing is very remote and the sealing of the enclosure should be sufficient to protect against this.

Oil Immersion – Ex ‘O’ (EN 50015)

Where the sparking components are immersed in oil and controlled venting is also used. Most commonly found in older type switchgear.

Special – Ex ‘s’

No formal standard exists for this type of protection and it is the responsibility of the manufacturer and the relevant test authority to ensure that the apparatus is safe to use in the intended zone.



Temperature Classification & Gas Groupings

Flammable mixtures can be classified under two main characteristics in respect of explosion protection; temperature of ignition by hot surfaces and the spark energy required to ignite the mixture. The spark energy of the ignition is also related to the intensity of the explosion.

Classification of maximum surface temperatures in both North America and Europe are similar but vary slightly in the nomenclature used. The temperature classification is important to ensure that the correct equipment is matched to the flammable atmospheres that could potentially exist in an area. This will take into account such things as maximum ambient temperature and maximum operating voltage with a + 10% over voltage or an overload condition applied.

In some types of protection such as Ex 'd' or Ex 'nR' the temperature classification is based on the outside temperature of the enclosure where as in other types of protection such as Ex 'e' or Ex 'nA' the temperature classification is based on the temperature of the internal components. It follows that equipment with a higher temperature rating and, therefore, lower operating temperature is suitable for use in a wider range of hazardous areas.

Equipment rated T6 is suitable for use with all gases and vapourised mists.

All Gases are grouped according to their physical properties and details of their grouping can be found in either National or International codes of practice. Some examples of gas groups are shown on the next page.

Temperature Classification Table

Maximum Surface Temperature	US (NEC 505) IEC CENELEC	US (NEC 500)
450°C (842°F)	T1	T1
300°C (572°F)	T2	T2
280°C (536°F)		T2A
260°C (500°F)		T2B
230°C (446°F)		T2C
215°C (419°F)		T2D
200°C (392°F)	T3	T3
180°C ((356°F)		T3A
165°C (329°F)		T3B
160°C (320°F)		T3C
135°C (275°F)	T4	T4
120°C (248°F)		T4A
100°C (212°F)	T5	T5
85°C (185°F)	T6	T6

Unless otherwise specified on the rating plate it is assumed that the operating ambient temperature is in the range -20°C to + 40°C (-4°F to 104°F) in accordance with European Standards.

- SX Range 1
- BPG Range 2
- BPGA Range 3
- ZAG Range 4
- High Voltage 5
- Fire Rated 6
- ZP Range 7
- Others 8
- Technical 9

Gas Grouping For Electrical Apparatus (EN 50014)

Group	Gas
I (Mining)	Methane (firedamp)
IIA	Industrial methane, Propane, Petrol & most industrial gases.
II B	Ethylene, Town Gas & other industrial gases
II C	Hydrogen, Acetylene & Carbon Di-sulphide.

Ambient Temperature

The ambient temperature is the surrounding temperature of the environment in which the equipment is installed, whether indoors or outdoors.

For electrical equipment certified in Europe it is assumed that the ambient temperature in which the equipment may be operated is between -20°C and + 40°C (-4°F to 104°F). Some types of equipment are certified for operation outside this range and if so must be stated on the equipment label or certificate.

North American Standards

In North America all electrical installations are governed by the National Electric Code (NEC).

Electrical equipment used in ordinary, wet and hazardous (or classified) locations must be 'listed' by an accredited approval agency for use in the intended location. The hazardous locations include areas in which flammable, combustible or ignitable substances may occur in hazardous quantities. Article 501 Codes of the NEC use a different way of categorising the hazardous locations, which is by Class and Division, compared with the European and IEC standards, which have adopted the Zonal method. Electrical apparatus approved in North America for use in hazardous locations must be categorised with an Equipment Class and suitable for a specified Division and Gas Group.

Classifications are made in line with the type of combustible material as follows;

Class I – Flammable gases, vapours or mists

Class II – Combustible dusts

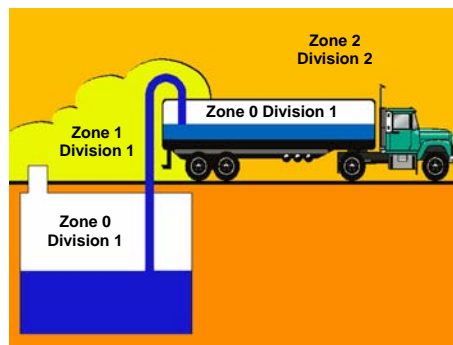
Class III – Ignitable fibres and flyings

In 1996 article 505 was introduced to the NEC which allowed Zonal classification of hazardous areas. This now means that products can be approved as follows:

Either, **Class, Division & Gas Group**
For example:
Class 1, Division 2, A,B,C,D

or **Class, Zone & Gas Group**
For example:
Class 1, Zone 2, IIA, IIB, IIC.

Although this code change permits the use of products that have a Zonal classification, in a similar way to European practice, the mixing of different forms of equipment approval across zones or divisions is not acceptable. For example products approved for Zone 1 do not necessarily meet the requirements of Division 1, which also encompasses Zone 0.



Although no direct equivalents exist between European/IEC and American codes of protection and Area Classification there are similarities and there is a developing acceptance of European/IEC methods in North America and vice versa. The following table shows the basic relationships between the North American and European Classifications.

Equivalent Division/Zone

NEC	European / IEC
Division 1	Zone 0
	Zone 1
Division 2	Zone 2

As can be seen from the above table, Division 1 covers both the European / IEC Zones 0 & 1. Therefore, care must be taken when using zone classified equipment in a Division 1 area to ensure the suitability of the protection employed.

Underwriters Laboratory (UL) and Factory Mutual (FM) are the two main certification bodies in North America and in some cases electrical equipment may also need to meet certain Marine Standards and be separately approved by the US Coast Guards, before it can be used e.g. on an offshore oil rig.

Ingress Protection

A major secondary protection parameter is the ingress protection of the electrical equipment. Moisture or dust, if allowed to come into contact with electrical circuits, could led to either sparking or physical breakdown of the components and interfere with the protection method being used. In some cases the IP rating forms part of the explosion protection method. All IP ratings for products in this catalogue have been carried out in accordance with EN 60529 (IEC 529) and have been witness tested by independent test laboratories.

It will be noted that some products have both IP66 and IP67 ratings. This is because in some instances the IP66 requirement is more onerous than the IP 67 equivalent.

Both the SX range and BPG ranges have also been tested to the Shell/ERA deluge specification. This is one of the most onerous water ingress tests and was designed specifically for electrical equipment which would be subject to deluge conditions, e.g. ships decks and fire deluge areas.

The following table shows the criteria for IP requirements to EN 60529(IEC 529).

First Digit	Degree of Protection (Dust)	Second Digit	Degree of Protection (Water)
0	No Protection	0	No protection
1	Protection against ingress of large solid particles	1	Protection against ingress of vertically dripping water
2	Protection against ingress of medium solid particles	2	Protection against ingress of water dripping at an angle of 75 – 90 degrees
3	Protection against ingress of solid particles greater in thickness than 2.5mm	3	Protection against ingress of sprayed water
4	Protection against ingress of small foreign bodies greater in thickness than 1mm	4	Protection against ingress of splashed water
5	Protection against ingress of dust in an amount sufficient to interfere with enclosed equipment	5	Protection against ingress of water jets
6	Complete protection against ingress of dust	6	Protection against ingress of water in heavy seas
		7	Protection against effects temporary immersion
		8	Protection against effects of indefinite immersion

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- Technical 9

ATEX Directive

The ATEX directive (94/9/EC) came into force in April 1994 and was enacted into UK law in March 1996. It became a mandatory requirement in July 2003. All of the products in this catalogue have an EC type examination certificate to the ATEX directive. ATEX covers both electrical and mechanical ignition hazards.

Apparatus are divided into Equipment groups (I for mining and II non-mining), source of ignition Gas (G) and Dust (D) and Categories 1, 2 and 3. The Categories provide respectively, very high, high and normal levels of protection against ignition. The Categories deliver the level of protection which is currently obtained by applying the existing protection techniques (Ex 'd', Ex 'e' etc) and they also take into account other protection concepts proposed by manufacturers and considered by the notified (certification) bodies who produce EC type examination (ATEX) certificates.

The Categories in practice are equated to suitability for Zones. The actual category of apparatus specified for a Zone depends on the overall risk assessment for a Zone. The Zoning considers only the probability of the existence of an explosive atmosphere. It does not consider the consequential effects of an ignition taking place. Apparatus are marked with the grouping and Category in addition to the marking required by the individual protection standards.

All ABTECH products are certified for use in Group II industrial applications, most are certified for both Gas (G) and Dust (D) hazards and are suitable for classification in Categories 2 and 3. This means that they are or will generally be suitable for use in Zone 1 and Zone 2 areas. Guidance is given by the codes of practice such as EN 60079-10 and EN 60079-14 etc. These codes of practice provide the user with guidance in selecting apparatus to obtain the degree of safety that is required for the particular hazardous area application.

An EC type examination by a notified body is required for Category 1 and 2 equipment but not for Category 3 where the certification is supplied by the manufacturer.

Junction Boxes In Hazardous Areas

Junction boxes and terminal enclosures for use in hazardous areas mainly contain non incandive devices i.e. terminals. For Ex 'e' certified apparatus there are two main criteria when specifying the apparatus.

1. Are the components acceptable for use in the enclosure i.e. non sparking, and
2. Will any components or wiring be hotter than the temperature classification of the apparatus allows.

To comply with the first requirement, only terminals or other components which are specifically allowed for in the certificate of compliance, and post July 2003 only ATEX certified components may be fitted (apparatus constructed prior to July 2003 need not meet this requirement).

To ensure compliance with the second criteria for safe use, all low voltage ABTECH enclosures are certified using the dissipated power method.

Through testing it has been determined what the maximum power dissipation can be from the components and wiring inside each enclosure size to ensure that the temperature of any of the components does not exceed the temperature classification of the apparatus.

This figure is shown for each of the products throughout the catalogue and can be found on each of the product certificates.

By knowing the total current through the enclosure and the total resistance of the terminals and wiring, using Ohms Law it is possible to calculate the dissipation power of the circuit.

Power Dissipation;

$$P \text{ (Watts)} = I^2 \text{ (Amps)} \times R \text{ (Ohms)}$$

Where I is the total current through the enclosure, and R is the total resistance of the terminals and conductor contained within the enclosure.

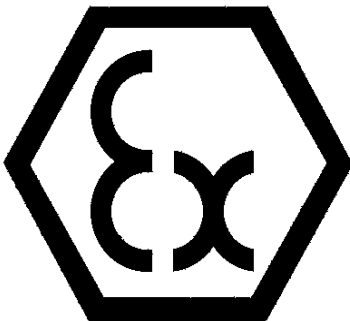
The resistance of the terminals can be sought from the terminal manufacturers and the resistance of the conductors is available in reference books or from the cable manufacturers.

Alternatively, the ABTECH *Enclosure Calculator software* will calculate this automatically for a given combination of enclosure and terminals.

For high current applications the terminal resistance can vary depending on the cable size, cable quantity, crimping method for cable lugs and the actual current flow. Correct installation is essential in order to limit the overall temperature rise and the maximum operating temperature of the terminals.

In all Ex certified enclosures it is important that an earth facility is provided. In plastic enclosures this may be by means of an internal/external earth stud or by an earth terminal fitted inside. Additional earthing for cable glands can be provided by an earth continuity plate fitted inside the enclosure wall. Plastic enclosures carry a risk of static discharge which could lead to a spark being produced if rubbed with a dry cloth. Plastic enclosures should only ever be cleaned using a damp cloth. Optionally, plastic enclosures with a graphite filling are available which reduces this risk.

For metallic enclosures the earth facility must earth the enclosure body and can be provided by earth terminals connected to the body through the terminal mounting rail and/or by means of an internal/external earth stud.



Cable Glands for use In Hazardous Areas

Cable glands used in enclosures intended for use in a hazardous area must meet with the same criteria as the enclosure to which they are connected. For example, cable glands used on an EEx'e' enclosure must meet the requirements for the enclosures of the EEx'e' standard i.e. must be capable of withstanding a 7Nm impact and capable of maintaining an ingress protection of at least IP54.

If a plastic or non-metallic cable gland is used it must be capable of passing these tests after having undergone an accelerated conditioning period.

Most reputable cable gland manufacturers have their products approved by a suitably notified body and will carry the certification markings on the body of the gland.

Cable glands are a very important element in the protection of electrical equipment and should not be underestimated. There are a vast array of different cables in use today and it is important that advice is sought from a cable gland manufacturer regarding selection.



SX Range

1

BPG Range

2

BPGA Range

3

ZAG Range

4

High Voltage

5

Fire Rated

6

ZP Range

7

Others

8

Technical

9

Suggested Clearance Dimensions for Common Gland Sizes

