



Electrical equipment for potentially explosive atmospheres.

Understanding the marking of an equipment intended for use in hazardous areas is often difficult. INERIS gives here some keys to compare marking issued from international, north american and european standards in the field of explosion protection.

Ex marking

| IEC | US (NEC 505) | US (NEC 500) | CENELEC |
|--|---|---|--|
| Explosion protected I.S. output Group Gas group Ex d [ia] IIC T5 Method of protection Temperature class | Permitted class American national standard Method of protection Group Gas group Class I, Zone I, AEx d [ia] IIC T5 Permitted zone Explosion protected I.S. output Temperature class | Method of protection <i>(optional except for I.S.)</i> Permitted class Explosionproof with I.S. Outputs, Class I, Division I, Groups A,B,C,D,T5 Permitted division <i>(optional except for division 2)</i> Permitted gas group Temperature class <i>(T5 & T6 optional)</i> | European standard Method of protection Group EEx d [ia] IIC T5 I.S. output Gas group Explosion protected Temperature class |

Area classification

| IEC CENELEC | Flammable material Present continuously | Flammable material Present intermittently | Flammable material Present abnormally |
|--------------------------|--|--|--|
| | Zone 0 <i>(Zone 20 - Dust)</i> | Zone 1 <i>(Zone 21 - Dust)</i> | Zone 2 <i>(Zone 22 - Dust)</i> |
| US NEC 505 NEC 500 | Zone 0 | Zone 1 | Zone 2 |
| | Division 1 | | Division 2 |

INERIS
notified
body

INERIS (*) is one of the notified bodies in European Union approved to carry out the conformity assessment procedures for equipment in hazardous areas. It can assist designers, manufacturers and users of such equipment. INERIS can also assume tests in order to obtain an overseas certification (Factory Mutual in States or CANMET in Canada, ...).

(*) INERIS steaming from CERCHAR

Training

INERIS technical courses:

- Provide you the essential knowledges about the ATEX European compliance in order to obtain the CE marking.
- Analyse the key elements of the other new approach directives as Electromagnetic Compatibility or Machinery directives.

(Training on your site or at INERIS).

Marking

According to the ATEX directive

Equipment group II (other than mines)

Category 1 (for zone 0 or 20)
 2 (for zone 1 or 21)
 3 (for zone 2 or 22)

G for gases, vapours and mist

D for dusts

Equipment group I

Category M1 and M2





The following figures inform you about relations between international applicable standards concerning protection methods and their applications according to hazardous areas classification.

Class I, Zone 0, 1 and 2 Protection Methods

| Area | Protection Methods | Applicable Certification Standards | | | | |
|---------------|---|---|---|---|--|--|
| | | UL | FM | CSA | IEC | CENELEC |
| Zone 0 | <ul style="list-style-type: none"> ■ Intrinsically safe, "ia" ■ Class I, Div. 1 Intrinsically safe method | UL 2279, Pt.11 ANSI/UL 913 | ----- FM 3610 | CSA-E79-11 CSA-157 | IEC 79-11 ----- | EN 50020 ----- |
| Zone 1 | <ul style="list-style-type: none"> ■ Encapsulation "m" ■ Flameproof "d" ■ Increased safety "e" ■ Intrinsically safe "ib" ■ Oil immersion "o" ■ Powder filling "q" ■ Purged/pressurized "p" ■ Any Class I, Zone 0 method ■ Any Class I, Div. I method | UL 2279, Pt.18 UL 2279, Pt.1 UL 2279, Pt.7 UL 2279, Pt.11 UL 2279, Pt.6 UL 2279, Pt.5 UL 2279, Pt.2 ----- ----- | FM 3614 FM 3618 FM 3619 FM 3610 FM 3621 FM 3622 FM 3620 ----- ----- | CSA-E79-18 CSA-E79-1 CSA-E79-7 CSA-E79-11 CSA-E79-6 CSA-E79-5 CSA-E79-2 ----- ----- | IEC 79-18 IEC 79-1 IEC 79-7 IEC 79-11 IEC 79-6 IEC 79-5 IEC 79-2 ----- ----- | EN 50028 EN 50018 EN 50019 EN 50020 EN 50015 EN 50017 EN 50016 ----- ----- |
| Zone 2 | <ul style="list-style-type: none"> ■ Nonincendive "NI" ■ Non-sparking device "nA" ■ Restricted breathing "nR" ■ Hermetically sealed "nC" ■ Any Class I, Zone 0 or 1 method ■ Any Class I, Div. 1 or 2 method | UL 2279, Pt.15 UL 2279, Pt.15 UL 2279, Pt.15 UL 2279, Pt.15 ----- ----- | FM 3611 ----- ----- ----- ----- ----- | CSA-E79-15 CSA-E79-15 CSA-E79-15 CSA-E79-15 ----- ----- | IEC 79-15 IEC 79-15 IEC 79-15 IEC 79-15 ----- ----- | EN 50021 EN 50021 EN 50021 EN 50021 ----- ----- |

INERIS resources and facilities

| | | |
|--|--|--|
| <p><u>Agreement, certification and evaluation</u></p> <ul style="list-style-type: none"> ■ Equipment and protective systems intended for use in potentially explosive atmospheres. ■ Equipment used in underground part of mines. ■ Safety components. ■ Protective personal equipment. ■ Explosives of civil uses. ■ Machines for the manufacture of pyrotechnics. ■ Explosive products and fireworks. ■ Opacity sensors metrology. | <p><u>Other services</u></p> <ul style="list-style-type: none"> ■ Risks due to electrostatic effects and lightning. ■ Routine tests according to international certification standards (IEC,...) and others requirements. ■ Training. ■ Assistance to users: risks analysis, area classification,... | <p><u>Full scale laboratory trials</u></p> <ul style="list-style-type: none"> ■ Testing equipment assuming temperatures until -50°C. ■ Ingress protection test chamber until 8m³. ■ Type tests of electrical and non-electrical equipment for use in explosion-hazardous areas (intrinsic safety, protection by enclosures,...). ■ Large scale facilities: fire test cell, explosive firing ranges, dust explosion cells, fire development chambers, anechoic chamber. |
|--|--|--|



Class 1

Flammable gases, vapors or liquids

Area classification

■ Division 1 and Zone 0

Where ignitable concentrations of flammable gases, vapors or liquids can exist all of the time or some of the time under normal operating conditions.

■ Zone 1

Where ignitable concentrations of flammable gases, vapors or liquids can exist some of the time under normal operating conditions.

■ Division 2 and Zone 2

Where ignitable concentrations of flammable gases, vapors or liquids are not likely to exist under normal operating conditions.

Groups

■ Division 1 and 2

- A (Acetylene)
- B (Hydrogen)
- C (Ethylene)
- D (Propane)

■ Zone 0, 1 and 2

- IIC (Acetylene & Hydrogen)
- IIB (Ethylene)
- IIA (Propane)

Class 2

Combustible dusts

Area classification

■ Division 1

Where ignitable concentrations of combustible dusts can exist all of the time or some of the time under normal operating conditions.

■ Division 2

Where ignitable concentrations of combustible dusts are not likely to exist under normal operating conditions.

Groups

■ Division 1 and 2

- E (Metals)
- F (Coal)
- G (Grain)

Class 3

Ignitable fibers & flyings

Area classification

■ Division 1

Where ignitable concentrations of ignitable fibers and flyings can exist all of the time or some of the time under normal operating conditions.

■ Division 2

Where ignitable concentrations of ignitable fibers and flyings are not likely to exist under normal operating conditions.

Groups

■ Division 1 and 2

None



Ingress Protection (IP)

| FIRST NUMBER | | SECOND NUMBER | |
|---------------------------------|-----------------------------|---------------------------|--|
| Protection against solid bodies | | Protection against liquid | |
| 0 | No protection | No protection | |
| 1 | Objects greater than 50 mm | Vertically dripping water | |
| 2 | Objects greater than 12 mm | 75° to 90° dripping water | |
| 3 | Objects greater than 2,5 mm | Sprayed water | |
| 4 | Objects greater than 1 mm | Splashed water | |
| 5 | Dust-protected | Water jets | |
| 6 | Dust-tight | Powerfull water jets | |
| 7 | | Temporary immersion | |
| 8 | | Continuous immersion | |

| APPROXIMATE US ENCLOSURE TYPE EQUIVALENT TO IPXX | | | | | |
|--|----|--------|----|----------|----|
| Type | IP | Type | IP | Type | IP |
| 1 | 10 | 3S | 54 | 6 & 6P | 67 |
| 2 | 11 | 4 & 4X | 55 | 12 & 12K | 52 |
| 3 | 54 | 5 | 52 | 13 | 54 |
| 3R | 14 | | | | |

Apparatus Grouping

| TYPICAL GAS | US (NEC 505) IEC CENELEC | US (NEC 500) |
|---|---|---|
| Acetylene Hydrogen Ethylene Propane Methane | Group IIC (Group IIB + H ₂) Group IIB Group IIA Group I | Class I / Group A Class I / Group B Class I / Group C Class I / Group D Gassy mines |
| Maximum surface Temperature | US (NEC 505) IEC CENELEC | US (NEC 500) |
| 450°C | T1 | T1 |
| 300°C | T2 | T2 |
| 280°C | | T2A |
| 260°C | | T2B |
| 230°C | | T2C |
| 215°C | | T2D |
| 200°C | T3 | T3 |
| 180°C | | T3A |
| 165°C | | T3B |
| 160°C | | T3C |
| 135°C | T4 | T4 |
| 120°C | | T4A |
| 100°C | T5 | T5 |
| 85°C | T6 | T6 |

who to contact

André Mallet
Tel: +33 (0)3 44 55 65 43
e-mail: Andre.Mallet@ineris.fr

Bernard Piquette
Tel: +33 (0)3 44 55 65 44
e-mail: Bernard.Piquette@ineris.fr

Alain Czyz
Tel: +33 (0)3 44 55 65 42
e-mail: Alain.Czyz@ineris.fr

Reciprocal agreements

FMRC
(Factory Mutual Research Corporation)
1151 Boston-Providence Turnpike
P.O. Box 9102
Nordwood MA 02062-9102
U.S.A.
Tel: 781 255 4840
Fax: 781 762 9375
e.mail: Approvals@factory-mutual.com

CANMET - CERL
(Canada Center for Mineral and Energy Technology)
Natural Resources, Canada
Canadian Explosives Research Laboratory
c/o 555 Booth street
OTTAWA, ONTARIO. CANADA
K1A 0G1
Tel: 613 996 1902
Fax: 613 996 2597
e.mail: mcote@rncan.gc.ca

B.K.I.
(Budapest Mikoviny Samuel)
u.2-4 H1037
PF 115
H.1300 Budapest . HUNGARY
Tel /Fax: 36 1 250 17 20
e.mail: bkiex@elender.hu

G.I.G.
(Główny Instytut Gornictwa)
Central Mining Institute
Plac Gwarkow n°1
40166 Katowice . POLAND
Tel: 48 32 581 631
Fax: 48 32 596 533
e.mail: gig@boruta.gig.katovice.pi