Ex-Basics

English Version

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Ex Basics - Explosion Protection Basics

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Ex Basics - Explosion Protection Basics

1. General information

An explosive atmosphere is a mixture composed of air and combustible gases, vapours, mist or dust under atmospheric conditions, which, once ignited, allows the combustion process to spread and include the entire mixture.
In the field of the chemical and petro-chemical industry, explosive atmospheres are frequently encountered as a result of technical processing sequences.
However, processes in the food industry, in mills and silos generate combustible dust, leading to a combustible atmosphere in conjunction with oxygen.
Methane gas and coal dust are encountered in mining. In these special underground areas, too, suitable protection measures have to be taken to prevent an explosion of these mixtures.
Further areas susceptible to developing explosive atmospheres include the production of biogas, paint and lacquer processing industry, power plant technology, recycling industry and areas of the metalworking industry.

The ignition of an explosive atmosphere causes explosions, which can entail substantial damage to assets and injury of persons.
To avoid explosions, protection directives, standards and regulations have been laid down world wide, which guarantee a high degree of safety.

On a global scale, these standards have been adopted down in the form of a binding explosion protection legislation by the International Electrical Committee (IEC) registered in Switzerland. For the area legally covered by the European Union, these IECEx regulations are compiled in the 94/4 EC directive - ATEX Regulation. This regulation prescribes safety measures that prevent explosion caused by possible ignition sources.

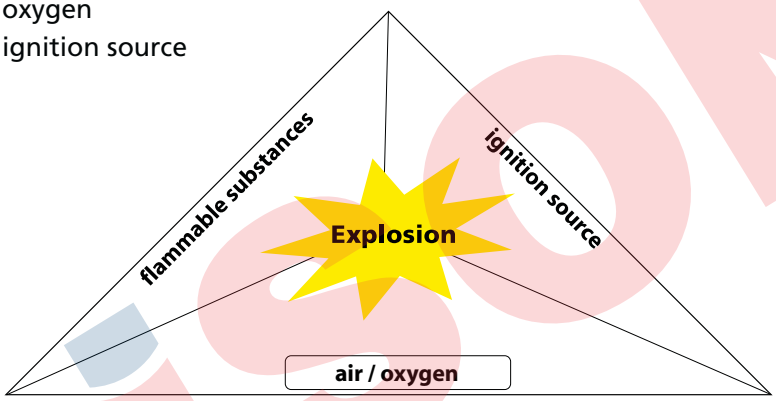
Explosion

2. Explosion

An explosion is an oxidation or decomposition reaction in conjunction with a sudden rise in temperature, pressure or both simultaneously (definition acc. to EN 1127-1). This generates a sudden expansion of the gas volume and the release of large quantities of energy in a small space.

The simultaneous existence of three factors is the prerequisite for an explosion to occur:

- combustible material
- oxygen
- ignition source



Prerequisite for the mixture to ignite and the subsequent explosion is a sufficient quantity of all three factors.
Combustible substances are gases, fluids or solids (dust particles) encountered in nature or produced by chemical processes.
The field of ignition sources is vast and offers a large number of possible triggers for an explosion:

- hot surfaces
- electrical sparks and arcs
- electrical discharges
- atmospheric discharges
- mechanical sparks caused by friction or impacts
- electro-static discharges
- ultrasound
- optical radiation
- chemical reaction
- open flames

Explosion protection measures

3. Explosion protection measures (IEC standard)

This term encompasses all protection measures and regulations relevant for the construction, production and installation of electrical / electronic devices in explosion endangered areas.
In general, there are two types:

- Primary explosion protection:
  Measures to prevent the **creation** of an explosive atmosphere

- Secondary explosion protection:
  Measures to prevent the **ignition** of an explosive atmosphere

Knowing that an explosive atmosphere is generated in many processes, manufacturers of electrical equipment have to take measures to prevent the ignition of this atmosphere during the intended of such devices.

Explosive atmospheres are encountered in many fields (also see 1. General information). However, there are fundamental differences regarding requirements in mining and applications above ground. For this reason, equipment is typically subdivided into two different groups of devices:

- Group I:

devices used in mines and above ground mining facilities,
which could be endangered by colliery gas and / or combustible dust.

Within this group of devices there is another subdivision into categories M1 and M2.

M1:
Devices that may continue operating in an explosive atmosphere

M2:
Devices that need to be switched off when reaching the lower explosion boundary

Category M1 devices feature a very high degree of safety and may remain in operation even in the presence of an explosive atmosphere; category M2 devices offer a high degree of safety, they must, however, be switched off when an explosive atmosphere is encountered.

Explosion protection measures

- Group II:

  Devices to be used in other areas that could be endangered by an explosive atmosphere.

Device group II
Devices to be used in the other areas that might be endangered by an explosive atmosphere.
Subdivision into categories:

1 (zones 0 ,20)	2 (zones 1 , 21)	3 (zones 2 , 22)

Devices of Group II are subdivided into three **categories (1-3)** reflecting different safety levels. The required protection measures must be adapted to the individually required safety level:

Category 1: Devices and systems are distinguished by a "very high degree" of safety
Category 2: Devices and systems offer a "high degree" of safety
Category 3: Devices and systems offer a "normal degree" of safety

According to their ignition and explosion behaviour, combustible substances are subdivided into the following classes: **Gas explosion protection** "G" and explosion protection measures for **combustible dust** "D".

IEC/EN 60079 contains the corresponding protection principles for electrical equipment in the gas industry.

Electrical equipment for areas susceptible to gas explosions			
	EN (old)	EN (new)	IEC
General requirements	EN 50014	EN 60079-0	IEC 60079-0
Flameproof enclosure (d)	EN 50018	EN 60079-1	IEC 60079-1
Pressure-proof enclosure (p)	EN 50016	EN 60079-2	IEC 60079-2
Sand casing (q)	EN 50017	EN 60079-5	IEC 60079-5
Oil casing (o)	EN 50015	EN 60079-6	IEC 60079-6
Increased safety (e)	EN 50019	EN 60079-7	IEC 60079-7
Intrinsic safety (i)	EN 50020	EN 60079-11	IEC 60079-11
Type of protection (n)	EN 50021	EN 60079-15	IEC 60079-15
Moulded encapsulation (m)	EN 50028	EN 60079-18	IEC 60079-18
Intrinsically safe systems		EN 60079-25	IEC 60079-25
Electrical equipment for zone 0	EN 50284	EN 60079-26	IEC 60079-26
Intrinsically safe fieldbus systems		EN 60079-27	IEC 60079-27
Optical radiation (op)		EN 60079-28	IEC 60079-28

Zone classification

Measures taken according to IEC/EN 61241 are valid for dust explosion protection.

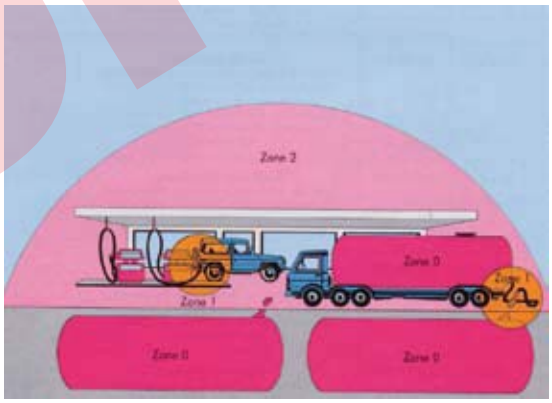
Electrical equipment for areas subject to combustible dust			
	EN (old)	EN (new)	IEC
General requirements		EN 61241-0	IEC 61241-0
Protection by the casing (tD)	EN 50281-1-1	EN 61214-1	IEC 61241-1
Pressure-proof enclosure (pD)		EN 61241-2	IEC 61241-2
Intrinsic safety (iD)		EN 61241-11	IEC 61241-11
Moulded encapsulation (mD)		EN 61241-18	IEC 61241-18

3.1 Zone classification

Explosion endangered atmospheres are subdivided into zones reflecting the probability of their occurrence. In accordance with the Ex regulations, the zones are defined as follows:

I Gases and vapours (EN / IEC 60079-10):

Zone 0:
Area subject to permanent, long-period or frequent presence of a dangerous explosive gas atmosphere.
Typically, these conditions are found inside containers, pipework, apparatus and tanks.



Zone 1:
Area in which a dangerous explosive gas atmosphere can be occasionally expected during regular operation. This includes the close vicinity to zone 0 as well as close areas around filling and discharging devices.

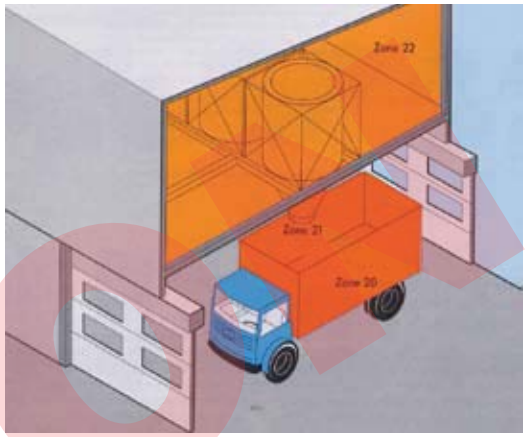
Zone 2:
Area not susceptible to a dangerous explosive gas atmosphere during regular operation. Its occurrence, if at all, is only short-period.
Zone 2 includes storage rooms exclusively used for storage, areas around disconnectable connections of pipework and, typically, the closer area around zone 1.

Zone classification

II Areas subject to combustible dust (EN 61241-14)

Zone 20:
Area subject to constant, long-period or frequent explosive atmosphere consisting of dust/air mixtures.

Zone 21:
Area in which an explosive atmosphere consisting of a dust/air mixture can be occasionally expected.



Zone 22:
Area not susceptible to an explosive atmosphere caused by swirled up dust. Its occurrence, if at all, will in all probability be infrequent and short-period.

Electrical equipment is subdivided into 3 categories 1, 2, 3 in accordance with its permitted use within the zones.

Identification of the units according to categories	Use in zone	combustible material	Definition
Ex II 1G	0	Gases, vapours, mist	Areas subject to permanent, long-period or frequent presence of an explosive atmosphere
Ex II 2 G	1 and 2	Gases, vapours, mist	Area in which a dangerous explosive gas atmosphere can be occasionally expected during regular operation. This includes the close vicinity to zone 0 as well as close areas around filling and discharging devices.
Ex II 3G	2	Gases, vapours, mist	Areas infrequently subject to an explosive atmosphere and, if at all, only short-period.

Zone classification

Identification of the units according to categories	Use in zone	combustible material	Definition
Ⓔx II 1D	20	Combustible dust	Areas subject to permanent, long-period or frequent presence of an explosive atmosphere
Ⓔx II 2 D	21 and 22	Combustible dust	Area in which a dangerous explosive dust atmosphere can be occasionally expected during regular operation. This includes the close vicinity to zone 20 as well as close areas around filling and discharging devices.
Ⓔx II 3D	22	Combustible dust	Areas infrequently subject to an explosive atmosphere and, if at all, only short-period.

Ignitability and the ability of an ignition flashback of an explosive gas/air mixture are typical properties of the substances according to which gases and vapours are subdivided into explosion groups. The subdivision criteria for gases are the boundary gap width or the minimum ignition energy respectively. For the different gases, these are determined by way of a defined test set-up.

The explosion groups are identified by the letters A, B or C. The requirements of the equipment increase from explosion group IIA to IIC as the hazardousness of the gases rises.
Equipment of class IIC may be used in IIA and IIB environments.
(see annex Table 5)

Temperature classes

3.2 Temperature classes

The subdivision of the different gases and vapours according to minimum ignition energies into explosion or gas groups is insufficient to adequately describe gases and vapours with regard to their explosive properties. On the one hand, gas can be brought to explosion by exceeding the ignition energy, but, on the other hand, can also be caused by high temperature, e.g. a hot surface.

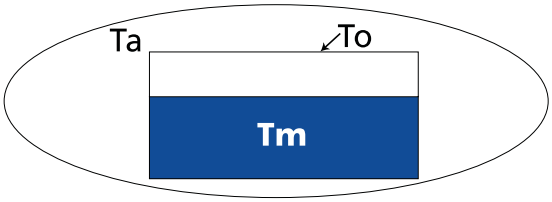
This ignition temperature, however, is generally not connected to the ignition energy, in other words, a gas with a low ignition energy must not necessarily explode at a low temperature.

For this reason, electrical equipment directly used in explosion endangered areas, are subdivided into temperature classes. The temperature classes describe the maximum surface temperature, also when faults occur. Analogously, the gases are subdivided according to their different ignition temperatures.

Temperature class	Permissible surface temperatures of the electrical equipment	Ignition temperature of combustible gases
T1	450 °C	> 450 °C
T2	300 °C	300 - 450 °C
T3	200 °C	200 - 300 °C
T4	135 °C	135 - 200 °C
T5	100 °C	100 - 135 °C
T6	85 °C	85 - 100 °C

For ignition temperatures and temperature classes of gases and vapours, please refer to Table 5 in the appendix.

Example: Temperature increasing factors in Ex terminal boxes



To	Surface temperature
Tm	Temperature of the medium (intrinsic heating)
Ta	Ambient temperature

Temperature classes

The surface temperature of equipment results from the ambient temperature and its intrinsic heat generated by the power dissipation of the electrical devices accommodated in the enclosure.

Combustible dust requires a considerably more detailed evaluation of the characteristic technical safety values.

1. Dust mixtures having a particle size of up to 400 µm are ignitable
2. Dust atmospheres are ignitable in concentrations of 60 g/m³ and 2 kg/m³
3. The ignition temperatures of combustible dust mixtures range between 240°C and 500 °C; depending on the type, for foodstuff and feedstuff dust, this value ranges between 410 °C and 500 °C
4. Type of test method:

   A: Settled dust
   B: Swirled up dust

The permissible limit temperature must always be below the ignition temperature.
Here, the following limit values apply:
Value acc. to test method A - 75K and
2/3 x the value acc. to test method B.
The lowest value found is considered as the limit temperature.

Designation of the solid material	**Values A** Ignition temperature **IEC 50281-2-1** Method A settled (°C)	**Values B** Ignition temperature IEC 50381-2-1 Method B swirled up (°C)	**Permissible limit temperature** Smallest calculated value (A-75K) and 2/3*B								
			450... > 300	300... > 280	280... > 260	260... > 230	230... > 215	215... > 200	200... > 180	180... > 165	165... > 160	160... > 135
Dust of natural products (examples)												
Cotton	350	560			275							
Grain	290	420						215				
Wheat flour	450	480		320								

For the complete table, please refer to the appendix, Table 6

Types of protection

3.3 Types of protection

The type of protection (protection type of electrical equipment) prevents the contact of switching sparks or hot surfaces with explosive atmospheres.
Or
The protection type allows contact between switching sparks / hot surfaces, but prevents the explosion made possible in this manner from migrating outside of the ignition protected electrical equipment.

Various protection measures reflected by the different types of protection can be used to avoid explosion.
The different types of protection have been developed for economic reasons. The correct selection of a type of protection for electric equipment notably affects the price.

The important factor is:

All types of protection offer equivalent safety!

The types of protection are defined in the IEC/EN 60079 (gas atmosphere) and IEC/EN 61241 (dust atmosphere) standards. The manufacturer has to meet these standards during the design, production and test phases.

Types of protection

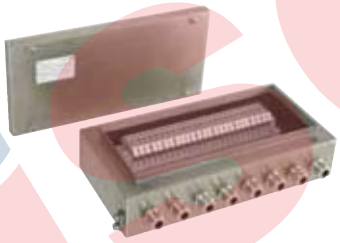
3.3.1 Types of protection in gas atmosphere

Type of protection "Increased safety" "-e":

Ex-e

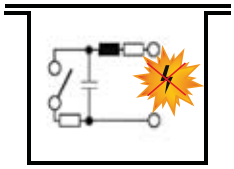
- Type of protection providing measures to prevent the possibility of undue hightemperatures developing and the occurrence of sparks or arcs inside or on outer parts of electrical equipment, which will not occur during regular operation, by an increased level of safety.
- Applications: Terminal boxes, junction boxes for components of other types of protection, such as motors, valves, lamps.
- Frequently in combination with other types of protection, e.g. connection room of a flameproof enclosure of controls and devices.
- Advantage of the type of protection: Simple connection by means of Ex-e approved cable glands.

Ex-ed Local control station



Ex e Stainless steel junction box

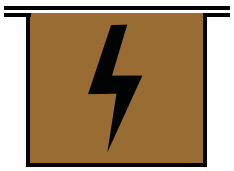
Type of protection "Intrinsic safety" "-i":



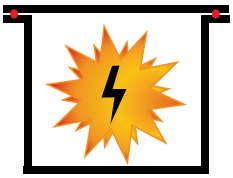
Ex-i

- Type of protection allowed by keeping the energy in the current circuit sufficiently low to exclude the generation of ignitable sparks, arcs or temperatures.
- Applications: Terminal boxes, sensors, limit switches, interface modules, assembly groups in measuring and control technology.
- Subdivision into 3 categories - ia, - ib and - ic. The meaning of the different letters a, b or c is that they reflect the number of technical safety related countable errors until the intrinsic safety expires and the use in the individual zone.
  ia: Intrinsic safety is still guaranteed (minimum requirement for equipment in zone 0) if two independent errors occur.
  ib: Intrinsic safety is still guaranteed (minimum requirement for equipment in zone 1) if one error occurs.
  ic: Under unfavourable conditions, such as the effect of heat and the <10^3 probability of an uninterrupted operation and the presence of non-countable errors, intrinsically safe current circuits may not generate an ignition of the explosive environment (requirement for zone 2).
  Built-in components:
  Typically, standard assembly groups are used which are usually identified by the colour blue.
  Example: Cable glands, terminals

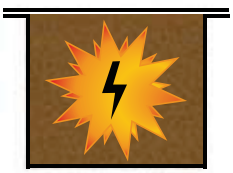
Types of protection



Ex-o



Ex-d



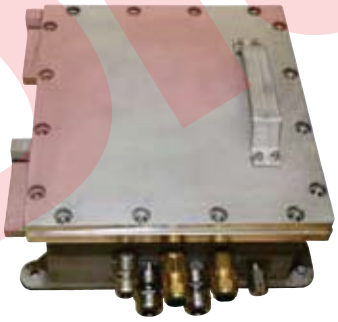
Ex-m

Type of protection "oil immersion" "-o"

- Type of protection safeguarding electrical equipment by immersion in oil to prevent contact between the explosive atmosphere with the potential ignition source.
- Applications: Switching devices for the chemical industry, transformers

Type of protection "Flameproof enclosure" "-d":

- Type of protection, accommodating components susceptible to igniting an explosive atmosphere in an enclosure resisting the pressure generated inside by the explosion of a gas mixture. The ignition energy is cooled through the gap and discharged.
- Applications: Motors, switching devices with N/O and N/C contacts, command devices, fusing elements, transformers, lamps
  Special feature:
  Flameproof enclosed elements are frequently combined with connection boxes of the "increased safety" type of protection, sparing the installer the necessity to open the flameproof enclosed enclosure. The connection area is subject to Ex-e and can be provided with standard conductor lead-ins (Ex-e).



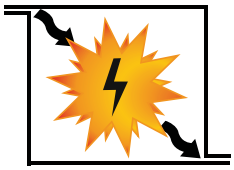
Type of protection "Moulded encapsulation" "-m":

- Type of protection safeguarding electrical equipment by encapsulation in a moulding compound to prevent the explosive atmosphere coming into contact with the potential ignition source.
- Applications: Relay modules, command devices, sensors, display units, valves, fusing elements

Types of protection

Type of protection "Pressurized enclosures" "-p":

- Type of protection preventing the ingress of explosive atmosphere into an enclosure by creating a permanent overpressure (> 0.5 mbar).
- Applications: Switch cabinets, control systems, larger measuring devices, current and voltage converter modules



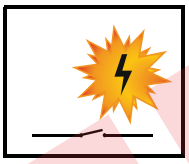
Ex-p

Type of protection "-n".

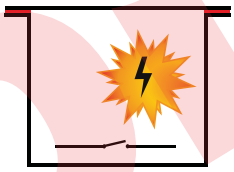
This type of protection only applies to electrical equipment of the 3G category, the intent being that during regular operation and certain abnormal conditions, the potential of this equipment igniting a surrounding explosive atmosphere is eliminated. This type of protection aims at finding an economical compromise between the "normal" industrial standard and the high technical safety requirements of the types of protection for equipment of the 2G category.

Ex-n

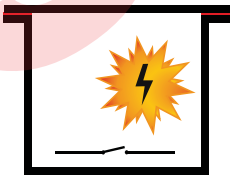
The following types of protection of the n category exist for the Zone 2 area:



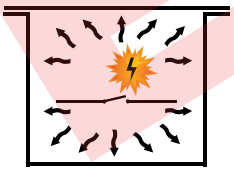
Hermetically sealed "nC"



Sealed "nC"

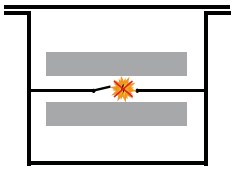


Encapsulated "nC"

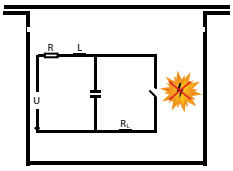


Enclosed "nC"

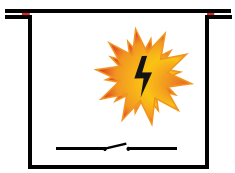
Non spark "nA"



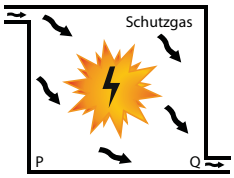
Not ignitable "nC"



Limited energy "nL"



Restricted breathing enclosure "nR"



Simplified pressure-proof enclosure "nP"

Types of protection

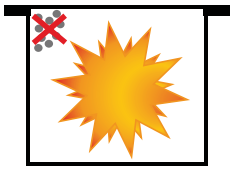
Equipment encompassing a combination of different types of protection (e.g. em) are also possible. Affix this information on the type plate when identifying the equipment.

Example Local control station

Identification **Ex edm**
Control station with Ex-e approved enclosure, Ex-d approved switches and Ex-em certified indicator lights.

3.3.2 Types of protection in combustible dust atmosphere

Type of protection "Protection by enclosures "tD"



Ex-tD

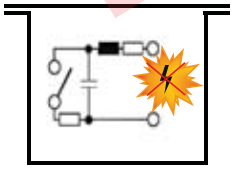
The -tD type of protection prevents the ingress of combustible dust into the casing. The casing must provide a minimum protection of IP 6x. The surface temperature of the casing is limited. The identification reads, e.g.: Ex tD A21 85°C

Type of protection "Moulded encapsulation "mD"

Ex-mD

The -mD type of protection is used to safeguard electrical equipment using an encapsulating moulding compound to prevent the explosive atmosphere from coming into contact with the potential ignition source.
Applications: Relay modules, command devices, sensors, display units, fusing elements

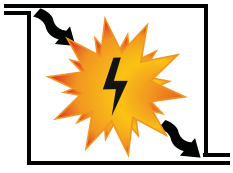
Type of protection "Intrinsic safety "iD"



Ex-iD

With the -iD type of protection, the energy in the current circuit is kept sufficiently low to prevent ignitable sparks, arcs or temperatures from from being generated. Applications: Interface modules, measuring and control technology modules

Type of protection "Pressure proof enclosure" "pD"



Ex-pD

The -pD type of protection is used to prevent the ingress of explosive atmosphere into an enclosure by creating a permanent overpressure.

Labeling

4. Labeling

Explosion protected equipment must be identified such that it will be correctly employed in accordance with its technical safety properties.
The information on the type label is defined in the EN 60079-0 for equipment for the gas industry and in the EN 61241-0 for equipment used in dust atmosphere.

CE 0123 ROSE Systemtechnik D- Porta Westfalica ROSE

Ex II2G Ex edm II C T6
II2D Ex tD A21 T+85°C
IP66

Type: **06 252616**
250V AC 4mm²
26.02.09 10372187

Nicht unter Spannung öffnen/ Do not open while energized
PTB 00ATEX1002
Made in Germany

The identification should reveal:

- The manufacturer who has put the electrical equipment into circulation	ROSE Systemtechnik GmbH D-32547 Porta Westfalica
- The type designation of the equipment	06.252616
- CE sign of conformity as well as the test mark number of the monitoring body	CE 0123
- Test authority and approval number of the equipment	PTB 00ATEX1002
- The area of application Group I or Group II	Ex II
- The category according to which the equipment is approved	2
- The area G (gas), D (dust) or M (mining)	G and D

for gas explosion protection:

- The type(s) of protection fulfilled by the equipment	ed m
- Explosion group (where required, including sub-group, e.g. IIC)	IIC
- The temperature class	T6

for dust explosion protection:

- The type(s) of protection fulfilled by the equipment	tD
- The test method	A
- The zone for which the equipment is approved	21
- The maximum permissible surface temperature	85°C

Labeling

The equipment-specific data

- Date of manufacture	26.02.09
- Electrical information	250 V
- Production number	10372187
- Moreover, additional or restricting information can be included (e.g. deviating ambient temperature)	-30°C<Ta<+50°C

Permits / approvals

5. Permits / approvals

For electrical equipment to be allowed to be used in an explosion protected area, various approvals must be available.

1. Certification of the production site(s) of the manufacturer

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Product Service

EC-Certificate

No. EX3 09 03 21302 008

Holder of Certificate: **Rose Systemtechnik GmbH**
Erbeweg 13-15
32457 Porta Westfalica
GERMANY

Scope of Certificate: **Junction boxes, empty enclosures, control enclosures,**
Equipment Group II, Category 2 G
increased safety e, intrinsic safety i;
protection by the enclosure tD

The certification body of TÜV SÜD Product Service GmbH certifies that the certificate holder maintains a quality system which fulfils the requirements of Annex VII of Council Directive No. 94/9/EC for Equipment and protective systems intended for use in potentially explosive atmospheres (ATEX). Validity of this EC-Certificate requires periodical surveillance. See also notes overleaf.

Report No.: 70008425

Valid until: 2011-02-28

Date, 2009-03-12 Siegfried Mosch

TÜV SÜD Product Service GmbH is a Notified Body in accordance with Council Directive 94/9/EC EC for equipment and protective systems intended for use in potentially explosive atmospheres with the identification number 0123.

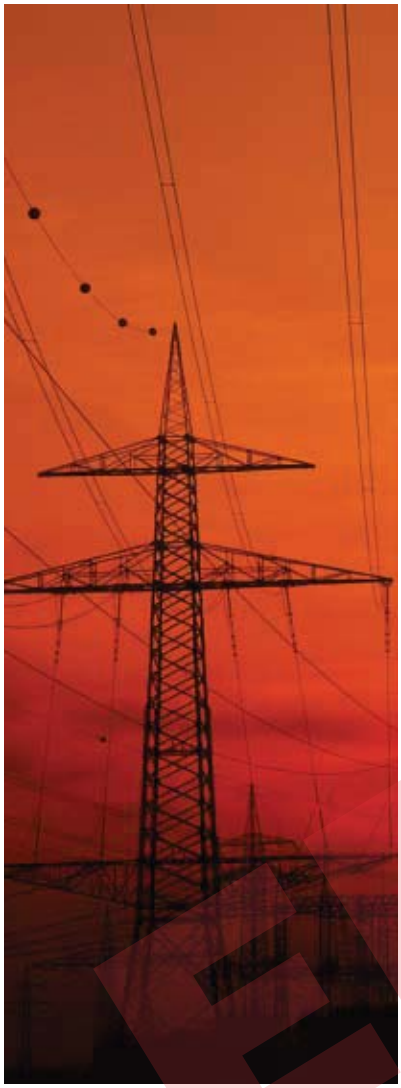
Page 1 of 2

TÜV SÜD 293512

TÜV Product Service GmbH · TÜV SÜD Gruppe · Zertifizierstelle · Ridlerstrasse 65 · 80339 München · Germany

Here the inspection body confirms that all technical safety steps and sequences during production meet the required measures to be fulfilled.

Permits / approvals



2. EC type examination certificate for the product within the member states of the EU, ATEX approbation, IECEx certification world wide

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

(1) **EC-TYPE-EXAMINATION CERTIFICATE**
(Translation)

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:
PTB 00 ATEX 1052

(4) Equipment: Power distribution, switchgear and controlgear assembly type 35. ..... und 36. .....

(5) Manufacturer: ROSE Elektrotechnik GmbH + Co. KG

(6) Address: D-32457 Porta Westfalica

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 00-10074.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 50014:1997 EN 50018:1994 EN 50019:1994 EN 50020:1994

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment.

(12) The marking of the equipment shall include the following:
II 2 G EEx e II T6 bzw. EEx ed IIC T6 bzw. EEx ia IIC T6 bzw. EEx e [ia] IIC T6 bzw. EEx ed [ia] IIC T6

Zertifizierungsstelle Explosionsschutz
By order: i. V.
In the absence of Dr. [illegible]
Regierungsdirektor

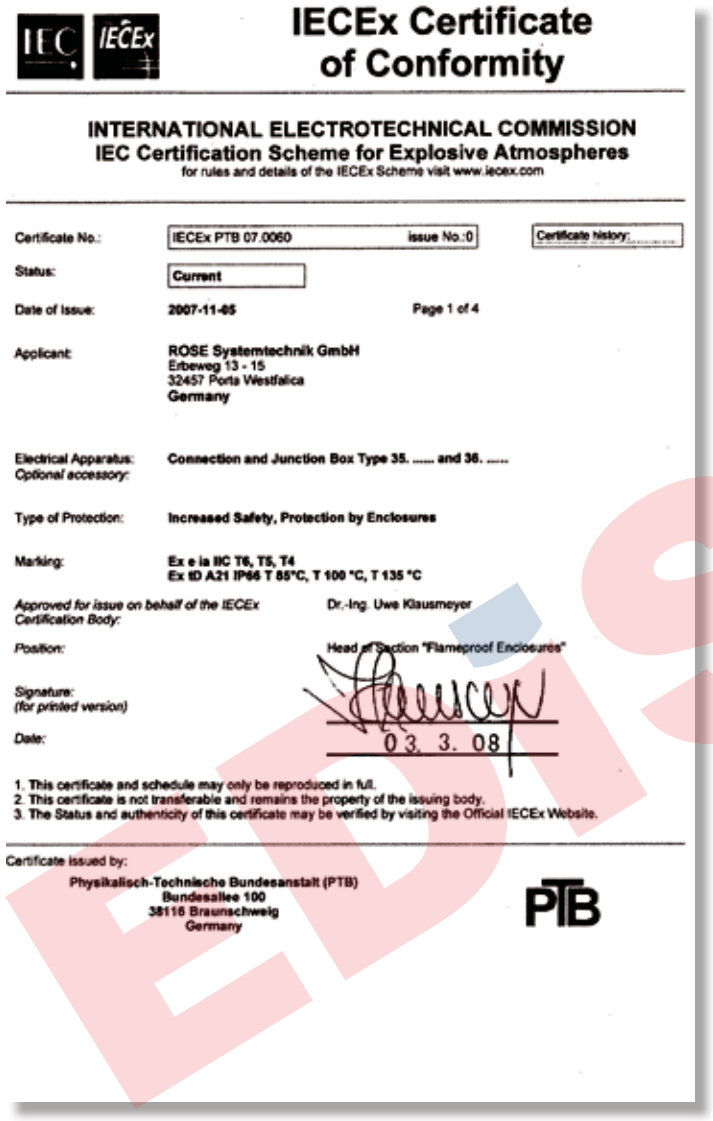
Braunschweig, July 27, 2000

sheet 1/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.
Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

This certificate certifies that the type examination certified equipment presented to the inspection body meets all legal requirements of the ATEX regulation with regard to technical safety.

Permits / approvals



IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: IECEx PTB 07.0060 issue No.:0 Certificate history:
Status: Current
Date of Issue: 2007-11-05 Page 1 of 4

Applicant: ROSE Systemtechnik GmbH
Erbeweg 13 - 15
32457 Porta Westfalica
Germany

Electrical Apparatus: Connection and Junction Box Type 35. ..... and 36. .....
Optional accessory:

Type of Protection: Increased Safety, Protection by Enclosures

Marking: Ex e ia IIC T6, T5, T4
Ex tD A21 IP66 T 85°C, T 100 °C, T 135 °C

Approved for issue on behalf of the IECEx Certification Body: Dr.-Ing. Uwe Klausmeyer

Position: Head of Section "Flameproof Enclosures"

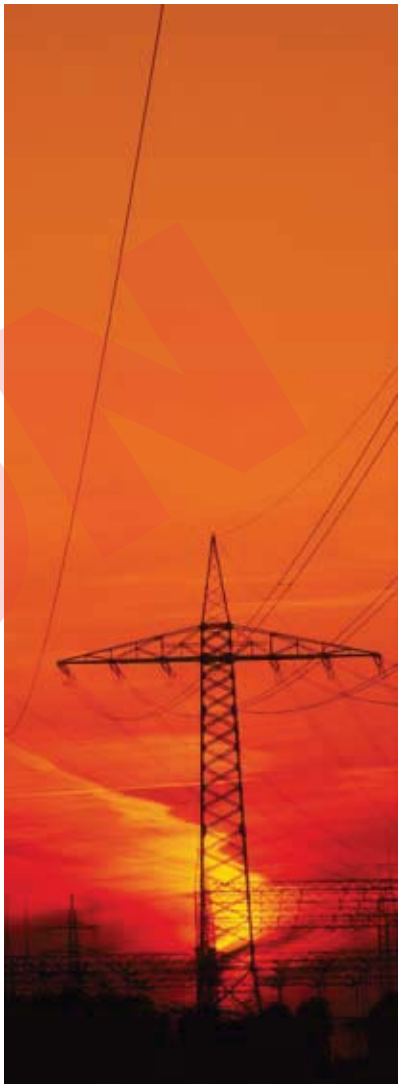
Signature: (for printed version)

Date: 03. 3. 08

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:
Physikalisch-Technische Bundesanstalt (PTB)
Bundesallee 100
38116 Braunschweig
Germany

PTB



This certificate certifies that the type examination certified equipment presented to the inspection body meets all legal requirements of the IEC regulation with regard to technical safety.

Permits / approvals

3. Declaration of conformity

Konformitätserklärung
Declaration of Conformity

ROSE
A Phoenix Mecano Company

ROSE Systemtechnik GmbH

(Name des Anbieters –*offerer's name*)

D-32457 Porta Westfalica; Erbeweg 13-15

(Anschrift - *adress*)

erklären in alleiniger Verantwortung, dass das Produkt
hereby declare in our sole responsibility, that the product

ROSE Ex-Klemmengehäuse:	Aluminium	05/15/25/06 06 03 – 05/15/25/60 60 20
ROSE Ex-terminal enclosures:	*Aluminium*	
	Polyester	06/16/26/08 08 06 – 06/16/26/14 03 00
	Polyester	
	Edelstahl	34/35/36/10 10 06 – 34/35/36/92 61 35
	Stainless steel	34/35/36/03 33 01 – 34/35/36/03 97 04
	Edelstahlschaltschränke	34/35/36/00 22 09 – 34/35/36/00 64 21
	Stainless steel cabinets	

(Bezeichnung, Typ oder Modell – *designation, type or model*)

auf das sich diese Erklärung bezieht, mit der/den folgenden Norm(en) oder normativen Dokument(en) übereinstimmt.
which is the subject of this declaration, is in conformity with the following standards or Normative documents.

EN/IEC 60079-0; EN/IEC 60079-1; EN/IEC 60079-7; EN/IEC 60079-11; EN/IEC 61241-0; EN/IEC 61241-1

(Titel und/oder Nummer der Norm(en) – *title and/or number of issue*)

Gemäß den Bestimmungen der Richtlinie:
According to the terms of the directive:

ATEX-Richtlinie **94/9/EG (ATEX 100a)**
ATEX-directive ***94/9/EG (ATEX 100a)***

Porta Westfalica, 02. März 2009

(Ort und Datum der Ausstellung)
(Place and date of issue)

i.V. Klaus Steinhauer	i.V. Heinfred Seligmann	i.V. Frank Dorpmüller
Ex-Verantwortlicher	Ex-Schutzbeauftragter	Leiter Qualitätsmanagement
Ex-responsible person	*Ex-protection authorized person*	*QA-Manager*

With this declaration, the manufacturer declares by his own responsibility that the equipment is designed and has been brought into circulation in accordance with the set legal conditions.

Permits / approvals

4. Additional approvals:

Outside of the EC, the ATEX approval is sufficient for many countries; there are, however, countries, which insist on their own national approvals:

e.g. East European countries, such as Russia, Kazakhstan, etc.

СИСТЕМА СЕРТИФИКАЦИИ ГОСТ Р
ГОССТАНДАРТ РОССИИ

СЕРТИФИКАТ СООТВЕТСТВИЯ

№ РОСС DE.ГБ05.В02316

Срок действия с 22.05.2008 г. по 22.05.2011 г.

7998241

ОРГАН ПО СЕРТИФИКАЦИИ РОСС RU.0001.11ГБ05
НАНИО "ЦЕНТР ПО СЕРТИФИКАЦИИ ВЗРЫВОЗАЩИЩЕННОГО И РУДНИЧНОГО ЭЛЕКТРООБОРУДОВАНИЯ".
109377, г. Москва, а/я 22, НАНИО "ЦСВЭ",
тел. факс: 554-2494, 554-1238, 554-1257, 554-0150, 554-5042, 557-8244, 558-8353, 558-8141, 743-6830. www.csve.ru

ПРОДУКЦИЯ
Управляющие и распределительные коробки типов AL-KE 05, 15, 25; Polyester-KE 06, 16, 26; ...-KE 34, 35, 36 с маркировками взрывозащиты 2ExeIIT6...T4 или 2ExedIICT6...T4 или 2Exe[ia]IICT6...T4 или 0ExiaIICT6...T4 или 2Exedmia[ia]IICT6...T4 или ExeIIU и DIP A21 T, 85/100/135°C. Серийный выпуск.

код ОК 005 (ОКП): 34 3439

СООТВЕТСТВУЕТ ТРЕБОВАНИЯМ НОРМАТИВНЫХ ДОКУМЕНТОВ
ГОСТ Р 51330.0-99 (МЭК 60079-0-98);
ГОСТ Р 51330.1-99 (МЭК 60079-1-98);
ГОСТ Р 51330.8-99; ГОСТ Р 51330.10-99 (МЭК 60079-11-99);
ГОСТ Р 51330.17-99 (МЭК 60079-18-92); ГОСТ Р МЭК 61241-1-1-99.

код ТН ВЭД России: 8536 90 850 0

ИЗГОТОВИТЕЛЬ
Фирма «ROSE Systemtechnik GmbH»,
Erbeweg 13-15, D-32457 Porta Westfalica, Германия.

СЕРТИФИКАТ ВЫДАН
Фирме «ROSE Systemtechnik GmbH»,
Erbeweg 13-15, D-32457 Porta Westfalica, Германия.
Тел. +49 571-5041-0, факс: +49 571-5041-159.

НА ОСНОВАНИИ
Протокола испытаний № 201.2008-И от 22.05.2008 г. ИЛ ЦСВЭ (рег. № РОСС RU.0001.21ГБ04).
Акта инспекционной проверки производства сертифицированной продукции № 203-И от 16.05.2008 г. ОС ЦСВЭ (рег. № РОСС RU.0001.ГБ05).

ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ
Схема сертификации 3а.
Сертификат с приложением на 6-ти листах.
Инспекционный контроль – апрель 2009 г., апрель 2010 г.

Руководитель органа А.С. Залогин
Эксперт С.В. Серов

Сертификат имеет юридическую силу на всей территории Российской Федерации

Approval GOST R

Permits / approvals

ФЕДЕРАЛЬНАЯ СЛУЖБА
ПО ЭКОЛОГИЧЕСКОМУ, ТЕХНОЛОГИЧЕСКОМУ И АТОМНОМУ НАДЗОРУ

РАЗРЕШЕНИЕ № РРС 00-30671

На применение

Оборудование (техническое устройство, материал):
Управляющие и распределительные коробки типов AL-KE 05, AL-KE 15, AL-KE 25; Polyester-KE 06, Polyester-KE 16, Polyester-KE 26; ..-KE 34, ..-KE 35, ..-KE 36.

Код ОКП (ТН ВЭД): 34 3439 (8536 90 850 0)

Изготовитель (поставщик): Фирма "ROSE Systemtechnik GmbH" (Германия).

Основание выдачи разрешения: Техническая документация, заключение экспертизы промышленной безопасности "Ex НИИ" № 11-ТУ-339-2008 (НХ), сертификат соответствия ОС НАНИО "ЦСВЭ" № РОСС DE.ГБ05.В02316 от 22.05.2008 г.

Условия применения:
1. Обеспечение соответствия поставляемых устройств требованиям национальных стандартов, норм, правил, руководящих документов, инструкций в области промышленной безопасности, действующих в Российской Федерации.
2. Применение поставляемых устройств на нефтехимических, химических, нефтеперерабатывающих и других взрывопожароопасных объектах в соответствии с технической документацией и паспортом.

Срок действия разрешения до 05.08.2013

Дата выдачи 05.08.2008

Заместитель руководителя
Б.А. Красных

АВ 045445

Import permit RTN

Explosion protection in North America

6. Explosion protection in North America (NEC standard)

6.1 Introduction

The basic principles of explosion protection are identical everywhere. Nonetheless, in the field of explosion protection of electrical devices and equipment, techniques and systems have evolved in North America that substantially differ from the IEC directives. The differences compared to the explosion protection in Europe and the IEC reside in the division of the explosion endangered areas, the design, the equipment and the installation of electrical plants.

6.2 Classification of explosion endangered areas

In the USA, explosion endangered areas are defined according to NEC 500 (NEC= National Electrical Code) and NEC 505, and in Canada according to section 18 of the CEC (CEC= Canadian Electrical Code).

Generally, a differentiation is made into three categories (Class I to Class III).

Class I: Combustible gases, vapours or mist

Class II: Dust

Class III: Fibres and fluffs

Depending on the frequency or the duration of these substances, the explosion endangered areas are divided into **Division 1** and **Division 2**.

In 1996, in addition to the existing system, the classification system used by IEC was introduced (NEC 505) for Class I in the USA and in Canada.

This, in turn, allows the user to select the optimal system, both from the technical and economical point of view.

Similar to the IEC directive, the explosive gases of Class I are further subdivided into the gas groups **A, B, C and D** and the combustible dust of Class II into the **groups E, F and G**.

Other than in the IEC directive, the groups A and E are the most dangerous gas groups (acc. to IEC this is group IIC).

The determination of the maximum surface temperature acc. to NEC 505 complies with IEC and features six temperature classes, T1 to T6.

6.3 Design regulations

In North America, various standards and regulations are in place for design and testing explosion protected electrical plants and equipment. In the USA, these are predominantly the standards of the Underwriters Laboratories Inc. (UL) and the Factory Mutual Research Corporation (FM); in Canada, these are the standards of the Canadian Standards Association (CSA).

Explosion protection in North America

6.4 Protection types of enclosures

In Europe, the IP protection types of enclosures are defined according to IEC 60529.
In North America, protection types are defined acc. to NEMA 250 (NEMA= National Electrical Manufacturing Association). These protection types cannot be directly compared to those of IEC, as additional ambient influences (e.g. coolants, cutting oil, corrosion, icing-up, hail) are taken into account. For this reason, the following table is to be considered as a guide only.

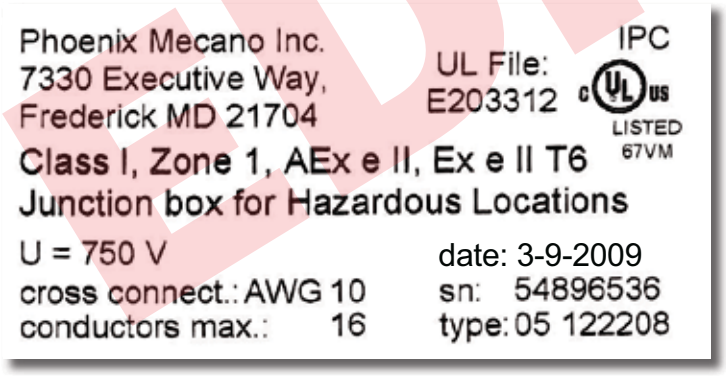
Protection types according to NEMA 250	Protection types according to IEC
1	IP 20
2	IP 22
3	IP 54
3R	IP 54
3S	IP 54
4	IP 65
4X	IP 65
6	IP 67
6P	IP 67
12	IP 54
12 K	IP 54

6.5 Certification and identification

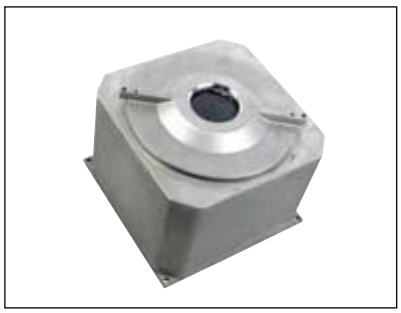
In the USA and in Canada, electrical devices and equipment installed in explosion endangered manufacturing sites generally require approval. An exception is electrical equipment that due to its design and properties is unable to ignite the explosive atmosphere in which it operates.
The competent authority decides about the obligation to seek approval. In the USA and in Canada, devices developed and produced for explosion endangered areas are tested and approved by nationally authorised test bodies. In the USA, these are, amongst others, the UL or FM test bodies, in Canada this is the CSA.
In addition to information, such as manufacturer, type, series No. and electrical parameters, the data related to explosion protection has to be integrated in the equipment identification.

Explosion protection in North America

Comparison of the IEC - NEC - CED classification				
	Gases, vapours or mist		Dust	Fibres and lint
	Class I	(IEC)	Class II	Class III
USA regulation	NEC 500-5	NEC 505-7	NEC 500-6	NEC 500-7
Canada regulation	CEC J18-004	CEC 18-006	CEC 18-008	CEC 18-010
Division	Division 1 Division 2	Zone 0 Zone 1 Zone 2	Division 1 Division 2	Division 1 Division 2
Groups	NEC 500-3 CEC J18-050	NEC 505-7 CEC J18-050	NEC 500-3 CEC J18-050	
	Div. 1 and 2 A (acetylene) B (hydrogen) C (ethylene) D (propane)	Zone 0,1,2 II A (propane) II B (ethylene) II C (acetylene, hydrogen)	 E (metals) F (coal) G (grains)	Div. 1 and 2 --
Temperature classes Class I:	Div. 1 and 2	Zone 0, 1 und 2	Div. 1 and 2	none
	T1 ≤ 450 °C T2 ≤ 300 °C T2A ≤ 280 °C; T2B ≤ 260 T2C ≤ 230 °C; T2D ≤ 215°C T3 ≤ 200 °C; T3A ≤ 180 T3B ≤ 165 °C; T3C ≤ 160 T4 ≤ 135 °C; T4A ≤ 120 T5 ≤ 100 °C T6 ≤ 85 °C	T1 ≤ 450 °C T2 ≤ 300 °C T3 ≤ 200 °C T4 ≤ 135 °C T5 ≤ 100 °C T6 ≤ 85 °C	T1 ≤ 450 °C T2 ≤ 300 °C T2A ≤ 280 °C; T2B ≤ 260 T2C ≤ 230 °C; T2d ≤ 215 °C T3 ≤ 200 °C; T3A ≤ 180 T3B ≤ 165 °C; T3C ≤ 160 T4 ≤ 135 °C; T4A ≤ 120 T5 ≤ 100 °C T6 ≤ 85 °C	



General information



7. Correct selection and configuration of Ex equipment

ROSE Ex Equipment offers planners and installers a large spectrum of products:
- Terminal boxes for increased and intrinsically safe current circuits
- Flameproof enclosures (Ex-d) to accommodate components not ex-approved
- Control stations with switches, buttons and indicator lights
- Ex installation material

For detailed information on products and technology, please refer to the ROSE technical catalogue "Ex-Equipment" and to our website **www.ROSE-Ex-Equipment.com**

Enclosed is important information on
- the equipment of terminal boxes
- the configuration of control stations and
- the handling of Ex-d enclosures

7.1 Junction boxes (Ex-e, Ex-i)

For process engineered systems, terminal boxes have to guarantee effective protection against corrosion and chemicals. For this reason, the design of ex terminal boxes is crucial. Terminal boxes of an explosion protected design as standard and flanged boxes are approved for use in gas zones 1 and 2 as well as in dust zones 21 and 22. The materials used for the enclosures are typically made of stainless steel, polyester, aluminium and polyamide. Enclosures made of sheet steel tend to corrode and, therefore, do not qualify in most cases. The basic prerequisites for enclosures are listed in the following:

- The properties of the enclosure material must be such that external mechanical stress will not deteriorate the type of protection. Required is an impact resistance of at least 7 Joule.
- All components, the enclosures, sealings, terminals, screw connections, must meet the required temperature conditions.

- For applications in the gas ex area, the protection type must at least equal IP 54 and at least IP 6x in the dust Ex area.

- Potentially dangerous electrostatic charges must be avoided (earthing or avoidance of chargeable surfaces).

- For the equipment of Ex-e enclosures, only Ex certified components (terminals and screw connections) may be used; the use of non-certified terminals is not permitted for Ex-i applications; however, screw-connections must always be Ex certified.

General information

- Number and size of the terminals are limited, depending on minimum spacing and heat generation.

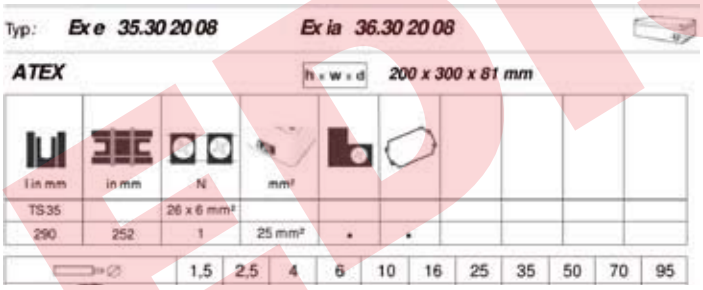
Typically, blue terminals and cable screw connections are used to visually identify Ex-i enclosures.

The equipment of Ex terminal boxes with terminals and cable screw-connections is subject to defined limits. It depends on the minimum gaps between the current carrying metal components of the terminals and the enclosure walls, and, in addition, on the heat generated at the terminal points. The maximum equipment for the individual enclosure size can be taken from the manufacturer documentation.

Example of an equipment configuration for an Ex stainless steel junction box

The equipment plan is composed of 3 different sections:

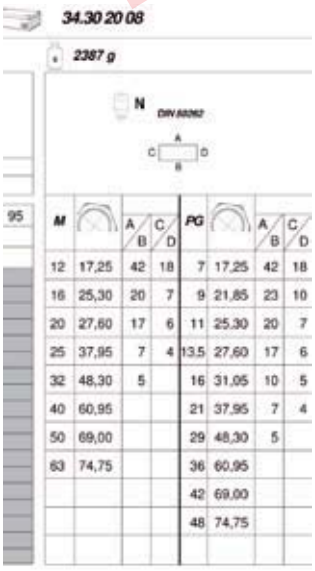
A:


Typ: Ex e 35.30 20 08 Ex ia 36.30 20 08

ATEX h x w x d 200 x 300 x 81 mm

l in mm	a in mm	N	mm²									
TS 35		26 x 6 mm²										
290	252	1	25 mm²	•	•							
		1,5	2,5	4	6	10	16	25	35	50	70	95

Information on the equipment possibilities (mounting rails, mounting plates etc.) as well as on the max. equipment with terminal blocks possible.

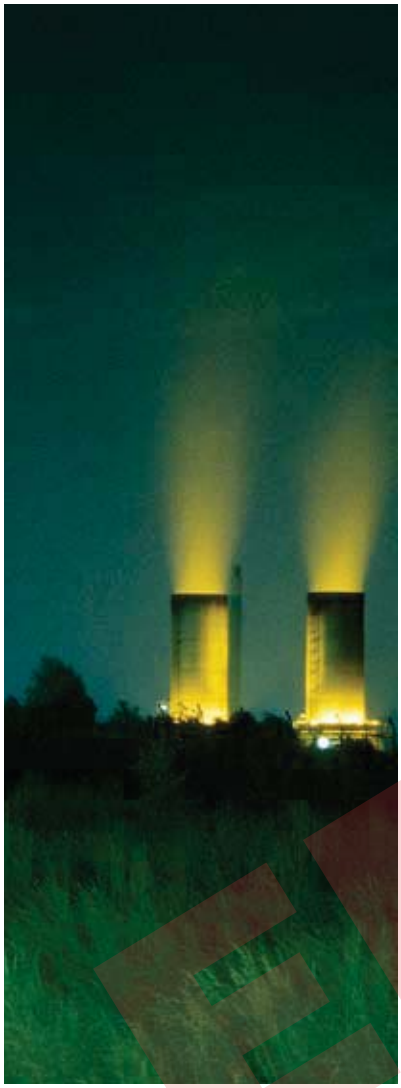

34.30 20 08

2387 g

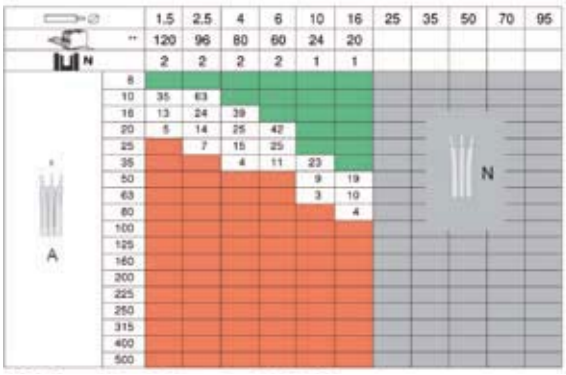
M		A/B	C/D	PG		A/B	C/D
12	17,25	42	18	7	17,25	42	18
16	25,30	20	7	9	21,85	23	10
20	27,60	17	6	11	25,30	20	7
25	37,95	7	4	13,5	27,60	17	6
32	48,30	5		16	31,05	10	5
40	60,95			21	37,95	7	4
50	69,00			29	48,30	5	
63	74,75			36	60,95		
				42	69,00		
				48	74,75		

B:
Information on the equipment with cable glands

General information



C:



Information about the maximum number of terminals in accordance with the heating calculations.

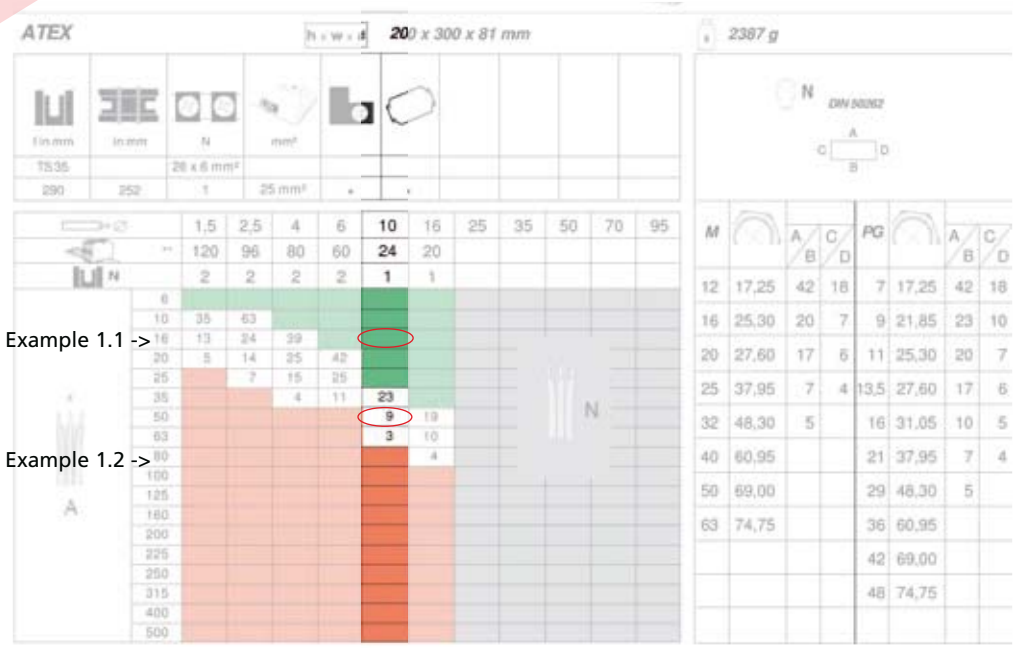
Green: The maximum number, as physically indicated, can be used; rising temperature does not lead to the limit temperature or the maximum permissible surface temperature in the temperature class being exceeded.

Red: Excessive heat generation; the limit temperature or the maximum permitted surface temperature will be exceeded.

Remedy:

- Reduction of current, or
- Selection of a larger conductor
- Selection of a larger enclosure

White field with numbers: Here the limit values are shown. The numbers in the fields result in the maximum number of terminal points to be used! A standard terminal block, e.g. UK5N, has 2 connections; i.e. the values have to be divided by 2. A standard double stack, e.g. DK4, has 4 connections; i.e. the values have to be divided by 4.



General information

Example 1: Enclosure with 24 10 mm² terminals:
The max. number of terminals for the equipment (physical dimensions) results from the maximum equipment length of 252 mm
The width of the terminal blocks for 10 mm² is 10.2 mm. This allows the equipment with 24 terminals (252 : 10.2 = 24 terminals + rest)

Equipment according to heat computation
1) Full use of all 10 mm² conductors with 16 A:
max. equipment is possible, as the values are within the green fields

2) Full use of the conductors with 50 A:
9 conductors are permissible = 4 terminals (10 mm²)

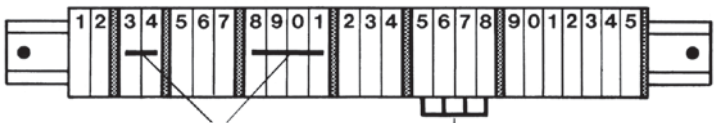
Example 2:
Mixed equipment: Enclosure 35.302008 with
8 x 2.5 mm² terminals with 10 A
3 x 4 mm² terminals with 20A
3 x 16 mm² terminals with 50A

Cross section/mm²	Current/amps	Number / utilisation
2,5	10	8 / (of 31) = 25 %
4	20A	3 / (of 12) = 25 %
16	50	3 / (of 9) = 33 %

Sum = 83% < 100 %
this means, that on technical heat grounds this equipment is permitted.

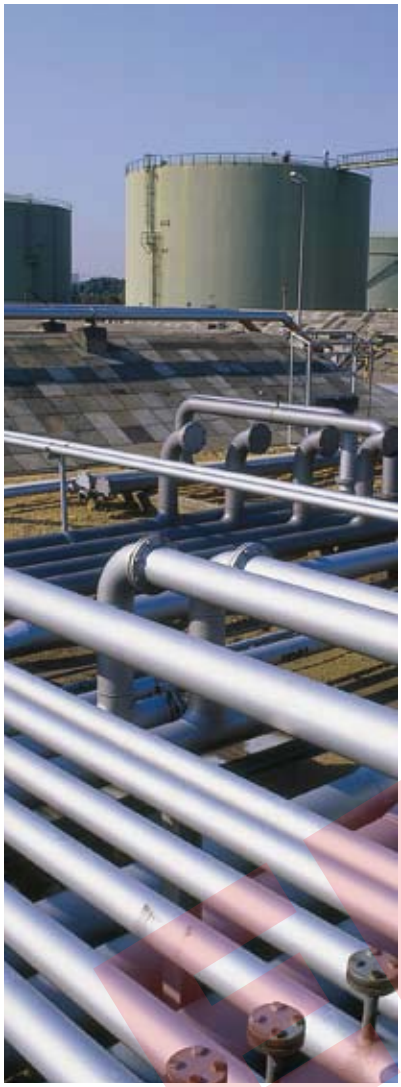
Where the rated current is within the green fields, any number of terminals can be used over the equipment lengths. In the white area, the maximum equipment is stated, taking the heat generation into account. If this is not fully used, the addition of terminals from the green area is permitted up to the equipment limit. This enclosure may not be used when the application applies to one of the red fields. A larger enclosure must be selected, the application of which will be in the green or white area.

Each terminal point may only be assigned one conductor. If cross connections are required, insert or screw-type jumpers can be used. To avoid the reduction of air gaps or creepage paths, partition plates must be used between neighbouring jumpers. Limitations for these accessories with regard to amperage and voltage also have to be taken into account. This applies in particular when using jumpers at every other terminal (e.g. terminal 1+3+5+7+9 bridged). In such cases, refer to the manufacturer information given in the relevant documentation.

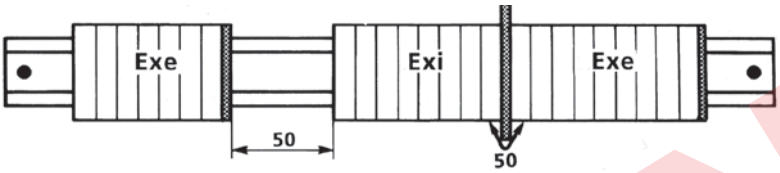


Cross connection rail Cross connector / jumper

General information

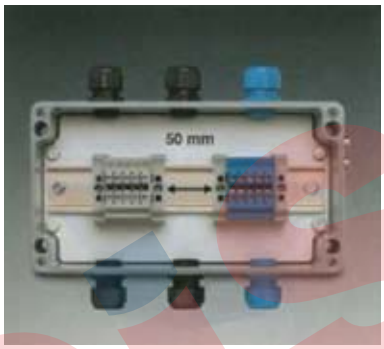


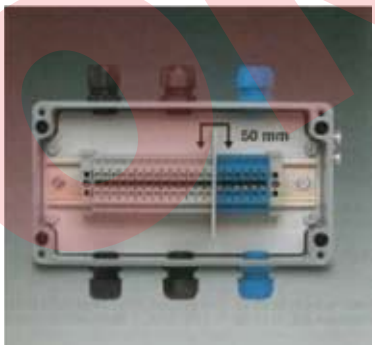
Enclosures accommodating a mixed equipment contain terminals with current circuits of increased safety (Ex-e) as well as intrinsically safe current circuits (Ex-i). This type of equipment requires a minimum spacing of 50 mm (tight string length) between the different current circuits. This can be achieved in two different ways:



1. Spatial distance

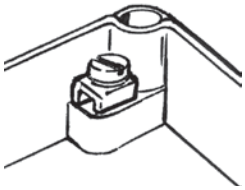
2. Distance by means of an insulating partition plate



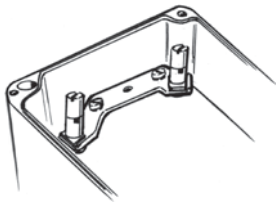


Protective earthing connection (internal)

Voltages above 50 V require a protective earthing connection for each connected cable. For this purpose, in Ex-e enclosures sheath terminals of a smaller design are used that are allowed to accommodate up to 4 conductors per terminal, depending on the connection cross section. With the exception of the small enclosures with mini terminals, these sheath terminals are fitted in pairs on protective earthing conductor mounting

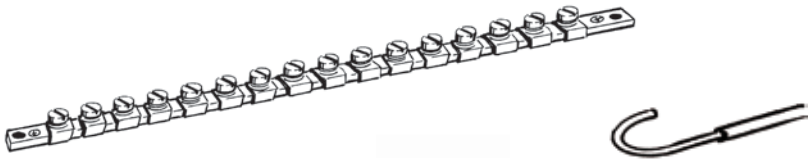


Mini terminal



Protective earthing conductor mounting bracket with sheath terminals

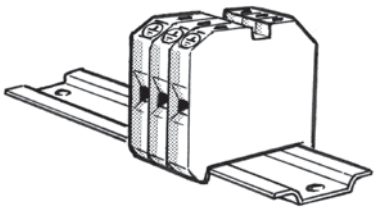
Terminal boxes of a larger design can be equipped with protective earthing busbars fitted with connection elements (up to 6 mm² connection cross section). 2 conductors can be connected per terminal point. If only 1 conductor is used, the conductor must be connected in the form of a tongue.



Protective earthing conductor busbar

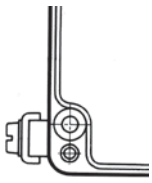
General information

As an alternative to the connection options mentioned above, protective earthing conductor terminal blocks can be fitted on the mounting rail.

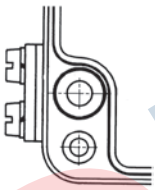


Always fit a PE terminal inside the enclosure for protective earthing conductor connections of more than 6 mm².

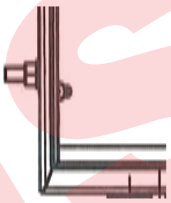
Protective earthing connection (external)
According to the IEC / ATEX directive, metal enclosures always require an external earth connection. This can be achieved by means of a terminal block, a saddle terminal or a stud terminal.



Terminal block



Saddle connection

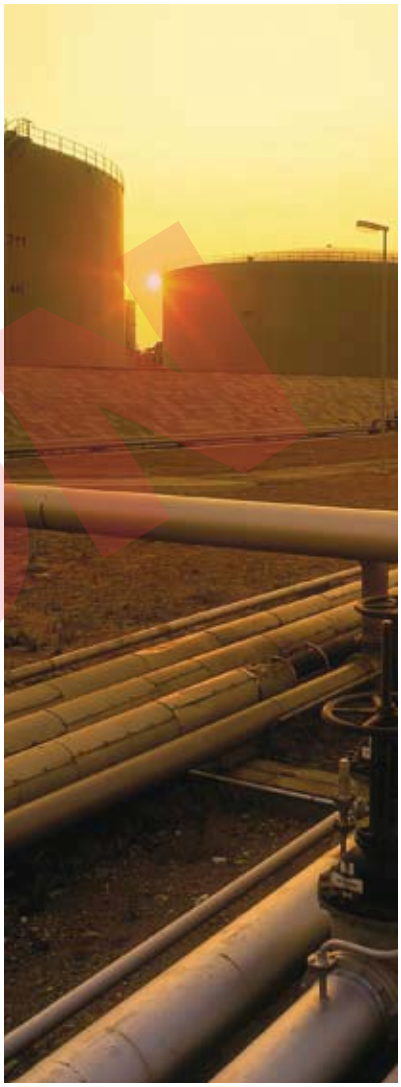


Stud connection

The cross section of the attendant protective earthing conductor in relation to the current carrying conductor is defined in the VDE 0660 T500/EN60439-1, section 7.4.3.1.7:

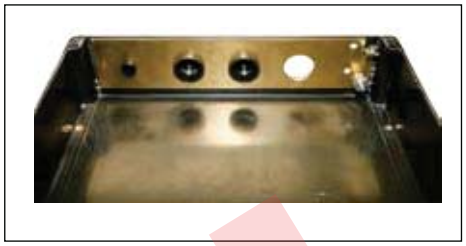
Cross section area of the current carrying conductor S mm²	Minimum cross section of the corresponding protective earthing conductor (PE, PEN) S mm²
S ≤ 16	S
16 < S ≤ 35	16
S > 35	S/2

Examples:
Example 1: Nominal cross section = 4 mm² Protective earthing conductor= 4 mm²
Example 2: Nominal cross section = 35 mm² Protective earthing conductor= 16 mm²
Example 3: Nominal cross section = 240 mm² Protective earthing conductor= 120 mm²



Continuity plates

Where plastic enclosures are equipped with metal screw-connections (e.g. for sheathed cables), these screw-connections must be earthed.
Special metal plates (continuity plate) are available for polyester enclosures, which metallically connect all led-in screw-connections on one side of an enclosure and therefore, only need one earthing point. These are generally available either made of brass, stainless steel or galvanised sheet steel.

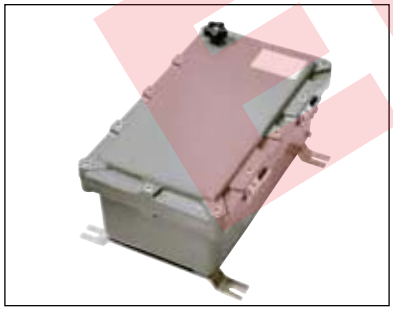


Mounting rails

In the event of a short circuit and when PE terminals are used, the mounting rails must discharge the rated current. Copper mounting rails must be used for high rated currents.

(Table VDE 0611 Section 3/ EN 60947-7-2/) see Table 9 in the appendix

7.2 Flameproof enclosures (Ex-d)



Application of flameproof enclosures:
There is a large number of applications for flameproof enclosure systems:
Sturdy local control stations (LCS)
Complete Ex-d control systems
Safety units preventing surge voltages
Fieldbus interfacing devices in the Ex area.

The following is generally valid:
Ignitable electrical/electronic equipment is accommodated in an Ex-d enclosure to ensure that in the case of an explosion the enclosures resist to the pressure given their design and wall thickness, and the energy is cooled down to a point where, should it escape, an ignition of the external atmosphere is no longer possible.
The gap dimension between the cover and the bottom section of the enclosure is crucial. Gaps technologically required are of a tight design and have a length that cause hot gases to lose their ignitability when escaping the enclosure, i.e. the energy and the temperature of the escaping gases have become so low that an ignition of the atmosphere outside of the enclosure is impossible. The parameters (width and length) of the gap prevent propagation of flame on explosion for the explosion sub-groups IIA, IIB and IIC vary. Enclosures of the explosion sub-group IIC are subject to the highest requirements with regard to gap parameters.

Explosion group	Limit gap width
IIA	> 0,9
IIB	0,5 - 0,9
IIC	< 0,5

General information

There are three different realisation possibilities for the connection of conductors in the Ex-d area:

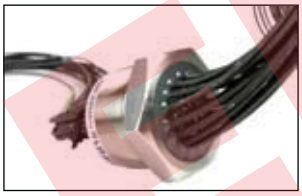
1. Direct connection - Ex-d cable gland

The Ex- d cable gland ensures that, in the event of an explosion, hot ignitable gases will not escape from the enclosure.

2. Ex-d enclosures in combination with an Ex-e connection box

Advantage of this type of connection: cable glands and cables with Ex-e approval can be used from the distribution point in the Ex-e connection box.

A cable connection preventing the propagation of flame on explosion must be used between the Ex-d and Ex-e areas (typically moulded lead-throughs with integrated cables).



3. Conduit lead-in

Conductors and cables are routed in metal tubes; a moulding compound infill socket is provided at regular increments. Conduits are mostly employed for applications meeting the American Ex standard.

7.3 Local Control Stations

Local control stations (LCS) are used for installations in the chemical and petrochemical industry, in mechanical engineering, control, apparatus and plant construction, in the pharmaceutical and food industry as well as in offshore technologies.

They are based on Ex approved enclosure systems made of stainless steel, polyester, polyamide or aluminium. The enclosures are designed meeting the requirements of the "Increased safety" or "Flameproof safety" types of protection. Depending on the specification and number of units, various enclosure types and sizes are available. Depending on the technical requirements, approved command, signalling and display units as well as fieldbus interfacing modules can be installed in the control stations.

Appendix / Terminology

8. Appendix

8.1 Terminology

Ambient temperature
The ambient temperature is the temperature of the medium in which the electrical equipment is installed and in operation.

ATEX
‚ATmosphère EXplosible' - Ignitable atmosphere

ATEX directives
Unofficial 'family name' for EC directives pertaining to explosion protection

Calculation, measuring and assessment data
Compilation of calculation, measuring and assessment values as well as operating conditions.

Calculation, measuring and assessment value
A quantitative value specified by the manufacturer for a certain operating condition of a device, protection system or component.

Category: see Device category

CE mark
Identification confirming that all requirements in accordance with the regulations pertaining to the product have been met.

Cloud of dust
Swirling up of flour, powder.

Combustible dust
Dust, fibres or suspended matter that can burn or smoulder in the air and generate explosive mixtures with the air in the presence of atmospheric pressure and at normal temperatures.

Combustible equipment
Equipment that can ignite a defined explosive atmosphere during normal operation.

Component
Each assembly part required for the safe operation of devices and protection systems.

Conduit system
Routing of a tubing system for cables in the Ex area in accordance with the American Ex regulations.

Appendix / Terminology

Continuity plate
Metal plate connecting the potentials of several metal screw-connections inside an enclosure.

Dangerous dust concentration
... prevailing, for instance, in a room, if a 100 W bulb cannot be seen at a 1 m distance. Dangerous dust concentration depends on the grain size and the type of dust. Lower explosion boundary: 20 to 60 g/m³; upper explosion boundary: 2000 to 6000 g/m³

Declaration of conformity
The declaration of conformity is a written confirmation at the end of a conformity assessment, by which the responsible party (e. g. manufacturer, dealer) or the organisation (e. g. test laboratory, user/owner of a quality system) bindingly declares the rendering of a service for a product, and confirms that the object (product, service, station) features the properties specified in the declaration. The properties are typically specified by the quotation of the standards met by the object.

Detonation
Explosion propagating at supersonic speed, characterised by a shock wave.

Devices
Machines, equipment, stationary or mobile devices, control and equipment parts as well a warning and prevention systems, intended either individually or in combination for the generation, transmission, storage, measurement, control and conversion of energy and/or to process materials, and which imply their own potential ignition sources and might, for this reason, cause an explosion.

Device category
Within a group of units, the category defines the classification with regard to the required level of safety. The device category indicates the technical requirements placed on a device for use in the individual Ex zone. The categories are defined as follows:
Category 1 encompasses devices the design of which is such that they can be operated in conformity with the characteristic values specified by the manufacturer and guarantee a very high degree of safety.
Category 2 encompasses devices the design of which is such that they can be operated in conformity with the characteristic values specified by the manufacturer and guarantee a high degree of safety.
Category 3 encompasses devices the design of which is such that they can be operated in conformity with the characteristic values specified by the manufacturer and guarantee a normal degree of safety.

Dust
Small solid particles in the atmosphere, which settle due to their own weight, however, can stay airborne in the atmosphere for some time as a dust/air mixture.

Appendix / Terminology

Dust combustion
Ignition of a layer of dust. A dust combustion can evolve into a dust explosion.

Dust explosion
A very fast chemical reaction sequence of a combustible substance (dust), which can release large amounts of energy.

Dustproof enclosure
Enclosure that can prevent the ingress of all visible dust particles (IP 6X).

EC type examination certificate
Confirmation of the conformity of an Ex equipment with the pertinent international and national engineering standards.

Electrical equipment
All objects serving the application of electrical energy, either as a whole or in part. These include, amongst others, objects or the generation, transmission, distribution, storage, measuring, control, conversion and consumption of electrical energy, as well as telecommunication devices.

Electrostatic charge
An electrostatic charge is created when disconnecting non-conductive material from another (conductive or non-conductive) material after a close contact between both.

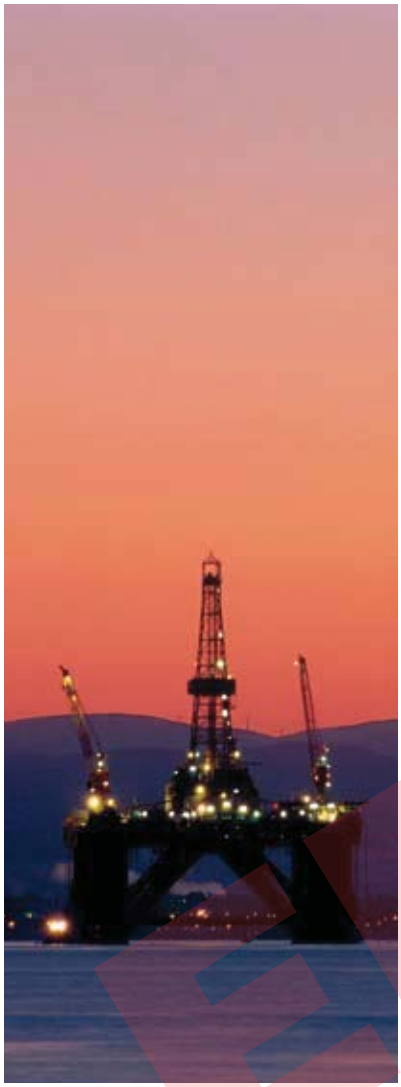
Enclosure protection (IP)
With regard to their suitability for various ambient conditions, the systems are subdivided into respective protection types, the so-called **IP codes** . These are laid down in the DIN EN 60529 under the title Protection types provided by enclosures (IP code). The letters IP always being part of the designation of the protection type are appended a double-digit number. This number indicates the scope of protection offered by an enclosure with regard to contact or foreign bodies (first digit) and moisture (second digit).

Equipment identification
The equipment identification informs, amongst others, about the ambient and environmental conditions in which the device may be used. This information also includes the device category, the device group, the maximum surface temperature, the type of protection and the notified body having inspected the device concerned.

Explosion
Sudden oxidation or decomposition reaction causing a rise in temperature, pressure or both at the same time.

Explosion area
Area susceptible to a combustible substance concentrating in the air and causing an explosion.

Appendix / Terminology



Explosion boundaries
Boundaries of the explosion area; differentiation of lower and upper explosion boundaries.

Explosion endangered area
Area where an explosive atmosphere is present or can be expected in quantities that exact special measures with regard to the design, the installation and the use of equipment
(see zoning).
Remark: Layers, deposits and the accumulation of combustible dust should be regarded as a source prone to the formation of an explosive atmosphere.

Explosion protection
Primary explosion protection: Measures to be taken in order to prevent the creation and propagation of an explosive atmosphere.
Secondary explosion protection: Measures to be taken in order to prevent the ignition of an explosive atmosphere.

Explosion protection document
This document provides information, such as: Description of the operating area, the method, the actions and the quantities of substances; data of substances (technical safety characteristic values); risk assessment; zoning; technical and organisational protection measures; measures to be taken in emergencies as well as operating instructions and work release.

Explosion protection measures
Protection measures and regulations relating to the design, production and installation of devices used in Ex areas.

Explosive atmosphere
An explosive atmosphere is a mixture of combustible substances and air.

Explosive dust atmosphere
A mixture of air and a combustible substance in the form of dust or fibres under atmospheric conditions, allowing, once ignited, the combustion to propagate throughout the entire unconsumed mixture.

Flameproof enclosure Ex-d
Protection concept providing pressure resistance of the walls in the event of an explosion inside the enclosure, and allowing the energy to cool down to a point where an ignition of the atmosphere outside the enclosure is no longer possible.

Group of devices (of electrical equipment for explosive atmospheres)
Classification of electrical equipment according to the explosive atmosphere in which its use is intended (EN 60079-0). The group of devices indicates whether the device is to be used underground (I) or in one of the other areas (II).

Appendix / Terminology

IEC
International Electro-Technical Commission, international committee for standardisation in the field of electrical and electronic engineering, registered in Geneva.

IECEx
IECEx is a global approval based on the decisions reached by the IEC. IECEx is comparable to the European ATEX.

Ignition of a cloud of dust
Spark-off of an explosion by transmitting energy to a cloud of dust in the air.

Ignition of a layer of dust
The ignition is to be regarded as have been taken place as soon as smouldering or flame formation in the material was triggered or when during the test a temperature of at least 450° C or a temperature rise to at least 250K above the defined temperature of a hot surface is measured.

Ignition sources
Every source with sufficient energy to trigger combustion, i.e. hot surfaces, flames, smouldering pockets, mechanically generated sparks, electrical equipment, electrostatic discharges causing clouds of dust or dust deposits to ignite.

Ignition temperature
The lowest temperature of a heated surface causing the ignition of an explosive atmosphere under defined conditions.

Increased safety -"e"
Type of protection providing a higher degree of safety to prevent the ignition of an explosive atmosphere.

Inspection body
see notified body

Intrinsic safety Ex-i; Ex-i D
Intrinsically safe current circuits are current circuits in which no spark or thermal effect can cause a dust-air mixture to ignite.

Intrinsically safe equipment
Electrical equipment all current circuits of which are intrinsically safe.

IP protection
Protection identification according to EN 60529, for which degrees of protection are defined provided by enclosures protecting against foreign bodies and the ingress of water and their adverse effects.

Layer of dust
Deposit of flour or powder on equipment.

Appendix / Terminology

Lower explosion boundary
Lower boundary of the area of concentration in which a mixture can be brought to explosion. Lower boundary of the explosive area.

Lower ignition boundary
The lowest concentration of combustibles mixed with air, at which the air/combustibles mixture is combustible.

Maintenance
Combination of all technical and administrative measures, including monitoring steps, geared to maintain or restore the functioning condition of a unit (IEC 60050-191).

Manufacturer
Organisation registered in one or several indicated locations, which carries out or monitors manufacturing, assessment, handling and storages steps of a product that qualify this organisation to assume responsibility for the conformity of the product with the pertinent requirements on a permanent basis, and, in this context, to exercise all obligations attached (EN 13980).

Maximum operating temperature
Maximum temperature reached when a device or protection system is operated within the operating conditions specified or it.
Remark: Individual parts of each device or protection system can reach different operating temperatures.

Maximum surface temperature
The maximum temperature a part or surface of a device, a protection system or a component can achieve during operation under the most unfavourable conditions (however, within the recognised permissible deviations) which can lead to ignite the surrounding explosive atmosphere.

Minimum ignition energy
Smallest electrical energy stored in a capacitor and defined under prescribed test conditions, which when discharged is sufficient to ignite the most ignition prone explosive atmosphere.

Minimum ignition temperature of a layer of dust
The lowest temperature of a hot surface, at which a layer of dust of a defined thickness on this hot surface is ignited.

Moulded encapsulation Ex-m; Ex-mD
Type of protection moulding those components susceptible of igniting an explosive atmosphere.

Normal operation
State in which the devices, protection systems and components fulfil their intended function within their design parameters.

Appendix / Terminology

Notified body (inspection body)
Inspection body for the inspection and certification of devices.

Offshore
Processes and functions, such as mineral oil and gas extraction from beneath the ocean.

Oil immersion -"o"
Type of protection safeguarding electrical equipment by being immersed in oil to avoid contact between an ignition source and explosive atmosphere.

Onshore
Processes and functions, such as mineral oil and gas extraction on land.

Operating conditions meeting the intended use
The task assigned to the device or the protection system by the manufacturer, based on the calculation, measuring and assessment values.

Operating manual
Documentation addressed to the installer and user/owner providing relevant information on a piece of equipment and its correct and safe use.

Operating temperature
The temperature of the equipment reached during its rated operation.

Pressure proof enclosure Ex-p; Ex-pD
Type of protection preventing the generation of an explosive atmosphere inside an enclosure in that an internal overpressure is maintained in relation to the surrounding atmosphere by means of pressurised gas, and in that, if necessary, the enclosure interior is permanently supplied with pressurised gas that combustible mixtures are diluted.

Protection by enclosure -"tD"
Type of protection providing an enclosure, the sealing of which prevents the ingress of combustible dust. The surface temperature of the outer enclosure is limited.

Risk of dust explosion
Danger exists when combustible dust (powder, flour) is produced or handled in a factory.

Smouldering temperature
- see minimum ignition temperature of a layer of dust

Temperature class
Division of devices, protection systems or components for use in explosive atmospheres in accordance with their maximum surface temperature.

Appendix / Terminology

Temperature limitation (dust)
It is necessary to determine the maximum permissible surface temperature of equipment for use on one of the three zones, by deducting a safety factor from the lowest ignition temperature of the dust concerned.

Type (degree) of protection
Scope of protection by an enclosure against access to dangerous parts, against the ingress of solid foreign bodies and/or against the ingress of water, and proven by standardised inspection/test methods (EN 60529).

Type of protection
Special measures taken on devices to prevent the ignition of the surrounding atmosphere.

Upper explosion boundary
Upper boundary of the area of concentration, in which dust mixed with air can be brought to explosion. Upper boundary of the explosive area.

Zone classification - dust zones
Explosion endangered areas are divided into zones defined by the frequency of the occurrence and the duration of the presence of an explosive dust/air mixture; the following definitions only apply to the device group II.
Zone 20: Area in which a dangerous explosive atmosphere generated by clouds of dust in the air exists permanently, for longer periods of time or frequently. The presence of personnel and the performance of work are not possible in zone 20.
Zone 21: Area occasionally susceptible to the formation of a dangerous explosive atmosphere in the form of a cloud of combustible dust in the air during normal operation.
Zone 22: Area in which, during normal operation, an explosive atmosphere in the form of a cloud of combustible dust in the air normally does not occur or only for a short period of time.

Appendix / Tables

8.2 Tables

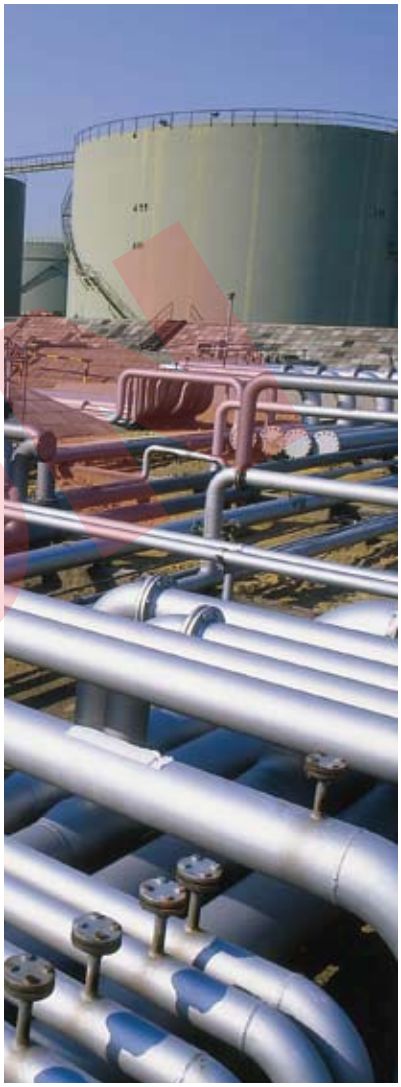


Table 1
Review of electrical types of protection (gas) according to IEC/EN 60079

Electrical equipment for areas susceptible to gas explosions			
	EN (old)	EN (new)	IEC
General requirements	EN 50014	EN 60079-0	IEC 60079-0
Flameproof enclosure (d)	EN 50018	EN 60079-1	IEC 60079-1
Pressure-proof enclosure (p)	EN 50016	EN 60079-2	IEC 60079-2
Sand casing (q)	EN 50017	EN 60079-5	IEC 60079-5
Oil casing (o)	EN 50015	EN 60079-6	IEC 60079-6
Increased safety (e)	EN 50019	EN 60079-7	IEC 60079-7
Intrinsic safety (i)	EN 50020	EN 60079-11	IEC 60079-11
Type of protection (n)	EN 50021	EN 60079-15	IEC 60079-15
Moulded encapsulation (m)	EN 50028	EN 60079-18	IEC 60079-18
Intrinsically safe systems		EN 60079-25	IEC 60079-25
Electrical equipment for zone 0	EN 50284	EN 60079-26	IEC 60079-26
Intrinsically safe fieldbus systems		EN 60079-27	IEC 60079-27
Optical radiation (op)		EN 60079-28	IEC 60079-28

Table 2
Review of electrical types of protection (dust) according to IEC/EN 61241

Electrical equipment for areas subject to combustible dust			
	EN (old)	EN (new)	IEC
General requirements		EN 61241-0	IEC 61241-0
Protection by the casing (tD)	EN 50281-1-1	EN 61214-1	IEC 61241-1
Pressure-proof enclosure (pD)		EN 61241-2	IEC 61241-2
Intrinsic safety (iD)		EN 61241-11	IEC 61241-11
Moulded encapsulation (mD)		EN 61241-18	IEC 61241-18

Appendix / Tables

Table 3
Review of the assignment of equipment categories to zones

Identification of the units according to categories	Use in zone	combustible material	Definition
Ⓔx II 1G	0	Gases, vapours, mist	Areas subject to permanent, long-period or frequent presence of an explosive atmosphere
Ⓔx II 2 G	1 and 2	Gases, vapours, mist	Area in which a dangerous explosive gas atmosphere can be occasionally expected during regular operation. This includes the close vicinity to zone 0 as well as close areas around filling and discharging devices.
Ⓔx II 3G	2	Gases, vapours, mist	Areas infrequently subject to an explosive atmosphere and, if at all, only short-period.
Ⓔx II 1D	20	Combustible dust	Areas subject to permanent, long-period or frequent presence of an explosive atmosphere
Ⓔx II 2 D	21 and 22	Combustible dust	Area in which a dangerous explosive dust atmosphere can be occasionally expected during regular operation. This includes the close vicinity to zone 20 as well as close areas around filling and discharging devices.
Ⓔx II 3D	22	Combustible dust	Areas infrequently subject to an explosive atmosphere and, if at all, only short-period.

Appendix / Tables

Table 4
Review of temperature classes

Temperature class	Permissible surface temperatures of the electrical equipment	Ignition temperature of the combustible substances
T1	450 °C	> 450 °C
T2	300 °C	300 - 450 °C
T3	200 °C	200 - 300 °C
T4	135 °C	135 - 200 °C
T5	100 °C	100 - 135 °C
T6	85 °C	85 - 100 °C

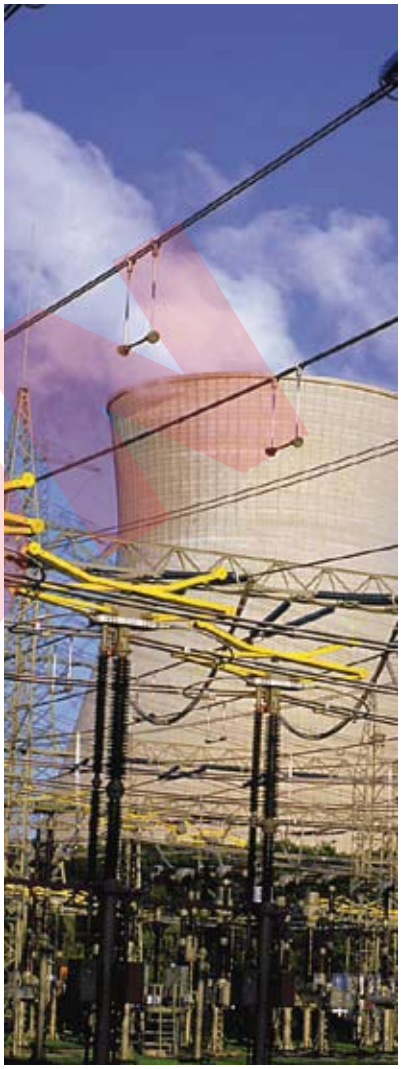


Table 5
Excerpt of technical safety relevant characteristics of combustible gases and vapours

Designation of substance	Ignition temperature °C	Temperature class	Explosion group
Acetaldehyde	155	T4	II A
Acetone	535	T1	II A
Acetylene	305	T2	II C
Ethane	515	T1	II A
Ethyl acetate	470	T1	II A
Ethyl ether	175	T4	II B
Ethyl alcohol	400	T2	II B
Ethyl chloride	510	T1	II A
Ethylene	440	T2	II B
Ethylene oxide	435	T2	II B
Ammonia	630	T1	II A
i-Amyl acetate	380	T2	II A
Benzines, gasolines, flash point < 135 'C	220 to 300	T3	II A
Special benzines, flash point > 135 'C	220 to 300	T3	II A
Benzol (pure)	555	T1	II A
n-Butane 365	365	T2	II A
n-Butyl alcohol	325	T2	II A
Cyclohexanon	430	T2	II A
1,2-Dichlorethane	440	T2	II A
Diesel fuels DIN 51601/04.78	220 to 300	T3	II A
Jet engine fuels	220 to 300	T3	II A

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Designation of substance	Ignition temperature °C	Temperature class	Explosion group
Acetic acid	485	T1	II A
Acetic acid anhydride	330	T2	II A
Fuel oil L DIN 51603 Part 2/10.76	220 to 300	T3	II A
Fuel oils M and S DIN 51603 Part 2/10.76	220 to 300	T3	II A
n-Hexane	230	T3	II A
Carbon oxide	605	T1	II A
Methane	595	T1	II A
Methanol	440	T1	II A
Methyl chloride	625	T1	II A
Naphthalene	540	T1	II A
Phenol	595	T1	II A
Propane	470	T1	II A
Carbon disulphide	95	T6	II C
Hydrogen sulphide	270	T3	II B
City gas (illuminating gas)	560	T1	II B
Toluol	535	T1	II A
Hydrogen	560	T1	II C

Appendix / Tables

Table 6 Limit temperatures of dust

Designation of the solid material	Values A Ignition temperature **IEC 50281-2-1** Method A settled (°C)	Values B Ignition temperature IEC 50381-2-1 Method B swirled up (°C)	Permissible limit temperature Smallest calculated value (A-75K) and 2/3*B									
			450... > 300	300... > 280	280... > 260	260... > 230	230... > 215	215... > 200	200... > 180	180... > 165	165... > 160	160... > 135
Dust of natural products (examples)												
Cotton	350	560			275							
Brown coal	225	380										150
Cellulose	370	500		295								
Grain	290	420						215				
Wood resin	290	500						215				
Wood dust	300	400					225					
Cocoa	460	580	385									
Copra	290	470						215				
Cork	300	470					225					
Concentrated feed	295	525					220					
Flax	230	440										155
Milk powder	340	440			265							
Paper	300	540					225					
Pectin sugar	380	410			273							
Soy	245	500								170		
Starch	290	440						215				
Black coal	245	590								170		
Tobacco	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				

Appendix / Tables

Table 7
Protection types USA / Europe

Protection types according to NEMA 250	Protection types according to IEC
1	IP 20
2	IP 22
3	IP 54
3R	IP 54
3S	IP 54
4	IP 65
4X	IP 65
6	IP 67
6P	IP 67
12	IP 54

Table 8
Protective earthing conductor dimensioning according to EN 60439-1

Cross section range of the outer conductor S mm²	Minimum cross section of the corresponding protective earthing conductor (PE, PEN) S mm²
$S \leq 16$	S
$16 < S \leq 35$	16
$S > 35$	S/2

Appendix / Tables

Table 9
Short-circuit resistance of mounting rails according to EN 60947-7-2

Type	Rail profile	Material	Short-circuit resistance = E CU conductor (mm²)	Short-period current resistance 1s (kA)
TS 15				
TS 15 unperforated	Top hat rail according to EN 60715 - 15 x 5,5	Steel	10	1,2
TS 15 perforated	Top hat rail according to EN 60715 - 15 x 5,5	Steel	10	1,2
TS 32				
TS 32 unperforated	G rail according to EN 60715 - G 32	Steel	35	4,2
TS 32 perforated	G rail according to EN 60715 - G 32	Steel	35	4,2
TS 32 - CU / 35 mm² unperforated	G rail, dimensions according to EN 60715 - G 32	Copper	120	14,4
TS 32 - CU / 120 mm² unperforated	G rail, similar to EN 60715 - G 32	Copper	150	18,0
TS 35 / 7.5				
TS 35 / 7.5 unperforated	Top hat rail according to EN 60715 - 35 x 7.5	Steel	16	1,92
TS 35 / 7.5 perforated	Top hat rail according to EN 60715 - 35 x 7.5	Steel	16	1,92
TS 35 / 7.5 V2A (stainless steel) unperforated 2000 mm	Top hat rail according to EN 60715 - 35 x 7.5	Steel	16	1,92
TS 35 / 7.5 CU unperforated 2000 mm	Top hat rail according to EN 60715 - 35 x 7.5	Copper	50	6,0
TS 35 / 15				
TS 35 / 15 - 2.3 unperforated	Top hat rail according to EN 60715 - 35 x 7.5	Steel	50	6,0
TS 35 / 15 unperforated	Top hat rail similar to EN 60715 - 35 x 7.5	Steel	25	3,0
TS 35 / 15 perforated	Top hat rail similar to EN 60715 - 35 x 7.5	Steel	25	3,0
TS 35 / 15 CU unperforated	Top hat rail similar to EN 60715 - 35 x 7.5	Copper	95	11,4

Ex-Basics

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