Hazardous Area Regulations

# Safety Competence

## Hazardous Area Regulations and Standards

**Weighing equipment and control terminals intended for use in explosive atmospheres must comply with extensive regulations, standards and directives before they can be traded and operated worldwide.**

Safety is crucial for industries that operate in potentially explosive environments. Standards and regulations play an important role in these hazardous manufacturing venues by specifying the framework of conditions which guide both equipment manufacturers and operators to help ensure safety in manufacturing.

This paper provides insights into safety regulations and standards for hazardous area use around the world. It explains their relevance for the processing industries and also highlights how they can be applied when choosing weighing equipment that will be used in hazardous locations.


**Contents**



METTLER TOLEDO

# 1 Why Regulate Hazardous Areas?

Increasing numbers of accidents in processing industries globally are highlighting the importance for comprehensive, harmonized safety regulations and guidelines.

Safety problems related to the design and use of electrical equipment in hazardous areas have led authorities to impose strict rules. It has also elicited awareness of safe-equipment design.

Equipment design is regulated by regional notified bodies. National differences in technical requirements and approvals for explosion-protected equipment make significant demands – primarily on global companies. They require considerable transparency in development and testing.

Standards and regulations governing equipment used where there is explosion risk cover everything from risk assessment and classification up to the product certification and employee protection requirements.

Recognized authorities work to develop uniform standards on both a national and international scale. However, historical and country-specific developments have meant that many safety concepts – including explosion protection – do not yet have a corresponding global standard in place (Figure 1).

**Globally harmonized standards and mandatory safety regulations would help facilitate the free movement of goods by identifying a uniformly recognized framework. However, no truly globally recognized schema yet exists.**

Whether looking country-by-country or seeking to understand international standards, manufacturers of equipment applied in hazardous areas are responsible for designing and producing equipment in accordance with the appropriate standards. The equipment must be certified and comply with regional or country specific regulations where products are to be shipped. These companies are confronted with different protective measures and operator obligations in each case, and it is important that they understand and operate in compliance with relevant rules.

In addition, equipment purchaser is responsible for the safety and protection of their workers. Therefore, those companies must ensure that the equipment they select is designed in accordance with the appropriate safety regulations and standards. They are also responsible for training of their employees to safely operate equipment installed in hazardous areas.


Figure 1. Worldwide Hazardous Standards and Regulations

# 2 Global Regulations for Electrical Equipment

There are two major global organizations that set hazardous-area standards globally.

One is the International Electro-Technical Commission (IEC). This is the premier international standardization organization for electric, electronic and related technologies. The aim of the IEC is to harmonize the many different standards and regulations throughout the world and to remove trade barriers for related products. For example, the IEC 60079 standards are related to the general requirements for hazardous areas. The IEC system is followed in Europe, Asia, Australia, Africa and some other regions.

The second system is the North American system with the National Electrical Code (NEC) Guidelines, which are published by the National Fire Protection Association (NFPA).

The requirements for hazardous areas and safety in the workplace are defined in ATEX directives in the European Union and in NEC articles in the USA.
To promote the harmonization of standards, many local regulatory bodies worldwide have totally or partly adopted to the IEC standards. Even the NEC and the Canadian Electrical Code (CEC) are now partly recognizing the IEC/CENELEC hazardous-areas certification system (Figure 2).

In the following chapters we explore the differences among existing standards and their adoption in various countries worldwide.

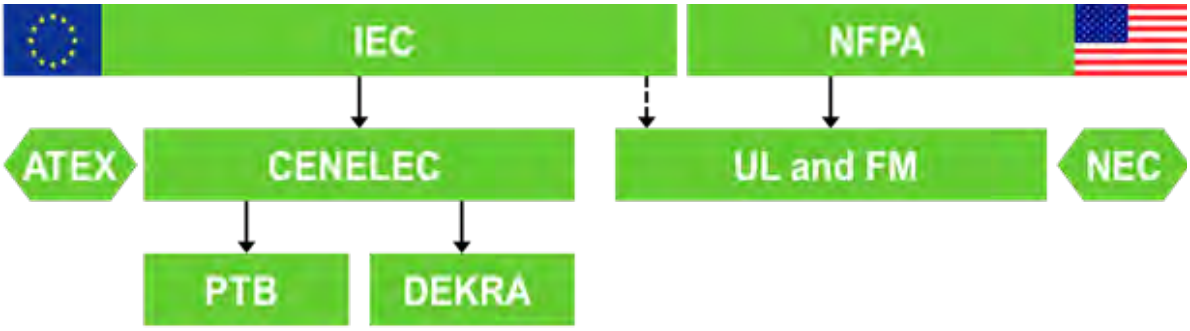


Figure 2. Global View of Hazardous Standards and Regulations

# 3 European Standards and Directives

To establish requirements and safety standards that are the same throughout Europe, the EC commission has compiled product-related "European Directives." These directives apply to all types of products.
The corresponding European standards developed the European Committee for Electrotechnical Standardization (CENELEC).

One function of CENELEC is to establish uniform standards, testing procedures and markings for equipment to be used in hazardous areas. The objective of CENELEC is to encourage free trade of certified equipment for hazardous areas between member countries. Generally, CENELEC utilizes IEC standards. However, in some cases, CENELEC provides more precise requirements.

CENELEC does not perform product testing. Other organizations called "Notified Bodies" (NB) carry out product testing according to European Norms and ATEX directives. There are several "Notified Bodies" throughout Europe. Two examples are the PTB, located in Germany, and Dekra, located in the Netherlands (Figure 3).

## ATEX Directive

ATEX stands for "atmosphere explosibles," which is the French term for "potentially explosive atmosphere."

The ATEX Directive was introduced to remove trade barriers within Europe. It is a **mandatory legal directive** relying on several forms of conformity assessment. Its purpose is to set a level of perceived safety, which is to be regarded as "good enough" to ensure that national authorities would have no reason to prevent free trade within the European Community.

The two directives concerned with hazardous areas are ATEX94/9/EC and ATEX 1999/92/EC. The directives describe the equipment and the work environment acceptable within an explosive atmosphere.

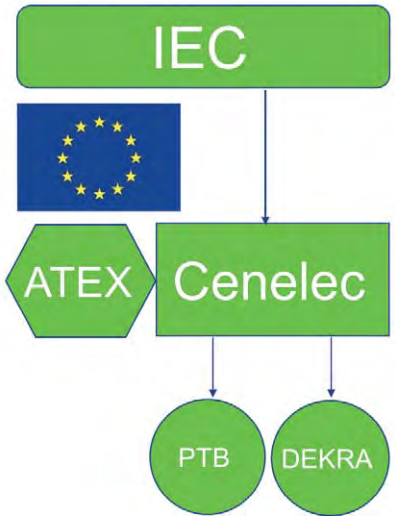


Figure 3. European Standardisation Schema

## The ATEX Product Directive – 94/9/EC

**The ATEX 94/9/EC Directive** applies to the manufacture and distribution of equipment and protective systems intended to use in potentially explosive atmospheres.

The main objective of this directive is to eliminate or minimize the risks resulting from the use of specified equipment in potentially explosive atmospheres. It specifies the Essential Health and Safety Requirements (EHSRs) relating to the design and construction of the equipment and protective systems intended for use in such atmospheres.

The directive became available for use in March 1996 and became mandatory in July 2003. The sixth revised edition of ATEX Guidelines was issued in 2012 and went into force July 1, 2013.

The directive is a new approach for CE Marking of the equipment and is intended to enable the free movement of goods within the European Community.

**Ultimately, it is the equipment manufacturer's responsibility to ensure that the equipment produced and certified for use in potentially explosive atmospheres complies with the scope of the above directive.**

As such, the manufacturer must:

- Carry out a risk assessment;
- Identify ignition sources;
- Define the requirements of the equipment to be used inside potentially explosive atmospheres and the controlling devices installed in the safe area contributing to the safe operation; and
- Produce and certify the equipment.

Directive 94/9/EC deals with the special risk of explosion and has one major aim: to prevent its "own potential source of ignition." The directive defines two equipment groups divided into five equipment categories. Equipment categories define the required level of protection for equipment.

- **Group I** equipment applies to equipment used in underground operations, such as mines.
- **Group II** equipment applies to surface-processing industries. The petrochemical, chemical, pharmaceutical as well as food industries are these typical processing industries (Figure 4).

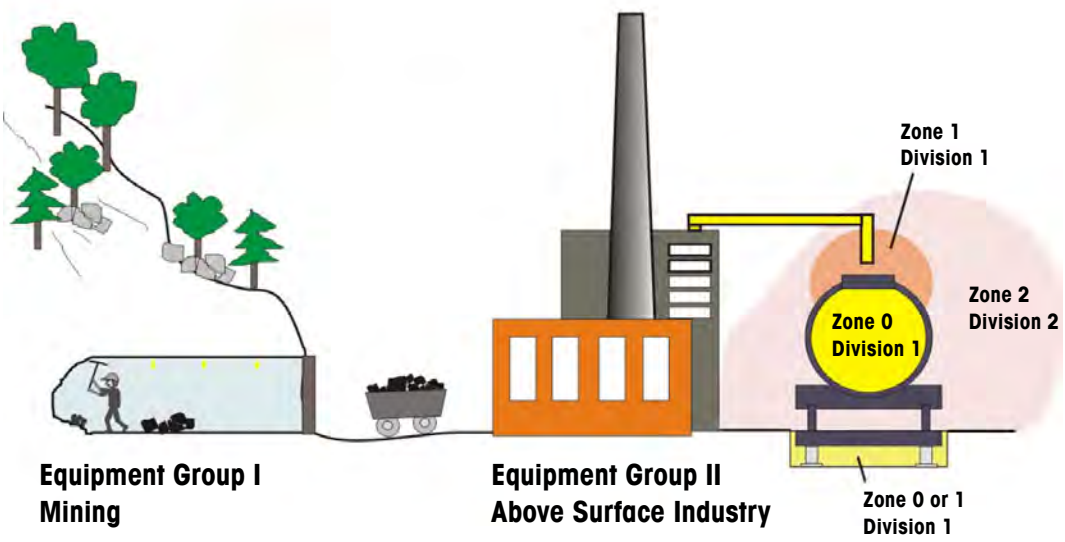


Figure 4. Definition of Equipment Groups and Categories According to the ATEX94/9/EC

The equipment groups are further sub-divided into categories as shown in the Table 1. Group I is divided into categories M1 and M2. Group II is sub-divided into equipment categories 1, 2 and 3.

| | Category of Equipment | Hazardous Atmosphere | Level of Ignition Protection | Conditions of Operation | Performance of Protection |
|---|---|---|---|---|---|
| Equipment Group I | M1 | Methane, Dust | Very High | Equipment remains energized and functioning when explosive atmosphere present | 2 independent protection methods or safe with 2 faults |
| | M2 | | High | Equipment is de-energized in the event of an explosive atmosphere | Sufficient level of safety during the normal operating conditions |
| Equipment Group II | Cat.1 | Gas, Vapor, Mist, Dust | Very High | Equipment remains energized and functioning in Zones 0,1,2 (G) and/or 20, 21,22 (D) | 2 independent protection methods, or safe with 2 faults |
| | Cat.2 | | High | Equipment remains energized and functioning in Zones 1,2 (G) and/or 21,22 (D) | Suitable for normal operation and frequently occurring disturbances, or safe with 1 fault |
| | Cat.3 | | Normal | Equipment remains energized and functioning in Zones 2 (G) and/or 22 (D) | Suitable for normal operation |

Table 1. Equipment Group and Category Classification According to ATEX 94/9/EC

In some cases, the manufacturer has the option of performing and documenting the testing procedure themselves. However, typically a notified body, such as British Standards Institution (BSI) in the UK, and TÜV, Dekra, PTB (etc.) in Germany must carry out an EC examination and certification. Additionally, to fulfill all requirements of the directive 94/9/EC as well as any further directive applicable in EU community, the manufacturer issues an "EC Declaration of Conformity."

To allow free movement of goods through Europe, the CE and Ex Marking must be affixed to the equipment.

## CE Marking

CE marking is mandatory and **must be placed before equipment is assigned to be distributed** on the market or put into service. It is intended to facilitate the free movement of equipment within the European Union by signifying that essential health and safety standards have been met. It used as a declaration that the product was produced in conformity with all applicable provisions and requirements of the Directive 94/9/EC, and that the product has been the subject of the appropriate conformity assessment procedures (Figure 5).

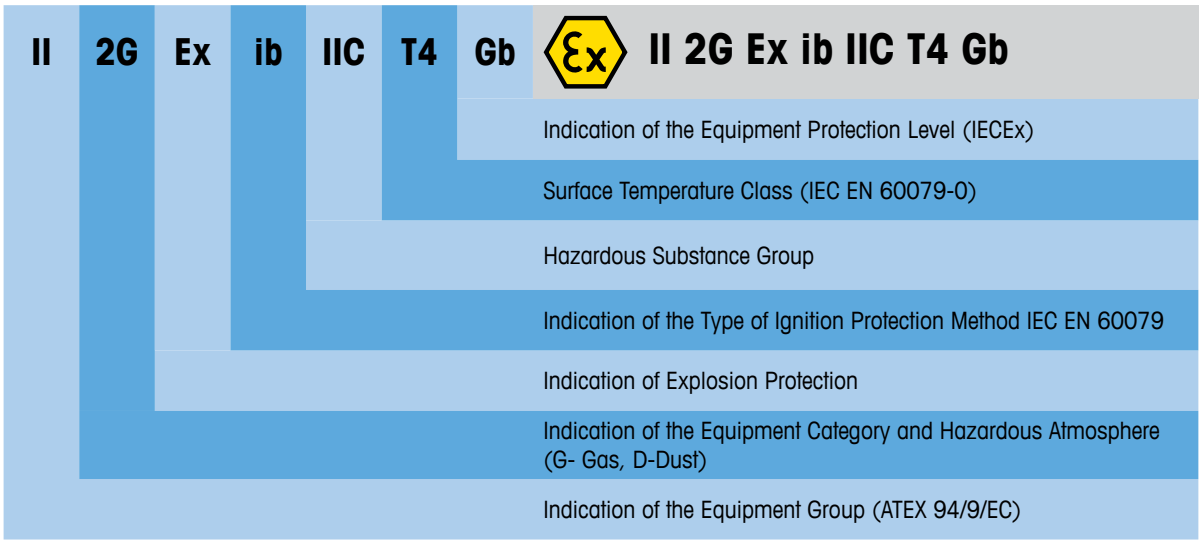

Figure 5. Typical Electrical Equipment Marking According to ATEX 94/9/EC

## The ATEX Workplace Directive - 1999/92/EC

**ATEX 1999/92/EC or ATEX 137** Directive is applied for **users of equipment** in potentially explosive atmospheres. It provides minimum requirements for improving the health and safety protection of workers potentially at risk from explosive atmospheres.

The directive is intended to complement ATEX 94/9/EC and offers health and safety protection for employees in hazardous areas. **The directive also applies to the installation and use of electrical equipment.**

The general requirements for employers are to eliminate or control the risks from dangerous substances. In addition, the directive requires conducting the risk assessment and classification of areas into "Zones" where hazardous explosive atmospheres may occur. This is done according to explosion probability.

## Employer Obligations

The directive sets out specific obligations that employers must fulfill. At this point, all existing workplaces must comply with the requirements, which were established June 30, 2003 and went into full effect by June 30, 2006.

These obligations include:

- Prevent and protect against explosions;
- Carry out an assessment of explosion risks;
- Ensure safe working conditions including the provision of instructions, training, supervision and technical measures;
- Classify areas where explosive atmospheres may occur into Zones, including appropriate marking of entry points into such areas;
- Select appropriate equipment, e.g identify possible ignition sources; and
- Prepare an explosion protection document, which is intended to demonstrate that explosion risks have been identified and assessed and show that adequate prevention and protection measures have been taken.

## Zone Classification

According to the ATEX 1999/92/EC Directive, hazardous areas are divided into three zones for gases and three zones for dust substances.
The classification given to a particular zone, its size and location is made based on the frequency and duration of the occurrence of the explosive atmosphere (Table 2).

| Zone Classification | | |
|---|---|---|
| Gas | Zone 0 | An explosive atmosphere is present **continuously** or for **long periods of time**. |
| | Zone 1 | An explosive atmosphere is likely to **occur occasionally** during normal operation. |
| | Zone 2 | An explosive atmosphere is likely to **occur infrequently** or for **short periods of time**. |
| Dust | Zone 20 | An explosive atmosphere is present **continuously** or for **long periods of time**. |
| | Zone 21 | An explosive atmosphere is likely to **occur occasionally** during normal operation. |
| | Zone 22 | An explosive atmosphere is likely to **occur infrequently** or for **short periods of time**. |

Table 2. Zone Classification According to ATEX 1999/92/EC

Table 2 shows the Zones classification concept. The concept has been used successfully for many years for specification and selection of electrical equipment for explosive gas and dust atmospheres. The Zone 0, 1, and 2 are used to denote explosive atmospheres containing gases and vapors. The Zone 20, 21, and 22 are the Zones containing explosive and flammable dusts.

A methodology for potentially explosive area classification is also available in European Standards EN 60079-10 for both gases and vapors and EN 50281-3 for dusts. The methodology applied in the standards is based on the concept of three "sources of release," namely continuous primary and secondary. Figure 6 shows the classification of the Zones based on the above mentioned standards.

The processing industries, including petrochemical, chemical and pharmaceutical, are named surface industries and belong to Group II industries. They are exposed to gas as well as to dust-laden atmospheres.

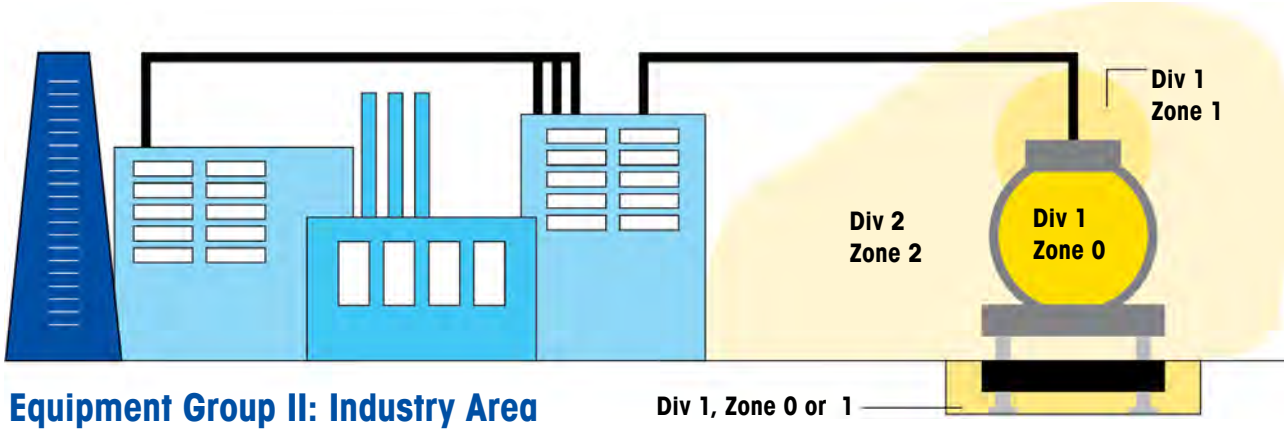


Figure 6. Hazardous Areas Classification According to IEC EN 60079-10

## Equipment Selection

The Directive 1999/92/EC specifies criteria for the selection of equipment and protective systems. According to the directive, the equipment to be used in the classified Zones must be selected to the assigned equipment categories which are scope of the ATEX 94/9/EC Directive.

The equipment categories that must be used in the classified hazardous Zones are shown in the table 3.

Table 3 presents an overview of the relationship between hazardous-areas classification, equipment categories and EPL.

Equipment category 1G / 1D or Ga / Da correspond to a **"very high" level of protection**. The equipment is safe even when rare equipment fault is possible or safe with two faults.

| Equipment Group | Zone Classification | | Equipment Category (ATEX 1999/92/EC) | Equipment Protection Level (EPL) (IEC/ CENELEC) | |
|---|---|---|---|---|---|
| | Gas | Dust | | Gas | Dust |
| II | 0 | 20 | Cat. 1 | Ga | Da |
| | 1 | 21 | Cat. 1 or 2 | Gb | Db |
| | 2 | 22 | Cat. 1, 2 or 3 | Gc | Dc |

Table 3. Equipment Selection according to Zone Classification

The general principles and basic protection concepts for electrical equipment are defined in European Standard IEC EN60079- 0, and for non-electrical equipment in the standards IEC EN 13463-1. The user can apply these principles to their equipment selection.

In terms of harmonization the IEC /CENELEC have introduced other terms, such as equipment protection level (EPL). Both classifications can be used when marking equipment.

Equipment category 2G / 2D or Gb / Db are considered **"high safety level"** or **"high protection level."** The equipment is suitable for normal operation and frequently occurring disturbances, or safe with one fault.

Equipment category 3G / 3D or Gc / Dc is the **"normal"** protection level, which means that the equipment is suitable for normal operation in the areas where the explosive atmosphere occurs occasionally.

Unlike ATEX 94/9/EC, countries could adapt or adopt this directive according to their particular local regulations.

# 4 Comparison of ATEX 94/9/EC and ATEX 1999/92/EC

Table 4 shows the comparison between two directives for manufacturers and for employees. There is a direct link between the two directives in that the three equipment categories specified in ATEX 94/9/EC correspond to the three Zones used in ATEX 1999/92/EC for the classification of hazardous areas.

Therefore, in Zone 2/22, equipment category 3 may be used, whereas in Zone 0/20 (explosive atmosphere can be present continuously), equipment category 1 must be used.

| Manufacturer Requirements ATEX 94/9/EC | User Requirements ATEX 1999/92/EC |
|---|---|
| Definition of area of use of equipment, specification of equipment group / category | Risk assessment of hazardous area in working places, employee safety Gas |
| Equipment Category 1<br>Equipment Category 2<br>Equipment Category 3 | Zone 0/20<br>Zone 1/21<br>Zone 2/22 |
| Comply with essential safety and health requirements or relevant standards | Comply with installation and maintenance requirements |
| Carry out a risk / ignition-hazard assessment of equipment | Carry out a risk assessment of the work place, duty of coordination |
| Prepare conformity documentation | Prepare an explosion document |
| Appropriate quality control | Regular updates |
| Mandatory since July 2003 | Mandatory since October 2002 |

Table 4. Comparison ATEX 94/9/EC and ATEX 1999/92/EC

# 5 USA and Canada Regulations and Standards

Despite the fact that basic explosion-protection principles are similar all over the world, there are some differences in the techniques and systems which have been developed in North America. The main differences from the European IEC system are that they include classification of hazardous areas and equipment design and installation requirement for electrical equipment in potentially explosive atmospheres (Figure 7).

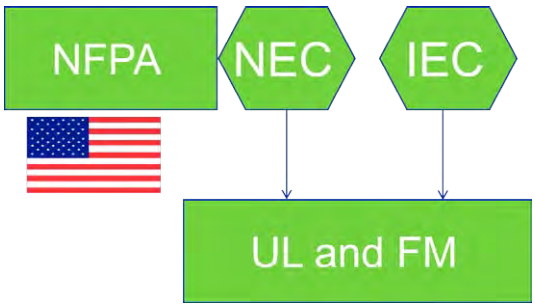


Figure 7. American Standardisation Schema

## Classification of Hazardous Areas - NEC System

In the USA, all regulations related to manufacturing facilities at risk are found in the National Electrical Code (NEC) Handbook. The articles 500, 501, 502, 503 define the requirements for classification of hazardous locations into Classes, Groups and Divisions.

In the 1990s, the National Electrical Code has developed the article NEC 505 which classifies hazardous locations of Class I Division 1 and 2 in three Zones (Zone 0, 1 and 2). This classification is based on the IEC/ CENELEC Zone classification system and is developed as an alternative classification to the Division classification system of NEC 500.

According to NEC 500 hazardous locations are divided into Substance Classes I, II, and III depending on the type of material present. Table 5 shows the classification of the hazardous locations according to NEC 500 - 505 articles.

- **Class I** locations are those in which flammable gases or vapors are present in the air in quantities sufficient to produce explosive or ignitable mixtures (NEC 501).
- **Class II** locations are those that the dust is present in quantities sufficient for a fire or explosion hazards to exist. To be considered a "dust" the combustible material must exist as finely divided solid particles of 420 microns (0.017 In) or less (NEC 502).
- **Class III** locations are those are hazardous because of the presence of easily ignitable fibers or flying's (NEC 503).

Article NEC 500 is used the classification of Class I and II in two Divisions - Division 1 and Division II. The classification depends on the likelihood of the flammable or combustible material being present in ignitable concentrations.

<table>
<tr><th rowspan="2">Substance</th><th rowspan="2">Substance Class</th><th colspan="2">Area Classification</th><th rowspan="2">Hazardous Location Characteristics</th></tr>
<tr><th>NEC500</th><th>NEC505</th></tr>
<tr><td rowspan="3">Gases / Vapors</td><td rowspan="3">Class I (NEC 501)</td><td rowspan="2">Division 1</td><td>Zone 0</td><td rowspan="2">Explosion hazard present continuously or occasionally under normal operating conditions</td></tr>
<tr><td>Zone 1</td></tr>
<tr><td>Division 2</td><td>Zone 2</td><td>Ignitable concentrations of flammable gases or vapors are not normally present, but could be present in the case of a fault</td></tr>
<tr><td rowspan="2">Dusts</td><td rowspan="2">Class II (NEC 502)</td><td>Division 1</td><td rowspan="2">-</td><td>Combustible dusts are presents in quantities sufficient to produce explosive and ignitable mixtures</td></tr>
<tr><td>Division 2</td><td>Combustible dust due to abnormal operations may be present in quantities sufficient to produce explosive or ignitable mixtures</td></tr>
<tr><td rowspan="2">Fibers</td><td rowspan="2">Class III (NEC 503)</td><td>Division 1</td><td rowspan="2">-</td><td>Easily ignitable fibers / flyings are handled or manufactured</td></tr>
<tr><td>Division 2</td><td>Easily ignitable fibers / flyings are stored or handled</td></tr>
</table>

Table 5. Hazardous Locations Classification System According to NEC 500 - 505.

Each Class is also divided into the material Groups A, B, C, D, E, F and G. Article 500-3 defines the classification of the of Substance classes into Substance groups according to their properties. Table 6 presents this classification.

| Substance Class | Substance Group (NEC 500) | Substance Group (NEC 505) | Substance Name |
|---|---|---|---|
| Class I | A | IIC | Acetylene |
| | B | | Hydrogen |
| | C | IIB | Ethylene |
| | D | IIA | Propane |
| Class II | E | IIIC | Combustible Metal Dust |
| | F | | Combustible |

Table 6. Substance Class / Group Classification according to NEC 500-3.

Article NEC 506 is an alternative classification system to Class II and Class III that is based on the Zones of the International Electrotechnical Commission (IEC). Zones 20, 21 and 22 apply to combustible dusts or ignitable fibers or flyings. Combustible metallic dusts are not covered by NEC article 506.

In Canada, the Canadian Electrical Code (CEC) defines related regulations. Section 18 of CEC and Annex J defines the requirements for hazardous-area classification. The CEC system accepts the IEC/CENELEC Zone classification system and maintains Class and Division standards in a separate Appendix.

The CEC includes the following rules:
Rule 18-000 – General Class I, Zone and Class II and III, Division requirements
Rule 18-090 – Specific Class I, Zone 0 requirements
Rule 18-100 – Specific Class I, Zone 1 and 2 requirements
Rule 18-200 – Specific Class II, Division requirements
Rule 18-300 – Specific Class III, Division requirements
Appendix J – General and Specific Class I, Division requirements

The NEC and CEC for Canada can be viewed as starting point from which all subsequent aspects of North American hazardous Installation Code (Haz Loc) are derived. The NEC codes include all details on equipment construction, performance and installation requirements as well.

## Equipment Construction and Installation Requirements

NEC articles 500 to 504 require equipment construction and installation that ensure safe performance under conditions of proper use and maintenance. Different standards and regulations apply to the construction and testing of explosion protected electrical equipment. The standards regulating electrical equipment design and construction are developed by Underwriters Laboratories Inc. (UL), Factory Mutual (FM) and International Society for Measurement and Control (ISA). In Canada the construction designed is regulated by the Canadian Standards Association (CSA).

## NEC Marking

Similar to European ATEX Guidelines/NEC System, these Systems require marking of electrical equipment to show the environment for which it has been evaluated. The marking includes the information specified in the NEC 500.8 (C1-5) (Figure 8).

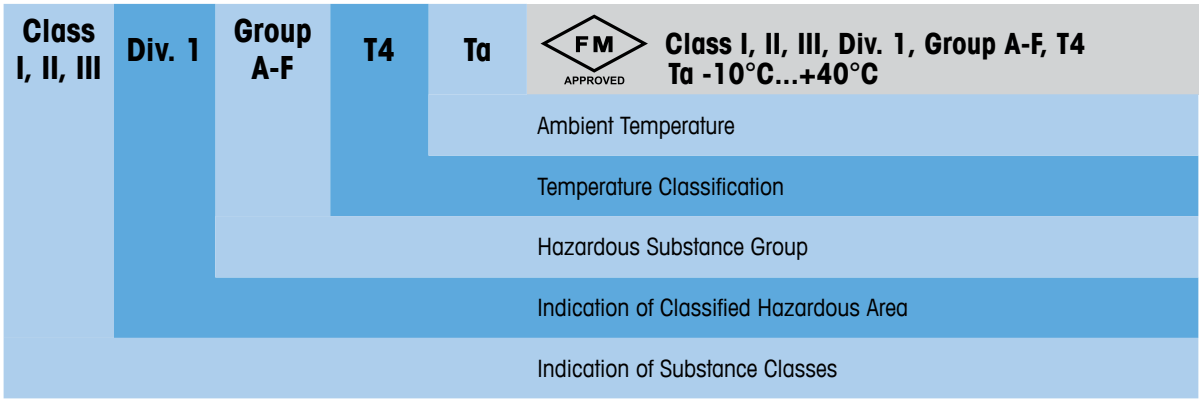


Figure 8. Example of the Electrical Equipment Marking According to NEC 500.

Example of the equipment marking according to NEC 505 is shown in Figure 9.

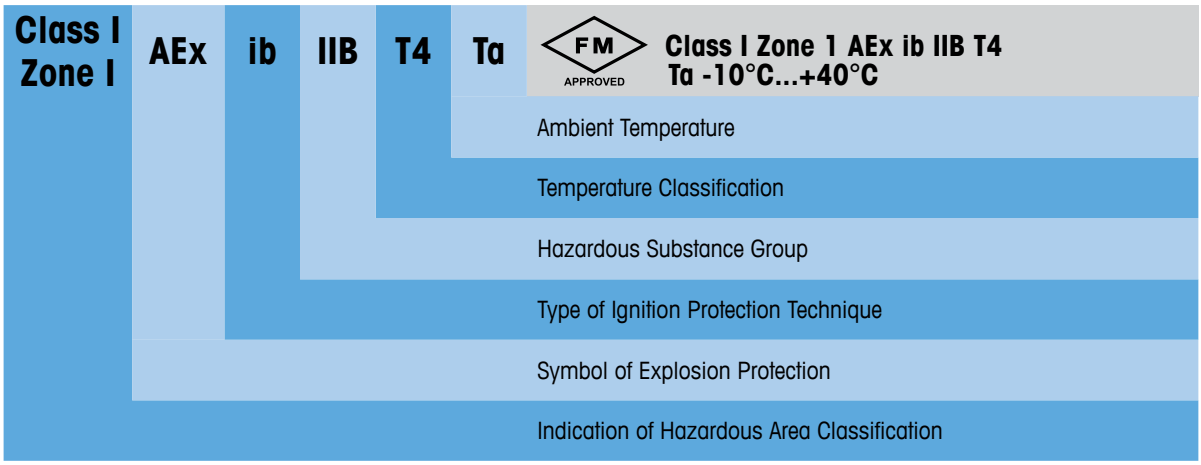


Figure 9. Example of the Electrical Equipment Marking According to NEC 505.

# 6 IECEx Standardization Scheme

IECEx is a single global certification framework based on IEC international standards, and it is fast becoming the preferred route for international safe certification of products for use in hazardous areas. It caters to countries whose national standards are either identical to those of the IEC or else very close to IEC standards. IECEx certification is a global concept, which reduces trade barriers caused by different conformity assessment criteria in various countries and opens up new markets with a worldwide certificate.

The scope of IECEx is defined by the standards issued by IEC Standards Committee TC 31. The general requirements for electrical equipment are covered by the IEC 60079-0 which defines a precise process for testing and certifying new products and appoints authorized bodies to carry out these tasks. The certification system is extended to cover maintenance and repairs for explosion-protected equipment.

A third aspect of the IECEx concept defines the expertise required by specialists working in areas at risk of explosion.

# 7 Bringing IECEx, ATEX and FM Together

A common route to compliance is to use pre-approved products in the specified manner. "Notified Bodies" such as Baseefa, Sira, TUV, Dekra Exam provide a conformity assessment to gain additional certification. Unfortunately for global export this is not always sufficient.

Global export requires an international solution that ensures equipment designs are acceptable in any part of the world without significant modification. The approach would use recognized practices to achieve a common acceptable level of safety with the goal of facilitating free trade across all major world markets. Table 7 highlights the similarities and the differences among the three major global standards.

| | ATEX | NEC/CEC | IECEx |
|---|---|---|---|
| **Regulatory Status** | Mandat | Mandatory System | Mandatory System |
| **Aim** | Covers equipment, remove barriers to trade and improve safety for equipment and workers | Covers electrical equipment, safe installation and maintenance | One single certificate for any hazardous area product and services recognized and accepted worldwide |
| **Conformity Basis** | Any Standards complying with the EU-directives (EHSR) (EN Standards) | US/Canadian Standards e.g. ISA, UL, FM, CAN/CSA | IEC Standards |
| **Area Classification** | Zone | Zone, Class and Division | Zone |
| **Conformity Assessor** | Ex Notified Bodies (Ex NB) Manufacturer | NRTLs (UL, FM, CSA,…) | Ex Certifying Bodies (ExCB) Ex test labs |
| **Issued documents** | EC-Type Examination Certificate | Certificate of conformity | Certificate of conformity |
| | Ex Test Report | Ex Test Report | Ex Test Report (ExTR) |
| | Ex QAM Certificate/Report | Ex Audit Report | Ex Quality Assessment Report |
| | | | Online availability of all documentation |
| **Acceptance** | European Union | North America, Canada | Worldwide with national deviations Australia / New Zeeland without national deviations |
| **Conformity Mark** | CE Ex | SP Ex FM APPROVED C US C UL US | IEC IECEx |
| **Regional Acceptance of Technical Report (TR)** | Europe, North America, Japan, Brazil, China | North America, Canada, Mexico | 36 IECEx Member States |

Table 7. Comparison ATEX / NEC / CEC and IECEX Directives

# 8 Examples of Regional Regulation

## China

In China, the certification of explosion-proof equipment is mandatory according to the following laws:
- Standardization Law of PRC
- Product Quality Law

According to these laws, the design, installation, usage, maintenance and rebuild of equipment for hazardous areas must comply with national standards.

In the last decade, several new standards were issued on explosion-protective equipment. Due to the policy of preferential adaptation of international standards, the Ex standards in China have adapted to relevant IEC standards.

The certification process in China is conducted by several certification bodies including:
- National Supervision and Inspection Center for Explosion Protection and Safety of Instrumentation (NEPSI) and
- China National Quality Supervision and Test Center for Explosion Protected Electrical Products (CQST)
- Supervision & Test Center of Ex-products of China Petroleum & Chemical Industry

As an Ex test lab (ExTL), NEPSI accepts IECEx test reports (ExTR) and ATEX reports, and based on that will issue a national certificate.

## Korea

The Korean Agency for Technology and Standards (KATS) is an official representative of the IECEx in Korea.

Similar to other countries, this Korean agency accepts an Ex Test Report (ExTR) and/or an ATEX Report as a basis for issuing national certification.

There are also several certification organizations in Korea:
- The Korean Occupational Safety and Health Agency (KOSHA) is the national certification organization that certifies electrical equipment in Korea. It works together with the Korea Electro-technology Research Institute (KERI) in terms of testing and certification of electrical equipment.
- KERI is a government-sponsored institution and it is approved for testing and certifying domestic and imported electric equipment with an international certification.

Both organizations adopted and follow IEC standards. There are also KTL testing and certification laboratories in Korea, which provide tests and certification on both national and imported electrical equipment.

## Russia

All electrical equipment used in hazardous areas must be certified in Russia and CIS countries as well. To confirm that equipment is manufactured according to standards requirements and is safe and reliable, it must undergo the approval procedure.

Certification in Russia is governed by federal laws and legislation. Each CIS country has its own approval certificates and permissions for operating in hazardous areas. The legal basis for such equipment certification is "Rules of certification of electrical equipment for explosive atmospheres" (PB 03-538-03). This decree is published by Russian Governmental Standards No:28/10 dated March 2003.

In Russia, explosion-protected equipment must comply with GOST R ex-proof standards. The corresponding certificate is issued by the "Rostest" testing and certification laboratory.

However, Russian ex-proof standards have been harmonized with IEC standards as well as European ATEX 95 and ATEX 137 Directives and relevant European norms. Russia is a member of the IECEx international certification system.

If the equipment is certified according to ATEX, UL, FM or CSA standards, the verification process to obtain the GOST R Ex-Proof Certificate of Conformity can be limited to document review with no additional laboratory testing.

# 9 Weighing Equipment Safety Requirements

Intrinsically safe weighing systems for hazardous area use consist of several components such as weighing platforms, control terminals, power supply interfaces, communication modules, safety barriers and usually a wide range of peripheral equipment such as PCs, printers or even data communication systems. Depending on weighing system requirements, the system must comply with not only the legal directives but also provide an appropriate safety concept that fulfills the requirements of numerous standards and regulations.

Choosing the right equipment depends upon application requirements as well as hazardous area classification. It is crucial to be aware of the possible risks and safety concepts. The figure and table below show the different weighing system components and related risks, and highlights the corresponding safety design concept (Figure 10, Table 8).

**Weighing System Safety Concept:**

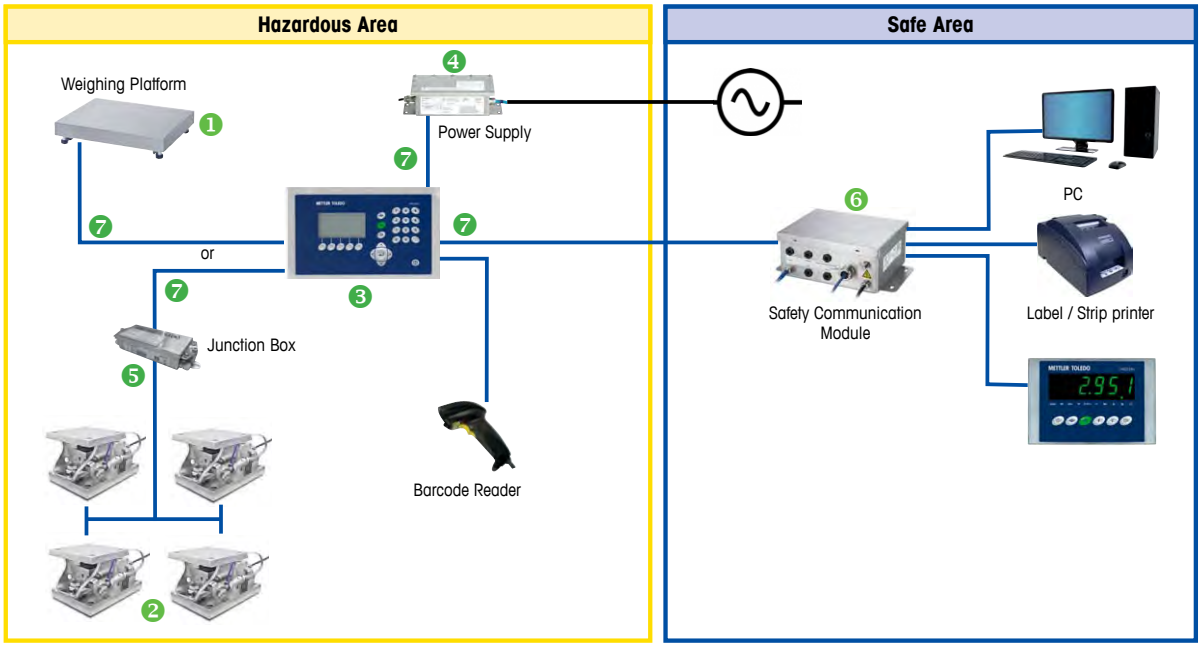


Figure 10. Weighing System Configuration in Hazardous Area Zone 1 / 21, Division 1

| No. | Name | Relevant Risks/Concerns | Design Safety Concept |
|---|---|---|---|
| **1** | Weighing Platform | Shock resistance, mechanical, electrical sparks, heat and static discharges, combustible dust particles, ingress of solid foreign bodies | Stainless steel housing, equipotential bonding, assessment according non-electrical components standard |
| **2** | Weigh modules | Shock resistance, mechanical sparks, heat and static discharges, ingress of solid foreign bodies | Intrinsically safe design (ib); non-sparking design (nA) dust-protected enclosure; ingress protection |
| **3** | Control terminal | Heat and static discharges, electrical transients combustible dust particles ingress of solid foreign bodies | Intrinsically safe design; non-sparking design (nA) dust protected enclosure; improved ingress protection (after aging, impact and high-low pressure test of IP level) |
| **4** | Power Supply | Heat and static discharges, electrical transients combustible dust particles ingress of solid foreign bodies, | Stainless steel housing, intrinsically safe design (ib) or non-sparking design (nA), increased safety (e) dust-protected enclosure, improved ingress protection (after aging, impact and high-low pressure test of IP level) |
| **5** | Junction Box | Heat and static discharges, ingress of solid foreign bodies | Stainless steel housing, intrinsically safe design (ib) or non-sparking design (nA), dust-protected enclosure, improved ingress protection (after aging, impact and high-low pressure test of IP level) |
| **6** | Communication Interface Module | Heat and static discharges, electrical transients | Stainless steel housing, intrinsically safe connection design (ib) or non-sparking connection design (nA), dust protected enclosure, Ingress protection |
| **7** | Wires | Cable glands, mechanical damage – safe conduit sealing rings in US | Used approved components, intrinsically safe design |

Table 8. Risk Concerns and Safety Concepts for Weighing Equipment Design

METTLER TOLEDO designs and develops the weighing solutions for hazardous areas according to the global standards and regulations in mind. All components of the weighing system follow the general requirements concept of IEC EN 60079-0 / FM 3600, UL 60079-0 and CSA 60079 certificates as well as the other certificates to ignition protection design and to the mechanical concepts. Testing and certification is done by certified notified bodies such as Dekra in Europe and FM in USA. All components of the system, therefore, comply with ATEX, IECEx and FM certificates (Figure 11).


Figure 11. Example of IECEx and ATEX approval certificates.

# 10 Responsibilities of Involved Parties

Everyone involved in construction, installation, operation and maintenance of electrical equipment for hazardous areas must work together to ensure safety in areas at risk of explosion.

## User

The user of the weighing system is responsible for the safety of their equipment and must comply with the relevant national laws and standards. Their primary duty is to assess the explosion risk in the facility and specify hazardous areas. These form the basis for the protective measures to be taken and for selecting appropriate equipment. The manufacturer must also ensure that all employees comply with protective measures and, if necessary, provide appropriate training. Additionally, the employing manufacturer is responsible for correct installation and commissioning. Regular maintenance and testing must be carried out to ensure safe operation of the weighing equipment. In the case of an equipment move, the new location must also be checked to ensure if it is appropriate for the equipment.

## Manufacturer

The equipment manufacturer is responsible for ensuring the weighing system is eligible for trade as intended. The duty of the manufacturer is to comply with the laws and directives of the country in question and carry out the appropriate testing and assessment procedures, ensuring that the relevant equipment markings and documentation are in line with the appropriate standards and regulations. In Europe, for example, equipment must have the CE and Ex markings as well as installation and operation instructions. An appropriate quality assurance system must be in place to ensure that every piece of equipment is produced using tested construction methods.

## Notified body

Notified bodies are the neutral and independent organizations whose main task is to carry out conformity assessments on products intended for free-trade movement.

# 11 Summary

Many standards that are applied worldwide are based on other standards. While standards are similar throughout the world, there is still no uniform global standard. Therefore, products sold in different countries also have different certifications for different explosion-risk environments. Furthermore, symbols on the respective labels differ. Many countries in Southeast Asia and Latin America have no local standards of their own and accept international and national IECEx, ATEX and FM approval; however, locations such as China, Korea and Russia do have local certification requirements that must be adhered to, although primary certification schemes may be accepted for most purposes, depending on nation.

METTLER TOLEDO develops weighing equipment for hazardous areas and obtains approvals on the global level, e.g. IECEx, ATEX, and FM, which are accepted in most countries.

Learn more about hazardous area regulations, standards and how to apply them to choose the right weighing equipment:
**www.mt.com/haz-safety**

# 12 Additional Resources


- IEC TC31 Equipment for Explosive Atmospheres, December, 2012
- ATEX Directive 94/9/EC: Guidelines on Application, Europe Commission, Fourth Edition, 2012
- National Electrical Code®, Article 500, NFPA 70, 2011, Delmar: Nacional Electric Code
- National Electrical Code, Article 505, NFPA 70, 2011, Delmar: Nacional Electric Code
- IEC EN 60079-0: Explosive Atmospheres – Part 0: Equipment – General Requirements
- IEC EN 60079-10-1: Explosive Atmospheres – Part 10-1: Classification of Areas – Explosive Gas Atmosphere

- METTLER TOLEDO Hazardous On-Demand Webinar Basic
  **www.mt.com/ind-haz-basics**

- METTLER TOLEDO Hazardous On-Demand Webinar Advanced
  **www.mt.com/ind-haz-advanced**

- METTLER TOLEDO Hazardous Catalog
  **www.mt.com/ind-hazcat**

- METTLER TOLEDO (2013), "Intrinsically Safe Solutions: Accurate Weighing in Hazardous Areas", Greifensee, Switzerland, 1-10
  **www.mt.com/ind-intrinsic-safe**


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