



Dust explosion protection

# *A leading position for safety engineering*

## **The BARTEC company**

Reinhold A. Barlian founded the BARTEC company in 1975 and creates the corporate philosophy:

**BARTEC protects people and the environment  
by the safety of components, systems and plants.**

## **Safety engineering**

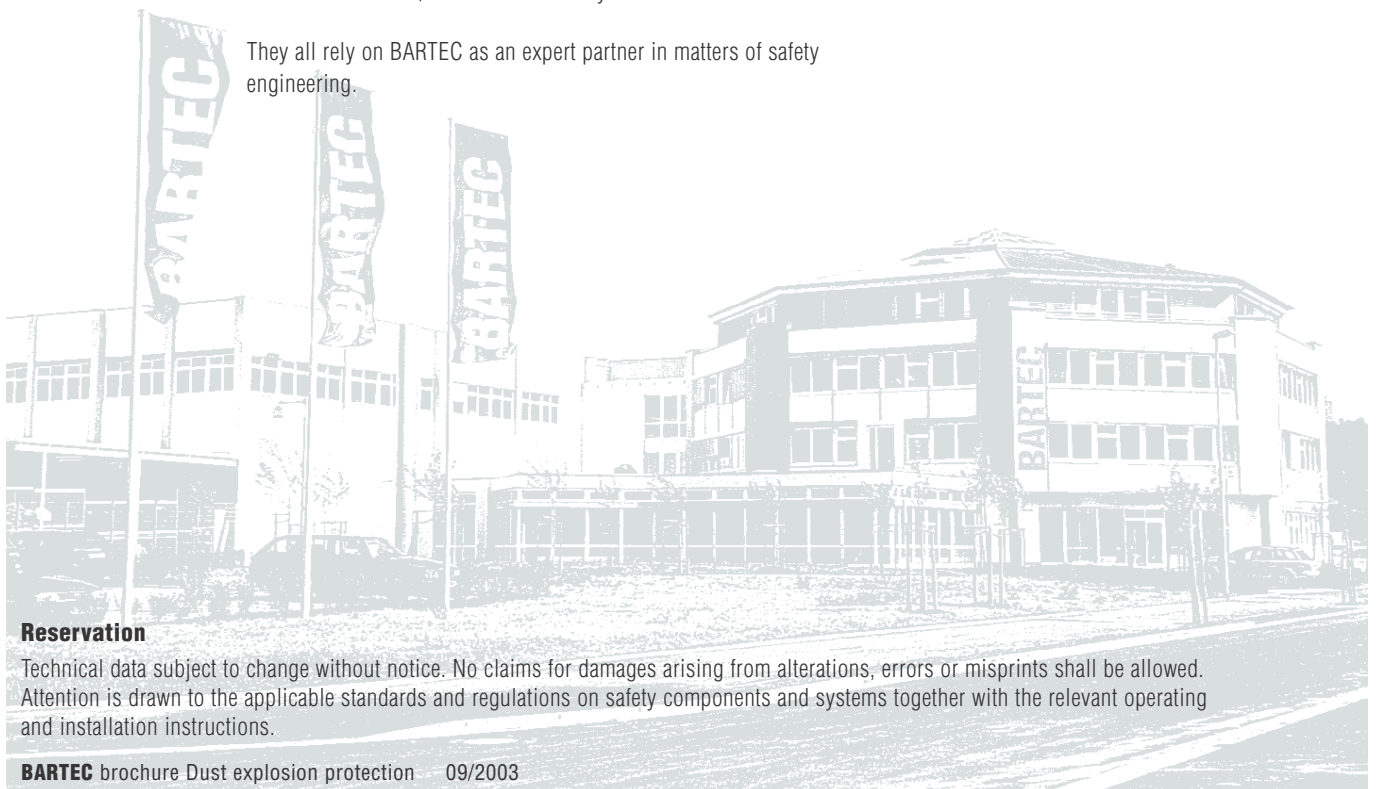
We are full of ideas for new products. For ever new applications, for new markets. Thus within a space of 27 years, we have acquired a leading position among safety engineering suppliers with our innovative components and systems tested to international standards.

We design and build components and systems for machine and equipment constructors and for original equipment manufacturers; for constructors and operators of industrial plant, for the chemical, petrochemical, pharmaceutical, power generation and environmental engineering industries.

Expertise and reliability build the foundations of an efficient partnership for:

- Machine and equipment construction
- Original equipment manufacturers
- Constructors and operators of plant  
in the chemical, petrochemical pharmaceutical, power  
generation and environmental engineering industries
- Food industries
- Wood/paper processing
- Building materials
- Plant automation/Automobile industry

They all rely on BARTEC as an expert partner in matters of safety engineering.



## **Reservation**

Technical data subject to change without notice. No claims for damages arising from alterations, errors or misprints shall be allowed. Attention is drawn to the applicable standards and regulations on safety components and systems together with the relevant operating and installation instructions.

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## Electrical protection from dust explosions

### Dust explosions

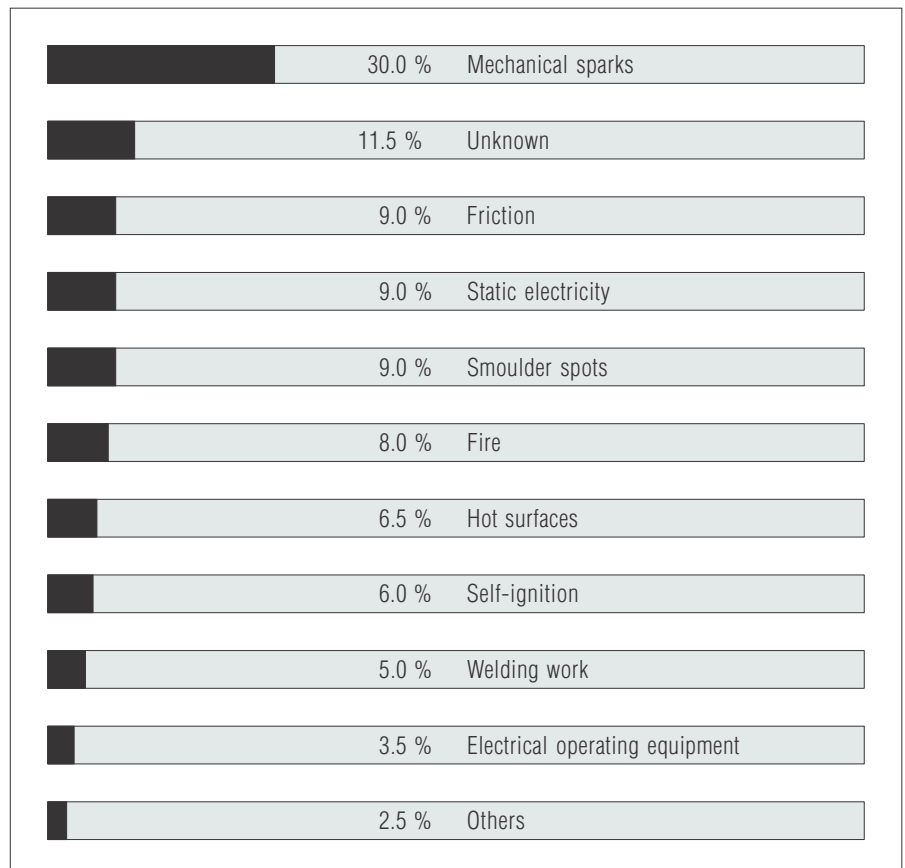
Dust explosions have been known in Europe since the first cereal mills were built. There is a risk of fires and explosions in all industrial works which have to deal with combustible dust, whether this be as a production material or as residual waste.

In order to avoid danger to people, plant and the environment, electrical operating equipment in zones endangered by dust explosions may not be a source of ignition.

The following must therefore apply to all electrical operating equipment:

1. No static electricity
2. No hot surfaces
3. No mechanically generated sparks
4. No inflammable dust (volumes capable of combustion) may penetrate an enclosure with an internal source of ignition

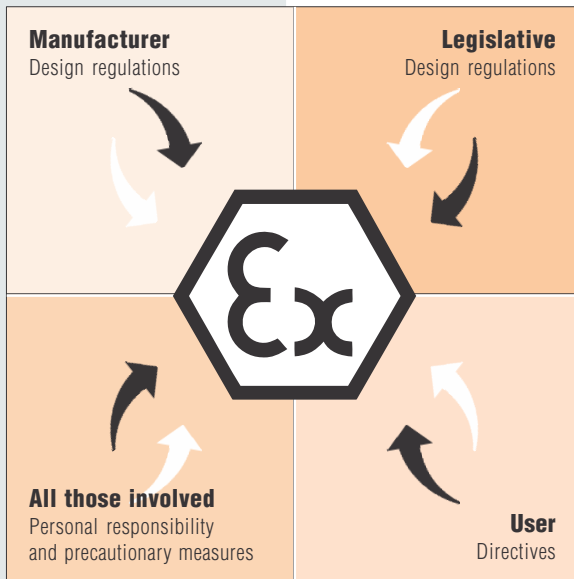
### Ignition sources as a percentage of dust explosions in Germany





### Technical development of explosion protection

Electrical equipment was introduced into industry and the household in the last century. Immediately afterwards, because of the methane and coal dust occurring in coal mines, the basics of electrical explosion protection were developed. The advantages of electricity were so convincing, that intensive work was carried out to find the means of reliably preventing contact between a potentially explosive atmosphere and ignition sources - originating from the use of electrical equipment - and thus preventing explosions.



After bitter experiences in the beginning, mine explosions were able to be made very much rarer, and well-monitored electrical equipment was utilised with very high safety standards.

Even more relevant than these solutions which concentrate on the ignition sources (the so-called secondary explosion protection) is primary explosion protection, i.e. the use of non-flammable materials which cannot form a potentially explosive atmosphere.

However, it is not always possible to exclude flammable material such as flour dust in mills. Protection and safety are in such cases provided by equipment which is reliably protected against explosions.

These days, the construction of explosion-protected equipment has long left electrical engineering. In the future non-electrical equipment will also require testing or at least assessing. The knowledge about the explosion protection of electrical equipment that manufacturers have collected also benefits the manufacturers of non-electrical equipment.

There are many applications which require explosion protected equipment. Modern safety engineering makes it possible for electrical measuring technology to be used, even where an explosion hazard is permanently present, for example in reaction vessels.

Formation and processing of combustible dusts in mills, carpentries and in the pharmaceutical industry creates hazardous zones. Explosion protected equipment creates safety.



Internationally unified design regulations for electrical engineering have been drawn up in the form of IEC standards and reports have been formulated, largely in agreement with those in the CENELEC standards.

The European Community has provided itself with an obligatory, uniform design requirement for the explosion protection of systems, devices and components with the Ex directive 94/9/EC, which is supported by the EN standards mentioned above and the CENELEC and CEN standardisation organisation.

With the help of these standards, the manufacturer is safe to assume during the design and assessment of the explosion protection, that he is developing safe, explosion protected systems, devices and components conforming to the Ex directive 94/9/EC, which will be tested by applying uniform and obligatory criteria in an authorised EC test centre. The EC authorised test centres provide a manufacturer-independent EC prototype certification which guarantees a uniform quality throughout, with regard to the required safety of the explosion protected equipment, at a very high or enhanced safety level. These EC prototype certificates, or assessments provided by the manufacturer, are the prerequisite for the production and distribution of systems, devices and components at a very high or enhanced safety level.

Constant, uniform quality requirements are, according to Ex directive 94/9/EC, also required for the type of the installation and for the servicing required for maintaining the safe state. The technical parameters are also defined in EN standards.

Uniform classification of the explosion-hazard equipment is the basis for the selection and classification of systems and devices, including their installation. The appropriate EN standards are being developed and passed step by step as directive 1999/92/EC is becoming adopted. According to this EC directive, an Ex document is the precondition for setting up and operating an explosion-hazard facility. Only such a document makes it possible to select and install, operate, maintain and eventually repair it as required by the standard systems, devices and components.

Using the two EC directives mentioned above, a consistent system is created which allows successful prevention of explosions for the effective protection of people, the environment and property.

BARTEC develops and constructs component and system solutions for safety engineering.

BARTEC's corporate goal is:

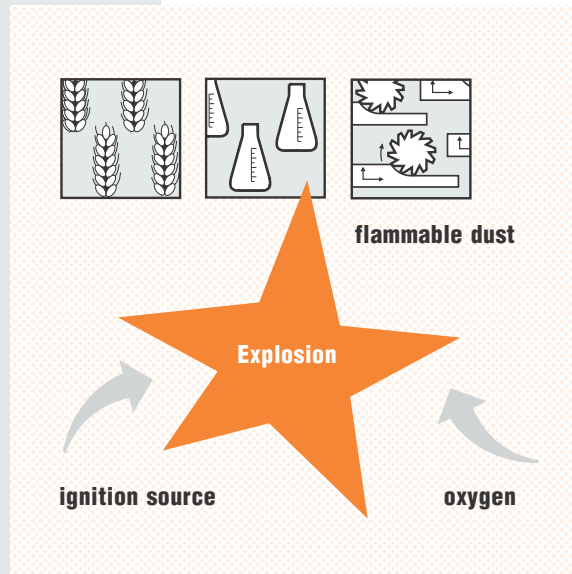
**BARTEC protects people and the environment  
by the safety of components, systems and plants.**





## Explosion

An explosion is defined as a sudden reaction involving a rapid physical or chemical oxidation reaction or decay generating an increase in temperature or pressure or both simultaneously. The most familiar reactions are those of flammable gases, vapours or dust with the oxygen contained in the air.



## Basis for an explosion

As a rule, for explosions to happen in atmospheric air, three factors have to be present at the same time:

- flammable substance
- oxygen (air)
- source of ignition

In production and work areas an increased risk of explosion can develop wherever the preconditions for an explosion are fulfilled. Typical explosion-hazard areas form in mills and stores for milled products and other combustible dust.

The first two components - the flammable substance and air - must be present in sufficient quantities to form a potentially explosive atmosphere. The statutory definitions of explosion protection - deduced from the health and safety at work regulations - are concerned with workplaces. For this reason discussions about explosion protection are usually restricted to reactions with the oxygen in the air. Oxidation reactions normally involve the release of heat and a pressure increase, and therefore fulfil the criteria of an explosion.

It is generally assumed that a volume of 10 l of a potentially explosive mixture in an enclosed space can cause damage - particularly to people. For this reason, any area in which such a volume of a potentially explosive mixture can collect is described as an explosion hazard zone.

## Explosion range

In the internal combustion engine the three components work together in a sensible way: petrol, air/oxygen and the ignition spark produce an explosion inside the enclosed cylinder. For this to take place the ratio of petrol to air must be correct. If the petrol tank is empty, the air filter is blocked or if the ignition does not work, one of the components for triggering this controlled, useful explosion is missing and the motor will not start.

Combustible materials mixed with air have a lower and an upper explosion limit, between these limits the explosion range is found. When considering the safety of workplaces, the lower explosion limit is the more important value, a possible concentration of at least 20 % less than that value is often regarded as safe.



## Prevention of explosions

Explosion protected equipment is able to exclude one of the preconditions for an explosion - the ignition source - and is in that way an important contribution to explosion protection.

In domestic areas, constructional measures ensure that normally an explosive atmosphere cannot form. The conscious restriction of these measures, e.g. the intended, unimpeded flow of flammable gases or a reduction in ventilation can lead to explosion if an ignition source is also present.

The easiest and simplest way to understand small and safe explosions is by looking at a gas lighter. When the nozzle of the lighter is opened it releases a small amount of flammable gas. This gas mixes with the surrounding air, the spark from the flint ignites the mixture, and a weak sound is heard - the burning.

Some distance away from the nozzle the proportion of the flammable gas is already so low that the explosion and the flame are restricted to the immediate vicinity of the nozzle. In other words, the design of the gas lighter has ensured that it is safe to use.

The effect of an explosion in enclosed spaces and under non-atmospheric conditions is often more powerful. Just think of the useful application of explosions in vehicle engines.

Effective preventive explosion protection for non-controlled, unintended and therefore very damaging explosions can only be achieved by removing one of the three components.

BARTEC products prevent the effect of ignition sources where electricity is being used in a potentially explosive atmosphere, and in that way they are effective at preventing explosions, because the other components - at workplaces the oxygen in the air and often the flammable substance - cannot be reliably and permanently excluded.

## Primary explosion protection

Primary explosion protection aims at substituting something else for the flammable substances or the atmospheric oxygen or reducing their quantities to the point where there is no danger of a potentially explosive mixture forming. Increased air circulation, air flushing, through ventilation can be achieved by structural measures; e.g. the open layout of filling stations where the explosion hazard area is very small. Replacing the atmospheric oxygen is not an option for areas where people work. For this reason the measures available for such locations are limited to:

- avoidance or restriction of substances which are capable of forming a potentially explosive atmosphere
- avoidance or restriction of release of the flammable substances and therefore formation of potentially explosive mixtures.

## Secondary explosion protection

Action directed at secondary explosion protection aims to prevent sources of ignition. The hazard of combustion can emanate from electrical and mechanical operating equipment, or even from humans.

In practice, secondary explosion protection is implemented by technical action (see chapter on types of combustion protection) and organisational action. Organisational action may take the form of instructing the workforce and having plant and equipment cleaned properly.





### Tertiary explosion protection

Action directed at tertiary explosion protection aims to negate the harmful effects of explosions and thus minimise the risks to the health of operatives.

Such action could be:

- explosion pressure-resistant design
- using rupture plates
- organising escape routes

### Three factors

#### Flammable substances

Flammable substances can be gaseous, liquid or solid. For a general discussion relevant to workplaces, their reactivity with atmospheric oxygen is considered.

##### ■ Flammable solids

Flammable solids in the form of **dust, fibres or flock** can react with atmospheric oxygen and produce disastrous explosions. Normally more energy is required for activating the explosion in air than with gases and vapours. However, once combustion starts, the energy released by the reaction produces high temperatures and pressures. In addition to the chemical properties of the solid itself, the fineness of the particles and the overall surface area, which increases with increasing fineness, play an important part. The properties are processes which take place immediately at the surface of the solid. Lighting and extinguishing a paraffin wax candle provides a demonstration of a series of processes undergone by a solid material within a short period of time which cannot easily be presented in a simplified form.

An experiment shows that when the wick of a candle is lit, the paraffin wax melts and then vaporises and that this vapour feeds the flame. After extinguishing the candle, the paraffin vapour can still be smelled, the melted paraffin wax solidifies and the paraffin vapours disperse. Now the paraffin wax candle is once again a harmless object.

Dust reacts very differently, depending on whether it is in a deposited layer or whether it is in a suspended dust cloud. Dust layers are liable to begin smouldering on hot surfaces, while a dust cloud which has been ignited locally or through contact with a hot surface can explode immediately. Dust explosions are often the consequence of smouldering dust layers which become stirred up and already carry the ignition initiation. When such a layer is stirred up, for example by mechanical cleaning methods or inappropriate extinguishing attempts, this can lead to a dust explosion.

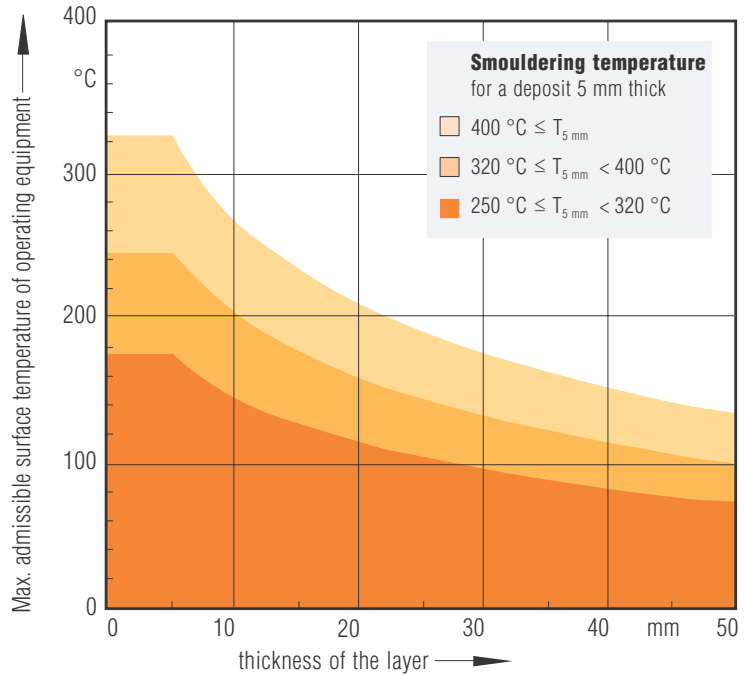
A gas or vapour/air explosion can also stir up the dust, which then often leads to the first, the gas explosion, turning into the second, the dust explosion. In deep coal mines methane/firedamp explosions often have triggered off coal dust explosions whose consequences were more serious than those of the original firedamp explosion.

**Layers of dust from 5 mm to 50 mm thick**

If deposits of dust more than 5 mm up to 50 mm thick are able to settle on operating equipment, the maximum admissible surface temperature must be lowered accordingly. The reduction in the maximum admissible surface temperature of equipment operated in zones affected by dust, and where the combustion temperature for 5 mm is more than 250 °C, must agree with the reference lines in the graphic.

EN 50281-1-2 or IEC 61241-1-2 should be consulted before using the diagram.

Lowering the maximum admissible surface temperature as the thickness of the dust layer increases



The dependence of the smouldering temperature on the thickness of the layer must be found in laboratory trials if a layer of dust 5 mm thick can smoulder at below 250 °C, or if doubts exist about the usefulness of the diagram

**Thicker than average layers of dust**

If it is not possible to prevent dust deposits of above-average thickness forming on the top, to the side or underneath operating equipment, or if the equipment is fully cloaked in dust, the thermal insulation effect this creates means that ignition can occur at a much lower surface temperature.

**Examples of dust deposits of above-average thickness with the need for examination in a laboratory**

<p>Excessive dust deposits on the top of operating equipment</p>	<p>Dust deposits settled on top of operating equipment is "excessive" because the dust has a low smouldering temperature</p>	<p>Excessive dust deposits to the sides of operating equipment</p>	<p>Equipment fully covered; limit values for the dimensions "b", "s" and "t" must be found in laboratory trials.</p>

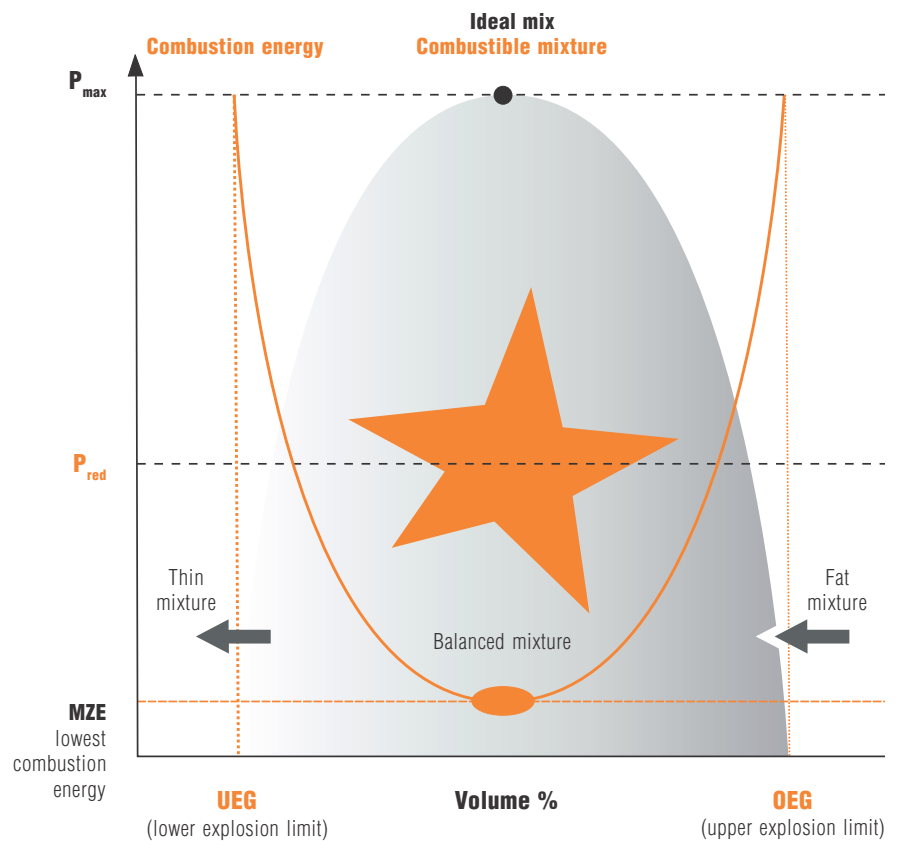


### Oxygen

The quantity of oxygen available in the air is only sufficient to oxidise/burn a certain quantity of the flammable material. The ratio can be determined theoretically, it is called the stoichiometric mixture. When the quantity of the flammable substance and the available atmospheric oxygen are near to at the correct ratio, the effect of the explosion - temperature and pressure increase - is most violent. If the quantity of flammable material is too small, combustion will only spread with difficulty or will cease altogether. The situation is similar when the quantity of flammable material is too great for the amount of oxygen available in the air.

All flammable materials have their explosive range, which also depend on the available activation energy. This is usually determined by igniting the mixture with an electric spark. The explosion range is bounded by the lower explosion limit and the upper explosion limit. This means that below and above these limits, explosions will not happen. This fact can be utilised by sufficiently diluting the flammable substances with air or by preventing the ingress of air/oxygen into parts of the equipment. The latter option is, however, not, or only with restrictions, possible in environments where people regularly work and must therefore be reserved for technological equipment.

### Explosion pressure/explosion limits





## Sources of ignition

With technical equipment a large number of ignition sources is possible. In the following overview the numbers given behind the ignition sources refer to the appropriate sections of the basic standard:

EN 1127-1: 1997 „Explosive atmospheres - Explosion prevention and protection- Part 1: Basic concepts and methodology.“

➔ **Hot surfaces (6.4.2)** arise as the result of energy losses from systems, devices and components during normal operation. In the case of heaters they are desired. These temperatures can usually be controlled.

In the event of a malfunction - for example with overloading or tight bearings - the energy loss, and therefore the temperature, increases unavoidably. Technical equipment must always be assessed as to whether it is stabilising - i.e. whether it can attain a final temperature, or whether non-permissible temperature increases are possible which need to be prevented by taking appropriate measures.

Examples: coils, resistors or lamps, hot equipment surfaces, brakes or overheating bearings

➔ For example, grinding and cutting devices **mechanically generated sparks (6.4.4)** during normal operation are therefore not permitted in explosion hazard zones. Cracks in rotating parts, parts sliding over each other without sufficient lubrication and similar situations can generate such sparks when malfunctioning, and this must be carefully thought about when considering malfunctions.

Examples: tools such as a rusty hammer and chisel in contact with light alloys or the metal fork of a fork lift truck

➔ **Visible electric sparks - lightning (6.4.8)** must normally be regarded as a sufficient ignition source. Only very low energy sparks with energies of only microwatt seconds may be regarded as too weak to start an explosion. For this reason, suitable measures must be adopted to prevent these ignition sources.

Examples: switching sparks, sparks at collectors or slip rings

➔ Independently of whether or not there is an electrical voltage supply, electrical sparks can be caused by **static electricity - (6.4.7)**. The stored energy can be released in the form of sparks and function as an ignition source. Because this ignition source can arise quite independently of an electrical voltage supply, it must also be considered with non-electrical devices and components. It is connected with separation processes; therefore these cases must be assessed where this ignition source needs to be taken into account.

Friction during normal operation can be the cause of electrostatic charging. For example, portable devices cannot - due to their portability - be earthed or connected to an equipotential bonding ring. When interacting with the clothes of the user, static charging can occur during normal operation. Static electricity must be prevented from becoming an ignition source by taking appropriate measures.

Examples: Transmission belts made from plastic materials, housings of portable devices, synthetic clothing material. Separation processes when rolling out paper or plastic film, plastic pipe systems



➔ Electric rails and other earthed voltage supplies e.g. for electric corrosion protection of equipment, can result in **stray electric currents, cathodic corrosion protection (6.4.6)** which then may result in a potential difference between different earthing points. This is why a highly conductive connection to all the electrically conductive parts of the equipment must be provided so that the potential difference is reduced to a safe level. It is not relevant whether the conductive equipment is electrical or non-electrical parts of the installation, as the cause of the current may be found outside of the equipment.

An equipotential bonding must always be provided, irrespective of whether or not such currents are expected or whether its sources are known.

➔ **Flames, hot gases and particles (6.4.3)** can occur inside combustion engines or analysis devices during normal operation and when a fault has occurred. Protective measures are required here which are able to permanently prevent them from leaving the housing.

Examples: Exhausts from internal combustion engines or particles which are formed by the switching sparks of power switches eroding material from the switch contacts

➔ Among the ignition sources where radiation energy enters the potentially explosive mixture, the following deserve to be mentioned:

- **Ultrasonic (6.4.12)**
- **Electro-magnetic radiation - radio waves (6.4.9)**
- **Electro-magnetic radiation - IR radiation, visible light (6.4.10)**
- **ionising radiation - UV radiation (6.4.11)**

If their parameters are permanently and securely limited and tested, systems, devices and parameters utilising radiation can be operated in explosion hazard zones, otherwise the radiation must be reliably prevented from entering the explosion hazard area.

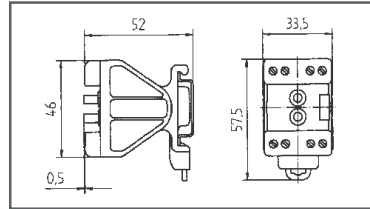
Examples: transmitting and receiving equipment, mobile telephones, photoelectric barriers and scanners

➔ Finally, **adiabatic compression and shock waves (6.4.13)** as they occur inside tube-shaped structures operated at an underpressure can become an ignition source.

Examples: breakage of a long fluorescent tube which is filled with a hydrogen/air atmosphere



Prevention of ignition sources



Idea



Designed to design regulations EN 50281-1-1



Approval by an accredited organisation EC model test certification



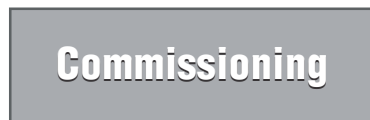
Quality assurance system in operation in conformity with directive 94/9/EC



Manufacturer – Routine tests



Installation in conformity with the regulations regarding manufacture EN 50281-1-2



Commissioning e. g. by an accredited expert



Maintenance by safety engineering personnel



## Protection principles

This refers to principles which are suitable for preventing ignition sources in systems, devices and components.

Ignition sources which are caused by sparks from friction or impact or from electro-static charging have to be prevented in explosion-protected equipment by selecting an appropriate material and by constructive measures, and this must be verified and confirmed by the appropriate tests.

Two protection principles can prevent equipment from becoming an ignition source. The types of protection listed in the examples are discussed in a different section.

An important precondition for all the protection principles is that parts which are in unhindered contact with the potentially explosive atmosphere must not be able to reach non-permitted temperatures, which depend on the ignition temperature. This means that the ignition temperature is relevant for all protection principles.

The principles allow construction in the different safety categories, category 1 - with the highest protection and therefore a very high degree of safety, category 2 - with increased protection and therefore a high degree of safety and category 3 - with the usual protection and therefore the usual degree of safety. Which classification can be achieved, is stated with the protection types.

### Overview

Protection principles	Flammable substances	Types of protection	Category
1. The item of equipment is provided with an enclosure that prevents the ingress of a potentially explosive mixture and/or contact with sources of ignition arising from the normal.	dust	Pressurized apparatus	2
		encapsulation	2
		Protection by enclosure	2
2. Potentially explosive mixtures can penetrate the enclosure but can not be ignited. Sparks and temperatures able to cause ignition may only occur within certain limits.	dust	Intrinsic safety	1 + 2

BARTEC applies these protection principles to its different pieces of equipment according to the application for which they are going to be used. The industrial products of other manufacturers are also equipped by BARTEC for use in explosion hazard zones.

### Non-technical measures

The requisite preconditions for the safe operation of electrical equipment in hazardous areas are created in a joint effort by the manufacturers of explosion-proof electrical equipment and the constructors and operators of industrial plants. It is important that the operator of such plants should ensure that their personnel know how the danger of explosions is likely to arise and the measures that are to be taken to prevent it.

Courses should be held for employees at regular intervals to inform them about the explosion protection documentation according to directive 1999/92/EC the company-internal rules and written, regularly updated operating instructions should be issued. BARTEC as a specialist for safety technology offers such consultation and training.



## Design regulations for explosion protected systems, devices and components - equipment

Hazards arising from the handling of flammable gases, vapours and dust are caused by uniform chemical and physical processes. For this reason, the protection against these hazards must be carried out in a uniform manner.

Nearly universal uniform requirements have now been formulated by the International Electrotechnical Commission IEC, by the European Standardisation Committees CENELEC and CEN and by DKE and DIN.

Manufacturers and operators are required to adhere to these, and where there is an increased protection requirement, they are monitored by accredited test houses and the authorities.



## Regulations

An overview of the regulations for the determination of the parameters, the classification of the zone, the design regulations for systems, devices and components as well as installation and operation in the area where potentially explosive gases, vapours and dust is present, is shown in the table below.

Title/Content	Document ident. <b>IEC</b> Publication date	Document ident. <b>CEN/CENELEC</b> Publication date	Document ident. <b>DIN</b> Publication date
<b>Basics</b>			
Explosive atmospheres - Explosion prevention and protection Part 1: Basic concepts and methodology	-	EN 1127-1 1997-08-00	DIN EN 1127-1 1997-10-00
Potentially explosive atmospheres - Explosion prevention and protection Part 1: Terms and definitions for equipment and protective systems intended for use in potentially explosive atmospheres	-	prEN 13237-1 1998-05-00	DIN EN 13237-1 1998-07-00
<b>Characteristics of combustible dusts</b>			
Electrical apparatus for use in the presence of combustible dust Part 2-1: Test methods - Section 1: Methods for determining the minimum ignition temperatures of dust Attention: Included Corrigendum at August 1999	IEC 61241-2-1 1994-12-00	EN 50281-2-1 1998-09-00	DIN EN 50281-2-1
Electrical apparatus for use in the presence of combustible dust Part 2-2: Test methods - Section 2: method for determining the electrical resistivity of dust in layers Attention: Included Corrigendum at May 1994	IEC/TR 61241-2-2 1993-08-00	EN 61241-2-2 1995-08-00	DIN EN 61241-2-2 1996-04-00
Electrical apparatus for use in the presence of combustible dust Part 2-3: Test methods - Section 3: Method for determining minimum ignition energy of dust/air mixtures	IEC 61241-2-3 1994-09-00	<i>EN 50281-2-3*</i>	-
Electrical apparatus for use in presence of combustible dust Part 2-4: Test methods - Section 4: Method for determining the low explosive limit of dust/air mixtures	<i>IEC 61241-2-4*</i>	<i>EN 50281-2-4*</i>	-



Title/Content	Document ident. <b>IEC</b> Publication date	Document ident. <b>CEN/CENELEC</b> Publication date	Document ident. <b>DIN</b> Publication date
<b>Classification of hazardous areas with combustible Dusts</b>			
Electrical apparatus for use in the presence of combustible dust Part 3: Classification of areas where combustible dusts are or may be present are	IEC 61241-3 1997-05-00	-	-

\* Changes to the registration number can arise due to the comparison between IEC or ISO and CENELEC or CEN. Information that is ambiguous to the author or incomplete is for this reason given in *italics*.

<b>Examples of dust deposits of above-average thickness with the need for examination in a laboratory</b>			
Excessive dust deposits on the top of operating equipment	Layers of dust on top of equipment are "excessive" because the dust has a low smouldering temperature	Excessive dust deposits to the sides of operating equipment	Equipment fully covered; limit values for the dimensions "b", "s" and "t" must be found in laboratory trials

Title/Content	Document ident. <b>IEC</b> Publication date	Document ident. <b>CEN/CENELEC</b> Publication date	Document ident. <b>DIN</b> Publication date
<b>■ combustible dust</b>			
Electrical apparatus for use in the presence of combustible dust Part 1-1: Electrical apparatus protected by enclosures and surface temperature limitation - Specification for apparatus Attention: In connection with EN 50014 (1997-06) Included Corrigendum at July 1999, and August 1999	IEC 61241-1-1 1999-06-00	EN 50281-1-1 1998-09-00	DIN EN 50281-1-1 1999-10-00
Electrical apparatus for use in the presence of combustible dust Part 4: Type of Protection "pD"	<i>IEC 61241-4*</i>	<i>EN 50281-4*</i>	<i>DIN EN 50281-4*</i>
Electrical apparatus for use in the presence of combustible dust Part 5: Type of Protection "ID"	<i>IEC 61241-5*</i>	<i>EN 50281-5*</i>	<i>DIN EN 50281-5*</i>
Electrical apparatus for use in the presence of combustible dust Part 6: Type of Protection "mD"	<i>IEC 61241-6*</i>	<i>EN 50281-6*</i>	<i>DIN EN 50281-6*</i>

\* Changes to the registration number can arise due to the comparison between IEC or ISO and CENELEC or CEN. Information that is ambiguous to the author or incomplete is for this reason given in *italics*.



Title/Content	Document ident. IEC Publication date	Document ident. CEN/CENELEC Publication date	Document ident. DIN Publication date
<b>Explosion protection in plants: Installation, maintenance and repair</b>			
Electrical apparatus for explosive gas atmospheres Part 13: Construction and use of rooms or buildings protected by pressurization	IEC/TR 60079-13 1982-00-00	-	-
Electrical apparatus for explosive gas atmospheres Part 16: artificial ventilation for the protection of analyzer houses	IEC/TR 60079-16 1990-04-00	-	-
Electrical apparatus for explosive gas atmosphere Part 14: Electrical installations in hazardous areas (other than mines) Attention: In connection with IEC 60079-0	IEC 60079-14 1996-12-00	EN 60079-14 1997-00-00	DIN EN 60079-14 1998-08-00
Electrical apparatus for use in the presence of combustible dust  Part 1-2: electrical apparatus protected by enclosures; section 2: selection, installation, and maintenance Attention: In connectin with EN 50281-1-1 (1998-09) Included Corrigendum at July 1999 and August 1999	IEC 61241-1-2 1999-06-00	EN 50281-1-2 1998-09-00	DIN EN 50281-1-2 1999-11-00
Electrical apparatus for explosive gas atmospheres Part 19: repair and overhaul for apparatus used in explosive atmospheres (other than mines or explosives)	IEC 60079-19 1993-09-00	<i>EN 60079-19*</i>	<i>EN 60079-19*</i>
Electrical apparatus for explosive gas atmospheres Part 17: Inspection and maintenance of electrical installations in hazardous areas (other than mines)	IEC 60079-17 2002-07-00	EN 60079-17 1997-08-00	DIN EN 60079-17 2002-10-00

\* Changes to the registration number can arise due to the comparison between IEC or ISO and CENELEC or CEN. Information that is ambiguous to the author or incomplete is for this reason given *in italics*.

**Note about how to use the table**

The information is based on the IEC titles, in cases where there is no IEC document available, the EN titles have been used. The year information has been standardised. It refers to the state on 2000-01-07 which was accessible to the author. This style seems to be becoming universally accepted, but has not been introduced in all the documents. The table is to provide an information overview of the standard. For concrete work with the standards and their procurement, the latest update should be requested from the publisher or from the standardisation committee. According to our experience, it must be expected that in the years up to 2004, a number of the standards will be modified.

With the help of this table, the following contents listed in the title/contents column can be correlated to the regional and national equivalents. The regional and national title does not need to correspond to the "world" title. (Please also note the footnote for the table!)

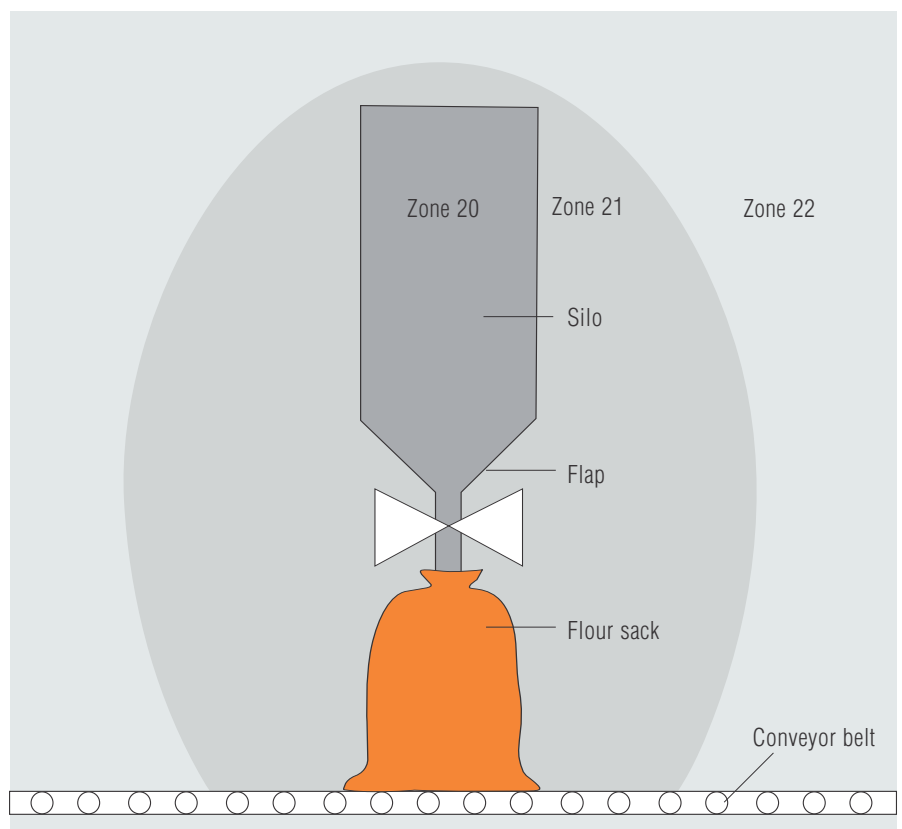
At BARTEC the design regulations are consistently applied for electrical equipment. Conformity is - after the completion of the development at BARTEC - checked by EC notified bodies, test houses for the IEC Ex procedure or by national test houses, and compliance is monitored and realised using a quality assurance system for every piece of equipment produced. During the routine test, safety-relevant requirements are checked according to the specifications and confirmed by means of a marking.

BARTEC also supports its customers with non-electrical equipment using the knowledge it has accumulated over decades of experience.

## Relevance and advantage of the classification in zones

The practice has been established of dividing hazardous areas into zones. This classification takes the different dangers from potentially dangerous atmospheres into account and allows explosion protection measures to be taken which reflect the situation both from the point of view of safety engineering and of economics. For the European community, the zone definitions are uniformly provided in directive 1999/92/EC. It must be applied with technical understanding of the concrete situation.

IEC 61241-3 provides support for the zone classification with dust. Explosion hazard zones are classified depending on the frequency and duration of the potentially explosive atmosphere. This classification provides the scope of the measures to be taken according to annex II section A in the directive 1999/92/EC in conjunction with annex I of the directive 94/9/EC.



Zone 20
Zone 21
Zone 22

### Classification of hazardous places (RL 1999/92/EC)

**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.

**Zone 21** A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally.

**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.

#### Notes:

1. Layers, deposits and heaps of combustible must be considered as any other source which can form an explosive atmosphere.
2. 'Normal operation' means the situation when installations are used within their design parameters.

In places of work the explosion hazard areas are normally classified at most as zone 21 and 22. Zone 20 are restricted to very small inaccessible areas in workplaces or are usually restricted to the inside of technical equipment.



### Explosion engineering parameters

In order to allow a combination of measures for explosion protection, which is optimised with respect to the chemical-physical properties of the flammable gases, vapours or dust to be made, and therefore a standardisation of the types of protection to be possible for the manufacturer, a system of explosion engineering parameters has been created. These are determined using an application orientated testing method.

Before flammable substances can react with the atmospheric oxygen in an explosion, energy must be provided.

This energy may, for example, be exchanged on a surface. A heated surface increases the energy content of the potentially explosive mixture in contact with it. If the surface temperature is sufficiently high, this increased energy content can lead to the explosive reaction. However, the energy may also be supplied through a spark or a hot gas jet flowing out of a gap into the potentially explosive mixture. Both types lead to different explosion engineering parameters being defined.

### Ignition temperature

For different types of dust, the method for determining the ignition temperature has also been unified and coded in document IEC 61241-2-1. Please note that dust in its deposited form - determined using procedure A - has a different ignition temperature than in its stirred form - determined as a cloud using procedure B.

The permissible surface temperature for those parts of the systems, devices and components accessible to the dust is determined by subtracting 75 K from the value determined using procedure A and by multiplying by 2/3 the value determined using procedure B. The smaller of the 2 values determined in this way corresponds to the lowest permissible surface temperature of the equipment. The surface is the area accessible to the dust, temperature classes are not defined for dust, so that a concrete type of dust must always be assumed. The parameters are made available in comprehensive tables, laboratories determine the values on request, and a small, non-official overview is contained in the following table.



Examples of the ignition temperatures of different types of dust

Designation of the solid material	A values ignition temperature IEC 50381-2-1 procedure A deposit (°C)	B values ignition temperature IEC 50381-2-1 procedure B cloud (°C)	Permissible limiting temperature lowest value of the calculation (A-75K) und 2/3*B									
			450... > 300	300... > 280	280... > 260	260... > 230	230... > 215	215... > 200	200... > 180	180... > 165	165... > 160	160... > 135
<b>Dust from natural materials</b> (examples)												
Cotton	350	560			275							
Brown coal	225	380										150
Cellulose	370	500		295								
Cereals	290	420							215			
Wood resin	290	500							215			
Sawdust (wood)	300	400					225					
Cocoa	460	580	385									
Copra	290	470							215			
Cork	300	470					225					
Fodder concentrate	295	525					220					
Linen	230	440										155
Milk powder	340	440			265							
Paper	300	540					225					
Pectin sugar	380	410			273							
Soya	245	500								170		
Starch	290	440							215			
Hard coal	245	590								170		
Tabacco	300	450					225					
Tapioca	290	450							215			
Tea	300	510					225					
Peat	295	360					220					
Wheat flour	450	480	320									
Sugar beet	290	460							215			
<b>Dust of chemical technical products</b> (examples)												
Cellulose ether	275	330								200		
Isosorbide dinitrate	240	220										146
Unvulcanised rubber	220	460										145
Petroleum coke	280	690							205			
Polysaccharide deriv.	270	580								195		
Polyvinyl acetate	340	500			265							
Polyvinyl chloride	380	530	305									
Soot	385	620	310									
Laminated plastic	330	510					255					
Sulphur	280	280								186		
<b>Metal dust</b> (examples)												
Aluminium	280	530							205			
Bronze	260	390								185		
Iron	300	310							206			
Copper silicon alloy	305	690					230					
Magnesium	410	610	335									
Manganese	285	330							210			
Zinc	440	570	365									



## Types of protection

It applies to all types of protection that parts that are in unhindered contact with the potentially explosive atmosphere must not reach unacceptable temperatures. Taking into account both the environmental temperature and the heating effect, the temperature may at most only reach a value which corresponds to the temperature class in which the potentially explosive atmosphere has been classified.

### General requirements

#### Principle

All the general requirements for the equipment are summarised in this standard. The ignition protection type standards may raise these requirements or lower them. Uniform protection requirements concerning several types of protection such as protection against electrostatic charging, provision of a potential bond for metal housings, or mechanical strength against impact, are summarised in this standard under general engineering requirements. In this case, individual, more specific standards can demand either more stringent requirements or less stringent ones.

These requirements are based partially on those for electrical equipment for gases and vapours, deviations for dust and non-electric equipment are contained in the individual basic standards. Categories 1 to 3 which the equipment has to fulfil can also include different general requirements.

Temperature ranges take, on the one hand, the situation at the workplace into account and also, on the other, a certain heating up of the equipment when operating. The explosion pressure, permissible gap widths and permissible non-igniting currents change outside this temperature range. This has to be considered when using the equipment, and it can require different test conditions.



#### Information about the use of the markings

The markings used below for non-electrical equipment and dust explosion protection are still under discussion. For this reason they have to be treated as provisional.



### Pressurized apparatus

#### Marking "Ex pD" in accordance with IEC 61241-4

#### Principle

The ingress of the surrounding atmosphere into the housing of electrical equipment is prevented by maintaining an ignition shield gas (air, inert or a different suitable gas) inside it at a pressure above atmospheric pressure. The overpressure is maintained with or without constant flushing of the protective gas.

#### Important design parameters

- Housing strength; the enclosing, flushed housing must withstand 1.5 times the overpressure experienced during normal operation.
- Shut-down or alarm if the flushing gas flow or overpressure fails.

#### Applications

- Equipment where during normal operation sparks, electric arcs or hot surfaces are generated and complex industrial equipment (controls) which must be operated in explosion hazard zones protected by this type of ignition protection.
- Large machines, slip ring or collector motors, switch cabinets and control cabinets and analytical apparatus.



### Encapsulation

**Marking "Ex mD" in accordance with IEC 61241-6**

#### Principle

Parts that could ignite a potentially explosive atmosphere by means of sparks or heat are potted so as to prevent ignition of the potentially atmosphere. This is achieved by encapsulating the components in a compound resistant to physical - especially electrical, thermal and mechanical - and chemical influences.

#### Important design parameters

- Encapsulation:
  - Breakdown strength
  - Low water absorption
  - Resistance to various influences
  - Potting must be of the stipulated thickness all round
  - Cavities are only permitted to a limited extent
  - As a rule the potting is only penetrated by the cable entries
- The load on the components is limited or reduced
- Increased clearance between live parts

#### Applications

- Static coils in ballasts, solenoid valves or motors, relays and other control gear, of limited power and complete PCBs with electronic circuits.

### Protection by enclosure

**Marking "Ex tD" in accordance with IEC 61241-1-1**

#### Principle

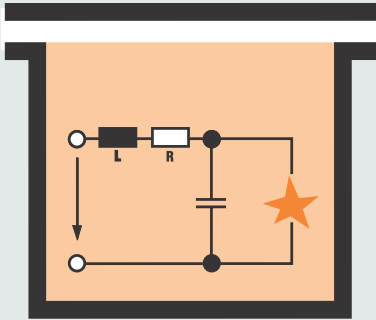
The housing is sealed so tight, that no combustible dust can enter. The surface temperature of the external housing is limited.

#### Important design parameters

- Minimum degree of protection in accordance with IEC/EN 60529  $\geq$  IP 6X
- Consideration of dust accumulating on the surface and reduction of permissible surface temperature with dust layer  $\geq$  5 mm are possible.

#### Applications

- Various equipment where during normal operation sparks, electric arcs or hot surfaces occur and complex industrial designs (controllers) which by means of this type of ignition protection can be utilised in explosion hazard zones.



## Intrinsic safety

### Marking "Ex iD" in accordance with IEC 61241-5

#### Principle

Intrinsically safe electrical equipment contains only circuits that meet the requirements of intrinsically safe circuits.

Intrinsically safe circuits are circuits in which no spark or thermal effect occurring under the test conditions laid down in the standard can ignite the potentially explosive atmosphere of subgroups IIA, IIB and IIC or of an air/dust mixture. The test conditions cover normal operation and certain fault conditions stipulated in the standard.

#### Important design parameters

- Use of certain components for electrical and electronic circuits
- Lower permitted load on the components than in ordinary industrial applications with regard to
  - voltage related to electric strength
  - current related to heat
- Voltage and current, including a safety margin, are kept permanently so low that no impermissible temperatures can occur, and, in the event of open circuit or short-circuit, sparks and electric arcs possess so little energy that they are unable to ignite a potentially explosive atmosphere.
- An impression of this protection type is provided by the fact that potentially explosive atmospheres of subgroup IIA require only a few hundred  $\mu\text{W}$  and those of subgroup IIC only 10  $\mu\text{W}$  for ignition.

#### Applications

- Measuring and monitoring instrumentation and control
- Sensors working on the basis of physical, chemical or mechanical principles and at limited power
- Actuators working on the basis of optical, acoustic and, to a certain extent, mechanical principles.

## Marking

### Contents of the marking

The rules for the marking of systems, devices and components are uniformly defined in the standards relating to the general technical requirements.

Because the European Community has agreed in the future to also formulate uniform requirements and to introduce a uniform classification for devices, systems and component, other than electrical equipment, the marking has also been unified. Additional symbols have been introduced.

This has been defined in the directive 94/9/EC on "Devices and protective systems for use in hazardous areas".

This directive includes electrical equipment, and for this reason the markings are prefixed by additional symbols.

The marking on all devices and protective systems for hazardous areas must indicate the area of their designated use.





**Principle**

The marking must indicate the following

- The manufacturer who has put the item of equipment on the market
- A designation which allows it to be identified
- The application zone: underground I, other areas II, gases and vapours - G -, dust - D - or mines - M -
- The categories which indicate whether the device is only suitable for specific zones.
- The type(s) of ignition protection the equipment fulfils
- The explosion group, and if required, the explosion hazard subgroup for which it is suitable and
- The temperature class for which the piece of equipment is suitable
- The test centre where the test certificate was issued, the standard or revision of a standard applicable to the piece of equipment including the registration number of the certificate at the test centre, and, if necessary, which special conditions must be observed.

In addition, the information which is required for a similar device of industrial construction must be available.

The description according to EC guideline 94/9/EC will for example appear as follows for all parts:

**CE 0032 Ex II 2D IP 65 T 80 °C** in accordance with EC directive 94/9/EC

**CE** Conformity mark

**0032** notified body who certified the QA system in accordance with 94/9/EC

**The following device groups are distinguished**

Device group <b>II</b>	other areas
Category/protection level <b>2</b>	suitable for zone 1
Flammable dusts	marking with prefix <b>D</b>

Area	Classification of the explosion hazard	Required marking of the used equipment	
		Device group	Category
other	Zone 20	II	1 D
other	Zone 21	II	2 D + 1 D
other	Zone 22	II	3 D + 2 D + 1 D

Type of ignition protection, explosion group/subgroup and temperature class, conforming to which the piece of equipment has been produced and is suitable for, will continue to be found using the marking customary for electrical equipment.

**Example of a marking - electrical equipment**

**BARTEC Type 07-5103-.../....**

**Ex II 2D IP 65 T 80 °C**

**IBExU 00 ATEX 1081**

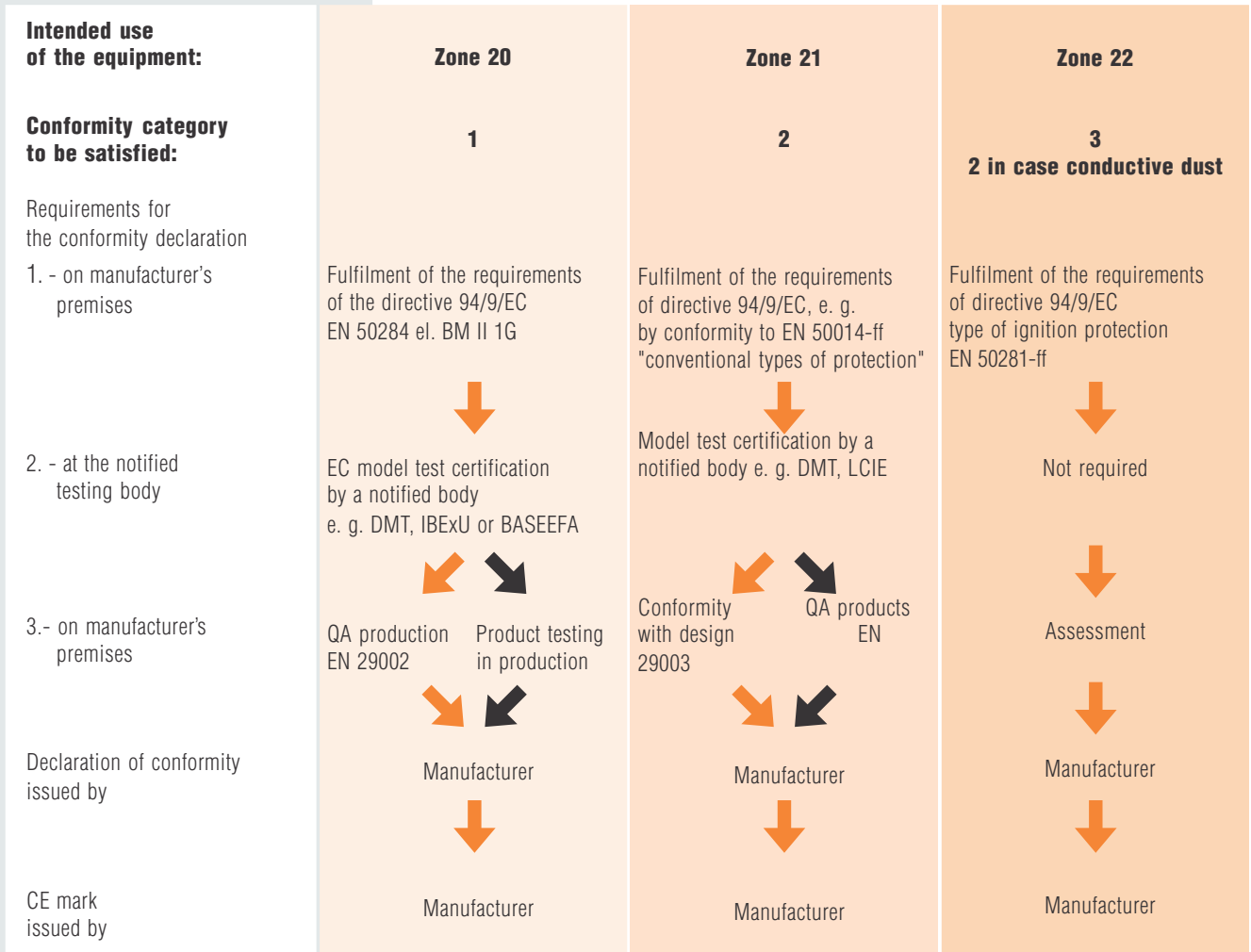
- Manufacturer and type designation
- manufactured in accordance with EN 550281-,-, flameproof enclosure, over ground, subgroup +80 °C temp. class IP 65
- symbol of the notified body
- certified 2000
- ATEX generation
- serial number of notified body



## CE -Conformity

**The following route to CE conformity for electrical apparatus is prescribed according to EC directive 94/9/EC.**

Depending on the conformity category, it defines which path the manufacturer has to follow towards making the CE conformity declaration. The overview below shows these paths for the different electrical equipment conformity categories.



During the transitional period, equipment will be distributed which corresponds to the EC directives, which by then will have become valid, such as the EMC directive, the machinery directive and the low voltage directive. Stepwise, the Ex directive 94/9/EC will also have to be complied with and EC model test certificates will be issued which will be marked "ATEX". Until this happens the EC directives which are being fulfilled will be listed in the Declaration of CE conformity. With the EC model test certificate according to the ATEX generation, the CE mark will be shown and the EC registration number issued in Brussels, at the notified body, where the quality assurance system according to directive 94/9/EC has been certified. For BARTEC in Bad Mergentheim this is e. g. TÜV Hannover/Sachsen-Anhalt with the number 0032.



## Choosing operating equipment

Most plant operators have been aware of the 94/9/EC guideline (ATEX), which deals with the design and development of devices and protective systems for zones endangered by explosions, for many years now.

As a company which manufactures such operating equipment, we are often asked by buyers and planners to supply "ATEX certified" operating equipment. What buyers and planners are referring to is the 1999/92/EC guideline, passed by the European Parliament and the Council on 16<sup>th</sup> December 1999, which prescribes minimum requirements to improve the health protection arrangements and the safety of workers at risk from explosive atmospheres.

This guideline is directed at all industrial works which have zones endangered by explosions and requires action to be taken to protect the safety, working hygiene and health of workers. A major component of the guideline is the call for safe operating equipment. This has been enacted in German law by the industrial safety directive.

These explanatory notes are intended to assist in selecting operating equipment in consideration of this guideline.

### **1. Selection of operating equipment for existing plant**

As of **01/07/2006 (in Germany from 01/01/06 under the industrial safety directive)**, plant operators must comply with minimum requirements to improve safety. Should changes be made to the plant, these regulations must be implemented immediately. These involve:

- Estimating the potential risk from the prevailing atmospheres and from the plant, equipment and protective systems
- Creating maximum safety at the workplace for operatives with regard to the dangers to life and limb which could result from explosions
- Having the effectiveness of explosion-proofing action in the overall plant inspected by a capable person
- Determining how explosive materials are to be disposed of or prevented
- Instructing operatives
- Issuing written instructions and work releases
- Equipping operatives with properly conducting work clothing to prevent the hazard of electrostatic ignition
- If necessary, providing the means of escape which allows workers to be evacuated before explosive conditions occur.

The following decision-making criteria apply to existing operating equipment:

*Has the equipment received model test certification for the relevant zone according to the 94/9/EC guideline?*

➔ **No further action**

*Has the operating equipment not been certified for the defined zone?*

➔ **Assess the risks according to Art. 3 of the guideline**

The operating equipment can be restarted once this level of safety has been achieved by means of additional technical or organisational action and appropriately documented. If this is not the case, then to protect operatives, the equipment must be replaced with a device with EC model test certification.

### **2. Selection of operating equipment for spare parts**

Spare parts in the works which have not been "ATEX certified" may still be used after 30/06/2003 providing:

the operating equipment is in the works' stores "ready for use" and, naturally, that its deployment can be regarded as safe (see above).



3. Selection of operating equipment for new plant and conversions as from 01/07/03

The following questions need to be considered when selecting operating equipment:

1. What kind of dust is involved?

Characteristic explosion variables can be assigned to every type of inflammable dust

- Ignition temperature
- Smouldering temperature
- Conductivity/non-conductivity of the dust

e. g. Brown coal

Ignition temperature 380 °C
Smouldering temperature 225 °C
Conductive

2. Which zone is the operating equipment going to be installed in?

In order to establish the extent of the action required to prevent effective sources of ignition, areas in which an explosion exists must be categorised into zones depending on the frequency that explosive atmospheres occur and their duration. Layers, deposits and accumulations of inflammable dust must be considered as yet another cause which can lead to the formation of an explosive atmosphere (1999/92/EC guideline).

Zone 20 Zone in which clouds of inflammable dust in the air form explosive atmospheres constantly, frequently or for long periods.

Zone 21 Zone in which it can be expected that clouds of inflammable dust in the air form explosive atmospheres from time to time.

Zone 22 Zone in which it cannot be expected during normal operations that clouds of inflammable dust in the air form explosive atmospheres, and should this occur, then only for a short time.

3. Choice of operating equipment

You can find the maximum admissible surface temperature for your operating equipment by using the reference figures under 1. in consideration of a safety factor

T\_max = Smouldering temperature -75 K e. g. brown coal 225 °C -75 °C = 150 °C or

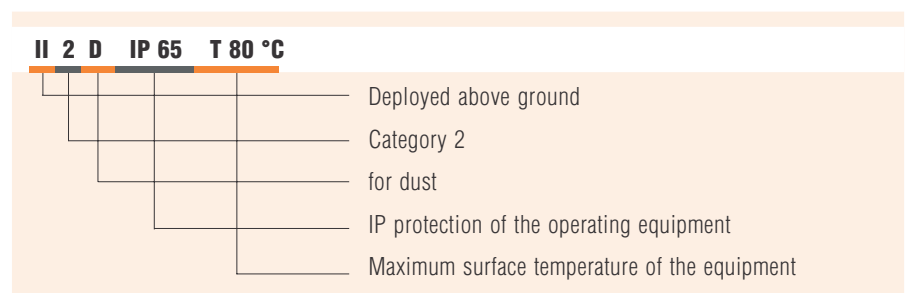
T\_max = 2/3 of the ignition temperature e. g. brown coal 2/3 \* 380 °C = 254 °C

The lower of the two temperatures must be used as the reference when selecting operating equipment. In our example, the surface of the equipment may reach a maximum temperature of T\_max 150 °C.

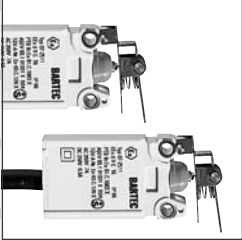
Using the table below, decide which category your operating equipment must conform to:

Table with 4 columns: Type of dust, Zone 20, Zone 21, Zone 22. Rows: Conducting, Non-conducting.

Now compare your requirements with the designation of the operating equipment



This operating equipment would be admissible for use in zones 21 and 22 for conductive and non-conductive dust, the ignition temperature of which, in consideration of safety factors, is over 80 °C.





Limit switch

### Description

These limit switches have been developed for Ex-areas where safe and reliable signalling is required, for example on pumps, petrol pumps, as well as in mechanical and high-tec engineering. The switches must be mounted into the respective devices or systems in such a way as to guarantee mechanical protection. No further tests are required. The connection cable is cast in on the back of the switch.

These switches can be deployed in the zones 21 and 22, plus in the zones 1 and 2.

For the connection in Ex-areas BARTEC provides a large variety of terminals and terminal boxes.

### Explosion protection

#### Ex protection type

Ex II 2D IP 66 T 80 °C  
suitable for protection class II

#### Certification

IBExU 01 ATEX 1007 X

#### Ambient temperature

-20 °C to +75 °C

### Technical data

#### EEx d limit switch

according to DIN EN 60947-5-1

#### Protection class

IP 66/IEC 60529

#### Electrical data

##### according to DIN EN 60947-5-1

Rated operating voltage AC 400 V

Utilization category

AC-15 2 A 400 V

DC-13 0.15 A 250 V

Isolation voltage 400 V

(further electrical data on request)

#### Electrical data

Rated current

AC 2 A 400 V

AC 7 A 250 V

DC 0.5 A 250 V

(further electrical data on request)

Ambient temperature +40 °C		
<b>AC switching capacity</b>		
	ohmic load	inductive load cos φ = 0.6
400 V	3 A	2 A
250 V	5 A	3 A
30 V	7 A	5 A

<b>DC switching capacity</b>		
	ohmic load	inductive load L/R = 3 μs
250 V	0.4 A	0.03 A
30 V	7 A	5 A

#### Tightening torque of fixing screws

0.6 Nm

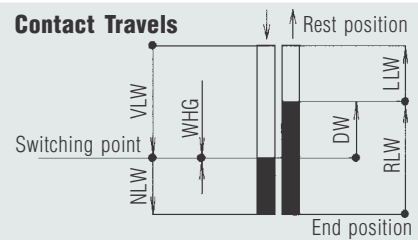
#### Rating of gold-coated contacts

Voltage: min. 5 V/max. 30 V

Current: min. 4 mA/max. 400 mA

- the product of voltage and current should not exceed 0.12 VA
- for alternating current these values have to be interpreted as peak values

### Contact Travels



Contact break distance 2 x ≥ 0.3 mm	
<b>Contact travels (in mm)</b>	
Pretravel VLW	max. 0.9
Overtravel NLW	min. 0.5
Differential value DW	max. 0.45
Release travel RLW	0.9
Release travel LLW	0.1 to 0.45
Repeat accuracy WHG (for repetitive actuation)	± 0.02
<b>Service life</b>	
mechanical	> 2 x 10 <sup>6</sup>
electrical	dependent on load
max. switching rate	1000 operations/h
<b>Switching actuation force</b>	
Single-break switch	max. 2.0 N
Double-break switch	max. 3.6 N
<b>Reset force</b>	
Single-break switch	min. 0.4 N
Double-break switch	min. 0.8 N

### Electrical connection

cable H05VV-F 0.75/A05VV-F 0.75

other cables on request

### Contact element

snap-action contact element (double-break) as, normally-open, normally-closed, changeover contact as well as N/O + N/C contacts for circuits with equal potentials.

### Contact material

Silver or gold-coated contacts (all contact elements have a standard protective gold-coating)

### Double-break switch (switch options)

- simultaneous switch sequence: chamber I and II almost simultaneous
- defined switch sequence: chamber I switches mechanically safe 0.03 up to 0.3 mm before chamber II

### Weight

Limit switch with 3 m cable:  
 single-break switch 210 g,  
 double-break switch 415 g

### Housing material

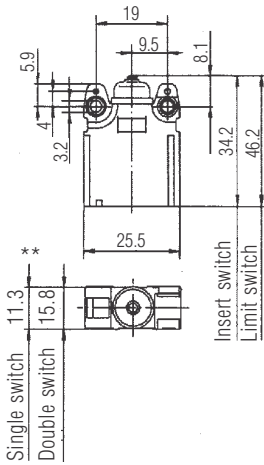
plastic (thermoplastics)

### Plunger/additional actuator

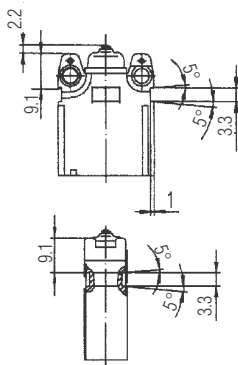
stainless steel



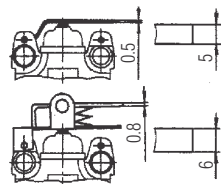
Dimensions in mm



Clip-on pockets



Lever widths



Selection chart

	Type of contact			Additional actuator *			
	Switch chamber 1	Switch chamber 2	Code no.	Options	Code no.	Options	Code no.
<b>Single-break switch</b>	(BN) 1 ○ (BU) 2		<b>10</b>	without additional actuator	<b>00</b>		<b>44</b>
	(BN) 3 ○ (BU) 4		<b>20</b>		<b>01</b>		<b>45</b>
	(BU) 2 ○ (BK) 4		<b>30</b>		<b>02</b>		<b>46</b>
	(BU) 1 ○ (BK) 3		<b>40</b>		<b>03</b>		<b>46</b>
	(BU) 2 ○ (BK) 4		<b>40</b>		<b>04</b>		<b>46</b>
	(BK) 11 ○ (BK) 12	(BU) 21 ○ (BN) 22	<b>11</b>		<b>21</b>		<b>47</b>
(BK) 13 ○ (BK) 14	(BU) 21 ○ (BN) 22	<b>21</b>		<b>22</b>		<b>48</b>	
(BK) 13 ○ (BK) 14	(BU) 23 ○ (BN) 24	<b>22</b>		<b>23</b>		<b>49</b>	
(2) (12) (13) (14) (1) (11) (1)	(2) (5) (6) (3) (4) (21) (24)	<b>33</b>		<b>24</b>		<b>61</b>	
(BK) 11 ○ (BK) 12	(BU) 21 ○ (BN) 22	<b>1A</b>		<b>25</b>		<b>62</b>	
(BK) 13 ○ (BK) 14	(BU) 21 ○ (BN) 22	<b>2A</b>		<b>26</b>		<b>63</b>	
(BK) 13 ○ (BK) 14	(BU) 23 ○ (BN) 24	<b>2B</b>		<b>27</b>		<b>64</b>	
(2) (12) (13) (14) (1) (11) (1)	(2) (5) (6) (3) (4) (21) (24)	<b>3C</b>		<b>28</b>		<b>66</b>	
(BK) 11 ○ (BK) 12	(BU) 21 ○ (BN) 22	<b>4D</b>		<b>29</b>		<b>73</b>	

( ) Code for connection cable

Complete order no.

Please enter code number.

07-2511- [ ] [ ] [ ] / [ ] [ ]

Length of connection cable in meters

e.g. 3 = 3 m

Please specify greater lengths in plain text, code no. = 0

Contact material

<b>1</b>	Silver
<b>3</b>	Gold-coated contacts

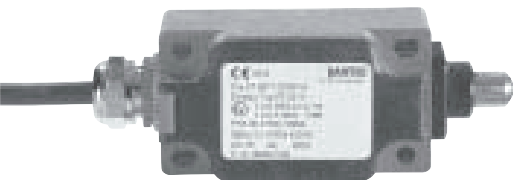
\* Dimensions for additional actuator are reference values

\*\* When packing several switches, these dimensions are reduced to 11 mm resp. 15.5 mm





Position switch



Features

- Dimensions and mounting dimensions according to DIN EN 50041
- Compatible with non-Ex DIN limit switches
- Different switching elements

Description

All dimensions and actuating elements of the EEx d position switch correspond to the DIN EN 50041 standard.

Its 30 x 60 mm mounting dimensions make the switch directly compatible to the position switch corresponding to the same DIN standard. The switch is equipped with snap-action contacts with several switching element versions. A micro-switch with connection cable type 07-2511 (IBExU 01 ATEX 1007 X) is mounted as switching element.

Different actuators are available for the variety of actuating possibilities. After the removal of four screws these knobs can be rotated by 90 °C allowing so four different directions of actuation.

Gold-plated or gold-nickel contacts are available for the switching of low currents of voltages.

Standard length of the connection cables are 3 m.

BARTEC has designed a very extensive range of EEx e terminal boxes of polyester and aluminium for the connection of the position switch within the EEx area.

Explosion protection

Ex protection type

II 2D IP 66 T 80°C

Enclosure

Typ 07-2511

Certification

IBExU 01 ATEX 1007 X

Ambient temperature

-20 °C to +75 °C

Technical data

Protection class

IP 66/IEC 60529

Electrical data for DIN EN 60947-5-1

Rated operating voltage AC 400 V

Utilisation category

AC-15	2 A	400 V
DC-13	0.15 A	250 V

Isolation voltage 400 V (further electrical data on request)

Electrical data

Nominal current

AC	2 A	400 V
AC	7 A	250 V
DC	0.5 A	250 V

(further electrical data on request)

Ambient temperature +40 °C		
Switching capacity AC		
	ohmic load	inductive load cos φ = 0.6
400 V	3 A	2 A
250 V	5 A	3 A
30 V	7 A	5 A
Switching capacity DC		
	ohmic load	inductive load L/R = 3 μs
250 V	0.4 A	0.03 A
30 V	7 A	5 A

Switching elements

see table

Travels, forces

see table

Max. switching frequency

1 000 h

Mechanical life

max. 10<sup>6</sup> switching cycles depending on plunger operating speed and angle

Electrical life

dependent on load

Electrical connection

connection cable HO5VV-F/AO5VV-F

Enclosure material

aluminium or plastic





Dimensions*		Selection chart								
		Type of contact			Actuators					
		Interrupter chamber 1	Interrupter chamber 2	Code no.	Max. operating force	Pretravel	Overtravel	Differential approx.	Max. plunger operating speed	Code no.
Plunger			—	<b>10</b>	17 N	1 mm	5 mm	0.4 mm	5 m/s	<b>10</b>
			—	<b>20</b>						
			—	<b>30</b>						
Roll lever			—	<b>11</b>	17 N	1 mm	5 mm	0.4 mm	5 m/s	<b>20</b>
			—	<b>22</b>						
			—	<b>21</b>						
Axle lever			—	<b>21</b>	6 N	10°	70°	4°	5 m/s	<b>30</b>
			—	<b>33</b>						
					other actuators on request					

( ) specification for cable tail

➔ **Complete order no.**  
Please enter code number.

07-2911-    /

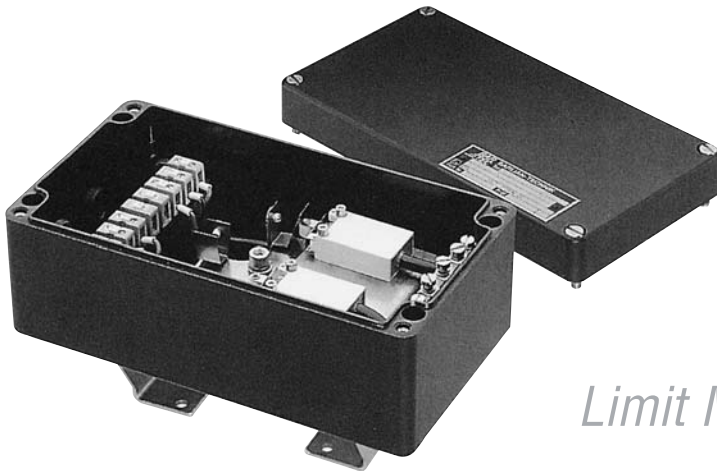
**Special versions,**  
please specify clearly

- gold-plated contacts
- gold-nickel contacts
- different ambient temperature

**Length of connection cable**  
in meters, e.g. code no. **3** = 3 m  
please specify greater length in text, plain text  
code no. **0**

<b>1</b>	<b>Aluminium enclosure</b>
<b>2</b>	<b>Plastic enclosure</b> (only for contact type 10, 20, 30)

\* Dimensions for actuator are reference values



## Limit Monitor

### Description

The limit value transmitters of types 07-31...-.../... are deployed in conjunction with pneumatic actuators on valves and fittings. They serve to signal the „open/closed“ status of a fitting. This end position is communicated via two (max. six) pressure-proof enclosed limit switches with the appropriate connection and mounting elements, or by intrinsically safe initiators according to NAMUR. To ensure mechanical adaptability to the pneumatic actuators, we supply 4 consoles according to VDI/VDE 3845.

The limit value transmitters and their components confirm to the pertinent standards EN 60947-5-1. The limit value transmitters have likewise been designed for connecting intrinsically safe power circuits. In this case they are given a special designation.

BARTEC's limit value transmitters can be deployed in explosion-endangered areas of zones 21 and 22 in accordance with the certified max. surface temperature.

### Explosion protection

**Ex protection type** Ex II 2D IP 65 T 80 °C

**Certification** IBEU 02 ATEX 1126

### Technical data

**Protection class** Enclosure IP 65 according to EN 60529 and IEC 60529

**Material**  
 Typ 07-31A aluminium plated ALSi 12  
 Typ 07-31B polyester black  
 Typ 07-31D high-quality stainless steel

**Mounting bracket and connection dimensions** according to ISO 5211 (DIN 3337) or VDI/VDE 3845

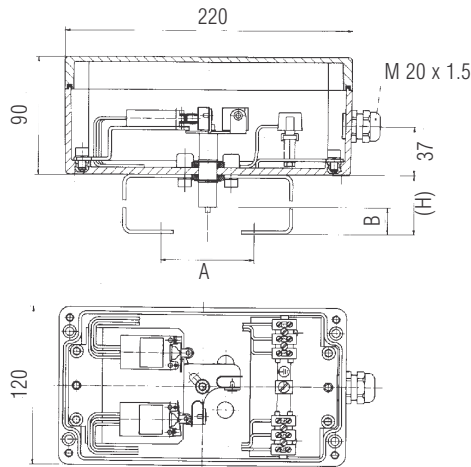
**Connection** Ex-glands M20 x 1.5 and M16 x 1.5

### Selection chart for standard version of polyester limit monitors

	Polyester enclosure, black, 220 x 120 x 90 mm, for zone 1 + 2 and 21 + 22	Console (dimensions in mm)			Order no.
		A	B	H	
Table 1	Console VDI/VDE 3845	130	50	75	<b>07-31B1-2209/9004</b> <b>07-31B1-2209/9003</b> <b>07-31B1-2209/9002</b> <b>07-31B1-2209/9001</b> <b>07-31B1-2209/9007</b>
	Console VDI/VDE 3845	130	30	55	
	Console VDI/VDE 3845	80	30	55	
	Console VDI/VDE 3845	80	20	45	
	Connection dimensions ISO 5211 F05	-	-	-	
<b>Polyester enclosure, black, 110 x 75 x 55 mm, for zone 1 + 2 and 21 + 22</b>					
Table 2	Console VDI/VDE 3845	130	50	75	<b>07-31B1-1105/9005</b> <b>07-31B1-1105/9004</b> <b>07-31B1-1105/9003</b> <b>07-31B1-1105/9002</b> <b>07-31B1-1105/9001</b>
	Console VDI/VDE 3845	130	30	55	
	Console VDI/VDE 3845	80	30	55	
	Console VDI/VDE 3845	80	20	45	
	Connection dimensions ISO 5211 F05	-	-	-	
<b>Polyester enclosure, black, 110 x 75 x 55 mm, for zone 1 + 2 and 21 + 22</b>					
Table 3	Console VDI/VDE 3845	130	50	75	<b>07-31B2-1105/9005</b> <b>07-31B2-1105/9004</b> <b>07-31B2-1105/9003</b> <b>07-31B2-1105/9002</b> <b>07-31B2-1105/9001</b>
	Console VDI/VDE 3845	130	30	55	
	Console VDI/VDE 3845	80	30	55	
	Console VDI/VDE 3845	80	20	45	
	Connection dimensions ISO 5211 F05	-	-	-	



**Dimensions in mm**



**■ Polyester enclosure 220 x 120 x 90 mm**

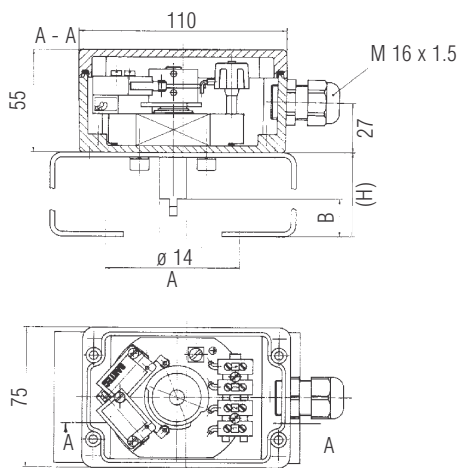
**Built-in components** 2 microswitches  
Switching function: changeover contact

**Rated nominal values**

Rated operating voltage $U_e$	AC 250 V	AC 400 V		DC 125 V	DC 250 V	
Rated operating current $I_e$	4 A	5 A	2 A	2.5 A	0.1 A	0.15 A
Utilization category	AC-15	AC-14	AC-15	AC-14	DC-14	DC-13

Cable connection via EEx e modular terminals. An EEx e cable gland is provided for the cable connection M 20 x 1.5 (6-12).

The version with enclosure dimensions 220 x 120 x 90 mm optionally provides additional terminals for the connection of a magnetic valve.



**■ Polyester enclosure 110 x 75 x 55 mm**

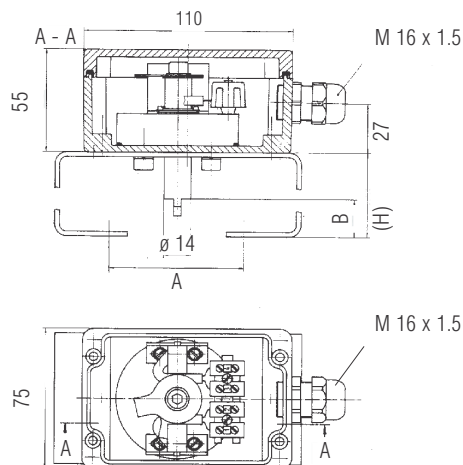
**Built-in components** 2 microswitches  
Switching function: NO contact

**Rated nominal values**

Rated operating voltage $U_e$	AC 250 V	AC 400 V		DC 125 V	DC 250 V	
Rated operating current $I_e$	4 A	5 A	2 A	2.5 A	0.1 A	0,15 A
Utilization category	AC-15	AC-14	AC-15	AC-14	DC-14	DC-13

Cable connection via EEx e terminals.

Cable inlet via EEx e cable gland M 16 x 1.5 (5 - 10)



**■ Polyester enclosure 110 x 75 x 55 mm**

**Built-in components** slot proximity switch  
no contact, inductive according to DIN 19234, NAMUR

Cable connection via EEx e terminals.

Cable inlet via EEx e cable gland M 16 x 1.5 (5 - 10)



## ComEx control stations

### Description

#### The ComEx program

ComEx is a flexible system offering standard as well as customer-specific local control and indicating units.

You have the choice between three standard enclosures which can accommodate up to three different control and indicating units.

Combinations of up to three ComEx enclosures are possible.

Either stuffing glands sizes M 20 x 1.5 and M 25 x 1.5 of plastic or cable glands of metal are available for the electrical connection.

The plastic glands require no lock nuts. Metal glands are screwed into a metal earth plate sheet inside of the enclosure. Maximum amount of cable glands M 20: two off.

To ensure easier operation on site, each enclosure can be equipped with an individual info-label.

An electrostatic charge is guaranteed by reduction of the surface resistance of the enclosure material. A maximum surface temperature  $T = 80\text{ °C}$  is guaranteed through installation of the relevant components.

#### Fully preassembled ComEx units

On the following pages you will find our complete range of fully preassembled ComEx units. The units are equipped with 1 to 3 elements.

Standard cable entries are plastic glands type M 20 x 1.5 for a 6 to 12 mm diameter cable.

### Features

- 3 standard enclosures
- Easy to install
- Extremely flexible
- Customer - tailored solutions

### Explosion protection

#### Ex protection type

Ex II 2D IP 66 T 80 °C

#### Certification

PTB 00 ATEX 1068

#### Permissible ambient temperature

-20 °C to +60 °C

### Technical data

#### Connection

Terminals 2.5 mm<sup>2</sup>

#### PE conductor terminals

4 x 2.5 mm<sup>2</sup>

#### Rated insulation voltage

max. AC 690 V

#### Nominal current

max. 16 A

#### Cable entry

standard version:  
M 20 x 1.5 for cable  $\varnothing$  6 to 12 mm

special versions:  
M 20 x 1.5 for cable with  $\varnothing$  5 to 9 mm  
M 25 x 1.5 for cable with  $\varnothing$  13 to 18 mm  
M 25 x 1.5 for cable with  $\varnothing$  9 to 16 mm

#### Enclosure

thermoplastics

#### Protection class

IP 65

### Actuators

#### Technical data

##### Shock resistance

7 Nm

##### Enclosure material

Enclosure: thermoplast

Seals: EPDM

##### Protection class

IP 66/IP 67

### Modules

#### Technical data

##### Switch module

Rated insulation voltage

690 V

#### Rated operating voltage

400 V	400 V	110 V	24 V	230 V
-------	-------	-------	------	-------

#### Utilization category

AC-12	AC-15	DC-13	DC-13	
-------	-------	-------	-------	--

#### Rated operating current

16 A	10 A	0.5 A	1 A	10 A
------	------	-------	-----	------

#### Nominal currents $I_{th}$

16 A/+40 °C, 11 A/+60 °C

#### Contact arrangement

1 NO and 1 NC

2 NO or 2 NC

##### Indicator light

Rated insulation voltage

AC 12 V to 250 V (-55 °C to +50 °C)

DC 12 V to 60 V (-55 °C to +50 °C)

AC/DC 12 V to 24 V (-55 °C to +60 °C)

Lamp

LED

Electrical life

> 10<sup>5</sup> hours illuminated

##### Illuminated button

Rated insulation voltage

AC 12 V to 250 V (-55 °C to +50 °C)

DC 12 V to 60 V (-55 °C to +50 °C)

AC/DC 12 V to 24 V (-55 °C to +60 °C)

Lamp

LED

Electrical life

> 10<sup>5</sup> hours illuminated

Contact element

Contacts 1 NC or 1 NO

Nominal voltage AC-15, 230 V

Nominal current 1 A












##### Measuring instrument





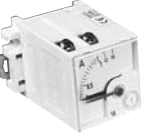
Operating voltage 420 V

Nominal current 0.7 A to 10.7 A

Measuring range 0 - 1 A to 0 - 16 A



Selection chart actuators	
Description	Code no.
 <b>Pushbutton</b> with rubber membrane and with four loose labels: red, green, yellow, white	<b>P7</b>
 <b>Emergency Stop</b> marked 'NOT-AUS EMERGENCY STOP'	<b>N8</b>
 <b>Locking-type mushroom pushbutton</b> push in without key, unlock with key; for emergency stop functions	<b>K3</b>
 <b>Mushroom pushbutton, black</b>	<b>P8</b>
 <b>Position selector</b> 2 positions, 0 + I latching	<b>S9</b>
 <b>Position selector, 3 positions I-0-II</b> I + II latching I + II momentary-contact I latching, II momentary-contact I momentary-contact, II latching	<b>S0</b>
	<b>S1</b>
	<b>S2</b>
	<b>S3</b>
 <b>Keyswitch</b> - lockable in both positions, key retractable in both positions lock 4 A 185 - lockable in its depressed position, key retractable in its depressed position lock 4 A 185 - lockable in its initial position, key retractable in its initial position lock 4 A 185	<b>K0</b>
	<b>K1</b>
	<b>K2</b>
	<b>K4</b>
 <b>Lock (RONIS)</b> lockable in both positions key retractable in both positions lock 445	<b>K4</b>
 <b>Lamp</b> red green yellow white blue	<b>LR</b>
	<b>LG</b>
	<b>LY</b>
	<b>LW</b>
	<b>LB</b>
 <b>Illuminated button actuator</b> red green yellow white blue	<b>TR</b>
	<b>TG</b>
	<b>TY</b>
	<b>TW</b>
	<b>TB</b>
	<b>TB</b>
 <b>Blanking plug</b> black, to cover unused holes in the front panel	<b>B1</b>

Selection chart modules	
Description	Code no.
 <b>Switch module</b> 1 NC/1 NO 2 NC 2 NO	<b>4</b> <b>1</b> <b>2</b>
 <b>Indicator light</b> red green yellow white blue	<b>R</b> <b>G</b> <b>Y</b> <b>W</b> <b>B</b>
 <b>Illuminated button</b> red green yellow white blue	<b>R</b> <b>G</b> <b>Y</b> <b>W</b> <b>B</b>
 <b>Terminal block</b> with 6 modular terminals 2.5 mm <sup>2</sup> , EEx e II	<b>6</b>
 <b>Measuring instrument</b> 1 A 5 A	<b>MM 1</b> <b>MM 5</b>

➔ Complete order no.

<b>Control unit</b> <b>07-3511-10</b>	<b>single unit</b>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>Control unit</b> <b>07-3512-10</b>	<b>double unit</b>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>Control unit</b> <b>07-3512-10</b>	<b>double unit</b>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>Control unit</b> <b>07-3513-10</b>	<b>triple unit</b>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>Control unit</b> <b>07-3513-10</b>	<b>triple unit</b>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Please enter code numbers.

Actuator or lamp	<input type="checkbox"/> <input type="checkbox"/>
Switch module or indicator light or terminal block	<input type="checkbox"/>
Measuring instrument	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>



Control switch

Features

- Contacts with positive break
- Latched and momentary-contact positions
- Simple assembly
- Customer-specific solutions

Description

This control switch has been designed for safe and reliable switch arrangements in zones 21 and 22.

Four switch contacts as opening and closing elements in different permutations permit a variety of functions. The opener contacts are with positive break. The switch actuator offers latched and momentary-contact positions with different switch positions.

The control switch is supplied in double or triple enclosures, or in combination with other command devices, such as control units.

Explosion protection

Ex protection type

Ex II 2D IP 66 T 80 °C

Certification

PTB 00 ATEX 1068

Permissible ambient temperature

-20 °C to +60 °C

Technical data

Connection

Terminals 2.5 mm<sup>2</sup>

PE conductor terminals

4 x 2.5 mm<sup>2</sup>

Rated insulation voltage

max. AC 690 V

Nominal current

max. 16 A

Cable entry

Standard version:

M20 x 1.5 for cables with ø 6 to 12 mm

Special version:

M20 x 1.5 for cables with ø 5 to 9 mm

M25 x 1.5 for cables with ø 13 to 18 mm

M25 x 1.5 for cables with ø 9 to 16 mm

Enclosure material

Thermoplastic

Protection type

IP 66

Contact material

AgSnO<sub>2</sub>

Switching function

4 switch contacts

NC/NO in different switch permutations

Latching and momentary-contact functions with different switch positions

Contacts

contacts with positive break

Switch isolator

DIN EN 60947-3 (main motor switch)

P/AC-3/AC-23 A	AC-3	AC-23
230 V	3ph/3kW	1ph/2.2 kW
400 V	3ph/5,5 kW	1ph/3 kW

I<sub>e</sub> = AC-23/400 V/10 A

Control switch

according to DIN EN 60947-5-1

(auxiliary current switch)

AC-15 400 V 10 A

AC-12 400 V 16 A

DC-13 24 V 1 A

Electrical data

Rated insulation current

U<sub>i</sub> = 690 V

U<sub>e</sub> = 400 V

Rated impulse strength

U<sub>imp</sub> = 6 kV

Conditional rated short/circuit current at 400 V

i<sub>e</sub> = 4 kA

Short circuit current

(general-purpose I.b.h.b.c back-up fuse for the protection of cables and circuits)

max. 16 A

Nominal thermal current

(+40 °C) I<sub>the</sub> = 16 A

(+60 °C) I<sub>the</sub> = 11 A



Selection chart			
Labelling	Code no.	Switching arrangement of control switch	Code no.
0 - I	01		001
I - II	02		
I - 0 - II	03		002
0 - I - II	04		
0 - I - II - III	05		003
0 - I - II - III - IV	06		
AUS - EIN	07		004
OFF - ON	08		
HAND - 0 - AUTO	09		005
HAND - 0 - AUTO - EIN	10		
HAND - BETRIEB - I	11		006
STOP - START	12		
HAND - AUTO	13		007
SENKEN - HEBEN	14		
REMOTE - LOCAL	15		008
AUS - BETRIEB - EIN	16		
AUS - 0 - EIN	17		009
AUF - 0 - AB	18		
OUT - OFF - HAND	19		010
LOCAL - REMOTE - AUTO	20		
STOP - 0 - START	21		010
AUS - AUTO - EIN	22		
OFF - AUTO - ON	23		010
0 - IN - START	24		
ENTRIEGELT - VERRIEGELT	25		

Switching arrangement for switch isolator		
		400
		401

➔ Complete order no.

Control unit double unit 07-3512-10G

Control unit triple unit 07-3513-10G








Please enter code numbers Labeling position selector

Switching arrangement

Switch module or indicator light






Other labellings and switching arrangements on request



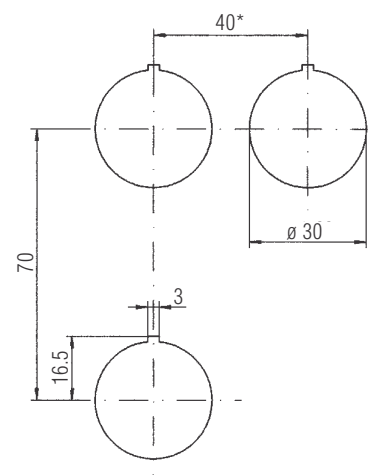
Selection chart		
Illustrations	Description	➔ Order no.
	<b>Fixing nut</b> M 30 to fix the actuating elements in the mounting wall of enclosure	<b>05-1138-0009</b>
	<b>Printed pushbutton labels</b> 6 loose pushbutton labels 1 x green marked START, ON, I 1 x red marked STOP, OFF, O	<b>05-0091-0019</b>
	<b>Spanner</b>	<b>05-1191-0001</b>
	<b>Label holder</b> Label holder for actuating elements with label insert	<b>05-0044-0001</b>
	<b>Contrast label</b> for Emergency Stop NOT-AUS yellow Ø 90 mm	<b>03-5412-0057</b>
	<b>Label</b> unmarked, for device information	<b>03-3600-0021</b>
	<b>Marking tag</b> for an additional label, for all actuating elements	<b>05-1105-0020</b>





Selection chart		
Illustrations	Description	➔ Order no.
	<b>ComEx flange set</b> for the connection of two ComEx enclosures includes 1 threaded sleeve, 1 lock nut and 1 O-ring	<b>05-0091-0046</b>
	<b>Locking device</b> (without padlock) for ComEx enclosure NIRO frame, transparent hood of high-quality thermoplast	<b>05-0037-0007</b>
	<b>Locking device</b> (without padlock) for control boxes NIRO frame, transparent hood of high-quality thermoplast	<b>05-0037-0006</b>
	<b>Protective metal shroud</b> for emergency stop actuating element to prevent accidental switching	<b>05-0032-0009</b>
	<b>External Earth Stud</b> for outside-connection	<b>05-0012-0124</b>

**Mounting dimensions**  
for switching and light elements  
according to EN 60947-5-1



\* recommended distance for mushroom pushbutton and emergency switch 100 mm



## Plug-and-socket devices

### Explosion protection

#### Ex protection type

Ex II 2GD EEx ed IIC T6 IP 66/67 T 85 °C

#### Certifications

Typ 07-8101-.... (DXN1)  
LCIE 99 ATEX 6027 X

Typ 07-8102-.... (DXN3)  
LCIE 00 ATEX 6010 X

Typ 07-8103-.... (DXN6)  
LCIE 02 ATEX 6029 X

### Technical data

#### Protection class

IP 66/67

#### Temperature range

-40 °C to +40 °C

### Description

BARTECs plug-and-socket devices for areas in which an explosion hazard exists are particularly well-suited for use in raw atmospheres because of their high degree of IP protection and their resistance to chemicals. Their integrated switch function gives them the ability to switch overloads as per IEC/EN 60947-3 Cat. AC 22 or AC 23. Silver-plated butting contacts ensure a constant contact pressure with low transfer resistances.

#### Plugs

The modular design of the plug-and-socket system allows choosing between plugs and couplers. They are supplied in unmounted state.

#### Wall socket

BARTEC supplies both a fully certified wall socket and a socket with a 30° adapter to flange onto housings.

Plug-and-socket devices from BARTEC are approved in accordance with the European directives not only for zones 1 and 2, but also for zones 21 and 22. Likewise for Class I Div. 2 Groups A, B, C, D and Class II Div. 2, Groups E, F, H in accordance with the American standards.

### Electrical data

#### Switching performance in accordance with IEC/EN 60947-3

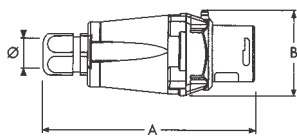
Voltage			Max. conductor cross-section (mm <sup>2</sup> )			Type
440 V	500 V	690 V	Flexible	Rigid	Auxiliary contacts	
20 A AC-23	20 A AC-22		2.5	4		<b>07-8101</b>
32 A AC-23	32 A AC-22	32 A AC-22	10	16		<b>07-8102</b>
32 A AC-23	32 A AC-22		10	16	2.5	<b>07-8102</b> with auxiliary contact
60 A AC-23	60 A AC-22	60 A AC-22	16	25		<b>07-8103</b>
60 A AC-23	60 A AC-22		16	25	2.5	<b>07-8103</b> with auxiliary contact

#### The following plastic screwed connections are available for the electrical connection:

Plug housing		Type	Wall socket		Type
16 A	M 20 x 1.5 (8 to 13 mm)	<b>07-8101-5...</b>	16 A	M 25 x 1.5	<b>07-8101-1...</b>
32 A	M 25 x 1.5 (13 to 19 mm)	<b>07-8102-5...</b>	32 A	M 25 x 1.5	<b>07-8102-1...</b>
60 A	M 32 x 1.5 (17 to 25 mm)	<b>07-8103-5...</b>	60 A	M 25 x 1.5	<b>07-8103-1...</b>



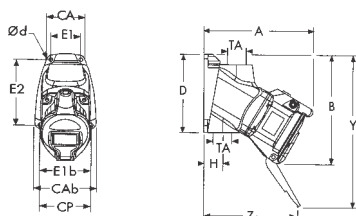
**Dimensions plug**



**Plug**

A	B	Ø	Type
127	51	8 to 13	<b>07-8101-5...</b>
128	68	13 to 19	<b>07-8102-5...</b>
149	83	17 to 25	<b>07-8103-5...</b>

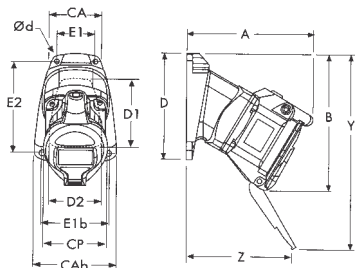
**Dimensions wall socket**



**Wall socket**

A	B	CA	CAb	CP	D	E1	E1b	E2	H	TA	Y	Z	Ød	Typ
127	131	45	68	57	90	36	56	78	37.5	M25 x 1.5	180	111	4.5	<b>07-8101-1...</b>
138	132	84	-	73	107	70	-	70	17.5	M25 x 1.5	200	105	6.0	<b>07-8102-1...</b>
165	162	89	-	82	122	77	-	88	24.0	M25 x 1.5	236	114	6.5	<b>07-8103-1...</b>

**Dimensions socket with 30° adapter**



**Socket with 30° adapter**

A	B	CA	CAb	CP	D	D1	D2	E1	E1b	E2	Y	Z	Ød	Type
108	120	45	68	57	90	75	50	36	56	78	169	92	4.5	<b>07-8101-3...</b>
119	141	76	-	73	107	65	95	63	-	95	209	86	5.5	<b>07-8102-3...</b>
136	156	76	-	82	107	65	95	63	-	95	230	85	5.5	<b>07-8103-3...</b>

**Selection chart**

Amperage	Code no.	Execution	Code no.	Assignment	Code no.	Auxiliary contacts	Code no.
16 A	<b>1</b>	Plug	<b>51</b>	L + N + PE (230 V)	<b>1</b>	without	<b>0</b>
32 A	<b>2</b>	Wall socket	<b>12</b>	2 + PE (400 V)	<b>2</b>	with two auxiliary contacts*	<b>1</b>
60 A	<b>3</b>	Socket with 30°-adapter	<b>32</b>	3 + PE (400 V)	<b>3</b>		-
	-		-	3 + N + PE (400 V)	<b>4</b>		-

➔ **Complete order no.** 07-810  -

Please enter code number. Auxiliary contacts\* only possible for 32 A and 60 A models.



Local control stations with polyester-, aluminium- or stainless steel enclosures



Features

- The right size enclosures
- Optimum functionality thanks to the great variety of components
- Customised planning and implementation

Description

For the explosion-proof, local controllers BARTEC offers an extensive range of polyester, aluminium and stainless steel enclosures. Depending on the customer's specific needs of control equipment and components, we provide different enclosure sizes. The control stations will be equipped according to your individual requirements with control, alarm, display units and bus interface modules. The components are mounted either on DIN rails or installed on the front door panel. Depending on your needs and requirements, BARTEC not only supplies you with the control units but also offers their complete wiring to rail mounted terminals.

Fields of application

For installations in machinery, control, equipment and plant construction. Owing to the large number of variants, the enclosures are ideally suited for local control stations and bus connecting modules.

Explosion protection

Ex protection type

Ex II 2D IP 65 T 80 °C

Certification

for zone 21 and 22  
IBExU 00 ATEX 1079

Ambient temperature

-20 °C to +40 °C

Technical data

Material

Glass-fibre reinforced polyester

surface resistance < 10<sup>9</sup> Ω

halogen-free

Colour: RAL 9005, black

Aluminium, die and shell casting

ALSi 12, Mg < 6 Gew.-%

Colour: RAL 7001, silver grey

special varnish and seawater-resistant

varnish on request

Stainless steel enclosure with door

high-quality stainless steel 1.4301/

ALSi 304 with hinged door,

delivered with mounting plate of sheet steel,

powder-coated RAL 2000

Standard seals

EPDM -20 °C to +85 °C,

Silikon -55 °C to +100 °C

Mechanical resistance acc. to EN 50014

Impact energy 7 Nm

Protection class

EN 60529/IEC 60529

IP 65

Electrical data

Nominal voltage

up to 1000 V

Nominal current

max. 125 A depending on accessories



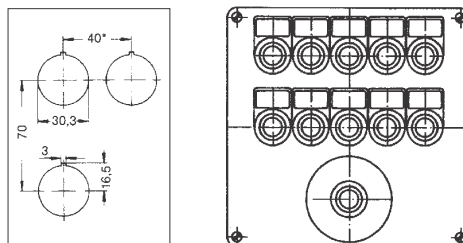
Polyester enclosure				Aluminium enclosure				Stainless steel enclosure with door			
Ext. dimensions (mm)			Order no.	Ext. dimensions (mm)			Order no.	Ext. dimensions (mm)			Order no.
Width	Height	Depth		Width	Height	Depth		Width	Height	Depth	
122	120	90	<b>07-3S03-1209</b>	122	120	90	<b>07-3S01-1209</b>	200	300	155	<b>07-3S36-2015</b>
160	160	90	<b>07-3S03-1609</b>	160	160	90	<b>07-3S01-1609</b>	380	300	155	<b>07-3S36-3815</b>
260	160	90	<b>07-3S03-2609</b>	260	160	90	<b>07-3S01-2609</b>	300	380	210	<b>07-3S36-3021</b>
360	160	90	<b>07-3S03-3609</b>	360	160	90	<b>07-3S01-3609</b>	360	380	210	<b>07-3S36-3821</b>
560	160	90	<b>07-3S03-5609</b>	200	230	110	<b>07-3S01-2011</b>	380	600	210	<b>07-3S36-3822</b>
255	250	120	<b>07-3S03-2512</b>	280	230	110	<b>07-3S01-2811</b>	600	600	210	<b>07-3S36-6021</b>
400	250	120	<b>07-3S03-4012</b>	330	230	110	<b>07-3S01-3311</b>	600	760	210	<b>07-3S36-6121</b>
400	405	120	<b>07-3S03-4112</b>	400	230	110	<b>07-3S01-4011</b>	760	760	300	<b>07-3S36-7630</b>
600	250	120	<b>07-3S03-6012</b>	400	310	110	<b>07-3S01-4111</b>	800	1000	300	<b>07-3S36-8030</b>
				600	230	110	<b>07-3S01-6011</b>				
				600	310	110	<b>07-3S01-6111</b>				

**Mounting dimensions for switching and light elements**

according to DIN 50007 and IEC 60337 - 2C

All information on the installed elements can be found in the range of ComEx control and indicator devices.

**Example:** Dimensions 255 x 250 x 120 mm



**Project Planning Information for control stations**

**Typ of enclosure** 07-3S   -

**Dimensions** Width \_\_\_\_\_ Height \_\_\_\_\_ Depth \_\_\_\_\_

**Enclosure material** \_\_\_\_\_

**Nominal voltage** AC \_\_\_\_\_ V / DC \_\_\_\_\_ V

**Threaded glands** \_\_\_\_\_

**Accessories - code/position** \_\_\_\_\_



## Polyester distribution boxes

### Features

- High mechanical strength ensures long service life
- ATEX certified
- Short delivery times

### Description

Polyester distribution boxes are designed in the type of protection "Protection through by enclosures", according to EN 50281-1-1. High grade polyester material, the use of high quality sealing material and fixing channels positioned outside the sealing area guarantees that the enclosure is permanently dust-free.

The enclosures provide reliable safe protection, even when used under extremely adverse environmental conditions, or under severe strong mechanical stress.

BARTEC equips the distribution boxes with terminals and cable screw connections cable glands, according to customers' wishes. The same distribution boxes can also be supplied for zone 1.

*Polyester distribution boxes Type 07-5103-... and 07-5105... (with terminals for intrinsically safe power circuits)*

### ➤ Explosion protection

#### Ex protection type

Ex II 2D IP 65 T 80 °C

#### Certification

IBExU 00 ATEX 1081

#### Ambient temperature

-20 °C to +40 °C

### ➤ Technical data

#### Material

glass-fibre reinforced polyester,  
surface resistance < 10<sup>9</sup> Ω

#### Colour

RAL 9005, black

#### Lid screws

stainless steel,  
captive cross-head (+ -)

#### Mechanical resistance

impact energy 7 Nm

#### Protection class according to EN 60529

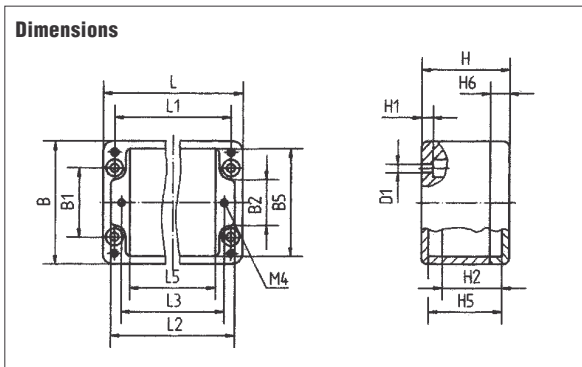
max. IP 66/67 possible

#### Rated voltage

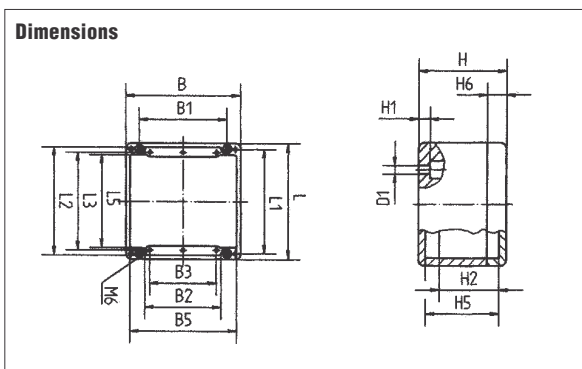
max. 1100 V



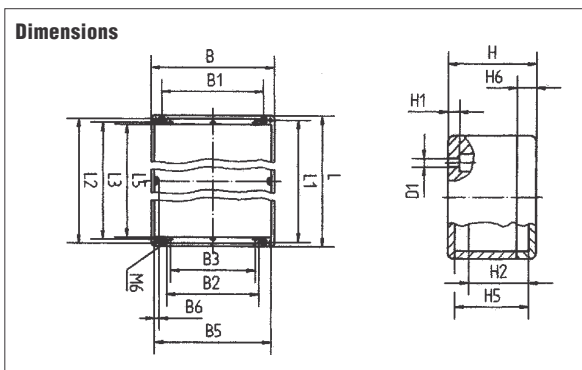
**Selection chart**



Type 1	Dimensions enclosure			Enclosure mounting dimensions			
	L	B	H	L1	B1	H1	D1
<b>07-510.-0800/7555</b>	80	75	55	68.5	45	8.5	4.6
<b>07-510.-1100/7555</b>	110	75	55	98	45	8.5	4.6
<b>07-510.-1600/7555</b>	160	75	55	148	45	8	4.6
<b>07-510.-1900/7555</b>	190.5	75	55	178	45	9	4.6



Type 2	Dimensions enclosure			Enclosure mounting dimensions			
	L	B	H	L1	B1	H1	D1
<b>07-510.-1221/2090</b>	122	120	90	106	82	15.5	6.5
<b>07-510.-1221/2012</b>	122	120	120	106	82	15.5	6.5
<b>07-510.-2201/2090</b>	220	120	90.5	204	82	15.5	6.5
<b>07-510.-1601/6090</b>	160.5	160	91	140	110	21	6.5
<b>07-510.-1601/6012</b>	160.5	160	120	140	110	21	6.5
<b>07-510.-2601/6090</b>	260	160	92	240	110	21	6.5
<b>07-510.-3601/6090</b>	361	160	91	340	110	21	6.5
<b>07-510.-2552/5012</b>	256.5	251	121	236	200.5	21	6.5
<b>07-510.-1601/6012</b>	255	250	160	235	200	20	6.5
<b>07-510.-2601/6090</b>	401	406	120	381.5	356	21	6.8
<b>07-510.-3601/6090</b>	400	405	165	381.5	355	20	6.3
<b>07-510.-2552/5012</b>	402	250.5	120	381.5	201	21	6.5



Type 3	Dimensions enclosure			Enclosure mounting dimensions			
	L	B	H	L1	B1	H1	D1
<b>07-510.-2300/7550</b>	230	75	50	218	39	10	6.5
<b>07-510.-5601/6090</b>	560	160	90	541	110	20	6.5
<b>07-510.-6002/5012</b>	600	250	120	580	200	20	6.5



**Rail-mounted terminal components/maximum number**

Article no. Polyester distribution boxes	Terminals 2.5 mm <sup>2</sup>		Terminals 4 mm <sup>2</sup>	
	TS*	Terminals per rail TS	TS*	Terminals per rail TS
Typ 07-5103-.... and 07-5105-....				
07- [ ] [ ] [ ] [ ] -0800/7555	1	8		
07- [ ] [ ] [ ] [ ] -1100/7555	1	13		
07- [ ] [ ] [ ] [ ] -1600/7555	1	21		
07- [ ] [ ] [ ] [ ] -1900/7555	1	26		
07- [ ] [ ] [ ] [ ] -2300/7550	1	32		
07- [ ] [ ] [ ] [ ] -1221/2090	1	14	1	11
07- [ ] [ ] [ ] [ ] -1221/2012	1	14	1	11
07- [ ] [ ] [ ] [ ] -2201/2090	1	30	1	25
07- [ ] [ ] [ ] [ ] -1601/6090	1	24	1	20
07- [ ] [ ] [ ] [ ] -1601/6012	1	24	1	20
07- [ ] [ ] [ ] [ ] -2601/6090	1	43	1	34
07- [ ] [ ] [ ] [ ] -3601/6090	1	60	1	50
07- [ ] [ ] [ ] [ ] -2552/5012	2	43	2	35
07- [ ] [ ] [ ] [ ] -2552/5016	2	43	2	35
07- [ ] [ ] [ ] [ ] -4002/5012	2	67	2	56
07- [ ] [ ] [ ] [ ] -4002/5016	2	67	2	56
07- [ ] [ ] [ ] [ ] -4004/0512	3	67	3	56
07- [ ] [ ] [ ] [ ] -4004/0516	3	67	3	56
07- [ ] [ ] [ ] [ ] -6002/5012	2	108	1	91

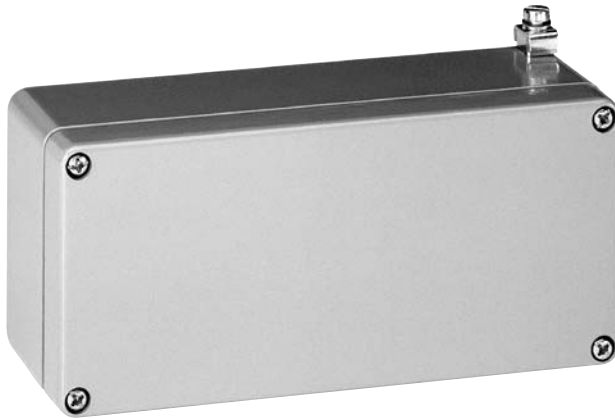
\* TS = mounting rail





Cable glands/maximum number		Polyester distribution boxes									
Article no. Polyester distribution boxes	Side	M 12 x 1.5	M 16 x 1.5	amplified clamping range M 16 x 1.5	M 20 x 1.5	amplified clamping range M 20 x 1.5	M 25 x 1.5	M 32 x 1.5	M 40 x 1.5	M 50 x 1.5	M 63 x 1.5
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -0800/7555	A/B C/D	4 1	2 1	2 -	2 -	1 -	1 -	- -	- -	- -	- -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -1100/7555	A/B C/D	6 1	4 1	3 -	3 -	2 -	2 -	- -	- -	- -	- -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -1600/7555	A/B C/D	12 1	6 1	5 -	4 -	4 -	3 -	- -	- -	- -	- -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -1900/7555	A/B C/D	15 1	8 1	6 -	5 -	5 -	4 -	- -	- -	- -	- -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -1221/2090	A/B C/D	13 4	9 4	5 2	5 2	4 2	2 -	1 -	1 -	1 -	1 -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -1221/2012	A/B C/D	13 4	9 4	5 2	5 2	4 2	2 -	1 -	1 -	1 -	1 -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -2201/2090	A/B C/D	28 4	18 4	12 2	11 2	10 2	5 -	3 -	3 -	2 -	1 -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -1601/6090	A/B C/D	18 8	14 8	8 5	8 4	6 4	4 2	2 1	1 -	1 -	1 -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -1601/6012	A/B C/D	18 8	14 8	8 5	8 4	6 4	4 2	2 1	2 -	1 -	- -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -2601/6090	A/B C/D	33 8	26 8	17 5	14 4	12 4	7 2	4 -	3 -	3 -	2 -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -3601/6090	A/B C/D	48 8	38 8	24 5	20 4	18 4	10 2	6 -	5 -	4 -	3 -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -2552/5012	A/B C/D	53 12	34 12	23 10	20 8	18 8	9 4	7 3	4 2	3 -	2 -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -2552/5016	A/B C/D	53 12	34 12	23 10	20 8	18 8	9 4	7 3	4 2	3 -	2 -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -4002/5012	A/B C/D	88 12	58 12	38 10	35 8	30 8	17 4	13 3	6 2	5 -	4 -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -4002/5016	A/B C/D	80 12	58 12	38 10	36 8	30 8	17 4	8 3	6 2	5 -	- -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -4004/0512	A/B C/D	88 26	58 20	38 16	35 14	30 10	17 6	13 4	6 2	5 2	- -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -4004/0516	A/B C/D	135 42	89 38	58 34	53 30	46 24	26 8	20 5	9 3	7 -	4 -
07- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> -6002/5012	A/B C/D	130 12	84 12	56 10	52 8	46 8	24 4	18 3	10 2	6 -	4 -

Each enclosure side wall has only a limited number of gland entries to ensure the mechanical stability of the enclosure.



## Aluminium distribution boxes

### Features

- High mechanical strength ensures long service life
- ATEX certified
- Short delivery times

### Description

Aluminium distributors from BARTEC are executed in the „Protection through enclosure“ type of protection according to EN 50281-1-1. The high quality of materials and sealants used, plus the fastening channels situated outside the sealing area, provide a permanently dust-tight enclosure.

The distributors are provided with an external 4 mm<sup>2</sup> protective conductor connection for potential equalisation.

The maximum admissible rated currents are laid down in the relevant accompanying sheets. The enclosures offer reliable protection, even when used under extreme ambient conditions or heavy mechanical loadings.

BARTEC fits terminals and cable glands to its distributors according to customer specifications. The same distributors can also be supplied for zone 1.

*Aluminium enclosures Typ 07-5101-... and 07-5102... (with terminals for intrinsically safe power circuits)*

### ➔ Explosion protection

#### Ex protection type

⊕ II 2D IP 65 T 80 °C

#### Certification

IBExU 00 ATEX 1080

#### Ambient temperature

-20 °C to +40 °C

### ➔ Technical data

#### Material

aluminium, die and shell casting, ALSi 12, Mg < 6 thread -%

#### Colour

RAL 7001, silver grey  
special varnish on request

#### Lid screws

stainless steel, captive,  
cross-head (+ -)

#### Mechanical resistance

impact energy 7 Nm

#### Protection class

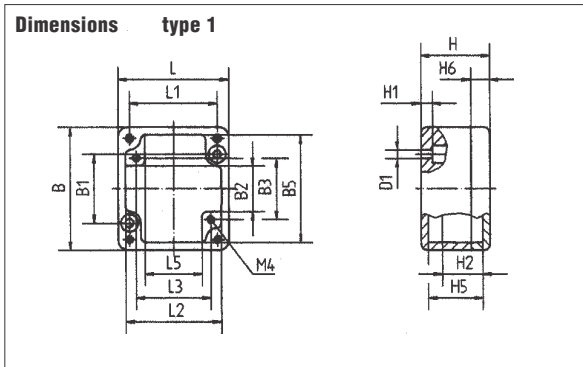
according to EN 60529  
max. IP 66/67

#### Rated voltage

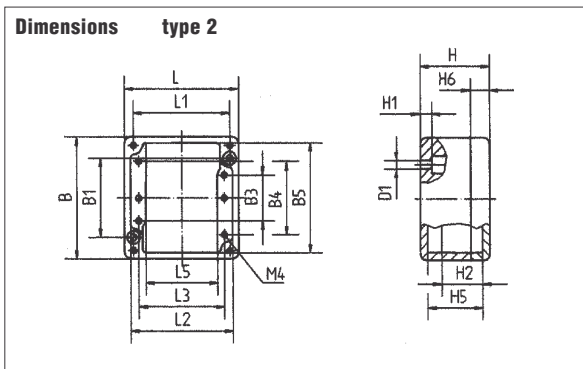
max. 1100 V



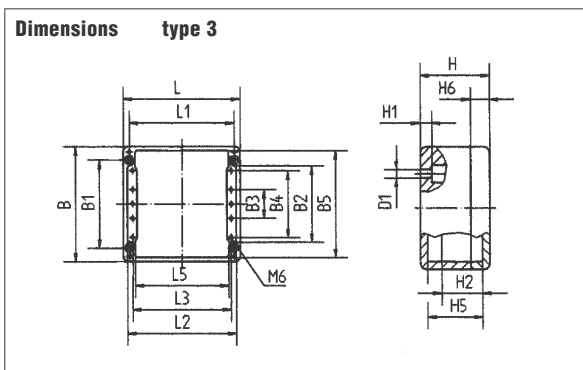
Selection chart



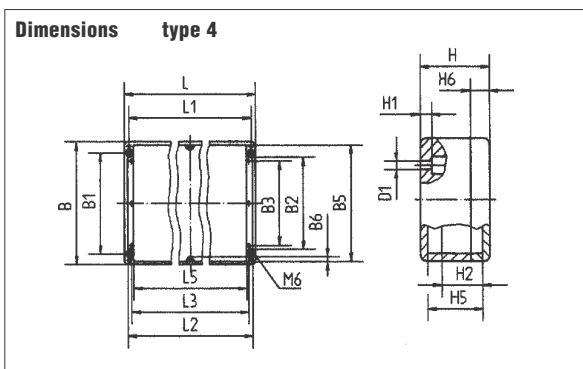
Type 1	Dimensions enclosure			Enclosure mounting dimensions			
	L	B	H	L1	B1	H1	D1
07-510.-0580/6436	58	64	36	64	36	6 <sup>±2</sup>	4.4
07-510.-0980/6436	98	64	36	86	36	6 <sup>±2</sup>	4.4
07-510.-1500/6436	150	64	36	138	36	6 <sup>±2</sup>	4.4



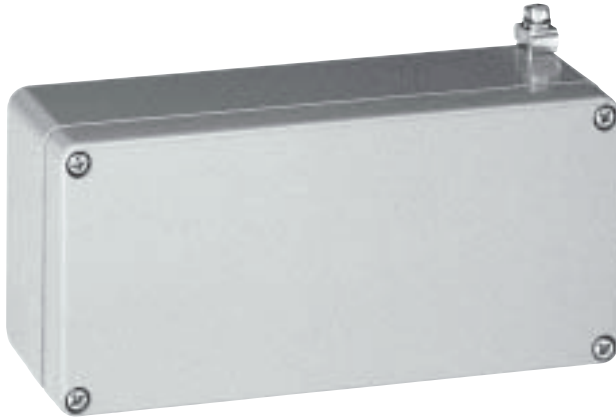
Type 2	Dimensions enclosure			Enclosure mounting dimensions			
	L	B	H	L1	B1	H1	D1
07-510.-0750/8057	75	80	57	63	52	10.5	4.3
07-510.-1250/8057	125	80	57	113	52	10.5	4.3
07-510.-1750/8057	175	80	57	163	52	10.5	4.3
07-510.-2500/8057	250	80	53	238	52	8	4.5



Type 3	Dimensions enclosure			Enclosure mounting dimensions			
	L	B	H	L1	B1	H1	D1
07-510.-1221/2080	122	122	80	106	82	7	6.5
07-510.-1221/2090	122	120	90	106	82	17	6.3
07-510.-2201/2080	220	120	80	204	82	17	6.3
07-510.-2201/2090	220	120	90	204	82	17	6.3
07-510.-3601/2080	360	122	80	344	82	7	6.3
07-510.-1601/6090	160	160	90	140	110	21,5	7
07-510.-2601/6090	260	160	90	240	110	21	6.3
07-510.-3601/6090	360	160	90	340	110	21,5	7
07-510.-2002/3011	200	230	110	180	180	21	6.4
07-510.-2802/3011	280	230	110	260	180	21	6.4
07-510.-3302/3011	330	230	110	310	180	21	6.7
07-510.-4002/3011	401	230	110	381	180	21	7
07-510.-4003/1011	403	310.5	110	382.5	261	21	7



Type 4	Dimensions enclosure			Enclosure mounting dimensions			
	L	B	H	L1	B1	H1	D1
07-510.-5601/6090	560	160	90	540	110	21	6.3
07-510.-6002/3011	600	230	110	580	180	27	7
07-510.-6003/1011	600	310	110	580	261	26,5	7



**Rail-mounted terminals/maximum number**

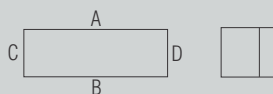
Article no. Aluminium enclosure	Terminals 2.5 mm <sup>2</sup>		Terminals 4 mm <sup>2</sup>	
	TS*	Terminals per rail	TS*	Terminals per rail
Type 07-5101-.... and 07-5102-....				
07- [ ] [ ] [ ] [ ] -0580/6436	-	3		
07- [ ] [ ] [ ] [ ] -0980/6436	-	7		
07- [ ] [ ] [ ] [ ] -1500/6436	-	11		
07- [ ] [ ] [ ] [ ] -0750/8057	1	7		
07- [ ] [ ] [ ] [ ] -1250/8057	1	6		
07- [ ] [ ] [ ] [ ] -1750/8057	1	22		
07- [ ] [ ] [ ] [ ] -1221/2080	1	21	1	11
07- [ ] [ ] [ ] [ ] -1221/2090	1	21	1	11
07- [ ] [ ] [ ] [ ] -2201/2080	1	29	1	26
07- [ ] [ ] [ ] [ ] -2201/2090	1	29	1	26
07- [ ] [ ] [ ] [ ] -3601/2080	1	60	1	49
07- [ ] [ ] [ ] [ ] -1601/6090	1	23	1	20
07- [ ] [ ] [ ] [ ] -2601/6090	1	42	1	34
07- [ ] [ ] [ ] [ ] -3601/6090	1	62	1	50
07- [ ] [ ] [ ] [ ] -5601/6090	1	102	1	85
07- [ ] [ ] [ ] [ ] -2002/3011	3	30	2	25
07- [ ] [ ] [ ] [ ] -2802/3011	3	44	2	38
07- [ ] [ ] [ ] [ ] -3302/3011	3	53	2	46
07- [ ] [ ] [ ] [ ] -4002/3011	3	68	2	58
07- [ ] [ ] [ ] [ ] -6002/3011	2	109	1	90
07- [ ] [ ] [ ] [ ] -4002/1011	4	68	2	58
07- [ ] [ ] [ ] [ ] -6003/1011	3	110	2	91

\* TS = mounting rail



Aluminium distribution boxes

External dimensions, earth bars, mounting plates



Article no. Aluminium enclosure	Side	amplified clamping range		amplified clamping range		amplified clamping range		amplified clamping range		amplified clamping range	
		M 12 x 1.5	M 16 x 1.5	M 16 x 1.5	M 20 x 1.5	M 20 x 1.5	M 25 x 1.5	M 32 x 1.5	M 40 x 1.5	M 50 x 1.5	M 63 x 1.5
07- [ ] [ ] [ ] [ ] -0580/6436	A/B C/D	1 -	1 -	1 -	- -	- -	- -	- -	- -	- -	- -
07- [ ] [ ] [ ] [ ] -0980/6436	A/B C/D	3 1	3 1	3 1	- -	- -	- -	- -	- -	- -	- -
07- [ ] [ ] [ ] [ ] -1500/6436	A/B C/D	6 1	5 1	4 1	- -	- -	- -	- -	- -	- -	- -
07- [ ] [ ] [ ] [ ] -0750/8057	A/B C/D	5 2	3 2	2 2	2 1	1 -	1 -	- -	- -	- -	- -
07- [ ] [ ] [ ] [ ] -1250/8057	A/B C/D	9 2	6 2	4 2	3 1	3 1	2 -	- -	- -	- -	- -
07- [ ] [ ] [ ] [ ] -1750/8057	A/B C/D	14 2	9 2	6 2	5 1	4 1	3 -	- -	- -	- -	- -
07- [ ] [ ] [ ] [ ] -1221/2080	A/B C/D	12 4	10 4	6 3	6 2	5 2	3 1	2 1	1 -	1 -	1 -
07- [ ] [ ] [ ] [ ] -1221/2090	A/B C/D	12 4	9 4	6 2	5 2	4 2	2 -	1 -	1 -	1 -	1 -
07- [ ] [ ] [ ] [ ] -2201/2080	A/B C/D	27 4	17 4	12 3	11 2	10 2	5 1	3 1	3 -	2 -	2 -
07- [ ] [ ] [ ] [ ] -2201/2090	A/B C/D	27 4	17 4	12 2	11 2	10 2	5 -	3 -	3 -	2 -	1 -
07- [ ] [ ] [ ] [ ] -3601/2080	A/B C/D	48 4	30 4	22 4	21 2	18 2	9 1	6 1	5 -	- -	- -
07- [ ] [ ] [ ] [ ] -1601/6090	A/B C/D	18 8	14 8	8 5	8 4	6 4	4 2	2 -	1 -	1 -	1 -
07- [ ] [ ] [ ] [ ] -2601/6090	A/B C/D	33 8	26 8	17 5	14 4	12 4	7 2	4 -	3 -	3 -	2 -
07- [ ] [ ] [ ] [ ] -3601/6090	A/B C/D	48 8	38 8	24 5	20 4	18 4	10 2	6 -	5 -	4 -	3 -
07- [ ] [ ] [ ] [ ] -5601/6090	A/B C/D	84 8	60 8	42 5	34 4	28 4	20 2	10 -	8 -	6 -	4 -
07- [ ] [ ] [ ] [ ] -2002/3011	A/B	38	24	16	15	12	8	5	3	2	2
07- [ ] [ ] [ ] [ ] -2002/3018	C/D	20	15	10	10	6	4	3	2	2	-
07- [ ] [ ] [ ] [ ] -2802/3011	A/B C/D	58 20	30 15	25 10	23 10	20 6	11 4	8 3	4 2	3 2	2 -
07- [ ] [ ] [ ] [ ] -3302/3011	A/B	70	46	30	28	24	14	10	5	4	2
07- [ ] [ ] [ ] [ ] -3302/3018	C/D	20	15	10	10	6	4	3	2	2	1
07- [ ] [ ] [ ] [ ] -4002/3011	A/B C/D	58 20	56 15	38 10	35 10	30 6	17 4	12 3	6 2	4 2	3 1
07- [ ] [ ] [ ] [ ] -6002/3011	A/B C/D	126 25	84 15	56 10	52 10	46 6	24 4	18 3	8 2	6 2	4 1
07- [ ] [ ] [ ] [ ] -4003/1011	A/B	85	56	38	35	30	17	12	6	4	3
07- [ ] [ ] [ ] [ ] -4003/1018	C/D	30	25	20	18	10	5	4	2	2	1
07- [ ] [ ] [ ] [ ] -6003/1011	A/B	126	84	56	52	46	24	18	8	6	4
07- [ ] [ ] [ ] [ ] -6003/1018	C/D	30	25	20	18	10	5	4	2	2	1

Each enclosure side wall has only a limited number of gland entries to ensure the mechanical stability of the enclosure.



## Stainless steel distribution boxes/cabinets

### Features

- High mechanical strength ensures long service life
- ATEX certified for the zones 21 and 22
- kundenspezifische Ausführungen für den jeweiligen Anwendungsfall

### Description

BARTEC stainless steel distribution boxes are designed in the type of protection "Protection through by enclosures", according to EN 50281-1-1. High-grade material, the use of high-quality sealing material and of press-in nuts for fixing and as potential equalisation ensures that the enclosure is permanently dust-free.

For potential equalisation the distribution boxes are fitted with an exterior M5 protective conductor connection M5 connection for protective earthing. Maximum permissible reference currents rated currents are specified in the relevant supplements.

BARTEC distribution boxes provide reliable protection, even when used under extremely adverse environmental conditions or under severe strong mechanical stress.

This model series includes enclosures with screwed covers, and cabinets with hinged doors. As from an enclosure height of 120 mm the enclosures can be supplied both with and without flange plates.

We will be pleased to fit the distribution boxes with terminals and cable screw connections cable glands according to customers needs and requirements. The same distribution boxes can also be supplied for zone 1 as required.

Stainless steel distribution boxes Type 07-56.2-... and 07-56.4... (with terminals for intrinsically safe power circuits)

### ➔ Explosion protection

#### Ex protection type

Ex II 2D IP 65 T 80 °C

#### Certification

IBExU 99 ATEX 1096

#### Ambient temperature

-20 °C to +40 °C

### ➔ Technical data

#### Material

stainless steel V4A 1.4404

#### Coating

brushed,  
painted or electro polished on request

#### Mechanical strength

according to EN 50014  
Impact energy 7 Nm

#### Protection class

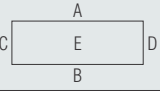
according to EN 60529  
max. IP 66

#### Rated voltage

max. 1100 V



**Selection chart**

						Gland plates openings minimum depth for flanges 120 mm 			
Version	Code no.	Dimensions enclosure in mm (L x W x H)	Code no.	Dimensions cabinets in mm (W x H x D)	Code no.	Flanges Side A, B, (E)	Code no.	Flanges Side C, D, (E)	Code no.
Distribution Box II 2D	2	100 x 100 x 60	17	200 x 300 x 155	51	closed	1	closed	1
				400 x 400 x 210	57	Face A	2	Face C	2
		150 x 150 x 80	01	400 x 600 x 210	58	Face B	3	Face D	3
				600 x 600 x 210	59	Face A + B	4	Face C + D	4
Distribution Box II 2D with intrinsically safe power circuits	4	200 x 200 x 80	03	600 x 800 x 300	61	Face E + A	5	Face E + C	5
				800 x 800 x 300	62	Face E + B	6	Face E + D	6
		300 x 300 x 120	07	800 x 1000 x 300	63	Face E + A + B	7	Face E + D + C	7
				800 x 800 x 300	62	Face E + A + B	7	Face E + D	6
				800 x 1000 x 300	63	Face E	8	Face E + D + C	7

**Complete order no.**

Please enter code number.

07-56   -

Example: EEx e Distribution Box with hinged door  
 Dimensions: 400 x 400 x 210 mm with gland plates on face B + C + D  
**Type 07-56D2-5734**

Other enclosure and cabinet sizes on request.

Version	Code no.
Enclosure with lid	<b>B</b>
Cabinet with door	<b>D</b>

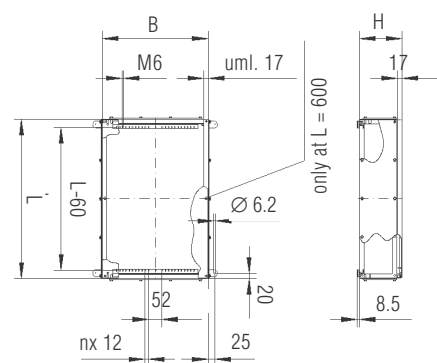


**Rail-mounted terminals/maximum number**

Article no. High-quality stainless steel enclosure Type 07-56.-....	Terminals 2.5 mm <sup>2</sup>		Terminals 4 mm <sup>2</sup>	
	TS*	Terminals per rail TS	TS*	Terminals per rail TS
07- [ ] [ ] [ ] [ ] -56B.-1711	1	8		
07- [ ] [ ] [ ] [ ] -56B.-0111	1	20	1	16
07- [ ] [ ] [ ] [ ] -56B.-0311	1	50	1	40
07- [ ] [ ] [ ] [ ] -56B.-0711	1	90	1	70
07- [ ] [ ] [ ] [ ] -56B.-1411	1	180	1	130
07- [ ] [ ] [ ] [ ] -56D.-5111	1	90	1	70
07- [ ] [ ] [ ] [ ] -56D.-5711	1	240	1	150
07- [ ] [ ] [ ] [ ] -56D.-5811	1	360	1	240
07- [ ] [ ] [ ] [ ] -56D.-5911	1	570	1	400
07- [ ] [ ] [ ] [ ] -56D.-6111	1	780	1	550
07- [ ] [ ] [ ] [ ] -56D.-6211	1	900	1	770
07- [ ] [ ] [ ] [ ] -56D./6311	1	1200	1	980

\* TS = mounting rail

**Enclosure dimensions**

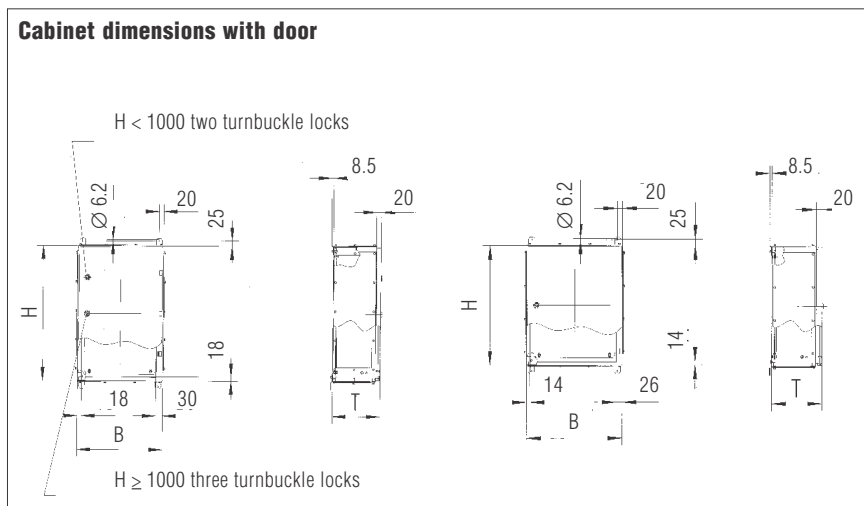






Rail-mounted terminals/maximum number High-quality stainless steel enclosure/distribution box											
Article no. High-quality stainless steel enclosure	Side										
		M 12 x 1.5	M 16 x 1.5	M 16 x 1.5	M 20 x 1.5	M 20 x 1.5	M 25 x 1.5	M 32 x 1.5	M 40 x 1.5	M 50 x 1.5	M 63 x 1.5
07- [ ] [ ] [ ] [ ] -56B.-1711	A/B C/D	6 3	5 2	4 2	3 -	2 -	2 -	- -	- -	- -	- -
07- [ ] [ ] [ ] [ ] -56B.-0111	A/B C/D	8 4	6 3	5 2	4 2	3 -	3 -	- -	- -	- -	- -
07- [ ] [ ] [ ] [ ] -56B.-0311	A/B C/D	6 4	5 3	5 3	4 3	4 2	3 -	2 -	2 -	- -	- -
07- [ ] [ ] [ ] [ ] -56B.-0711	A/B C/D	63 30	50 20	44 15	27 14	24 12	16 5	12 4	7 3	4 2	3 -
07- [ ] [ ] [ ] [ ] -56B.-1411	A/B C/D	80 60	60 45	52 35	48 28	36 20	18 10	15 7	12 5	8 4	6 3
07- [ ] [ ] [ ] [ ] -56D.-5111	A/B C/D	40 65	28 50	24 45	24 32	15 25	8 18	6 12	6 8	2 4	2 3
07- [ ] [ ] [ ] [ ] -56D.-5711	A/B C/D	125 115	105 95	78 70	72 65	50 45	32 28	20 16	16 7	10 5	8 5
07- [ ] [ ] [ ] [ ] -56D.-5811	A/B C/D	125 200	105 168	78 126	72 114	50 85	32 52	20 30	16 22	10 14	8 10
07- [ ] [ ] [ ] [ ] -56D.-5911	A/B C/D	206 600	172 168	130 126	116 114	88 85	53 52	31 30	22 22	14 14	10 10
07- [ ] [ ] [ ] [ ] -56D.-6111	A/B C/D	250 400	220 341	150 245	130 225	96 176	65 102	42 68	26 44	18 30	16 27
07- [ ] [ ] [ ] [ ] -56D.-6211	A/B C/D	430 400	352 341	252 245	234 225	184 176	108 102	70 68	48 44	33 30	30 27
07- [ ] [ ] [ ] [ ] -56D./6311	A/B C/D	430 550	352 451	252 324	234 297	184 232	108 132	70 85	48 60	33 42	30 36

The number of the screw connections is chosen for every enclosure side so that the side walls are not weakened and are not impaired the housing in its stability.





Cable glands

Description

BARTEC's cable glands are tested to EN 50281-1-1, EN 50014 and EN 50019 and approved for use on devices in areas endangered by dust explosions.

These cable glands retain the "protection through enclosure". That is why these are required for around 80 % of devices deployed in explosive zones with inflammable dust.

Cable glands from BARTEC conform to the requirements of EN 50014 and EN 50019 for "increased safety". They are available in black and blue.

Description	Protection class	Size	Cable range	Order no.
<p><b>Cable glands</b> for hazardous areas acc. to EN 50014 and EN50019 for zone 1 and zone 21</p> <p>➔ <b>Explosion protection</b></p> <p><b>Ex protection type</b> ⊕ II 2GD IP 66/67 EEx e II</p> <p><b>Certification</b> DMT 02 ATEX E 180 X</p> <p>➔ <b>Technical data</b></p> <p><b>Material</b> Body nylon</p> <p><b>Operating temperature</b> -20 °C to +95 °C</p> <p><b>. = Colour code Please insert last number</b> s = black RAL 5015 b = blue RAL 9005</p>	IP 66/67 according to IEC 60529	M 16 x 1.5	4 - 8	<b>07-9534-1M1.</b>
		M 20 x 1.5	6,5 - 12	<b>07-9534-1M2.</b>
		M 25 x 1.5	13 - 18	<b>07-9534-1M3.</b>
		M 32 x 1.5	18 - 25	<b>07-9534-1M4.</b>
		M 40 x 1.5	22 - 32	<b>07-9534-1M6.</b>
		M 50 x 1.5	32 - 38	<b>07-9534-1M7.</b>
		M 63 x 1.5	37 - 44	<b>07-9534-1M8.</b>
		M 16 x 1.5	3 - 6	<b>07-9534-2M1.</b>
		M 20 x 1.5	5 - 9	<b>07-9534-2M2.</b>
		M 25 x 1.5	9 - 16	<b>07-9534-2M3.</b>
		M 32 x 1.5	13 - 20	<b>07-9534-2M4.</b>
		M 40 x 1.5	20 - 26	<b>07-9534-2M6.</b>
		M 50 x 1.5	25 - 31	<b>07-9534-2M7.</b>
		M 63 x 1.5	29 - 35	<b>07-9534-2M8.</b>
M 16 x 1.5	5 - 10	<b>07-9534-3M1.</b>		
M 20 x 1.5	10 - 14	<b>07-9534-3M2.</b>		



## Flashing lamp

### Features

- 5 J flash energy
- long life of the light tube
- maintenance-free
- compact design
- very sturdy
- low weight (2 kg)
- low power demand due to high lamp efficiency
- easy installation

### Description

Plant and machinery are fitted with visual alarms to give timely warning of dangerous situations and to enable machinery to be shut down before damage occurs.

The flash intensity, whether viewed directly or indirectly, gives an ideal means of attracting attention. BARTEC Flashing lamps inform, warn and give alarm in industry, plant and machinery installations for zone 22.

### Explosions protection

**Ex protection type (EN 50281-1-1)**

Ex II 3D IP 65 T 80 °C

**Ambient temperature**

-20 °C to +40 °C

### Technical data

**Protection class**

IP 65 according to IEC 60529

**Enclosure material**

Aluminium, powder coated with borosilikal glass dome

### Electrical data

**Rated voltage**

AC 230 V ±10 %

DC 24 V

**Flash energy**

up to 5 Ws

**Flash frequency**

0.5 Hz up to 1.0 Hz

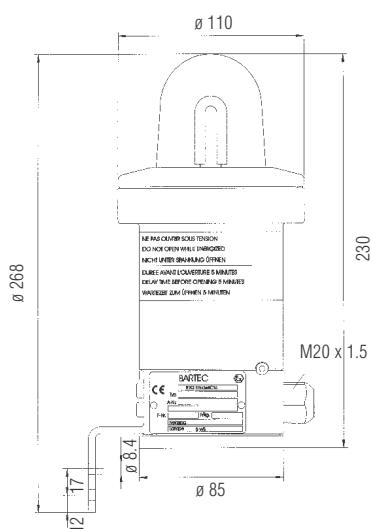
**ON time**

100 %

**Activation**

by connecting with the rated voltage

### Dimensions



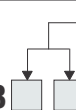
### Selection chart

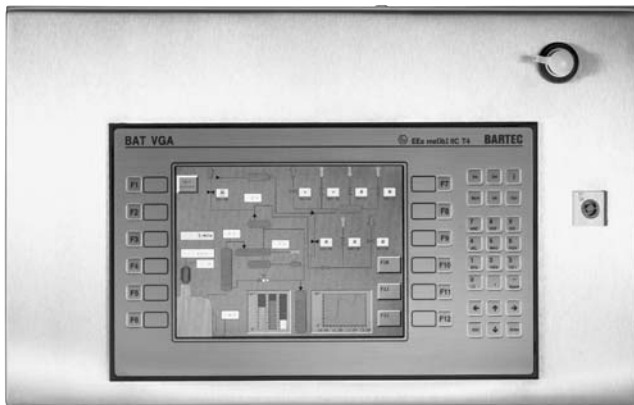
Name	Code no.
Flashing lamp AC 230 V, 5 Ws, < 33 W, dome colour yellow	13
Flashing lamp AC 230 V, 5 Ws, < 33 W, dome colour red	14
Flashing lamp DC 24 V, 5 Ws, < 15 W, dome colour yellow	83
Flashing lamp DC 24 V, 5 Ws, < 15 W, dome colour red	84

➔ **Complete order no.**

Please enter code number.

**A7-4838-33**





Display terminal  
BAT VGA pro DustEx

Features

- Graphic-capable TFT colour display
- Background illumination (220 cd/m<sup>2</sup>)
- Modular interface technology

Description

The BAT VGA pro full graphics display terminal combines high operator friendliness with all advantages nowadays required of a terminal that is used within the Ex area. Thanks to the combination of different types of protection the terminal no longer needs barriers, field bus links etc.

The terminals are connected directly to the PROFIBUS DP or the communication interface of the PLC.

The modular interface design allows the terminal interfaces to be adapted to the respective requirements. Available are, for example, TTY, RS422, RS485, PROFIBUS DP, ...

The display offers state-of-the-art TFT technology allowing it to be read from even extreme angles. Most unique is the intense brightness of 220 cd/m<sup>2</sup> in explosive areas. Operator friendliness has been increased by means of the innovative high-quality steel keyboard.

Minimum housing dimensions are 600 x 380 x 300 mm (types 07-56C1-..11/.... or 07-56D1-..11/....), the high-quality steel housing cutout for the terminal measures 386 x 226 mm. The front panel and keyboard surfaces consist of high-quality steel.

Explosion protection

Ex protection type

Ex II 2GD EEx me [ib] IIC T4 IP 66 T 80 °C

Certification

PTB 01 ATEX 2109

Technical data

Protection class according to EN 60529: 1991-06

IP 66

Electrical data

Rated voltage

DC 24 V ± 10 %

Rated current

≤ 2 A

Ambient temperature

0 °C ≤ Ta ≤ +50 °C

High-quality steel housing dimensions

e. g. 600 x 380 x 300 mm

Weight

approx. 20 kg (dep. on housing)

Selection chart

Version	Interface configuration	Code no.	
BAT VGA pro DustEx	TTY	2	2
	RS232	3	3
	RS422/485	4	4
	intrinsically safe for hand scanner	6	6
	PROFIBUS DP	-	4

Complete order no.

Please enter code number.

17-71P8-11   /0201



## *Long field lights*

### **Features**

- Low energy consumption
- Easy assembly
- Enclosure trough not subject to electrostatic charges
- Standard tubes used

### **Description**

Long field lights serve to illuminate buildings and plant in which there is a danger of dust explosions. They can be deployed in all dusty atmospheres in zone 21 and 22 whose ignition temperature is higher than +70 °C.

The fluorescent lamps are equipped with an electric lamp ballast.

On request, we can fit an extra safety switch to the lights to shut the power off when the lights are opened.

The electrical connection is made via two cable glands M25 x 1.5 (13 to 18 mm).

In the end of 2003 available

**BARTEC**





### **Ambient temperature**

Temperature of the air or other medium in which the equipment is intended to be used (IEV 826-01-04) (IEC 60204-32: 1998).

### **ATEX**

'ATmosphère EXplosible' – Explosive atmosphere

### **ATEX-directives**

Unofficial "family name" for EC directives relating to explosion protection, i.e. RL 94/9/EC and 1999/92/EC

### **CE - marking**

Identification marking confirming that all the requirements corresponding to the directive relevant to the product have been fulfilled.

### **Combustible dust**

Dust, fibres or flying particles that can burn or glow in air and can form explosive mixtures with air at atmospheric pressure and normal temperatures (EN 50028: 1987).

### **Component**

Every part required for safe operation of the equipment and protective systems.

### **Conductive dust**

Dust, fibres or flying particles with electrical resistivity equal to or less than  $10^3 \text{ Ohm}\cdot\text{m}$  (EN 50281-1-1: 1998).

### **Constructional measures**

Measures which limit danger through dust explosions, or reduce the effects of explosions in the building. Constructional measures lead to increase in safety.

### **Cubical law**

Volume dependence of the maximum, time-dependent pressure increase:  
 $(dp/dt)_{\text{max}} \cdot V^{1/3} = K_{\text{st}} = \text{constant}$ .

### **Dangerous dust concentration**

Occurs if, for example, a 100 W lamp cannot be seen in a room at a distance of 1 metre. A dangerous dust concentration depends on the particle size and type of dust:

Lower explosion limit: 20 to 60 g/m<sup>3</sup>

Upper explosion limit: 2000 to 6000 g/m<sup>3</sup>

### **Degree of protection**

Extent of protection provided by an enclosure against access to hazardous parts, against ingress of solid foreign objects and/or ingress of water and verified by standardised test methods (EN 60529: 1991)

### **Degree of protection of enclosure (IP)**

Numerical classification according to EN 60529: 1991 preceded by the symbol IP applied to the enclosure of electrical apparatus to provide for

- protection of persons against contact with or approach to live parts and against contact with moving parts (other than smooth rotating shafts and the like) inside the enclosure;
- protection of the electrical apparatus against ingress of solid foreign objects and, where indicated by the classification;
- protection of the electrical apparatus against harmful ingress of water

### **Detonation**

Explosion which is propagated at supersonic speed, and is characterised by a shock wave (EN 1127-1: 1997).





### **Dust**

Small solid particles in the atmosphere which settle out under their own weight, but which may remain suspended in air for some time (includes dust and grit, as defined in ISO 4225: 1994 (EN 50281-1-2: 1998)).

NOTE: Generally maximum particle size will not exceed 500 µm.

### **Dust/air mixture**

Whirled up dust in the air. Characteristic parameter is the dust concentration.

### **Dust cloud**

Whirled up flour or powder.

### **Dust explosion**

A very rapid chemical reaction of a combustible material (dust) in which large quantities of energy are released.

### **Dust explosion classes**

Classes in which dusts are classified on the basis of their K<sub>st</sub> values. Dust explosion class ST: ST1: 0<K<sub>st</sub>-value<200; ST2: 200<K<sub>st</sub><300; ST3: K<sub>st</sub>>300 (bar\*m/s).

### **Dust explosion hazard**

Danger which exists when combustible dust (powder, flour) is produced or handled, or when combustible solid materials are processed causing the formation of dust.

### **Dust fire**

Ignition of a dust layer. A dust fire can develop into a dust explosion.

### **Dust layer**

Deposit of flour or powder on a piece of equipment.

### **Dust protected enclosure**

An enclosure which does not completely prevent the entry of dust, but dust does not penetrate in a sufficient quantity to impair reliable operation of the equipment (device). Dust must not accumulate at any positions within the enclosure where it could cause danger of ignition (EN 50281-1-1: 1998).

### **Dust-tight enclosure**

Enclosure, capable of preventing the ingress of all observable dust (IP 6X), (EN 50281-1-1: 1998).

### **Effective ignition source**

Ignition source which can give off so much energy to the potentially explosive atmosphere that spontaneous propagation of combustion occurs (see ignition sources).

### **Electrical apparatus**

Items applied as a whole or in part for the utilisation of electrical energy. These include, among others, items for the generation, transmission, distribution, storage, measurement, regulation, conversion and consumption of electrical energy and items for telecommunications. (EN 50014: 1997).

### **Electrostatic charge**

An electrostatic charge is produced when a non-conducting material is separated from another (conductive or non-conductive) material, with which it was previously in close contact.

### **Encapsulation**

Type of protection in which the components which can ignite a potentially explosive atmosphere are embedded in a pourable sealing compound.

### **Enclosure (of equipment or protective system)**

All the walls including doors, covers, cable entries, rods, spindles and shafts which contribute to the type of protection and/or their degree of protection (IP) of the electrical apparatus (EN 50014: 1997).

### **Equipment**

Machines, operating material, stationary or mobile devices, control components and accessories, which are used, either individually or combined, for production, transmission, storage, measurement, regulation and conversion of energy and/or for processing of materials which have their own potential ignition sources and can therefore cause an explosion.



### **Equipment category**

Within an equipment group, a category is the classification according to the required level of protection.

The equipment category indicates what technical requirements are set on the equipment in the particular zone. The categories are defined as follows:

#### **Category 1**

includes equipment designed to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring a very high level of protection.

#### **Category 2**

includes equipment designed to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring a high level of protection.

#### **Category 3**

includes equipment designed to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring a normal level of protection

### **Explosion**

Abrupt oxidation or decomposition reaction producing an increase in temperature, pressure or in both simultaneously (EN 1127-1: 1997).

### **Equipment group**

Classification of electrical apparatus related to the explosive atmosphere for which it is to be used (EN 50014: 1997). The electrical apparatus group indicates whether the equipment is to be used underground (I) or in other areas (II).

### **Explosion pressure relief**

The vessel to be protected is fitted with a pressure relieving device which opens at a defined pressure, which should be well below the strength of the vessel. Such devices include, e.g. bursting disks or bleeder valves/explosion doors.

### **Explosion protection**

#### **Primary explosion protection**

Measures which must be taken in order to prevent the formation and spreading of an explosive atmosphere.

#### **Secondary explosion protection**

Measures which must be taken in order to prevent ignition sources becoming effective, i.e. explosion protection of electrical devices with "e" type protection.

#### **Tertiary explosion protection**

Measures which must be taken to keep the danger or effects of an explosion as small as possible if they cannot be avoided anyway.

### **Explosion protection document**

Contains information such as: description of the operational area, process, operations involved and material quantities, material data (safety parameters), risk assessment, zone classification, technical and organisational protective measures, emergency measures, operating instructions and release for work.

### **Explosion protection marking**

Common marking of explosion-protected equipment.

### **Explosion range**

Range of concentration of a flammable substance in air, within which an explosion can occur (EN 1127-1: 1997).

### **Explosion suppression**

Suppression of an explosion in the initial phase by means of flame or pressure sensors, brought about through fast injection of extinguishing agents.

### **Explosive dust atmosphere**

Mixture with air under atmospheric conditions, of flammable substances in the form of dust or fibres in which, after ignition, combustion spreads throughout the unconsumed mixture (see IEV 426-02-04).



### **Explosive limits**

Limits of explosion range (EN 1127-1: 1997).

### **Explosive test mixture**

Specified explosive mixture used for testing of electrical apparatus for potentially explosive atmospheres (EN 50014: 1997).

### **Hazardous area**

Area in which an explosive atmosphere is present, or may be expected to be present in quantities such as to require special precautions for the construction, installation and use of equipment.

NOTE 1: Layers, deposits and heaps of combustible dust should be considered as a source which can form an explosive atmosphere.

NOTE 2: Normal operation means a situation where installations perform within their design parameters.

NOTE 3: The terms "flammable" and "combustible" are used as synonymous.

### **Ignitable equipment (operating material)**

Equipment (operating material) which can ignite an established explosive atmosphere during normal operation. This also includes electrical devices which are not protected by one of the types of protection listed in EN 50016:1995, 1.8.1

### **Ignition of a dust cloud**

Initiation of an explosion by the transfer of energy to a dust cloud in air (EN 50281-2-1: 1998).

### **Ignition of a dust layer**

Ignition shall be considered to have occurred if glowing or flaming is initiated in the material, or a temperature of 450°C or more, or a temperature rise of 250 K or more above the temperature of the prescribed hot surface, is measured in the test (EN 50281-2-1: 1998).

### **Ignition sources**

Any source which has sufficient energy to trigger off combustion (ISO 13702: 1999), i. e. hot surfaces, flames, smoulder spots, mechanically produced sparks, electrical devices, electrostatic charges, on which dust clouds or dust deposits can ignite.

### **Ignition temperature of an explosive atmosphere**

Lowest temperature of a heated surface at which, under specified conditions the ignition of an explosive atmosphere will occur.

### **Ignition temperature of a dust cloud**

Lowest temperature of a hot inner wall of a furnace at which ignition occurs in a dust cloud in air contained therein (EN 50281-2-1: 1998).

### **Intrinsically safe apparatus**

Electrical apparatus in which all the circuits are intrinsically safe (EN 50020: 1994).

### **Intrinsic safety**

Intrinsically safe electric circuits are circuits in which no sparks or thermal effects can cause ignition of a dust-air mixture.

### **IP-protection**

System of naming according to EN 60529, which establishes the the degree of protection through the enclosure against foreign bodies and penetration of water with damaging effects.

### **Kst-value**

Dust and test-method-specific parameter. This is numerically the same value as that for the maximum, time-dependent pressure increase in a 1 m<sup>3</sup> vessel under the test conditions laid down in RL VDI 3673 and VDI 2263.



### **Lower explosion limit**

Lower limit of the concentration range in which a dust mixed with air can cause an explosion. Lower limit of the explosion range (EN 1127-1:1997)

### **Lower ignition limit**

The lowest concentration of fuel in a mixture with air at which the air/fuel mixture is combustible (EN 746-2:1997).M

Note: See also definition of „combustible material“.

### **Maintainability**

Ability of equipment, protective system or component under given conditions of intended use to be retained in, or restored to the state in which it can perform a required function when maintenance is performed in given conditions and using stated procedures and resources (see also IEC 60050: 1990)

### **Maintenance**

Combination of all technical and administrative actions, including supervisory actions, intended to retain an item in, or restore it to, a state in which it can perform as required (IEC 60050-191: 1990)

### **Manufacturer**

Organisation, situated at a stated location or locations, that carries out or controls such stages in the manufacture, assessment, handling and storage of a product that enables it to accept responsibility for continued compliance of product with the relevant requirements and undertakes all obligations in that connections (EN 13980: 2002).

### **Marking of operating equipment**

The marking of operating equipment includes, amongst others, information on the environmental conditions in which the equipment can be used.

The equipment category, equipment group, maximum surface temperature, type of protection and the named body which tested the particular piece of equipment are also listed.

### **Maximum explosion pressure $P_{max}$ .**

Maximum pressure occurring in a closed vessel during the explosion of a specific atmosphere in a closed vessel under specified test conditions (EN 1127-1: 1997).

### **Maximum rate of explosion pressure rise ((dp/dt) max)**

Maximum value of the pressure rise per unit time during the explosion of a specific atmosphere in a closed vessel under specified test conditions (EN 1127-1: 1997).

### **Maximum operating temperature**

Maximum operating temperature reached when equipment or protective system is operating at its intended operating conditions.

Note: Each piece of equipment or protective system may reach a different service temperature in different parts.

### **Maximum surface temperature**

The highest temperature reached by any part or the surface of the electrical equipment when testing under the specified dust-free conditions.

This temperature is produced under the testing conditions. An increase in the dust layer can cause an increase in this temperature owing to the heat insulating effect of the dust.

### **Maximum permissible surface temperature**

Highest temperature which is attained in service under the most adverse operating conditions (but within the recognised tolerance) by any part or surface of equipment, protective system or component which could be able to produce an ignition of surrounding explosive atmosphere.

The maximum permissible surface temperature depends on the type of dust, its layer thickness and on the use of a safety factor.

NOTE 1: The relevant surface temperature may be internal or external depending upon the type of protection concerned

NOTE 2: In order to avoid ignition it follows that the maximum surface temperature should always be lower than the ignition temperature of the explosive atmosphere.



### **Median value MW**

Value for mean particle size (50% by wt. of the dust is coarser and 50% by wt. is finer than the median value).

### **Minimum ignition energy MZE or $E_{min}$ .**

Lowest energy which is sufficient to effect ignition of the most easily ignitable explosive atmosphere under specified test conditions.

### **Minimum ignition temperature of a dust layer**

Lowest temperature of a hot inner wall of a furnace at which ignition occurs in a dust cloud in air contained therein (EN 50281-2-1: 1998).

NOTE 1: Because of the wide range of processes in industry, the ignition of dust layers may be dependent upon local conditions. This method of testing is not necessarily representative of all industrial conditions, where account may need to be taken of such factors as the presence of thick layers of dust and of the distribution of temperature in environment.

### **Most explosive atmosphere**

Explosive atmosphere with a concentration of flammable substances which under specified conditions, gives the highest value of the maximum explosion pressure after ignition.

### **Notified body**

Test centre for testing and certification of equipment of categories 1 and 2.

### **Normal operation**

Situation when the equipment, protective systems, and components are operating for their intended use within their design parameters.

Note: minor releases of flammable material may be part of normal operation.

### **Operating conditions for the intended purpose**

The function assigned to the apparatus or protection system by the manufacturer, based on the rated values given by the manufacturer.

### **Operating instructions**

Rules of procedure for employees for normal operation, as also in case of faults, and corresponding responsibilities.

### **Organisational measures**

Preparation of the explosion protection document, preparation of operating instructions, regular instruction of employees, wearing of personal protective clothing/equipment, cleaning of machines and their surroundings, maintenance of machines and equipment, carrying out of special work in potentially explosive areas only with special permission, marking or cordoning off of hazardous areas.

### **Operating temperature**

Temperature reached when the apparatus is operating at its rating (EN 50014: 1997).

NOTE: Layers, deposits and heaps of combustible dust should be considered as a source which can form an explosive atmosphere.

### **Oxygen limit concentration OLC or O<sub>2</sub>-LC**

Maximum oxygen concentration in a mixture of a combustible material with air and an inert gas, at which an explosion does not occur, determined under specified test conditions. (EN 1127-1: 1997).

### **Product**

The term product covers equipment, protective systems, devices, components and their combinations as well as software as defined in 3.4.2 von EN ISO 9000: 2000 (EN 13980: 2002).

### **Preconditions for dust explosions**

When fine combustible solids mixed with air come together at the same time and place (dust cloud) within the explosion limits (sufficient proportion of dust and oxygen), and also there is an effective source of ignition.



### **Pressurisation**

Technique of applying a protective gas to an enclosure in order to prevent the formation of an explosive atmosphere inside the enclosure by maintaining an overpressure against the surrounding atmosphere, and where necessary by using dilution (EN 50016: 1995).

### **Protection through enclosure**

Type of protection in which the enclosure is so tight that no combustible dust can penetrate into the interior. The surface temperature of the outside enclosure is limited.

### **Rating**

Set of rated values and operating conditions (EN 50014: 1997).

### **Rated value**

Quantitative value, assigned generally by the manufacturer, for a specified operating condition of a piece of equipment, protection system or component

### **Reduced explosion pressure (pred)**

Pressure generated by an explosion of an explosive atmosphere in a vessel, protected by either explosion relief or explosion suppression (EN 1127-1: 1997).

### **Self ignition of dust in bulk**

Ignition of dusts caused by the rate of heat generation from oxidation and/or decomposition reactions of the dust being greater than the rate of heat loss to the surroundings (EN 1127-1: 1997).

### **Smoulder temperature**

See minimum ignition temperature of a dust layer.

### **Temperature class**

Classification of equipment, protective system or component for explosive atmospheres based on its maximum surface temperature.

### **Temperature limitation**

The maximum permissible surface temperature of equipment to be used in one of the three zones must be determined by deducting a safety margin from the lowest ignition temperature of the particular dust. The ignition temperature of a dust cloud and the smoulder temperature of dust layers up to 5 mm thickness is determined using the method specified in EN 50281-2-1

### **Type of protection**

Specific measures applied to equipment to avoid ignition of a surrounding atmosphere

### **Upper explosion limit**

Upper limit of the concentration range in which a dust can explode in a mixture with air. Upper limit of the explosion range (EN 1127-1: 1997).

### **Zones - zones for dust**

Hazardous areas are classified into zones based upon the frequency of the occurrence and the duration of an explosive dust/air mixtures, the following definitions are only applicable to equipment group II

#### **Zone 20**

Area in which a dangerous explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently.

#### **Zone 21**

Area in which, during normal operation, a hazardous explosive atmosphere in the form of a cloud can occasionally be formed from combustible dust contained in the air.

#### **Zone 22**

Area in which, during normal operation, a potentially explosive atmosphere in the form of a cloud cannot normally occur (or only for a short time) from combustible dust contained in the air.



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## General Terms and Conditions of Sale of BARTEC GmbH

### I. General

- The scope of deliveries and/or services (hereinafter referred to as „Supplies“) shall be determined by the written declarations of both Parties. General terms and conditions of the Purchaser shall apply only if and when expressly accepted by the supplier or the provider of services (hereinafter referred to as „Supplier“) in writing.
- The Supplier herewith reserves any industrial property rights and/or copy-rights pertaining to its cost estimates, drawings and other documents (hereinafter referred to as „Documents“). The Documents shall not be made accessible to third parties without the Supplier's prior consent and shall, upon request, be returned without undue delay to the Supplier if the contract is not awarded to the Supplier. Sentences 1 and 2 shall apply mutatis mutandis to documents of the Purchaser; these may, however, be made accessible to third parties to whom the Supplier may rightfully transfer Supplies.
- The Purchaser shall have the non-exclusive right to use standard software, provided that it remains unchanged, is used within the agreed performance parameters, and on the agreed equipment. The Purchaser may make one back-up copy without express agreement.
- Partial Supplies shall be allowed, unless they are unreasonable to accept for the Purchaser.

### II. Prices and terms of payment

- Prices shall be ex works and exclude packaging; value added tax shall be added at the then applicable rate.
- If the Supplier is also responsible for assembly or erection and unless otherwise agreed, the Purchaser shall pay the agreed remuneration and any incidental costs required, e. g. travel costs, costs for the transport of tools and equipment, and personal luggage as well as allowances.
- Payments shall be made free Supplier's paying office.
- The Purchaser may set off only those claims that are undisputed or against which no legal recourse is possible.

### III. Retention of title

- Items pertaining to the Supplies („Retained Goods“) shall remain the property of the Supplier until each and every claim the Supplier has against the Purchaser on account of the business connection has been fulfilled. If the combined value of the security interests of the Supplier exceeds the value of all secured claims by more than 20%, the Supplier shall release a corresponding part of the security interest if so requested by the Purchaser.
- For the duration of the retention of title, the Purchaser may not pledge the Retained Goods or use them as security, and resale shall be possible only for resellers in the ordinary course of their business and only on condition that the reseller receives payment from its customer or makes the transfer of property to the customer dependent upon the customer fulfilling its obligation, to effect payment.
- The Purchaser shall inform the Supplier forthwith of any seizure or other act of intervention by third parties.
- Where the Purchaser fails to fulfill its duties, including failure to make payments due, the Supplier shall be entitled to cancel the contract and take back the Retained Goods in the case of continued failure following expiry of a reasonable time set by the Supplier; the statutory provisions that a time limit is not needed remain unaffected. The Purchaser shall be obliged to surrender the Retained Goods.

### IV. Time for Supplies; delay

- Times set for Supplies can only be observed if all Documents to be supplied by the Purchaser, necessary permits and releases, especially concerning plans, are received in time and if agreed terms of payment and other obligations of the Purchaser are fulfilled. Unless these conditions are fulfilled in time, times set shall be extended appropriately; this shall not apply where the Supplier is responsible for the delay.
- If non-observance of the times set is due to force majeure such as mobilization, war, rebellion or similar events, e. g. strike or lockout, such time shall be extended accordingly.
- If the Supplier is responsible for the delay (hereinafter referred to as „Delay“) and the Purchaser demonstrably suffered a loss therefrom, the Purchaser may claim a compensation as liquidated damages of 0.5 % for every completed week of Delay, but in no case more than a total of 5 % of the price of that part of the Supplies which because of the Delay could not be put to the intended use.
- Purchaser's claims for damages due to delayed Supplies as well as claims for damages in lieu of performance exceeding the limits specified in No. 3 above shall be excluded in all cases of delayed Supplies even upon expiry of a time set to the Supplier to effect the Supplies. This shall not apply in cases of mandatory liability based on intent, gross negligence, or due to injury of life, body or health. Cancellation of the contract by the Purchaser based on statute shall be limited to cases where the Supplier is responsible for the delay. The above provisions do not imply a change in the burden of proof to the detriment of the Purchaser.
- At the Supplier's request the Purchaser shall declare within a reasonable period of time whether the Purchaser cancels the contract due to the delayed Supplies or insists on the Supplies to be carried out.
- If dispatch or shipment is delayed at the Purchaser's request by more than one month after notice of the readiness for dispatch was given, the Purchaser may be charged, for every month commenced, storage costs of 0.5 % of the price of the items of the Supplies, but in no case more than a total of 5 %. The parties to the contract may prove that higher or, as the case may be, lower storage costs have been incurred.

### V. Transfer of risk

- Even where delivery has been agreed freight free, the risk shall pass to the Purchaser as follows:
  - if the Supplies do not include assembly or erection, at the time when the Supplies are shipped or picked up by the carrier. Upon request of the Purchaser, the Supplier shall insure the Supplies against the usual risks of transport at the expense of the Purchaser;
  - if the Supplies include assembly or erection, at the day of taking over in the own works or, if so agreed, after a fault-free trial run.
- The risk shall pass to the Purchaser if dispatch, shipping, the start or performance of assembly or erection, the taking over in the own works or the trial run is delayed for reasons for which the Purchaser is responsible or if the Purchaser has otherwise failed to accept the Supplies.

### VI. Assembly and erection

Unless otherwise agreed in writing, assembly/erection shall be subject to the following provisions:

- The Purchaser shall provide at its own expense and in good time:
  - all earth and construction work and other ancillary work outside the scope of the Supplier, including the necessary skilled and unskilled labour, construction materials and tools,
  - the equipment and materials necessary for assembly and commissioning such as scaffolds, lifting equipment and other devices as well as fuels and lubricants,
  - energy and water at the point of use including connections, heating and lighting,
  - suitable dry and lockable rooms of sufficient size adjacent to the site for the storage of machine parts, apparatus, materials, tools, etc. and adequate working and recreation, rooms for the erection personnel, including sanitary facilities as are appropriate in the specific circumstances. Furthermore, the Purchaser shall take all measures it would take for the protection of its own possessions to protect the possessions of the Supplier and of the erection personnel at the site,
  - protective clothing and protective devices needed due to particular conditions prevailing on the specific site.
- Before the erection work starts, the Purchaser shall make available of its own accord any information required concerning the location of concealed electric power, gas and water lines or of similar installations as well as the necessary structural data.
- Prior to assembly or erection, the materials and equipment necessary for the work to start must be available on the site of assembly/erection and any preparatory work must have advanced to such a degree that assembly/erection can be started as agreed and carried out without interruption. Access roads and the assembly/erection site itself must be level and clear.
- If assembly, erection or commissioning is delayed due to circumstances for which the Supplier is not responsible, the Purchaser shall bear the reasonable costs incurred for idle times and any additional travelling of the Supplier or the erection personnel.
- The Purchaser shall attest to the hours worked by the erection personnel towards the Supplier at weekly intervals and the Purchaser shall immediately confirm in writing if assembly, erection or commissioning has been completed.
- If, after completion, the Supplier demands acceptance of the Supplies, the Purchaser shall comply therewith within a period of two weeks. In default thereof, acceptance is deemed to have taken place. Acceptance is also deemed to have been effected if the Supplies are put to use, after completion of an agreed test phase, if any.

### VII. Receiving of Supplies

The Purchaser shall not refuse to receive Supplies due to minor defects.

### VIII. Defects as to quality

The Supplier shall be liable for defects as to quality („Sachmängel“, hereinafter referred to as „Defects“) as follows:

- All parts or services where a Defect becomes apparent within the limitation period shall, at the discretion of the Supplier, be repaired, replaced or provided again free of charge irrespective of the hours of operation elapsed, provided that the reason for the Defect had already existed at the time when the risk passed.
- Claims based on Defects are subject to a limitation period of 12 months. This provision shall not apply where longer periods are prescribed by law according to Sec. 438 para. 1 No. 2 (buildings and things used for a building), Sec. 479 para. 1 (right of recourse), and Sec. 634 a para. 1 No. 2 (defects of a building) German Civil Code („BGB“), as well as in cases of injury of life, body or health, or where the Supplier intentionally or grossly negligently fails to fulfill its obligation or fraudulently conceals a Defect. The legal provisions regarding suspension of expiration („Ablaufhemmung“), suspension („Hemmung“) and recommencement of limitation periods remain unaffected.
- The Purchaser shall notify Defects to the Supplier in writing and without undue delay.
- In the case of notification of a Defect, the Purchaser may withhold payments to a reasonable extent taking into account the Defect occurred. The Purchaser, however, may withhold payments only if the subject-matter of the notification of the Defect occurred is justified beyond doubt. Unjustified notifications of Defect shall entitle the Supplier to have its expenses reimbursed by the Purchaser.
- The Supplier shall first be given the opportunity to supplement its performance („Nacherfüllung“) within a reasonable period of time.
- If supplementary performance is unsuccessful, the Purchaser shall be entitled to cancel the contract or reduce the remuneration, irrespective of any claims for damages it may have according to Art. XI.
- There shall be no claims based on Defect in cases of insignificant deviations from the agreed quality, of only minor impairment of usefulness, of natural wear and tear or damage arising after the transfer of risk from faulty or negligent handling, excessive strain, unsuitable equipment, defective workmanship, inappropriate foundation soil or from particular external influences not assumed under the contract, or from non-reproducible software errors, Claims based on defects attributable to improper modifications or repair work carried out by the Purchaser or third parties and the consequences thereof shall be likewise excluded.
- The Purchaser shall have no claim with respect to expenses incurred in the course of supplementary performance, including costs of travel and transport, labour, and material, to the extent that expenses are increased because the subject-matter of the Supplies was subsequently brought to another location than the Purchaser's branch office, unless doing so complies with the intended use of the Supplies.
- The Purchaser's right of recourse against the Supplier pursuant to Sec. 478 BGB is limited to cases where the Purchaser has not concluded an agreement with its customers exceeding the scope of the statutory provisions governing claims based on Defects. Moreover, No. 8 above shall apply mutatis mutandis to the scope of the right of recourse the Purchaser has against the Supplier pursuant to Sec. 478 para. 2 BGB.
- Furthermore, the provisions of Art. XI (Other Claims for Damages) shall apply in respect of claims of damages. Any other claims of the Purchaser against the Supplier or its agents or any such claims exceeding the claims provided for in this Art. VIII, based on a Defect, shall be excluded.

### IX. Industrial property rights and copyright; defects in title

- Unless otherwise agreed, the Supplier shall provide the Supplies free from third parties' industrial property rights and copyrights (hereinafter referred to as „IPR“) with respect to the country of the place of destination. If a third party asserts a justified claim against the Purchaser based on an infringement of an IPR with respect to the Supplies made by the Supplier and then used in conformity with the contract, the Supplier shall be liable to the Purchaser within the time period stipulated in Art. VIII No. 2 as follows:
  - The Supplier shall choose whether to acquire, at its own expense, the right to use the IPR with respect to the Supplies concerned or whether to modify the Supplies such that they no longer infringe the IPR or replace them. If this would be unreasonable to demand from the Supplier, the Purchaser may cancel the contract or reduce the remuneration pursuant to the appli-cable statutory provisions.
  - The Supplier's liability to pay damages shall be governed by Art. XI.
  - The above obligations of the Supplier shall only apply if the Purchaser (i) immediately notifies the Supplier of any such claim asserted by the third party in writing, (ii) does not concede the existence of an infringement and (iii) leaves any protective measures and settlement negotiations to the discretion of the Supplier. If the Purchaser stops using the Supplies in order to reduce the damage or for other good reason, it shall be obliged to point out to the third party that no acknowledgement of the alleged infringement may be inferred from the fact that the use has been discontinued.
- Claims of the Purchaser shall be excluded if it is itself responsible for the infringement of an IPR.
- Claims of the Purchaser shall also be excluded if the infringement of the IPR is caused by specifications made by the Purchaser, to a type of use not foreseeable by the Supplier or to the Supplies being modified by the Purchaser or being used together with products not provided by the Supplier.
- In addition, with respect to claims by the Purchaser pursuant to No. 1 a) above, Art. VIII Nos. 4, 5, and 9 shall apply mutatis mutandis in the event of an infringement of an IPR.
- Where other defects in title occur, Art. VIII shall apply mutatis mutandis.
- Any other claims of the Purchaser against the Supplier or its agents or any such claims exceeding the claims provided for in this Art. IX, based on a defect in title, shall be excluded.

### X. Impossibility of performance; adaptation of contract

- To the extent that Supplies are impossible to be carried out, the Purchaser shall be entitled to claim damages, unless the Supplier is not responsible for the impossibility. The Purchaser's claim for damages shall, however, be limited to an amount of 10 % of the value of the part of the Supplies which, owing to the impossibility, cannot be put to the intended use. This limitation shall not apply in the case of mandatory liability based on intent, gross negligence or injury of life, body or health; this does not imply a change in the burden of proof to the detriment of the Purchaser. The right of the Purchaser to cancel the contract shall remain unaffected.
- Where unforeseeable events within the meaning of Art. IV No. 2 substantially change the economic importance or the contents of the Supplies or considerably affect the Supplier's business, the contract shall be adapted taking into account the principles of reasonableness and good faith. Where doing so is economically unreasonable, the Supplier shall have the right to cancel the contract. If the Supplier intends to exercise its right to cancel the contract, it shall notify the Purchaser thereof without undue delay after having realised the repercussions of the event; this shall also apply even where an extension of the delivery period had previously been agreed with the Purchaser.

### XI. Other claims for damages

- Any claims for damages and reimbursement of expenses the Purchaser may have (hereinafter referred to as „Claims for Damages“), based on whatever legal reason, including infringement of duties arising in connection with the contract or tort, shall be excluded.
- The above shall not apply in the case of mandatory liability, e. g. under the German Product Liability Act („Produkthaftungsgesetz“), in the case of intent, gross negligence, injury of life, body or health, or breach of a condition which goes to the root of the contract („wesentliche Vertragspflichten“). However, Claims for Damages arising from a breach of a condition which goes to the root of the contract shall be limited to the foreseeable damage which is intrinsic to the contract, unless caused by intent or gross negligence or based on liability for injury of life, body or health. The above provision does not imply a change in the burden of proof to the detriment of the Purchaser.
- To the extent that the Purchaser has a valid Claim for Damages according to this Art. XI, it shall be time-barred upon expiration of the limitation period applicable to Defects pursuant to Art. VIII No. 2 in the case of claims for damages under the German Product Liability Act, the statutory provisions governing limitation periods shall apply.

### XII. Venue and applicable law

- If the Purchaser is a businessperson, sole venue for all disputes arising directly or indirectly out of the contract shall be the Supplier's place of business. However, the Supplier may also bring an action at the Purchaser's place of business.
- Legal relations existing in connection with this contract shall be governed by German substantive law, to the exclusion of the United Nations Convention on Contracts for the International Sale of Goods (CISG).

### XIII. Severability clause

The legal invalidity of one or more provisions of this contract shall in no way affect the validity of the remaining provisions. This shall not apply if it would be unreasonable for one of the parties to continue the contract.

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