



ATEX

Safety switches for potentially explosive atmospheres

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ATEX products from EUCHNER

General information

The ATEX directive

Since 1 July 2003, all equipment in the EU that is used in a potentially explosive atmosphere must comply with directive 94/9/EC.

This directive is entitled “Equipment for potentially explosive atmospheres (ATEX)” – ATEX for short. The ATEX directive is intended for manufacturers and users of equipment and protective systems used in potentially explosive atmospheres. This directive was superseded by directive 2014/34/EU in April 2016.

All previously valid national regulations were standardized in the course of harmonizing the ATEX directive within the EU member states. Accordingly, the same, consistent rules for explosion protection are applicable here. Explosion protection is part of safety engineering and serves to avoid harm to persons and property damage.

Prerequisites for an explosion

The following prerequisites must be met for an explosion to occur:

- ▶ A potentially explosive mixture of
 - combustible material (gas, vapor, mist or dust)
 - oxidizing agents (oxygen)
- ▶ An ignition source (sparks, hot surfaces, etc.)

Combustible material




Air (oxygen)

Ignition source

Prevention of explosions

The most effective way of preventing an explosion is to prevent the formation of a potentially explosive atmosphere. This type of explosion protection is called **primary explosion protection**. Primary explosion protection is not always possible. For this reason, ignition of the potentially explosive atmosphere must be prevented. This measure is termed **secondary explosion protection**. In practice, this form of protection is achieved by using explosion protected equipment. This equipment ensures that no ignition source can be produced due to its operation in a potentially explosive atmosphere.

Marking of equipment

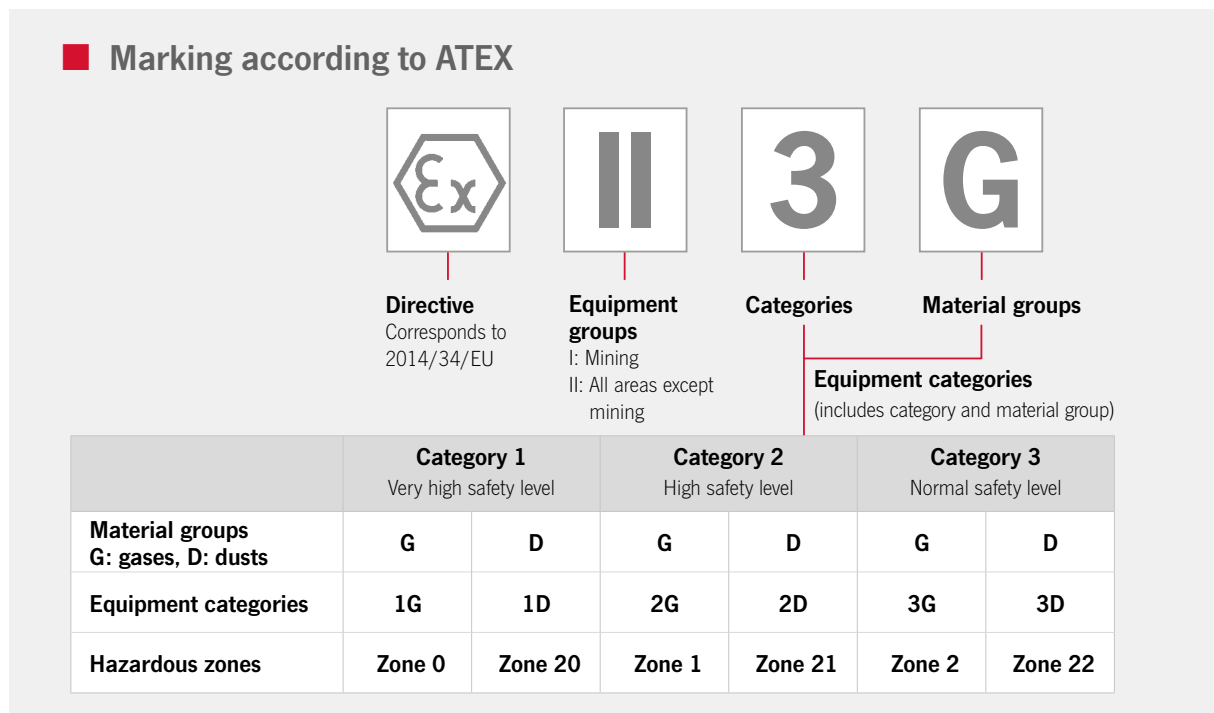
Equipment intended for potentially explosive atmospheres must be marked with the  symbol.

The equipment must be marked accordingly on the type label.

Explosion-protection equipment is marked according to:

- ▶ Application
- ▶ Equipment properties

Marking according to application



Equipment groups

Depending on the place of use, equipment is classified into the following groups according to the ATEX directive:

- ▶ **Group I:** Equipment for use in underground mining
- ▶ **Group II:** Equipment for all other potentially explosive atmospheres.

Equipment categories

The category describes the permissible application and the achieved safety level of equipment according to the ATEX directive. Equipment with equipment-related ignition sources must undergo an ignition hazard assessment to avoid potential ignition sources. This must form the basis for taking measures in accordance with the basic safety requirements to rule out the risk of ignition from this equipment.

The equipment category defines the hazardous zone in which a device (equipment) can be used.

Table 1 shows the classification and assignment of equipment categories and individual hazardous zones.

Material groups

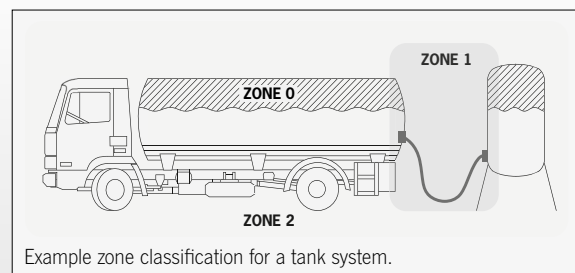
The ATEX directive divides combustible materials into so-called material groups. A distinction is made between the following material groups:

- ▶ **G** (gases, vapors and mists)
- ▶ **D** (dusts)

Hazardous zones

In accordance with EN 60079-10-1/2, the potentially explosive applications of electrical equipment are classified into hazardous

zones. The hazardous zone defines the probability of occurrence of a potentially explosive atmosphere. A distinction is made between zones for combustible gases (zones 0, 1 and 2) and combustible dusts (zones 20, 21 and 22). The related zone must be defined by the machine or plant manufacturer. The EN 60079-14 standard must be taken into account for selecting the equipment and for its subsequent assembly and setup.



Information on zone 2/22

- ▶ ATEX equipment manufactured by EUCHNER is suitable for use in zone 2 and zone 22.
- ▶ If cable glands are used on equipment for zone 2/22, they must possess special ATEX suitability. An appropriate cable gland is included with EUCHNER ATEX products.
- ▶ Equipment for zone 2/22 does not require a test certificate from a notified body. ATEX equipment is tested by the manufacturer under the manufacturer's responsibility.

Classification and assignment of the equipment categories							
Com- bustible materi- als	Temporary behavior of combustible materials in the explosion area. Explosive medium:	Hazardous zones	Equipment marking			Equipment protection level (EPL)	
			Equip- ment group	Equipment category			
Gases/ vapors / mists	present continuously, for long periods or frequently	Zone 0	II				
	present occasionally	Zone 1	II	1G			Ga
	probably not present. If present, only rarely or briefly	Zone 2	II		2G	3G	Gb Gc
Dusts	present continuously, for long periods or frequently	Zone 20	II				
	present occasionally	Zone 21	II	1D			Da
	probably not present due to disturbed dust. If present, only rarely/briefly	Zone 22	II		2D	3D	Db Dc

Table 1

Hazardous zones

▶ Zone 0

Area in which a potentially explosive atmosphere comprising a mixture of air and combustible gases, vapors or mists is **present continuously, for long periods or frequently**.

▶ Zone 20

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

▶ Zone 1

Area in which a potentially explosive atmosphere comprising a mixture of air and combustible gases, vapors or mists can **occasionally form during normal operation**.

▶ Zone 21

Area in which a potentially explosive atmosphere comprising a cloud of combustible dust in the air can **occasionally form during normal operation**.

▶ Zone 2

Area in which a potentially explosive atmosphere comprising a mixture of air and combustible gases, vapors or mists **usually does not form or forms only briefly during normal operation**.

▶ Zone 22

Area in which a potentially explosive atmosphere comprising a cloud of combustible dust in the air **usually does not form or forms only briefly during normal operation**.

Equipment categories

▶ Category 1G/1D

Equipment in this category is intended for use in areas in which a potentially explosive atmosphere comprising gases (G) or dusts (D) is present continuously, for long periods or frequently.

▶ Requirements for the equipment

Very high level of safety. The equipment remains protected against providing a source of ignition even in case of malfunctions to be expected only rarely. The equipment also remains safe if two independent failures occur. Safety is achieved using two independent means of protection against providing a source of ignition.

▶ Category 2G/2D

Equipment in this category is intended for use in areas in which it is to be expected that a potentially explosive atmosphere comprising gases (G) or dusts (D) may occur occasionally.

▶ Requirements for the equipment

High level of safety. The equipment remains protected against providing a source of ignition even in the case of malfunctions or fault conditions to be expected frequently. Safety is achieved using one means of protection against providing a source of ignition.

▶ Category 3G/3D

Equipment in this category is intended for use in areas in which it is not to be expected that a potentially explosive atmosphere may occur due to gases (G) or dusts (D). If a potentially explosive atmosphere nevertheless occurs, then in all probability it will occur only rarely and for a short period.

▶ Requirements for the equipment

Equipment offers a normal level of safety. The equipments remains protected against providing a source of ignition in normal operation. ATEX equipment manufactured by EUCHNER is category 3 equipment.

Marking according to equipment characteristics

■ Marking according to standard

Gases

Marking for use in atmospheres with combustible gases (zones 0, 1, 2) according to EN 60079-0



Explosion-protected equipment

Types of protection:

- i: Intrinsic safety
- m: Encapsulation
- o: Oil immersion
- e: Increased safety
 - ec: for equipment protection level Gc
- q: Powder filling
- p: Pressurization
- d: Flameproof enclosure
- n: Type of protection
 - nA: Non-sparking equipment
 - nR: Restricted breathing enclosure

Explosion groups:
IIA/IIB/IIC

Temperature class:
T1 to T6
Permissible surface temperature

Equipment protection level:
Ga/Gb/Gc

X:
Special conditions must be met (e.g. properly tightened cover screws)

Dusts

Marking for use in atmospheres with combustible dusts (zones 20, 21, 22) according to EN 60079-0



Explosion-protected equipment

Types of protection:

- i: Intrinsic safety
- m: Encapsulation
- t: Protection by enclosure
 - tc: for equipment protection level Gc
- p: Pressurization

Explosion groups:
IIIA/IIIB/IIIC

Maximum surface temperature:
 $T = T_a + T_i$
 T: Maximum surface temperature
 T_a : Max. ambient temperature
 T_i : Intrinsic heating of the equipment

Equipment protection level:
Da/Db/Dc

X:
Special conditions must be met (e.g. properly tightened cover screws)

Types of protection

The general requirements for electrical equipment are listed in the EN 60079-0 standard. Classification occurs into various types of protection: The type of protection the manufacturer uses for a device (equipment) essentially depends on the device

type and function, and it is included in the ATEX marking on the type label of the respective device.

EUCHNER uses the following types of protection (Table 2):

Basic standard	Marking	Type of protection	Standard corresponding to the type of protection
Gases EN 60079-0	Ex nR (zone 2)	Type of protection "nR" Restricted breathing enclosure Enclosure designed to restrict the penetration of gas, vapors and mists	EN 60079-15
	Ex nA (zone 2)	Type of protection "nA" Non-sparking equipment	EN 60079-15
	Ex ic (zone 2)	Type of protection "i" Intrinsic safety	EN 60079-11
	Ex ec (zone 2)	Type of protection "ec" due to increased safety	EN 60079-7
Dusts EN 60079-0	Ex tc (zone 22)	Type of protection "t" Protection by enclosure	EN 60079-31
	Ex ic (zone 22)	Type of protection "i" Intrinsic safety	EN60079-11

Table 2

Explosion groups

Explosion groups and temperature classes determine the media for which equipment may be used within the hazardous zones.

Explosion group IIC includes explosion groups IIB and IIA. ATEX equipment manufactured by EUCHNER belongs to explosion group IIB.

► Equipment for areas with combustible gases

The ignitability of an explosive atmosphere depends on the material.

Gases and vapors are classified into explosion groups IIA, IIB and IIC depending on the energy required for ignition (see Table 4 in the chapter on temperature classes).

The danger posed by the gases (ignitability) increases from explosion group IIA to IIC. The requirements on the equipment increase correspondingly. Electrical equipment approved for IIB, for example, may also be used for explosion group IIA.

► Equipment for areas with combustible dusts

Material group D is classified into explosion groups IIIA, IIIB and IIIC depending on the size and conductivity of the dust particles (see Table 3).

The danger posed by dusts (ignitability) increases from explosion group IIIA to IIIC. ATEX equipment manufactured by EUCHNER belongs to explosion group IIIC.

Explosion group		Dust types
IIIA	IIIB IIIC	Combustible fibers and lint (example: textiles)
		Non-conductive dust (example: sawdust, flour)
		Conductive dust (example: metal dust, dust containing carbon)

Table 3

Temperature classes

Electrical equipment is classified into temperature classes T1 to T6. The temperature class relates directly to the

- ▶ ignition temperature of gases and dusts (temperature above which an explosive atmosphere ignites) and
- ▶ smoldering temperature of dusts (temperature above which a deposited dust layer begins to smolder)

and thereby specifies the maximum permissible surface temperature of the equipment.

The maximum surface temperature must always be less than the ignition/smoldering temperature of the explosive atmosphere in which the equipment is used.

A safety clearance (maximum surface temperature to ignition/smoldering temperature) might also have to be taken into account.

On equipment intended for use in zones 0, 1, 2 (gases), the related temperature class must be given in the equipment marking.

On equipment intended for use in zones 20, 21, 22 (dusts), the maximum surface temperature must be given in the equipment marking.

Classification of explosive gases according to explosion groups and temperature classes							
Explosion group	IIA		<ul style="list-style-type: none"> ▶ Ammonia ▶ Methane ▶ Ethane ▶ Propane 	<ul style="list-style-type: none"> ▶ Ethyl alcohol ▶ Cyclohexane ▶ n-butane 	<ul style="list-style-type: none"> ▶ Gasoline ▶ Diesel ▶ Fuel oil ▶ n-hexane 	▶ Acetaldehyde	
		IIB					
			IIC	<ul style="list-style-type: none"> ▶ Town gas ▶ Acrylonitrile 	<ul style="list-style-type: none"> ▶ Ethylene ▶ Ethylene oxide 	<ul style="list-style-type: none"> ▶ Ethylene glycol ▶ Hydrogen sulfide 	▶ Ethyl ether
			▶ Hydrogen	▶ Acetylene		▶ Trichlorosilane	▶ Carbon disulfide
Temperature class			T1 < 450 °C				
			T2 < 300 °C				
			T3 < 200 °C				
			T4 < 135 °C				
			T5 < 100 °C				
			T6 < 85 °C				
Note: The list contains only some of the explosive materials.							


















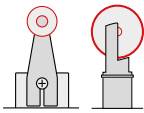
Table 4

Equipment protection level

Devices (equipment) for potentially explosive atmospheres are classified into protection levels (EPL: Equipment Protection Level). The marking consists of two letters.

The first letter indicates the type of explosive atmosphere: G for gas and D for dust. The second letter indicates the corresponding protection level (see Table 1).













Overview of ATEX safety engineering

		Electromechanical safety switches			
					
Marking according to					
ATEX	- Application (gases/dusts)	 Ex II 3 G D	 Ex II 3 G D	 Ex II 3 G D	 Ex II 3 G D
	- Equipment characteristics (gases)	Ex nR IIB T5 Gc	Ex nR IIB T5 Gc	Ex nR IIB T5 Gc	Ex nR IIB T4 Gc
	- Equipment characteristics (dusts)	Ex tc IIIC T90° Dc (NZHS) Ex tc IIIC T100° Dc (NZRS)	Ex tc IIIC T90° Dc	Ex tc IIIC T90° Dc X	Ex tc IIIC T110° Dc X
Approvals					
Features/specific advantages		- Basic housing according to EN 50041 - With impact resistant cover	- Basic housing according to EN 50041 - With impact resistant cover	- Identical mounting dimensions to safety switch STA - With impact resistant cover	- Metal actuating head - High locking force - With impact resistant cover
Inputs/outputs	Slow-action switching contacts				
	Positively driven contacts 	1 2 2 3 4	1 2 2 3 4	1 2 2 3 4	1 1 2 2 2 4
	NO contacts	1 - 2 1 -	1 - 2 1 -	1 - 2 1 -	1 - - 2 1 -
	NC contacts	- - - - -	- - - - -	- - - - -	- 1 - - 1 -
	Conventional thermal current	4 A	4 A	4 A	1 mA
	Switching current, min. (at 24 V)	1 mA	1 mA	1 mA	1 mA
	Mechanical life, min.	30 x 10 ⁶	2 x 10 ⁶	2 x 10 ⁶	1 x 10 ⁶
Environment	Housing material	Anodized die-cast alloy	Anodized die-cast alloy	Die-cast alloy	Die-cast alloy
	Housing dimensions, min. (HxWxD)	128 x 44 x 43.5 mm	142 x 44 x 43.5 mm	123 x 45 x 52 mm	191 x 43 x 46 mm
	Ambient temperature	-20 to +75 °C	-20 to +75 °C	-10 to +75 °C	-20 to +75 °C
	Degree of protection, max., acc. to IEC 60529	IP67	IP67	IP67	IP67
	LED indicators	-	-	-	-
	Approach/actuating directions	Depending on actuator 			
	Approach speed, max.	20 m/min.	20 m/min.	20 m/min.	20 m/min.
Guard locking	Solenoid operating voltage	-	-	-	24 V
	Power consumption	-	-	-	8 W
	Locking force, max.	-	-	-	3000 N
Connection	Cable entry (ATEX cable gland included)	M 20 x 1.5	M 20 x 1.5	3 x M 20 x 1.5	3 x M 20 x 1.5
	Accessories				
Accessories	Straight actuator/bent		●/-	●/●	●/●
	Hinged actuator		●	●	●
	Door radius, min.		165 mm	200 mm	200 mm
	Bolts for safety guards		-	-	-

● optionally available ○ available on request - not applicable

The specified data refer to the respective minimum and/or maximum values for the entire series.

Overview of ATEX safety engineering

				Transponder-coded safety switches		
				Without guard locking		With guard locking
						
				Safety switch CES-A-C5...EX	Safety switch CES-C04	Safety switch CTP...EX
Marking according to						
ATEX	- Application (gases/dusts)			Ex ic nA IIB T5 Gc X	Ex nA IIB T6 Gc X	Ex nA IIB T4 Gc X
	- Equipment characteristics (gases)			Ex ic tc IIIC T90° Dc X	Ex tc IIIC T80° Dc X	Ex tc IIIC T110° Dc X
	- Equipment characteristics (dusts)			Ex ic tc IIIC T90° Dc X	Ex tc IIIC T80° Dc X	Ex tc IIIC T110° Dc X
Safety category PL acc. to EN ISO 13849-1				Cat. 4 / PL e	Cat. 4 / PL e	Cat. 4 / PL e
Approvals						
Features/specific advantages				<ul style="list-style-type: none"> - No own pulsing of the safety outputs - External pulsing (possible with safe PLC, for example) 	<ul style="list-style-type: none"> - CES-C04 AP/AR switches may be used in potentially explosive atmospheres only when equipped with housing guard AM-C-C04-Ex-137528 - separate pulsing on safety outputs to detect short circuits 	<ul style="list-style-type: none"> - Metal actuating head - Attachment compatible with safety switch STA - With impact resistant cover - separate pulsing on safety outputs to detect short circuits
Inputs/outputs	Semiconductor safety outputs			2	2	2
	Monitoring outputs (semiconductor)			1	1	2
	Switching current per safety output (semiconductor)			100 mA	150 mA	150 mA
	Mechanical life, min.			-	-	1x10 ⁶
Environment	Switch			Integrated evaluation unit/ read head	Integrated evaluation unit/ read head	Integrated evaluation unit/ read head
	Dimensions, min. (HxWxD)			118 x 40 x 40 mm	75 x 30 x 20 mm	245 x 45 x 43 mm
	Ambient temperature			-20 to +50 °C	0 to +65 °C	-20 to +55 °C
	Degree of protection, max., according to IEC 60529			IP67	IP67/IP69/IP69K	IP65/IP67
	LED indicators			2	2	3
	Approach directions					
Guard locking	Solenoid operating voltage			-	-	24 DC
	Power consumption, max.			-	-	6 W
	Locking force, max.			-	-	2600 N
Connection	Plug connector			Plug connector M 12	Plug connector M 8 / connection cable	Plug connector M 12
	Rectangular actuator (transponder)			Typical switch-on distance: 22 mm	Typical switch-on distance: 14 mm	Straight actuator
Accessories	Bolts for safety guards			-	-	-

● optionally available ○ available on request - not applicable

The specified data refer to the respective minimum and/or maximum values for the entire series.

Ordering table

Item	Order no.	Guard locking type	Monitoring of solenoid position ¹⁾	Monitoring of door position ¹⁾	Suitable for zone G=gases/D=dusts	Temperature class/ max. surface temperature
Electromechanical safety switches						
NZ1RS-3131-M-EX	094169	---	---	⊖ 2 pos. dr. + 2 NO	2 / 22	T5/100 °C
NZ1HS-3131-M-EX	094167	---	---	⊖ 2 pos. dr. + 2 NO	2 / 22	T5/90 °C
NZ1VZ-2131E-M-EX	093660	---	---	⊖ 3 pos. dr. + 1 NO	2 / 22	T5/90 °C
SGA1A-2131A-M-EX	123460	---	---	⊖ 3 pos. dr. + 1 NO	2 / 22	T5/90 °C
STA3A-2131A024MF-EX	115584	Closed-circuit current principle	 ⊖ 2 pos. dr. + 1 NO	1 NC	2 / 22	T4/110 °C
STA4A-2131A024MF-EX	115585	Open-circuit current principle	 ⊖ 2 pos. dr. + 1 NO	1 NC	2 / 22	T4/110 °C
STA3A-4121A024MF-EX	115586	Closed-circuit current principle	 ⊖ 2 pos. dr.	1 NC + 1 NO	2 / 22	T4/110 °C
STA4A-4121A024MF-EX	123076	Open-circuit current principle	 ⊖ 2 pos. dr.	1 NC + 1 NO	2 / 22	T4/110 °C
Transponder-coded safety switches						
Safety switches without guard locking						
CES-A-C5H-01-EX (Unicode)	097945	---	---	2 safety outputs (semiconductor)	2 / 22	T5/90 °C
Actuator: CES-A-BBA-EX	098158				2 / 22	T6/85 °C
CES-A-BPA-EX	102125				2 / 22	T6/85 °C
CES-C04 (version AP/AR)	any			2 safety outputs (semiconductor)	2 / 22	T6/80 °C
Equipment protection: AM-C-C04-EX	137528				2 / 22	T6/85 °C
Actuator: CES-A-BBN-C04-EX	137527				2 / 22	T6/85 °C
Safety switches with guard locking						
CTP-L1-AP-U-HA-AZ-SA-EX (Unicode)	136675	Closed-circuit current principle	2 safety outputs (semiconductor) + monitoring output OL	1 monitoring output OD (semiconductor)	2 / 22	T4/110 °C
CTP-L1-AP-U-HA-AZ-SA-EX (Unicode)	129512	Closed-circuit current principle	2 safety outputs (semiconductor) + diagnostics output OI	1 monitoring output OD (semiconductor)	2 / 22	T4/110 °C
Actuator (straight): A-C-H-G-LS-EX	136826				2 / 22	T4/110 °C

1) pos. dr.: positively driven normally closed contact; NC: normally closed contact, NO: normally open contact

Further information

Details about the various ATEX safety switches and accessories can be found on our homepage at www.euchner.com



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