Ex designation

II 1 G Ex ia IIC T6

Temperature Class:

Group II electrical operating devided are split into temperature classes according to the maximum surface temperatures at which the Ex-atmosphere can be achieved. Equipment is temperature classified as follows:

Maximum permitted housing or component temperature of the operating devices					
T1	T2	T3	T4	T5	T6
450°C	300°C	200°C	135°C	100°C	85°C

Explosion groups:

The equipment group, amongst other items, appears again in this Designation Section.
Group I comprises operating devices for coal mining. where coal dust and methane atmospheres prevail.
Group II covers all other areas – gases and dusts. The "intrinsically safe", "flameproof enclosure" and "powder filling" types of ignition protection are sub-divided into explosion groups IIA to IIC (most dangerous explosion group) due to the differing parameters of the various flammable liquids / gases (including firing power).

CENELEC marking	Type of Gas	ignition energy/µJ
I	methane	280
IIA	propane	› 180
IIB	ethylene	60 … 180
IIC	hydrogen	‹ 60

Type of protection:

In areas where the occurrence of an explosive mixture of flammable materials and air cannot be prevented by applying primary explosion protection, special measures for the prevention of ignition sources are to be taken. For example: separation (o, q, m), exclusion (p), special mech. construction (d, e), limitation of energy (ia, ib) or other methods (s).

Explosion protection certified to CENELEC de-jure standard EN 50...

Conformity designations:
The operating device complies with the valid EN de-jure standards.
"Ex"
The operating device comprises features that guarantee at least the same safety level as that required by the European Standards.
e.g.: The operating device complies with the valid de-jure standards according to the world-wide IEC de-facto Standard.

Use in hazardous areas:

Equipment which are certified according to Directive 94/9/EC (ATEX 95 – replacing: ATEX 100a) regulations carries a special marking.
The device group appears first, then the device category and finally the atmosphere reference: (**G**)as and (**D**)ust

Device category:

Areas in which a hazardous potentially explosive atmosphere can occur are categorised into zones according to the probability of this ex-atmosphere occurring.
Depending on the respective zones, operating devices from a corresponding device category (in connection with the atmosphere) must be used.

EC Examination Mark

(special marking for prevention of explosions, Ex-sign)

ATEX

Atmospheres Explosibles

94/9/EC Directive

Harmonises legal provisions of member states for devices and protection systems for designated use in potentially explosive areas.
New: ATEX 95 (Old: ATEX 100a)

99/92/EC Directive

Minimum requirements for improving the health and safety protection of the worker at risk from explosive atmospheres.
New: ATEX 137 (Old: ATEX 118a)

Designation examples:

Use in gaseous atmospheres:	II 1 G EEx ia IIC T4
Use in dusty atmospheres:	II 2 D T90°C IP64
Use for mining applications:	I M2 EEx ia I

Max. surface temperature
(Data only for devices used in areas rendered potentially explosive by dust also possible through temperature classes)
-Max. temperature of a surface that dust can penetrate in the event of device failure

Evaluation by the user:

a.) Limit temperature 1=2/3 of min. ignition temperature of dust present

b.) Limit temperature 2=min. glow temperature of dust present minus 75k
(applies for layer thicknesses of up to 5mm)

The smaller value for the limit temperature must be above the indicated max. surface temperature of the device.

IP Code
(Data only for devices used in areas rendered potentially explosive by dust)

Figure 1Contact and foreign body protection:
5=Protection against dust deposits
6=protection against dust penetration

Figure 2Water protection
Protection against:
0=(no protection)
1=vertically falling drip water
2=drip water on operating device inclined to 15°
3=spray water
4=spray water
5=jet water
6=strong jet water
7=temporary immersion
8=continuous immersion

Ex | II 1GD | EEx | ia | IIC | T4 | T90°C | IP64

Device group
I = Mining
II = all other areas

Category
1 = can be used in Zones 0 or 20
2 = can be used in Zones 1 or 21
3 = can be used in Zones 2 or 22
M1= Mining **(comparable with Zones 0 and 1)**
M2= Mining **(comparable with Zones 2)**

Atmosphere
G = Gas
D = Dust

(Mining – no details)

conforms to European Ex-Standards

Types of ignition protection:
o = Oil immersion
p = pressurisation
q = Powder filling
d = Pressure-proof housing
e = Increased safety
ia = Intrinsic safety **(required for Zone 0)**
ib = Intrinsic safety **(adequate for Zone 1 (+2))**
m = Encapsulation
s = Special protection

n = Normal operation under normal conditions **(for Zone 2 only)**
nA = non-sparking
nC = protected contacts
nR = vapour-proof housing
nL = limited energy
nP = simplified pressurisation

Temperature classes:
(Max. temperature of a surface that gas / dust can penetrate in the event of device failure)

T1 =450°C
T2 =300°C
T3 =200°C
T4 =135°C
T5 =100°C
T6 = 85°C

Explosion group
(Data only for devices used in areas rendered potentially explosive by gas)
I = Methane (mining)
IIA
IIB
IIC (most dangerous group e.g. hydrogen)

Explosion Protection

The important principles for integrated safety explosion protection are as follows:

1. Measures are taken to avoid hazardous atmospheres whenever possible.

2. Measures are taken which prevent the ignition of hazardous atmospheres.

3. Measures are taken which limit the explosive effect to a safe degree.

This differs from:

Primary explosive protection:
These are precautions taken to prevent or restrict the formation of hazardous explosive atmospheres.

Secondary explosive protection:
This covers the second group of measures, which are intended to prevent the ignition of an atmosphere that is capable of exploding.

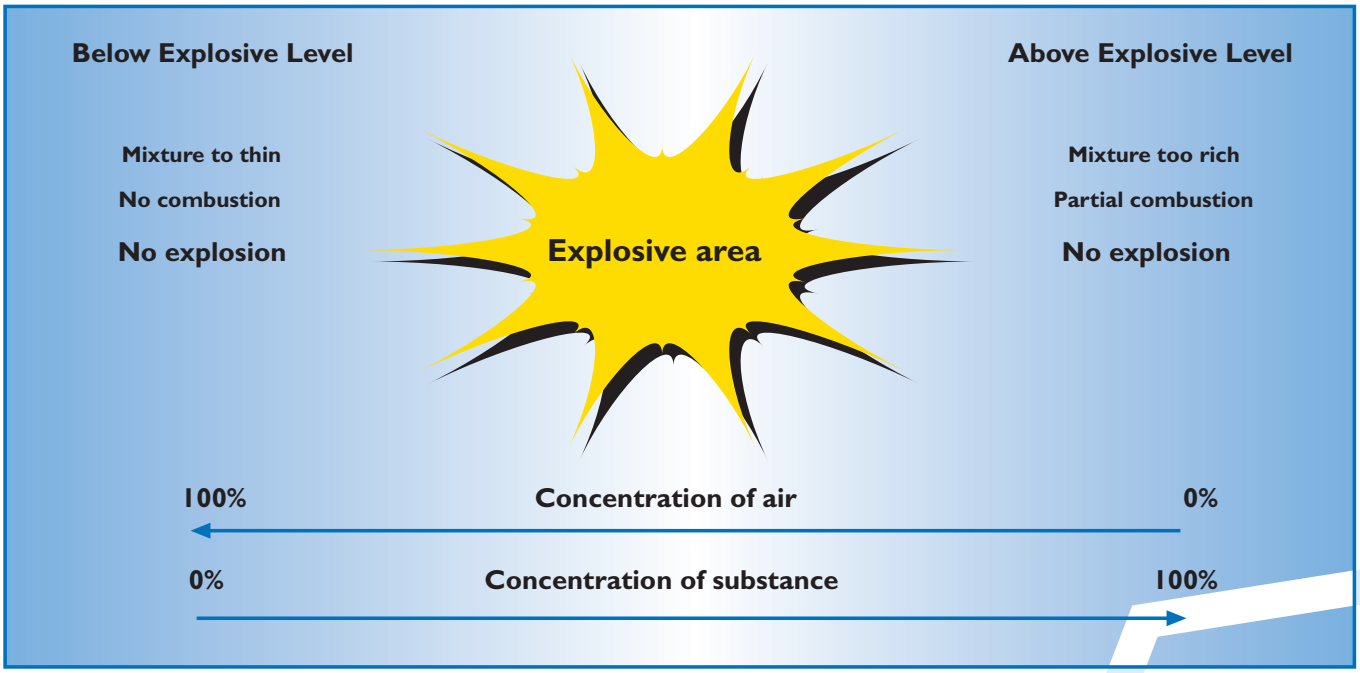
Definition in accordance with 1999/92/EC Directive (ATEX 137)	Reference values (not standardised	Zone	A device from the following device category must be used (see 1999/92/EC – ATEX 137 Directive):	e
Area in which a potentially explosive atmosphere as a mixture of air and flammable gases, vapours or mists is present either frequently or over a prolonged period.	> 1000 h/a	0	1	G
Area in which under normal operation a potentially explosive atmosphere as a mixture of air and flammable gases, vapours or mists can occasionally form.	10 ... 1000 h/a	1	2 (1G also possible)	G
Area in which under normal operation a potentially explosive atmosphere as a mixture of air and flammable gases, vapours or mists is not normally present but may occur for just a short period.	<10 h/a	2	3 (1G, 2G also possible)	G
Area in which a potentially explosive atmosphere in the form of a cloud of flammable air-borne dust is present either constantly, over prolonged periods or frequently.	> 1000 h/a	20	1	D
Area in which under normal operation a potentially explosive atmosphere in the form of a cloud of flammable air-borne dust can occasionally form.	10 ... 1000 h/a	21	2 (1D also possible)	D
Area in which under normal operation a potentially explosive atmosphere in the form of a cloud of flammable air-borne dust is not normally present although may occur for just a short period	<10 h/a	22	3 (1D, 2D also possible)	D

Division into Temperature Classes

The temperature class indication can be guaranteed only if the ambient temperature specified for the operating device is respected (see Technical Data or Rating Plate). Strict compliance is a mandatory requirement.
Once the maximum surface temperature of any apparatus reaches the ignition temperature of the surrounding hazardous atmosphere an explosion can occur.
Because of this, all equipment classified to Group II is divided into temperature classes. To allow for the possibility of potential hazardous atmospheres, the lowest ignition temperature must always be higher than the maximum surface temperature.

Temperature classes of flammable gases and vapours and permitted surface temperatures of the operating device in accordance with DIN EN 50014

Temperature class	T1	T2	T3	T4	T5	T6
Ignition temperature in °C	>450	>300	>200	>135	>100	>85
Maximum Surface temperature in °C	450	300	200	135	100	85
E.g.	Propane Methane Ammonia	Ethylene Alcohols Acetylene	Petrol Solvents	Ethylether Acetaldehyde	-	Carbon-disulphide



Explosions are dependent on many parameters.

For only atmospherical conditions and pure substances sufficient comparitive values and data are shown. An explosion can only occur where a flammable substance in the form of gases, vapours, smoke and dust exists along with sufficient oxygen to support combustion and there is a source of ignition.

e.g.

•Hydrogen	4,0 to 77,0 % in air	•Propane	1,7 to 10,6 % in air
•Ammonia	15,4 to 33,6 % in air	•Methane	4,4 to 16,5 % in air

Fundamental principles:
The manufacturer of operating devices for areas rendered potentially explosive through dust must indicate the maximum surface temperature of all devices that dust can penetrate (usually expressed in °C – indication of the temperature class should be avoided here). This temperature is part of the dust Ex-designation.

Designation examples:
II 2 D T90°C IP64
(If the ignition protection type is based on the housing, the housing protection rating should also be stated as an IP Code).
or II 2 D Ex iaD 21 T96°C

(This device has already been approved according to the new IEC de-jure standard "Intrinsic Dust Safety) – "iaD". This de-jure standard specifies that the designation also contains the corresponding zone – in this case 21)

Dust explosion protection – temperature:

Combustion and explosion parameters for dusts depend on the their condition. Parameters that affect combustion and explosion behaviour include particle size, particle shape, water content, purity and where applicable the content of the flammable solvents. The particle size distribution and the mean value (value for average particle size) should also be known.

In accordance with 1999/92/EG Directive (ATEX 137,replacing:ATEX 118a),the system operator /employer is obliged to make a hazard assessment and must therefore be aware of the minimum glow temperature of the dust.

Thereare t simple calculations to determine the two " temperatures " and they are carried out thus:

a) Limit temperature 1 = 2/3 of minimum ignition temperature
b) Limit temperature 2 = minimum ignition temperature* minus 75°K

These two limit temperatures must now be examined to confirm which guarantees the greater safety.

Example 1:

Minimum ignition temperature = +330°C, minimum glow temperature = +300°C:

a) Limit temperature 1 = 2/3 x +330°C = +220°C
b) Limit temperature 2 = +300°C - 75°K = +225°C

Greater safety: Limit temperature (1) = +220°C
Here a device with a max. surface temperature in the event of failure <= +220°C must be used. As stated, the device designation includes a corresponding value.

Example 2: Minimum ignition temperature = +186°C, minimum glow temperature = +180°C:

a) Limit temperature 1 = 2/3 x +186°C = +124°C
b) Limit temperature 2 = +180°C - 75°K = +105°C

Greater safety: Limit temperature (2) = +105°C
Here a device with a max. surface temperature in the event of failure <= +105°C must be used.

*The value for the glow temperature applies with a dust layer thickness of 5mm. The temperature safety distance must be increased for larger layer thicknesses.

Special case – Category 3 devices

In contrast to Category 1 and 2 devices, potential hazards in the event of failure (e.g. short circuiting, connection break etc.) do not have to be considered for Category 3 devices (for use only in Zones 2 and 22). The device is evaluated only in respect of hazards during normal operation. It is relatively unlikely that the device should fail at the same time as a short-term explosive atmosphere is present. No EC Type Approval Test Certificate is therefore required for Category 3 operating devices. The manufacturer may confirm that the operating device complies with the relevant standard. Nonetheless, ecom Category 3 devices are still tested by a certified centre and ecom is then awarded a declaration of conformity.
(- Of course, Category 2 operating devices also offer significantly greater safety in Zones 2 and 22..)

Ignition protection type "n"

Ignition protection type n is applicable only for Category 3 operating devices used in areas rendered potentially explosive by gases. Because only normal operation and no equipment failures are considered here, small differences occur in the designation for ignition protection type:

Designation example:

II 3 G EEx nCL IIC T6

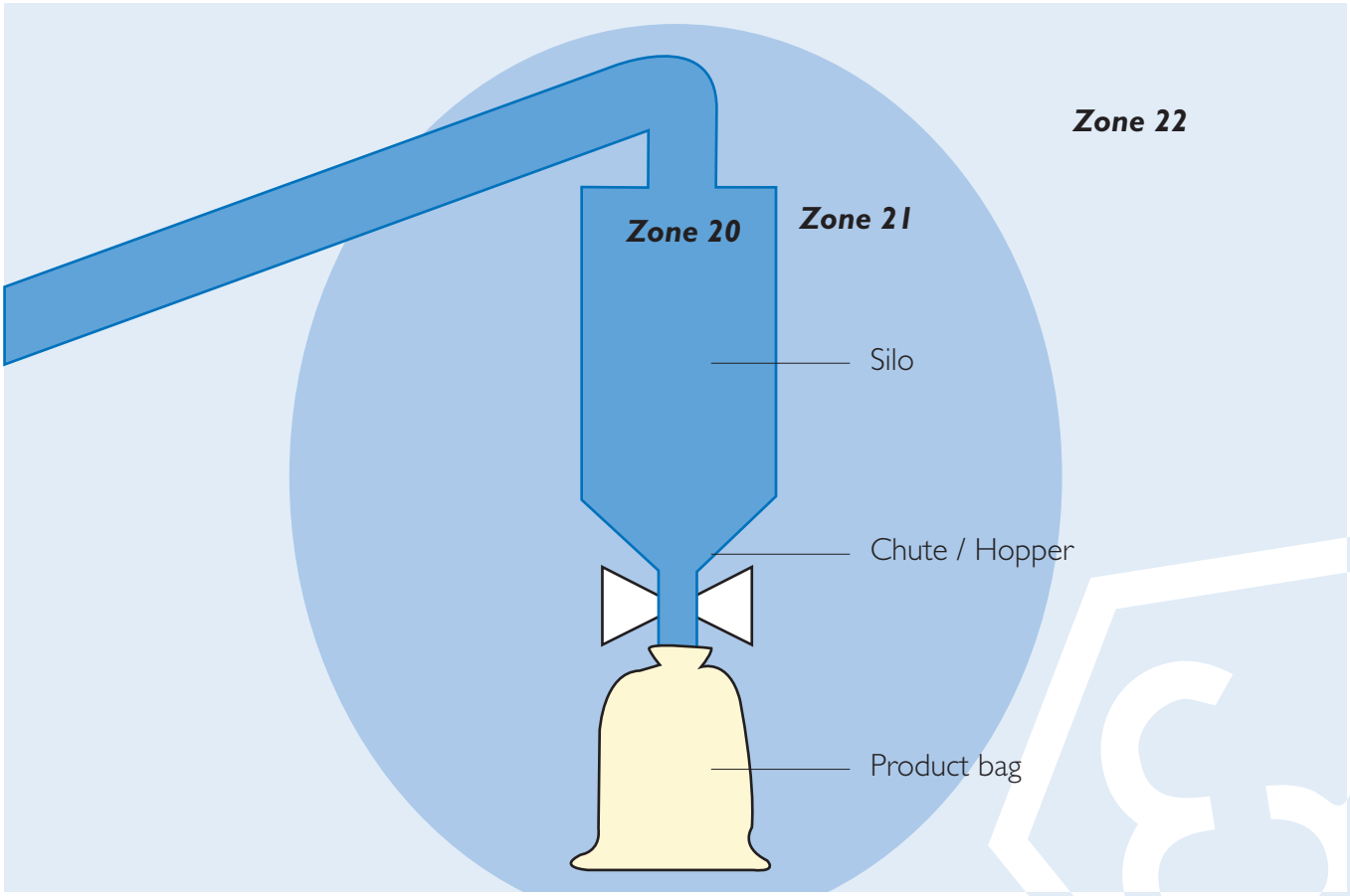
The letter "n" (denoting ignition protection type "n") is followed by a further "Explanation" of how the device is protected – in this case C (in simple terms: non-ignitable) and L (limited energy).The limited energy would probably correspond closest to intrinsic safety "ia" (Device Category 1 and/or 2) although must never be confused – hence the difference in the designation.
Category 3 devices usually reach very high temperature classes (in this case T6) normal operation temperatures only are considered.

Areas with an increased risk of explosion (directive 1999/92/EC)

Area 20 Area in which a potentially explosive atmosphere in the form of a cloud of flammable air-borne dust is present either constantly, over prolonged periods or frequently.

Area 21 Area in which under normal operation a potentially explosive atmosphere in the form of a cloud of flammable air-borne dust can occasionally form.

Area 22 Area in which a potentially explosive atmosphere in the form of a cloud of flammable air-borne dust is not expected and if so only for a short period.



IP 2 3 C H

- IP — Identification letters
- 2 — Protection against penetration by foreign bodies and dust (1st identification letter)*)
- 3 — Protection against penetration by water (2nd identification letter)*)
- C — Additional letter
- H — Supplementing letter

*) Should no degree of protection be specified,then the characters are replaced with the letter X e.g. **IP X4**

1. ident letter	Degree of protection	Symbol
0	No protection	
1	Protection against penetration by large foreign bodies, ø>50 mm No protection against intentional access	
2	Protection against small foreign bodies, ø>12,5 mm, exclusion of fingers or similar objects	
3	Protection against small foreign bodies, ø>2.5 mm, exclusion of tools, wires or similar objects	
4	Protection against grainy foreign bodies, ø>1 mm, exclusion of tools, wires or similar objects	
5	Protection against dust deposits (dust protected), complete exclusion of access.	
6	Totally protection against dust deposits (dust protected), complete exclusion of access.	

2. ident letter	Degree of protection	Symbol
0	No protection	
1	Protection against drops of water falling vertically (water drop)	
2	Protection against water falling at an angle (water drop), inclined at 15° to the normal operating position	
3	Protection against water spray, up to 60° from the vertical	
4	Protection against water splashes from any direction	
5	Protection against water jet from any direction	
6	Protection against heavy sea or strong water jet (Flooding protection)	
7	Protection against submersion in water at a certain pressure and for a certain period	
8	Protection against continuous submersion in water	...atü

Additional letter	Significance (facultative)
A	Back of the hand
B	Finger
C	Tools
D	Wire

Supplementing letter	Significance (facultative)
H	High voltage apparatuses
M	Machine running
S	Machine not running
W	Weather conditions